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1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.

1897. Steinhart, Dr. Oscar J., c/o Messrs. Steinhart, Vogel & Cloud, 4, Lloyds Avenue, Fenchurch Street, E.C., Manufacturing Chemist.

1903. Stell, S. F., 25, Henry Street, Keighley, Yorks., Teacher of Chemistry.

1887. Stenhouse, T., Townhead, Rochdale, Analytical Chemist.

1903. Stephan, Geo. B., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Perfumer.

1904. Stephen, A. E., Lachlan Gold Fields, Ltd. Forbes, N.S.W., Australia, Analytical Chemist.

1884. Stephens, H. Chas., M.P., Avenue House, Finchley, N., Ink Manufacturer.

1892. Stephens, M. E., 4, Carlton Gardens, London, S.W.; and (Journals) 57–60, Aldersgate Street, London, E.C., Ink Manufacturer.

1889. Stern, Arthur L., Southbank, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1906. Sternberg, Frank J. N., 18, Tyndall Avenue, Toronto, Canada, Analytical Chemist.

O.M. Stewart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.

1903. Steven, A. B., The University, Leeds, Lecturer on Dyeing.

1899. Stevenot, G. A., c/o H. A. Metz Co., 4, North Clark Street, Chicago, Ill., U.S.A., Chemist.

1898. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.

1904. Stevens, Edgar B., 688, Seventh Street, Buffalo, N.Y., U.S.A., Chemist (Wood Products Co.).

1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.

1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.

1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.

1903. Stevens, T. R. B., P.O. Box 120, Kalgoorlie, West Australia, Metallurgical Chemist.

1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, London, E.C., Secretary.

1907. Stevenson, Chas. F., 80, Polwarth Terrace, Edinburgh, Dyer.

O.M. Stevenson, Sir Thos., M.D., Guy's Hospital, London, S.E., Chemical Lecturer.

O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.

1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.

1903. Stewart, Jas., 3, Ludgate Circus Buildings, London, E.C., Editor ("Gas World").

1890. Stewart, Robt., 43, Leagrave Road, Luton, Chemical Works Manager.

O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, N.B., Technical Chemist.

1906 Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.

1904. Stieglitz, Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.

1904 Stiff, John T., 60, Parrock Street, Gravesend, Kent, Works Chemist.

1903 Stilwell, Albert G., 36, Gold Street, New York City, U.S.A., Chemist.

1903 Stingelin, Dr. Fritz, c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.

1886 Stirk, Jos., Sunnyside Hydro, Southport, Brewer's Engineer.

1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.

1900. Stockdale, Edgar, c/o E. Dewhurst and Co., Ltd., Printworks, Batley, Yorks., Colour Mixer.

1888 Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.

1887 Stocks, H. B., 12, Victoria Road, West Kirby, Cheshire, Analytical Chemist.

1903 Stoddard, Jesse D., Detroit Testing Laboratory, 1111, Union Trust Building, Detroit, Mich., U.S.A.

1885 Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.

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O.M. Stoker, G. N., 9, Lessar Avenue, Clapham Common, S.W., Analytical Chemist.

1899 Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.

1906 Stokes, Francis J., 17th and Cambria Streets, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1898. Stokes, Dr. Henry N., Bureau of Standards, Washington, D.C., U.S.A., Chemist.

1892. Stone, Frank, Laboratory, 193, Collins Street, Melbourne, Victoria, Analytical Chemist and Assayer.

1900. Stone, Geo. C., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Engineer.

1899 Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.

1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.

O.M. Storey, T. H., Haverbreaks, Lancaster, Chemical Manufacturer.

1903 Stormer, Edward J., c/o Case Threshing Machine Co., Racine, Wis., U.S.A., Analytical Chemist.

1902. Storr, Bertram V., 61, Balfour Road, Ilford, Essex, Chemist.

1888. Stowe, W. T., 11, Camphill Avenue, Langside, Glasgow, Analytical Chemist.

1904. Strange, Edward Halford, 7, Staple Inn, Holborn, London, Technical Research Chemist.

1905. Strange, Wm. Wallace, jun., Reduction Works, Anaconda Copper Mining Co., Anaconda, Montana, U.S.A., Chemist.

1883. Straugman, J. Pim, Bleacher.

1906. Straus, Louis, 18, West 83rd Street, New York City, U.S.A., Merchant.

1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.
1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1905. Strunz, Dr. C. E., 1437, Champa Street, Denver, Colo., U.S.A., Chemist
1906. Strunz, F. B., 672, Summit Avenue, St. Paul, Minn., U.S.A., Chemical Engineer.
O.M. Stuart, C. E., 29, Mosley Street, Newcastle-on-Tyne, Chemical Apparatus Dealer.
1905. Stuart, H. E., 176, Purchase Street, Boston, Mass., U.S.A., Vice-President, Mercantile Corporation.
1896. Stuart, Harry T. B., Know Mill House, Entwistle, near Bolton, Printworks Sub-Manager.
O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.
1901. Stuart, Dr. W. Theophilus, 197, Spadina Avenue, Toronto, Canada, Physician and Professor of Chemistry.
1896. Stubbs, Augustus J., 50, Calle de Ferraz, Madrid, Spain.
O.M. Studer, Dr. A., Postgebaude, Olten, Switzerland, Consulting Chemist.
1890. Studer, Simon J., Helvetia, Stockton Heath, near Warrington, Technical Chemist.
1903. Sturrock, Capt. G. C., R.A., Aruvankad, Nilgiris, India, Assistant Superintendent.
1896. Suckert, Dr. J. J., 141, Broadway, New York City, U.S.A., Manufacturing Chemist.
1895. Sudborough, Dr. J. J., University College of Wales, Aberystwith, Lecturer in Chemistry.
1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
1890. Sumner, Harold, Worthington, near Wigan, Dyer and Bleacher
1896. Sunderland, A., 84, Hainworth Wood Road, Ingrow, Keighley, Teacher of Chemistry.
1899. Sundström, Carl, c/o Solvay Press Co., Detroit, Mich., U.S.A., Chemist.
1895. Sundstrom, Karl J., Sibley, Mich., U.S.A., Manufacturing Chemist.
1906. Sutermeister, Edwin, Cumberland Mills, Maine, U.S.A., Chemist.
1884. Sutherland, D. A., 13, Victoria Street, and (Journals) 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist and Assayer
1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, The British Aluminium Co., Ltd., Baker Street, Greenock, N.B., Manager of Carbon Factory.
O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.
O.M. Sutton, Dr. Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Willesden Green, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.
O.M. Swan, Sir Jos. W., F.R.S., 58, Holland Park, London, W., Chemist and Electrician.
1898. Swanson, Jas. F., 5, Edmiston Terrace, Copland, Govan, N.B., Technical Chemist
1906. Sweet, Everell F., 33, Broad Street, Boston, Mass., U.S.A., Importer
1905. Swenarton, W. Hastings, Broadway Chambers, 277, Broadway, New York City U.S.A., Patent Lawyer.
1884. Swinburne, Geo. (Journals), 99, Queen Street, Melbourne, Australia; (subs.) c/o Jno. Coates and Co., Suffolk House, Laurence Pountney Hill, E.C., Gas Engineer.
1904. Swindells, Seth, 181, Orford Lane, Warrington, Chemist.
1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.
1903. Sykes, Harne, F. [illegible] U. Cardiff, Anal[illegible]
1902. Sylv[illegible] Herbert, 69 [illegible]sor, Alexandra [illegible] Drummoyne, Sydney, N.S.W., Australia, [illegible]ine an[illegible] lytical Chemist.
O.M. Syme, W. B., Elm Cottage, Addiewell, West Ca[illegible] Toronto N.B., Oil Works Chemist.
1906. Symes, Langford P., Parcora Freezing Wor[illegible] Leek Timaru, New Zealand, Chemist.
1903. Symmes, Whitman, 2231, Piedmont Avenue[illegible]etal. Berkeley, Cal., U.S.A., Chemical Engineer.
1906. Symonds, Abram E., Wick Lane Colour Works, [illegible]ley Old Ford Road, Bow., E., Colour Manufacturer.
1905. Szegö, A. S., 60, Bewsey Street, Warrington, [illegible] Chemist.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1896. Takagi, T., Kyoikuhin, Seizo Kaisha, Asakusa, Shichiben Cho, Tokyo, Japan, Chemical Engineer
O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.
O.M. Takamine, Dr. Jokichi, 521, West 179th Street, New York City, U.S.A., Engineer.
1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).
1905. Talbot, Prof. Henry P., Mass Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.
1903. Talbott, Dr. B. E., Chaneyville, Md., U.S.A., Manufacturing Chemist.
1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.
1906. Tanaka, S., 4, Uratakashimacho Nichome, Yokohama, Japan, Chief Chemical Engineer (Electric Wire Works).
1900. Tankard, Arnold R., 82, Llanthewy Road, Newport, Mon., Analytical Chemist.
O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
O.M. Tatlock, J., 45, Renfrew Street, Glasgow, Laboratory Furnisher.
O.M. Tatlock, R. R., 11, Bellshaugh Road, Kelvinside West, Glasgow, Consulting Chemist.
1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.
1906 Tattersfield, Frederick, The Hollins, Dewsbury, Yorks, Analyst.
1905. Taussig, Dr. Hugo, 237, East 72nd Street, New York City, U.S.A., Chemist.
1905. Taveau, René de Mortemer, 1218, Mount Royal Avenue, Baltimore, Md., U.S.A., Research Assistant, Johns Hopkins University.
1898. Taverner, W., Ashland, Oregon, U.S.A., Analytical Chemist.
1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Station F., Box 12, Cleveland, Ohio, U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.
1902. Taylor, Francis O., c/o Parke, Davis and Co., Detroit, Mich., U.S.A., Analytical Chemist.
1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.
1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.
1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.
O.M. Taylor, H. E., 702, Alexandra Parade, Dennistoun, Glasgow, Lead Works Manager.
1883. Taylor, Jas., Nymagee, N.S.W., Australia, Government Metallurgist.

Liverpool. ...essington,

1901. Taylor, Jno., c/o ... Co., Ltd., Tar Works, Litherland, Liverpool, Chemist.

Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.

1906. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, M. J., 77, Front Street East, Toronto, Canada, Soap Manufacturer.

1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.

1902. Taylor, Tom, jun., Journals to Kent House, Sale, Cheshire; communications to Cornbrook Chemical Co., Ltd., Stockport, Colour Manufacturer.

1898. Taylor, Walter, 20, Canning Street, Bury, Lancs., Technical Chemist.

1905. Taylor, Wm. H., 20, Balcaskie Road, Eltham Park, Kent, Chemist.

1903. Tazaki, T. M., 15, Kamiyoshicho, Asakusaku, Tokyo, Japan, Technical Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Ridgeway, Pa., U.S.A., Chemist

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

1905. Teeple, Dr. J. E., Industrial Laboratories, 164, Front Street, New York City, U.S.A., Director

1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.

1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst

1905. Temperley, Joseph, 22, Down Street, Piccadilly, London, W.; and (Journals) 72, Bishopsgate Street Within, E.C., Shipowner

1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., Savannah, Ga., U.S.A., Chemist.

1888. Terry, Albert, Verulam, Mount Albert Road, Balwyn, near Melbourne, Victoria, Brewer.

1884. Terry, Hubert L., (Journals) 3, Herbert Street, Moss Side, Manchester, and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 54, Penshurst Road, South Hackney, E., Oil Works Manager.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.

1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.

1907. Thomas, Alphonse H., 122, Front Street, New York City, U.S.A., Chemist

O.M. Thomas, Chas., J.P., D.L., Pitch and Pay, Stoke Bishop, near Bristol, Soap Manufacturer.

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1902. Thomas, Jas. E., Box 53, Krugersdorp, Transvaal, South Africa, Cyanide Manager.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.

1898. Thomas, Wm. Harrison, jun., R.F.D. No. 37, South Norwalk, Conn., U.S.A., Printworks Chemist.

1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.

1905. Thompson, A. J., Bernina, Friern Lane, Whetstone, N.; and (Journals) 42, Snow Hill, London, E.C., Buyer (Burroughs, Wellcome & Co.).

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., 32, Ulundi Road, Westcombe Park, S.E., Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Thompson, Dr. J. Fairfield, c/o Orford Copper Co., New Brighton, N.Y., U.S.A., Chemist.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.

O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.

1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.

1884 Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.

1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).

1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.

1899 Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.

O.M. Thomson, W., Royal Institution Laboratory, Manchester, Analytical and Consulting Chemist.

1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.

1902. Thorburn, Jas., c/o The British Explosives Synd., Pitsea, Essex, Manager.

O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.

O.M. Thorneycroft, Wallace, Plean House, Plean, Stirling, Technical Chemist

1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.

1907 Thornton, A. D., 13, Tupper Street, Montreal, Canada, Rubber Manufacturer.

1891. Thornton, Chris., 26, Larch Street, Providence, R.I., U.S.A., Printworks Manager.

1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks., Dyer.

1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.

1899. Thornton, Wm., (Journals) c/o Isaac Brandon and Bros., Panama, Central America; and (subsn.) c/o Thos. Thornton, Hermand, West Calder, N.B., Chemist.

1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.

1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.

1906. Thorp, Walter, Limerick, Ireland, Analytical Chemist.

1905. Thorpe, Dr. J. F., Yannaford, Heaton Mersey, Lancs., Lecturer, Manchester University.

O.M. Thorpe, Dr. T. E., C.B., F.R.S., Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 61, Ladbroke Grove, Notting Hill, W., Chief Chemist (Customs and Inland Revenue).

1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.

1902. Thurlow, Nathaniel, 78, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.

1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.

1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.

1905. Tichenor, Henry D., 18, Exchange Place, New York City, U.S.A., Custom House Broker.

1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.

1903. Tighe, Arthur, Springfield, Darlinghurst Road, Sydney, N.S.W., Australia, Chemical Student.

1901. Tilden, Philip S., c/o Franklin H. Kalbfleisch Co., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Tilden, Prof. W. A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.
1900. Tilley, Jas. W., 95A, Southwark Street, London, S.E., Research Chemist.
1906. Tillson, Henry E., 75, Abbott Street, Laurence, Mass., U.S.A., Dyer.
1901. Timmans, W. G., c/o Basford Chemical Co., Basford, Nottingham, Chemical Works Manager.
O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.
1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.
1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.
1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.
1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y., and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist
1886. Todd, A. M., 204, North Rose Street, Kalamazoo, Mich., U.S.A., Manufacturing Chemist.
1905. Todhunter, B. E., West Hydraulic Engineering Co., 23, College Hill, London, E.C.
1906. Tolman, Frank S., 451, State Street, Flushing, N.Y., U.S.A., Superintendent, Oakes Manufacturing Co.
1905. Tolson, Stanley, c/o The Elastes Co., Ltd., North Kent Works, Erith, Chemist and Factory Manager.
O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.
1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.
1899. Tone, Jay E., 1427, Woodland Avenue, Des Moines, Iowa, U.S.A.
1896. Tonkin, John, 2603, East Broad Street, Richmond, Va., U.S.A., Manufacturing Chemist.
1902. Torrey, Charles A., jun., Security Life Deposit Vaults, Boston, Mass., U.S.A., Chemist.
1905. Torrey, Prof. H. A., Harvard Chemical Laboratory, Cambridge, Mass., U.S.A., Assistant Professor of Chemistry, Harvard University
O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.
1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.
1892. Townsend, Oliver C., 22, Heston Crescent, Rugby, Chemical Manufacturer.
1897. Towse, Walter, 31, Malvern Street, Newcastle-on-Tyne, Technical Chemist.
1904. Toyne, Francis D., 270, Spotland Bridge, Rochdale, Chemist.
1905. Trainer, David, 43, Exchange Place, New York City, U.S.A., Agent (Orford Copper Co.)
1899. Trantom, Dr. Wm. Hawthorne Lodge, Lutchford, near Warrington, Chemist.
1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.
1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.
1904. Trautwein, Alfred P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).
1906. Travell, Norman E., 26, Forest Road, Nottingham, Lace Dresser.
1905. Travelli, Chas. I., United Printing Machinery Co., 246, Summer Street, Boston, Mass., U.S.A., Mechanical Engineer
1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India; and (communications) c/o J. Lyon and Co., 4, Lombard Court, London, E.C., Professor of Chemistry.
1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.
1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.
1895. Treharne, F. [illegible], Cardiff, Analyst.
1885. Trewby, Herbert, 62, St. [illegible] Street, Londo[illegible], Analytical Chemist.
1901. Trigger, Oliver, Chem. Dept., Royal A[illegible], Woolwich, S.E., Analytical Chemist. [illegible]uiline and
1898. Tripp, Dr. E. Howard, The Modern School, [illegible] Toronto, Science Master.
O.M. Trobridge, A., c/o Trobridge & Co., Ltd., Hewo[illegible], Leck, Shore, Felling-on-Tyne, Technical Chemist.
1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst. Metal-
1906. Trotz, Johan O. E., 311, Main Street, Worcester, Mass., U.S.A., Consulting Engineer. [illegible]rley
1904. Trubek, M., Wood Ridge, Bergen County, N.J., U.S.A., Manufacturing Chemist.
1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.
1887. Tsukiyama, S., 2nd of No. 2116, Fukiaicho, Kobe, Japan, Paper Mills Chemist.
1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.
1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.
1886. Tuer, Arthur H., Thornhill, near Wigan, Analytical Chemist.
1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.
1907. Tufts, John L., 15, Park Avenue, Winchester, Mass., U.S.A., Chemical Engineer
1901. Tulloch, Wm. F., 7, West George Street, Glasgow, Merchant.
1904. Tunnell, Raymond W., 425, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
1899. Turnbull, Dr. Andrew, Manchester and Liverpool District Tanners' Federation, 3, Lord Street, Liverpool, Consulting Chemist.
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24,563	1064
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24,724	817
24,733	477
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24,849	891
24,875	714
24,900	954
24,927	1209
24,935	273
24,946	273
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25,054	691
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25,498	844
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25,781	953
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25,957	858
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26,041	1061
26,076	699
26,119	938
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26,176	597
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26,274	861
26,275	233
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26,383	978
26,384	428
26,435	264
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26,730	1113
26,768	974
26,777	604
26,780	1108
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26,803	218
26,813A	1225
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26,821	283
26,847	876
26,876	642
26,893	1096
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26,962	753
26,980	1049
26,993	885
27,000	922
27,001	1033
27,009	1052
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20	1175
38	973
52	992
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81	260
82	224
83	802
92	425
98	850
239	1231
255	421
324	1153
367	947
437	1006
494	699
516	937
519	603
612	382
703	839
772	713
837	1135
915	1052
926	1101
968	879
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996	952
1003	1209
1019	993
1050	1226
1105	750
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1182	334
1204	536
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1295	454
1299	927
1300	586
1325	479
1331	747
1356	784
1377	652
1474	564
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1642	840
1660	1210
1764	638
1771	588
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1841	715
1850	997
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1927	432
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2047	984
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2506	1153
2520	835
2554	918
2559	947
2584	903
2622	922
2680	382
2682	1067
2708	427
2795	775
2823	992
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3417	828
3432	802
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3509	877
3516	327
3528	988
3536	759
3549	1090
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3655	930
3661	888
3680	1146
3788	703
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3901	850
3905	932
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4107	1156
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4199	998
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4230	838
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4427	832
4461	703
4486	1231
4503	1149
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4570	947
4579	893
4587	470
4638	767
4692	940
4716	293
4824	332
4996	840
4999	989
5129	1034
5185	1061
5195	491
5222	1033
5259	910
5276	1173
5328	[illegible]
5348	[illegible]
5349	[illegible]
5427	1091
5428	582
5503	913
5505	788
5519	1231
5551	478
5552	849
5559	554
5567	915
5590	1089
5901	811
5908	711
6009	944
6062	1067
6072	1033
6122	732
6123	998
6166	891
6189	291
6198	891
6314	778
6363	873
6375	908
6426	889
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6484	764
6569	1101
6590	1001
6606	495
6640	999
6676	775
6681	1036
6705	1232
6770	1232
6806	1067
6871	998
6942	775
6946	845
6985	841
7011	841
7125	1002
7273	1214
7287	832
7287A	832
7288	747
7375	748
7421	841
7464	980
7478	1219
7499	1062
7520	850
7541	845
7597	998
7510	748
7617	1033
7695	1067
7705	998
7818	760
7825	970
7869	998
7870	760
7871	750
7876	804
7937	1033
7938	849
7954	1161
7985	1033
8030	998
8037	998
8077	998

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1906.		**1906.**		**1906.**		**1906.**		**1906.**		**1906.**		**1906.**	
8167	950	9458	933	10,158	918	10,948	974	12,127	974	13,057	751	16,001	1081
8276	974	9501	1082	10,159	841	10,999	714	12,128	974	13,186	889	16,003	1136
8362	1095	9502	1113	10,160	918	11,133	1082	12,129	917	13,217	1229	16,078	924
8433	974	9621	1219	10,162	949	11,371	759	12,130	1152	13,232	1046	16,429	909
8452	1052	9622	941	10,187	1082	11,498	817	12,153	1211	13,568	1062	16,535	998
8507	989	9629	1092	10,296	904	11,623	989	12,159	985	13,788	1091	16,725	1174
8604	1088	9700	1214	10,219	1053	11,660	1138	12,178	1168	13,860	1174	17,116	1113
8627	930	9710	1161	10,228	866	11,675	1156	12,210	684	14,057	922	17,162	1088
8757	634	9750	1153	10,228A	1064	11,696	698	12,225	954	14,087	844	17,167	952
8778	974	9793	697	10,278	859	11,724	1081	12,246	1146	14,261	845	17,328	1152
8840	918	9799	850	10,303	933	11,725	908	12,262	1096	14,343	925	17,569	1148
8866	633	9800	884	10,323	751	11,760	751	12,329	1225	14,344	1090	17,891	1119
8884	821	9880	1061	10,405	751	11,764	1049	12,401	1095	14,435	1174	18,004	1231
8910	984	9971	1044	10,407	1002	11,767	759	12,421	978	14,438	1173	18,134	1224
8953	940	9988	841	10,480	1000	11,820	1044	12,517	807	14,602	941	18,707	1136
9002	1114	9989	922	10,486	1231	11,877	1056	12,518	844	14,901	1083	18,708	1113
9008	908	9996	1049	10,505	751	11,951	1040	12,554	1147	15,046	1168	19,182	1216
9100	887	10,051	1117	10,506	1215	11,979	1046	12,599	989	15,133	1040	19,732	1161
9121	1033	10,078	867	10,513	816	11,980	1169	12,716	953	15,293	1045	20,633	1143
9164	563	10,079	768	10,517	1091	11,981	1219	12,834	1044	15,295	877	20,889	1232
9183	997	10,080	904	10,608	1000	12,076	1033	12,916	903	15,300	1144	21,424	1230
9205	1062	10,094	753	10,852	985	12,080	1040	12,938	1040	15,445	858	21,567	1231
9288	1105	10,157	918	10,927	868	12,117	1090	13,005	1216	16,000	1081		

ERRATA, 1906.

Vol. XXV,	Page.	Column.	Line from Top.	Line from Bottom.	Corrigenda.
No. 1—Jan. 15	27	1	..	9 to 14	*Delete bracket* [. 18 *from bottom, and insert it at end of* l. 9 *from bottom, and word the sentence thus* : " In accordance with a suggestion by R. Messel to use basic calcium nitrate as normal calcium nitrate is," &c.
No. 3—Feb. 15	113	1	4th title and abstract	..	*For* " E. Mouti " *read* " E. Monti."
No. 4—Feb. 28	166	2	Bottom line (Obituary)	..	*For* " January 21 " *read* " January 14."
" "	184	1	..	25	*For* " Butternhaw " *read* " Buttenshaw."
" "	203	1	2	..	*Insert author's name* : " C. Renz."
No. 5—March 15	217	1	..	20	*Delete* " in the case of."
No. 7—April 16	334	2	1	..	*Delete* " are obtained."
" " "	292–302	..	..	..	Throughout paper, *for* " specific gravity " *read* " apparent density."
No. 9—May 15	401	2	List of quotations.	..	(3) *Insert comma after* " Ordonneau."
					Insert comma after " Windisch."
					Insert comma after " Behrend."
					(13) *Insert comma after* " Mohler."
					(14) *For* " Jahsbrich " *read* " Jahresbericht."
					For " Vereine " *read* " Vereins."
					Join up " Spiritus fabrikation " *to form one word.*
					(15) *After* " Cunlasse," *insert a comma.*
No. 11—June 15	523	1 (Obituary)	..	5	(17) *After* " Burch " *insert a comma.*
" "	523	2 (Obituary)	2	..	*For* " established " *read* " introduced."
No. 12—June 30	571	1	4	..	*For* " about this time " *read* " In the early years between 1880 and 1890," &c.
" "	601	1	16	..	*For* " 1850 kilos. HNO_3 " *read* " 1174 kilos. HNO_3."
No. 14—July 31	711	1	..	30	*For* " 1905 " *read* " 1906."
No. 15—Aug. 15	765	2	7	..	*For* " Abwässerklarmy " *read* " Abwässerklarung."
No. 16—Aug. 31	784	2	39	..	*For* " Brown " *read* " Brunn."
" "	791	1	40	..	*For* " (1851—2) " *read* " (1852—3)."
" "	792	2	..	5	*For* " Arafuni " *read* " Araxuni."
" "	794	1	6	..	*For* " products " *read* " product."
" "	794	1	9	..	*For* " $OH.MgCO_3,2H_2O$ " *read* " $OH.MgCO_3H,2H_2O$."
" "	795	1	39	..	*For* " $OH.MgCO_3H$ " *read* " $OH.MgCO_3H,2H_2O$."
" "	796	..	..	..	*For* " Krystall " *read* " Krystalle."
" "	798	1	7	..	*Heading of col. 3, Table* III. *to read* " Concentration $OH.MgCO_3H,2H_2O$ per litre," &c.
" "	803	1	..	24	*For* " $Mg(CO_3Na)$ " *read* " $Mg(CO_3Na)_2$."
" "	803	1	..	26	*After* " 1819° " *insert* " C."
No. 23—Dec. 15	1134	1	8	..	*For* " (2348°) " *read* " (2348° C.)."
" "	1136	2	..	4	*For* " 0·225 " *read* " 0·0225."
" "	1137	1	..	17	*For* " bank " *read* " tank."
" "	1139	2	..	4	*For* " 357,586 " *read* " 367,536."
" "	1149	1	22 and 42	..	*Title, for* " Siekert " *read* " Siebert."
					For " Schmidt " *read* " Smidth."

The asterisk in heading of col. 5, Table IV., p. 796, refers to the analyses at top of p. 797, whilst the footnote refers to asterisk on p. 797, col. 1, line 31.

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Society of Chemical Industry.

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United States.—1s. each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

Members are reminded that the subscription of 25*s.* for 1906, payable on January 1st, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal. Any changes of address for the new List of Members now in course of preparation should reach the General Secretary not later than January 31st, 1906.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Andreae, Dr. E. P., Crestalta (*not* Crestalba), Chandos Hill, S.E.

Anfilogoff, N.A.; Journals to Central Wharf, Bow, E.

Aykroyd, H. E.; communications to Ashdown, Apperley Bridge, near Bradford.

Beaver, Chas. J., l/o Cecil Road; Holme Lea, Ashley Road, Hale, Cheshire.

Bishop, J. T. F.; Journals to Chemical Club, Victoria Hotel, Manchester.

Bloxam, A. G.; communications to 105, Birkbeck Bank Chambers, Holborn, W.C.

Boor, Leonard G., l/o 39; 21, Mincing Lane, London, E.C.

Caro, Dr. Heinrich; Journals to C.8 N.9, Mannheim, Baden, Germany.

Clarke, Goddard; Journals to 60-64, Artillery Lane, London, E.

Dewhirst, Jno. A., l/o Shipley; Borough Laboratory, Halifax, Yorks.

Dickinson, A. J.; all communications to 57, Lewisham High Road, New Cross, S.E.

Douglas, Loudon M., l/o Baltic Wharf; Douglas Wharf, Putney, S.W.

Doulton, H. L.; communications to Royal Doulton Potteries, Lambeth, S.E.

English, Frank H., l/o Manor Park; 47, Shelley Avenue, East Ham, E.

Etheridge, Arthur T.; all communications to Clifton House, Featherstone Road, Stamford, Essex.

Evans, Jas. R., l/o Troy; 19, High Street, Pottstown, Pa., U.S.A., Chemist.

Fairhall, E. J., l/o London; c/o A. Boake, Roberts & Co., Ltd., 4 Rue Lamartine, Lille (Nord), France.

Fawsitt, Dr. Chas. E.; all communications to 9, Foremount Terrace, Glasgow.

Gall, Henry, l/o Paris; 4, Rue Albert Joly, Versailles, France.

Gardner, Prof. Walter M.; Journals to Technical College, Bradford, Yorks.

Gasdar, J. J.; all communications to 5, Wroxham Mansions, Canfield Gardens, N.W.

Goulding, Sir W. Joshua, Bart., l/o Eden Quay; North Wall, Dublin.

Guthrie, Alan, l/o Cawnpore; South End, Northallerton, Yorks.

Gyr, Dr. K. H., l/o Zürich; Zug, Switzerland.

Harden, Dr. Arthur; all communications to 2, Marlborough Road, Richmond, Surrey.

Hargreaves, Jas.; communications to May Villa, Peel House Lane, Widnes.

Harrison, G. Herbert, l/o Middlewich; Hagley, Stourbridge.

Hatschek, Emil, l/o New York; c/o Malto-Peptone Co., Ltd., Needham Market, Suffolk.

Hazen, C. R., l/o Collingwood; 33, Dartmoor Street, East Cleveland, Ohio, U.S.A.

Hollinshead, Peter, l/o Middlewich; 19, The Hollow Way, Runcorn, Cheshire.

Jerdan, Dr. D. S., l/o Edinburgh; Temora, Colinton, Midlothian, N.B.

King, Walter R., l/o Avalon; Holford Lodge, Trinity Avenue, Southend.

Kingzett, C. T., l/o Chislehurst; 1, Hornton Street, Kensington, W.; Journals as before.

Knudsen, Hans, l/o Gillingham Street; 68, Victoria Street, Westminster, S.W.

Marsh, Wm.; Journals to Soho Works, Ancoats, Manchester.

Marx, Dr. Emil; Journals to 12, Gordon Street, Gordon Square, W.C.

Moore, Chas. W.; Journals to Gloriastrasse 66, Zürich IV., Switzerland.

Morson, Thos.; communications to 38, Elsworthy Road, Primrose Hill, N.W.

Murrill, Dr. Paul I., l/o London; P.O. Drawer 986, Wilmington, Del., U.S.A.

Newall, F. S.; communications to Washington Station, R.S.O., Co. Durham.

Orr, Jno. B., l/o Widnes; Crossacres, Woolton, Liverpool.

Pakes, Dr. Walter C. C., l/o Box 1080; Box 4581, Johannesburg, South Africa.

Pearce, Richard; all communications to 1712, Sherman Avenue, Denver, Colo., U.S.A.

Reekie, J. A.; communications to Woodhouse, Hayfield, Derbyshire.

Reuter, Fred.; all communications to Underley House, Whitefield, Manchester.

Rink, Arnold, l/o Butler Street; 14, Hamsell Street, London, E.C.

Royal-Dawson, H.; Journals to c/o Messrs Peyton and Son, Chemical Works, Lister Street, Birmingham.

Ruddock, F. G., l/o Egypt Street; Corporation Street, Warrington.

Schoeller, Dr. W. R., l/o Shoreditch; c/o D. C. Griffith and Co., Victoria Avenue, Bishopsgate Without, E.C.

Searle, Alfred B.; Journals to Cliftonville, Claremont, Sheffield.

Shearer, A., l/o 43; 5, Derby Road, Burton-on-Trent.

Shedden, Frank, l/o Walsall; 25, Hareholme Lane, Clough Fold, Manchester.

Shonk, A., l/o Hendon; Alma, Merivale Road, Harrow.

Sindall, R. W.; Journals to Oxford Court, Cannon Street, London, E.C.

Sisson, G., Jun.; Journals to 13, Grey Street, Newcastle-on-Tyne.

Skurray, Thos.; communications to The Brewery, 40, Ock Street, Abingdon, Berks.

Smart, Bertram J., l/o Ennis Road; 35, Wrottesley Road, Plumstead, S.E.

Smith, F. Gurney, l/o Blackburn; Dept. of Chemistry, Manitoba University, Winnipeg, Canada.

Sowerby, T. H.; communications to Canal Soap Works, Verney Road, Rotherhithe, S.E.

Van Marken, J. C.; all communications to Technische Hochschule, Aachen, Germany.

Vernon, R. H., l/o London; c/o Westrumite Co. of America, 1117, Monadnock Building, Chicago, Ill., U.S.A.

Ward, G. J., l/o Nottingham; Hallam Fields, Ilkeston, Notts.

Whiffen, Thos. J., l/o Southfields; Cerris House, West Hill, Putney, S.W.

Wilson, Leonard P., l/o Hanwell; Heath House, Wallasey Village, Cheshire.

Woolcott, G. H., l/o Montenotte; Lady's Well Brewery, Cork, Ireland.

Young, J. H.; communications to c/o Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow.

New Year's Honours List.

His Majesty has been pleased to confer the honour of Knighthood on Prof. Alex. Pedler, C.I.E., F.R.S., Director of Public Instruction, Calcutta.

Deaths.

Christy, Thos., The Manor House, Wallington, Surrey.

Crosskey, Alexander Nash, elder son of Walter F. Crosskey, M.D., at Albion Street, Lewes. Jan. 7.

Ryland, Howard P., Moxhull Park, Erdington, Birmingham. Dec. 28.

Whichelo, Matthew A., at Woodleigh, Arundel Road, Eastbourne. Jan. 6.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 25,871. Messinger & Popper. Drying process and apparatus therefor.* Dec. 12.

" 26,040. Cole. Crucibles and furnaces. Dec. 14.

" 26,040A. Cole. Crucibles. Dec. 28.

" 26,065. Prache and Bouillon. Apparatus for the evaporation or concentration of liquids. [Ger. Appl., March 24, 1905.]* Dec. 14.

" 26,179. Humphrey. *See under* II.

" 26,409. Shaw. Apparatus for evaporating liquids. Dec. 19.

" 26,441. Watt. Kilns. Dec. 19.

" 26,705. Giron. Apparatus for charging vessels containing liquids with carbonic acid or other gas. [Fr. Appl., Jan. 14, 1905.]* Dec. 21.

[A.] 26,801. Lovell. Machine for macerating and mixing substances. Dec. 22.
„ 26,998. Clarke. *See under* II.
„ 27,167. Kaufmann. Accumulators for gaseous bodies. Dec. 29.
[C.S.] 25,204 and 25,204A (1904). Macquisten. Method and apparatus for separating solid particles from each other. Dec. 29.
„ 27,618 (1904). De Kierzkowski-Steuart. Means for atomising liquid and gaseous fluids. Dec. 20.
„ 27,875 (1904). Aktiebolaget Separator. Centrifugal separator for liquids. Dec. 30.
„ 27,876 (1904). Aktiebolaget Separator. Centrifugal separators for liquids. Dec. 30.
„ 29,178 (1904). Kestner and Liversedge. Centrifugal apparatus for purifying gases, applicable also for absorbing gas by liquids. Dec. 20.
„ 29,329 (1904). Shaw. *See under* XVI.
„ 29,512 (1904). Renshaw. Filtering apparatus. Dec. 29.
„ 1646 (1905). Lennox. Spraying devices for evaporating liquids and for other purposes. Dec. 30.
„ 5108 (1905). Crosfield and Markel. Separation of solids from liquids. Dec. 20.
„ 5225 (1905). Yagn. Drying apparatus. Dec. 20.
„ 6730 (1905). Voss and Stern. Producing heat and ignition by means of catalytic action. Dec. 30.
„ 13,603 (1905). Jules Jean et Cie., and Raverat. Process for recovering vapours of volatile solvents. Dec. 20.

II.—FUEL, GAS, AND LIGHT.

[A.] 25,926. Day und Wiesengrund. Suction gas producers. Dec. 13.
„ 26,108. Harry. Steatite incandescent gas mantle. Dec. 15.
„ 26,179. Humphrey. Apparatus for the treatment of gas, water and other liquids. Dec. 15.
„ 26,189. Love. Inclined coal gas retorts.* Dec. 15.
„ 26,262. Feld. *See under* VII.
„ 26,496. Evans. Vapourising oil or the like for combustion. Dec. 19.
„ 26,556. Campbell, Binnie and Reid (Smith). Apparatus for washing and separating coal and other minerals.* Dec. 20.
„ 26,666. Dibdin and Woltereck. Process for the production of permanent heating and illuminating gas. Dec. 21.
„ 26,763. Tangyes, Ltd., and Pitt. Producer gas plants. Dec. 22.
„ 26,829. Fielding. Suction gas generators. Dec. 23.
„ 26,847. Green and Mieville. Apparatus for producing gas from petrol for illuminating and heating purposes. Dec. 23.
„ 26,855. Bourdos, Rothschild and Sutcliffe. Filaments of incandescent electric lamps. Dec. 23.
„ 26,899. Browne. Treatment of spent oxide from gas purifiers for revivifying and rendering same fit for re-use.* Dec. 23.
„ 26,900. Browne. Treatment of spent oxide from gas purifiers for revivifying and rendering same fit for re-use.* Dec. 23.
„ 26,930. Bury and Brown. Carbonising coal. Dec. 23.
„ 26,998. Clarke. Condensing apparatus suitable for the purification of coal and other gases. Dec. 27.
„ 27,001. Hiby. Coke ovens. Dec. 27.
„ 27,002. Bloxam (Lux). Manufacture of electric incandescence lamp filaments from tungsten or molybdenum or an alloy thereof. Dec. 27.
27,134. Cox. Gas producing apparatus. Dec. 29.
[C.S.] 24,372 (1904). Leistner. Liquid fuel burners. Dec. 20.
„ 28,154 (1904). Kusel. Manufacture of light-emitting bodies for electric incandescent lamps. Dec. 29.
„ 28,508 (1904). Neilson. *See under* III.
„ 28,707 (1904). Wesselsky. Gas generator for the exploitation especially of dust coal. Dec. 29.
„ 6434 (1905). Crosta and Morton. Gas producers. Dec. 20.
„ 6794 (1905). Bell. Apparatus for the manufacture of gas. Dec. 29.
„ 14,491 (1905). British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Incandescent electric lamps and methods of making same. Dec. 30.
„ 15,646 (1905). Brunck. *See under* VII.
„ 19,995 (1905). Hutmacher. Production of carburetted generator or water gas. Dec. 20.
„ 23,097 (1905). Siemens und Halske A.-G. Manufacture of incandescence bodies for electric light. Dec. 29.
„ 24,136 (1905). Export-Gasglühlicht-Ges. m. b. H. Method of making incandescent bodies for incandescent gas lights. Dec. 30.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 26,917. Simpson. Decomposition of organic bodies. Dec. 23.
[C.S.] 28,508. (1904). Neilson. Purification of and recovery of tar, &c., from blast-furnace, producer and like gases. Dec. 29.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 26,383. Imray (Meister, Lucius und Brüning). Manufacture of *o*-oxymonoazo dyestuffs. Dec. 18.
„ 26,495. Meister, Lucius und Brüning. Manufacture of a new vat dyestuff. [Ger. Appl., Jan. 30, 1905.]* Dec. 19.
„ 27,000. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of an indophenol. Dec. 27.
[C.S.] 28,547 (1904). Lichtenstein. Products applicable as colouring matters and for other industrial purposes. Dec. 30.
„ 8908 (1905). Ransford (Cassella und Co.). Manufacture of new sulpho acids and dyestuffs therefrom. Dec. 29.
„ 9325 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new *p*-amidophenylethersulphonic acid and a colouring matter therefrom. Dec. 20.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 25,693. Feilmann. *See under* XIIIA.
„ 25,752. Lake (Soc. Anon. Coop. per la Stagionatura e l'Assaggio Delle Sete ed Affini). Treatment of silk.* Dec. 11.
„ 25,816. Young and Hardman. Bleaching vegetable fibres in the raw or manufactured state. Dec. 12.
„ 25,874. Koehler. Cop tubes. [U.S. Appl., Aug. 25, 1905.]* Dec. 12.
„ 26,173. Meister, Lucius und Brüning. Manufacture of a hydrosulphite preparation. [Ger. Appl., Dec. 28, 1904.]* Dec. 15.
„ 26,381. Johnson (Badische Anilin und Soda Fabrik). Pastes for the discharge of dyed textile fabrics.* Dec. 18.

[A.] 26,762. Mather and Platt, Ltd. (Marin). Apparatus for dyeing, washing and finishing fabrics and the like. Dec. 22.

„ 26,962. Bethmann. Process for dyeing wool or other animal fibres with Aniline Black.* Dec. 27.

„ 27,054. Arrowsmith. Machinery for washing, scouring, dyeing, drying, and otherwise treating textile piece goods. Dec. 28.

„ 27,222. Dreaper. Manufacture of artificial silk and the like filaments. Dec. 30.

[C.S.] 28,712 (1904). Tompkins and Crombie. Manufacture of fibres or threads from cellulose solutions. Dec. 30.

„ 29,272 (1904). Haddan (Baillieneourt). Machines for the preparation of textile vegetable fibres. Dec. 30.

„ 360 (1905). Waters. Dyeing machines. Dec. 29.

„ 1120 (1905). Moore and Moore. Apparatus for washing and drying fabrics, fibrous substances, &c. Dec. 29.

„ 6750 (1905). Fulton. Machines for treating or finishing fabrics. Dec. 29.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[C.S.] 27,870 (1904). Imray (Meister, Lucius und Brüning). Manufacture of irregularly coloured paper. Dec. 20.

„ 9119 (1905). Boult (Hurwitz and Schürmann). Gilding of paper and other materials. Dec. 20.

„ 17,103 (1905). Tittel. Apparatus for applying colouring matter in paper making machines for the manufacture of coloured and marbled papers. Dec. 20.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 26,205. Lewis. Treatment of graphite for the removal of siliceous or other impurities therefrom. Dec. 16.

„ 26,262. Feld. Treatment of gases for the extraction of ammonia therefrom. Dec. 16.

„ 26,380. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable dry hydrosulphites. Dec. 18.

„ 26,435. Soc. l'Air Liquide. Liquefying atmospheric air in several portions differing in composition. [Fr. Appl., March 30, 1905.]* Dec. 19.

„ 26,489. Cooper. Manufacture of sulphuric acid. Dec. 19.

„ 26,661. Brown. Method of utilising the arsenical product precipitated in the purification of hydrochloric, sulphuric and like acids. Dec. 21.

„ 26,728. Pawlikowski. Production of endothermic chemical compounds.* Dec. 21.

„ 26,788. Potter. Manufacture of silicon monoxide. [U.S. Appl., Dec. 30, 1904.]* Dec. 22.

„ 26,803. Kaiser. Process for producing ammonia. [Ger. Appl., Dec. 24, 1904.]* Dec. 22.

„ 27,009. Johnson (Badische Anilin und Soda Fabrik). *See under* XI.

„ 27,014. Rice and Johns. Pyrites burners or kilns. Dec. 27.

[C.S.] 27,907 (1904). Blackmore. Process of making sulphur trioxide and other compounds exothermic on formation. Dec. 30.

„ 28,433 (1904). De Stucklé. Manufacture of caustic alkalis or analogous hydrates. Dec. 29.

„ 29,283 (1904). Bloxam (Administration der Minen von Buchsweiler, A.-G.). Manufacture of sodium ferrocyanide. Dec. 20.

„ 29,602 (1904). Walker (Ray). Apparatus for evaporating brine. Dec. 30.

[C.S.] 9443 (1905). Clemm. Treatment of phosphates and production of chlorine and of citrate soluble phosphate. Dec. 20.

„ 15,646 (1905). Brunck. Extraction of ammonia from distillation gases. Dec. 20.

„ 21,347 (1905). Bloxam (Gebr. Siemens und Co.). Manufacture of forms of silicon carbide. Dec. 30.

„ 22,238 (1905). Wedge. Preparing iron pyrites for desulphurisation. Dec. 30.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 26,469. Moore. Furnaces for glass manufacture, &c. Dec. 19.

„ 26,642. MacHutcheon and MacHutcheon. Decorating porcelain and vitreous enamelled ware.* Dec. 21.

„ 26,893. Thompson. Treatment and utilisation of the waste sand (burgy) from glass works. Dec. 23.

[C.S.] 28,078 (1904). Stanley. Apparatus for burning the colours on tiles, glass, porcelain and ceramic ware. Dec. 19.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 26,007. South. Yorkstone cement. Dec. 14.

„ 26,539. Smith and Atherton. Asphalt compositions for road making and the like. Dec. 20.

„ 26,993. Hoettger. Preservation of wood. [Fr. Appl., March 22, 1905.]* Dec. 27.

„ 27,082. Angelis. Heat resisting composition. Dec. 28.

[C.S.] 27,308 (1904). Ward. Tar paving. Dec. 20.

„ 27,309 (1904). Ward. Manufacture of tar paving. Dec. 20.

„ 29,349 (1904). Brader. Heat insulating coverings. Dec. 30.

„ 5763 (1905). Assoc. Portland Cement Manufacturers (1900), Ltd., and Brooks. Manufacture of cement. Dec. 30.

„ 5797 (1905). Rawlings. Preparing lithographic stones. Dec. 29.

„ 14,288 (1905). Jacobs. Building materials. Dec. 29.

X.—METALLURGY.

[A.] 25,748. Simpkin and Ballantine. Magnetic separator. Dec. 11.

„ 25,845. Gillies. Apparatus for winning zinc and other sulphides from their ores. Dec. 12.

„ 25,941. Allison (Byrde). Percolation vats for treating ores. Dec. 13.

„ 25,976. Johnson (Saponia-Werke F. Boehm). *See under* XIII*B*.

„ 26,076. Babé and Louvrier. Metallurgical furnaces. [Ital. Appl., Dec. 14, 1904.]* Dec. 14.

„ 26,170. Goldschmid. Process for balling together pulverulent or dusty ores. [Ger. Appl., Jan 12, 1905.]* Dec. 15.

„ 26,263. Frodingham Iron and Steel Co., Ltd., and Mannaberg. Blast furnaces.* Dec. 16.

„ 26,277. Heberlein. Treatment of metalliferous compounds preparatory to smelting. Dec. 16.

„ 26,471. Angel. Treatment and reduction of complex sulphide ores. Dec. 19.

„ 26,472. Angel. Furnaces for treating sulphide or other ores. Dec. 19.

„ 26,529. Cowper-Coles. Zinc alloys. Dec. 20.

„ 26,530. Cowper-Coles. Manufacture of alloys. Dec. 20.

[A.] 26,534. Patchin and Rumbold. Method of obtaining lead and silver from ores or residues containing lead as sulphate or in a form capable of conversion into sulphate, and the silver as chloride. Dec. 20.

„ 26,556. Campbell, Binnie and Reid. *See under* II.

„ 26,577. Frith and Grist. Treatment of metals such as steel. Dec. 20.

„ 26,579. Frith and Grist. Treatment of metals such as steel and steel alloys. Dec. 20.

„ 26,580. Frith and Grist. Treatment of metals such as steel and steel alloys. Dec. 20.

„ 26,711. Sulman, Picard and Ballot. Separation of minerals. Dec. 21.

„ 26,712. Sulman, Picard and Ballot. Ore concentration. Dec. 21.

„ 26,790. Baker. Treatment of complex sulphide ores. Dec. 22.

„ 26,813. Ashcroft. *See under* XI.

„ 26,980. Heskett. Process and apparatus for obtaining metals from their sulphides. Dec. 27.

„ 27,023. Hemme. Brazing, and fluxes employed therein. Dec. 27.

„ 27,066. Cook. Metallurgical processes. Dec. 28.

„ 27,118. Fraser. Metallurgical process. Dec. 29.

„ 27,218. Blackman (Emett). Hardening cast iron and the like. Dec. 30.

[C.S.] 27,977 (1904). James. Extraction of precious metals from their ores. Dec. 30.

„ 28,570 (1904). Defays. Manufacture of steel. Dec. 30.

„ 1697 (1905). Wynne. Concentration of ores or other substances of different specific gravities. Dec. 29.

„ 2286 (1905). Rollaston. Treatment of auriferous, refractory or base ores. Dec. 30.

„ 2337 (1905). De Souza. Extraction of aluminium compounds for use in the manufacture of aluminium or aluminium alloys. Dec. 20.

„ 16,232 (1905), 16,233 (1905), and 16,234 (1905). Wedge. Preparing iron oxide for treatment in furnaces. Dec. 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 2004A. Bastian and Calvert. Electrode material for vapour electric apparatus. Dec. 30.

„ 26,662. Braun. Electrical batteries. Dec. 21.

„ 26,813. Ashcroft. Electrolysis of metallic compounds or ores. Dec. 22.

„ 26,876. Boult (Stebbins). Secondary batteries.* Dec. 23.

„ 26,902. Cowper-Coles. Electrolytic production of metallic sheets, wire, tubes, strip or the like. Dec. 23.

„ 26,903. Cowper-Coles. Anodes. Dec. 23.

„ 27,009. Johnson (Badische Anilin und Soda Fabrik). Electrolytic production of chromic acid and apparatus therefor. Dec. 27.

„ 27,159. Danville. Accumulators. Dec. 29.

[C.S.] 25,839 (1904). Thorp. Electrolysing apparatus. Dec. 30.

„ 27,986 (1904). N.S. Electric Storage Co., Ltd., and Niblett. Storage batteries. Dec. 29.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 26,119. Poohin and Richardson. Manufacture of soap powders or detergents. Dec. 15.

27,254. Klever. Manufacture of lubricating and anti-corrosive oils. [Ger. Appl., Jan. 4, 1905.]* Dec. 30.

XIII.—PIGMENTS, PAINS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 25,693. Feilmann. Products for use in dyeing and printing, and as pigments. Dec. 11.

„ 25,859. Fireman. Manufacture of printing ink pigments.* Dec. 12.

„ 27,036. Mills. Converting lead sulphate into a basic pigment and preparing paint therefrom. Dec. 28.

„ 27,252. Imray (Meister, Lucius und Brüning). Manufacture of colour lakes. Dec. 30.

(*B.*)—RESINS, VARNISHES.

[A.] 25,976. Johnson (Saponia-Werke F. Boehm). Material for cleaning and protecting metal. Dec. 13.

„ 26,176. Bosch. Process for treating rosin and rosin oils.* Dec. 15.

(*C.*)—INDIA-RUBBER.

[A.] 26,247. Pinney. Method of treating india-rubber for commercial purposes. Dec. 16.

[C.S.] 7694 (1905). Morisse. Treatment of the lactiferous juices of caoutchouc, gutta percha, balata and the like. Dec. 20.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 25,957. Klugmann. Process of treating skins and furs. Dec. 13.

„ 26,517. Karle. Process for producing artificial leather.* Dec. 19.

„ 26,550. The Bakau Co., Ltd., and Meikle. Method and apparatus for obtaining soluble extracts from bark and other vegetable matters. Dec. 20.

„ 26,771. Nowak. Substance for treating hides.* Dec. 22.

[C.S.] 6936 (1905). Castle. Adhesive or binding agent. Dec. 20.

„ 8514 (1905). Withey. Treatment of hides. Dec. 29.

„ 19,443 (1905). Magnus and Davis. Process of preparing leather. Dec. 30.

XV.—MANURES, ETC.

[A.] 26,780. Crone, Taylor and Williams. Manufacture of fertilisers and apparatus therefor. Dec. 22.

„ 26,886. Thompson (Schlutius). Manufacture of a material rich in phosphorus and nitrogen.* Dec. 23.

„ 26,887, 26,888 and 26,889. Thompson (Schlutius). Process of manufacturing artificial manures.

[C.S.] 9443 (1905). Clemm. *See under* VII.

XVI.—SUGAR, STARCH, GUM, ETC.

[C.S.] 27,289 (1904). Kollrepp and Wohl. Purification of sugar solutions. Dec. 29.

„ 29,329 (1904). Shaw. Apparatus for expelling water from syrups and the like. Dec. 30.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 26,041. Cowell. Treatment of malt. Dec. 14.

„ 26,250. Williams. *See under* XVIIIA.

„ 26,274. Lee. Process of brewing. Dec. 16.

„ 26,494. Hunt. Treatment of fusel oil or maturing of whisky and other potable spirits. Dec. 19.

[A.] 26,730. Ellermann. Drying apparatus for malt.* Dec. 22.

[C.S.] 27,626 (1904). Livingstone. Method of desiccating and preserving yeast. Dec. 20.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

[A.] 26,096. Mellor and Baildon. Separation of butter from cream or milk. Dec. 15.

„ 26,250. Williams. Aerating liquids. Dec. 16.

„ 26,777. Eybert and Eybert. Method and apparatus for treating flour with gases. [Fr. Appl., July 18, 1905.]* Dec. 22.

„ 26,794. Clarke. Manufacture of an alimentary product. Dec. 22.

„ 26,872. Andrews and Adam. Treatment of flour or the like. Dec. 23.

„ 27,188. Loring. Method of and apparatus for bleaching, sterilising, and conditioning flour. Dec. 29.

[C.S.] 27,516 (1904). Jung. Method of preserving milk and milk compounds. Dec. 20.

„ 28,374 (1904). Dubuisson. Preservation of natural butter. Dec. 29.

„ 13,479 (1905). Boykin and Mitchum. Process of making butter. Dec. 20.

(*B.*)—Sanitation; Water Purification.

[A.] 16,177A. Clark (Amer. Water Purifying Co.). Method and apparatus for purifying water.* Dec. 29.

„ 26,660. Adams. Sewage purification plant. Dec. 21.

„ 26,664. Boby. Purification of alkaline waters. Dec. 21.

„ 27,240. Cameron and Commin. Process for treating sewage and other waste products and means therefor.* Dec. 30.

(*C.*)—Disinfectants.

[C.S.] 8081 (1905). Holmes. Insecticide. Dec. 30.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 26,201. Krämer und van Elsberg, G.m.b.H., and Krämer. Producing brilliant transparent coatings on paper, pasteboards, &c. Dec. 16.

[C.S.] 27,870 (1904). Meister, Lucius und Brüning. *See under* VI.

[C.S.] 28,712 (1904). Tompkins and Crombie. *See under* V.

„ 8206 (1905). Kirner. Manufacture of half stuff from peat. Dec. 29.

„ 9119 (1905). Boult (Hurwitz and Schürmann). *See under* VI.

„ 16,433 (1905). Kron. Manufacture of pasteboard or carton and apparatus therefor. Dec. 29.

„ 17,163 (1905). Tittel. *See under* VI.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 25,891. Stuart. Extract of nubasa. Dec. 13.

„ 26,275. Meister, Lucius und Brüning. Manufacture of dialkylmalonylureas. [Ger. Appl., Jan. 9, 1905.]* Dec. 16.

„ 26,550. Bakau Co., Ltd., and Meikle. *See under* XIV.

„ 26,818. Ellis (Merck). Preparation of a new salt of eserine. Dec. 22.

„ 26,821. Hoffmann la Roche. Compounds or salts of theobromine. [Ger. Appl., May 30, 1905.]* Dec. 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 25,922. Brookes. Photographic printing paper or films. Dec. 13.

„ 26,569. Rowse. Method of preparing photographic prints for reproduction, in the manufacture of printing blocks. Dec. 20.

„ 27,088. Dischner. Process and apparatus for the production of photographs. [Ger. Appl., Dec. 29, 1904.]* Dec. 28.

[C.S.] 26,066 (1904). Kelly and Bentham. Photographic dry plates, films, or the like. Dec. 30.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 25,780. Reschke. Explosives.* Dec. 11.

„ 25,781. Reschke. Explosives.* Dec. 11.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 26,073. Rawson. Cupels for assay purposes.* Dec. 14.

„ 26,264. Noffke. Saccharometers. Dec. 16.

„ 26,637. McMyn. Weighing bottles for analysis. Dec. 21.

Deaths.

Christy, Thos., The Manor House, Wallington, Surrey.

Crosskey, Alexander Nash, elder son of Walter F. Crosskey, M.D., at Albion Street, Lewes. Jan. 7.

Ryland, Howard P., Moxhull Park, Erdington, Birmingham. Dec. 28.

Whichelo, Matthew A., at Woodleigh, Arundel Road, Eastbourne. Jan. 6.

Manchester Section.

Meeting held at Manchester on Friday, December 1st, 1905.

DR. G. H. BAILEY IN THE CHAIR.

CHIMNEY DRAUGHTING AND CONNECTING FLUES IN CHEMICAL WORKS.

BY HERBERT PORTER, F.I.C.

Much work has been done with reference to the volume and flow of gases or air in pipes, and many men of note have given the subject their close attention. Two hundred years ago Pitot studied this subject, and since then many others, coming down to the present day, such workers as Unwin, Threlfall, Fletcher, Lunge, Swan, Heenan, Gilbert, &c., &c., have all contributed to the subject mainly from a mathematical point of view. I do not intend to touch upon that subject, but I venture to think that the study of the mode of motion of gases in vessels, flues, or chimneys has not been made the subject of such close study as that of volume and velocity. By many, my experiments on the movement of gases in vitriol chambers will still be remembered, and I am proud to say the paper I read before this Society on that subject has created considerable interest both in this country and in America, and that the practical working on the lines laid down has proved the theory to be to a great extent correct. Being encouraged thus far, it is with the hope of throwing some further light on this question that the following paper was prepared.

The question of chimney draughting and connecting flues in works of all kinds, including chemical works, does not always receive the attention it should do, especially in old works where many changes in management and methods of working have taken place, or where the addition of fresh plant, if not new processes, has from time to time taken place. In a chemical works the chimney is the main spring which drives the whole machinery, and unless this means of promoting power be in proper proportion to the work to be done, or the connecting flues to the chimney be properly constructed, there will be trouble, loss in time and fuel, low level and local escapes, to say nothing of altorations, repairs, and experiments which otherwise would be unnecessary. In many otherwise well appointed works, or well constructed plant, troubles and difficulties arise from insufficient attention to the construction of flues in relation to the existing chimney draught. Also there is a note of warning needed to many on the question of employing electrical power in place of steam engines, or employing gas engines. These agents for power may pay for the particular purpose they are employed for, but in adopting such means there must be a corresponding reduction in the amount of steam generated and that means also a reduction of heat and reduction of motive power in the chimney.

Many processes carried on in a chemical works can be worked by the aid of artificial draught, such as fans, which are daily coming more into use, where the gases to be draughted are such as can be dealt with by a fan. On the other hand, there are gases which are almost impossible to deal with in that way and the manufacturer must look to the chimney draught for his motive power. The first point for consideration, after it has been decided to extend a plant, or put down an additional process, is the velocity and temperature of the chimney gases, and the velocity and capacity of the main flue to which such additional plant is to be attached. If the process to be added will contribute heat there will probably be an increase in velocity, and an increase in velocity means greater friction, which is another factor to be taken into consideration. Also there may be loss of power or draught due to the sudden enlargement of a flue, or to sharp bends, or to the entrance of other flues at right angles causing an eddy or whirlpool. Or, again, a new flue may be connected with the main flue contributing a large volume of cold gases, which will reduce the speed and increase the volume beyond the capacity of the flues. As regards steam boilers and furnaces, an insufficiency of draught in a chimney means loss of heat, incomplete combustion, and consequently loss in fuel, while, on the other hand, too much draught means also loss of heat due to excess of air drawn through the fires, and also increased consumption of coal. Having these points to bear in mind, it may be said that any speed over 10 ft. per second is excessive in a works chimney. At many works with which I am acquainted, the chimneys taking gases from various chemical processes as well as the boiler fire gases or furnace gases, very seldom exceed 7 to 8 ft. per second. Taking seven of the principal works where many processes are connected to one chimney, the average speed is 4·73 ft. per second, and these chimneys are all somewhat about the same height. The rule for calculating the power of a chimney is that the power varies as the square root of the height, but the temperature of the gases in the chimney also have an important relation to the power or speed. A tall chimney with a low temperature would be less powerful than a medium chimney draughting gas of the same temperature, because the question of friction and loss in temperature has to be considered.

It is generally assumed that inside all chimneys of whatever dimensions, there is a lining of gases for a thickness of about 2 in., that is practically stationary, that is to say, it has no upward velocity of any appreciable degree. It is often said that necessity is the mother of invention, but a study of nature and natural laws will often show that modern invention has been anticipated from the earliest times, and such natural phenomena will still be observed even under unnatural conditions. The principle of the ball bearings of a bicycle is understood by most people, and this same principle applies to the smoke ascending a chimney, acting in a line with the shaft instead of round its circumference as in the case of the bicycle. The lining or stationary gas at the sides of the chimney acts in the same way as the ball bearing, by revolving tubes or discs of gas, probably tubes, which allow the main shaft or core of gas to rapidly pass up the chimney, thus reducing the friction. As a further illustration of this ball-bearing movement may be instanced the hull of a ship at the water line, where the movement of the water at the sides of the vessel is very much the same as the movement of the gases at the sides of the chimney, making due allowance for the difference between gas and water. The hull of the ship represents the body of moving gases passing up the chimney, the water being the chimney and the sails of the vessel the motive power. This action can be seen in narrow canals, when a canal boat is moving along.

Again in the case of a stream of water running between two banks, most people will have noticed the vortex action at the bank side, wherever the least obstruction or unevenness exists. Nature in this way reduces friction, and if it were not so, the movement of the gases in the chimney would be difficult, likewise the vessel in the water, or the water in the stream.

This ball-bearing movement can be seen, under certain conditions, in the exit flue from a set of vitriol chambers, by looking into the flue through a ¾ in. or 1 in. hole at an angle from its centre, especially if there be a small glass window in the opposite side of the flue, a little above the hole of observation. It is well known that there is little or no motion indicated by the anemometer when the tubes are placed just inside the chimney wall,

so as to be in this lining or ball bearing of smoke, as the gases in this layer move very slowly in an upward direction, but rapidly, on the other hand, on an axis at right angles to the flow of the gases, in a series of vortex rings or circular tubes concentric with the chimney wall.

There are many simple illustrations of this movement, such as the discharge of steam and smoke from the funnel of a locomotive; at starting this can be plainly seen: and again, this vortex action can be seen in an ordinary gun, rook rifle, or air gun. To succeed in doing this, after firing three or four shots in quick succession, so as to warm the gun, open the breach, and hold up the barrel to the sunlight or other strong light, keeping the head some little distance from the breach. As the warm gases pass up the barrel a vortex action can be plainly seen and there is a clear space through the centre of the smoke up which the air is passing. This can be beautifully shown with an ordinary air gun, if a few drops of oil are placed on the leather washer which closes on the shot and through which the air passes from the cylinder. The light playing on the mist of oil in the barrel gives a beautiful effect to this vortex action.

A chimney, 3 ft. 6 ins. diameter, has an area of 9·62 sq. ft., but the effective area is only 7·87 ft., allowing for the 2 ins. of gas lining. According to Kent, mechanical engineer, New York, such a chimney, 80 ft. high, is sufficient to cause the combustion of 120 lb. of coal per hour per square foot of area of the chimney, and if the fire grate area is to the chimney as 8 to 1, a combustion of 15 lb. of coal per square foot of grate per hour. This is a fair quantity for a boiler of modern type, with heating surface large enough in proportion to the rate of combustion. Taking this chimney to be 80 ft. high, and 3 ft. 6 ins. in diameter, and supposing the speed to be 5 ft. per second, the volume of gases would be 39·35 cb. ft. per second or 142·26 cb. ft. per hour. Now, if to this chimney, which is only dealing with boiler fire gases, we connect a flue which shall contribute some other gases from some other plant or furnace at some distance, there will be a certain amount of extra friction or pull added, and the speed of the chimney will be slightly lessened, while, owing to the increased volume of gases passing up the chimney, there will be a corresponding decrease in the quantity of air drawn through the boiler fires, and this will mean loss of heat, waste of fuel and black smoke, granting that the conditions were perfect for the boiler fires prior to the flue connection.

Davis, in his handbook of "Chemical Engineering," Vol. 2, page 83, gives an illustration of this point. An original chimney under certain conditions was passing 1280 cb. ft. per second, and when another chimney was employed to assist in the work they were passing:—

No. 15 Chimney, at 60° F.	1152	cb. ft.
No. 16 „ „	178	„
Total for both.....	1330	„

The total number sufficiently near to the former (1280) to indicate that the fault was not with the chimney but with the flues.

Mr. Davis does not continue to describe the existing conditions of the flues or the processes connected therewith. At the time of the tests above recorded probably such information was not at his disposal; but could such detail have been obtained, it would have added much valuable information to so important a subject. For this point is of vital importance to the manufacturer, who may be frequently adding to or increasing his plant. His coal bill may increase, or his steam production may decrease, not to mention the troubles and annoyance he may meet with, caused by black smoke, due to imperfect combustion.

Coming to the flues connecting furnaces and plant to the chimney, we must first consider what is the action which goes on within them. Like the chimney, but to a much lesser degree, there is at the top and sides of a flue a certain amount of the ball-bearing action, while at the bottom of the flue and sides near the bottom there is quite a different motion. The reason for this is that the hottest portions of the gases rise to the top of the flue, while the cooler fall to the bottom and drag along the bottom until caught up by the draught of warmer portions coming on behind. So that, unlike the state of things in the chimney, there is a constant rising and falling and mixing of the gases in their horizontal travel through the flue, and a study of these movements is one which will repay the observer.

Returning to the ball-bearing motion in the chimney, I think I have shown the difference between the movements in the chimney and the flues; the action in the flues corresponds more closely to that which takes place in a vitriol chamber, as compared with what takes place in a chimney.

The all-important question from a practical point of view is, in what proportion to the chimney should the flues be in an ordinary works where many contributions to the main processes are connected? This is a most difficult question to answer. From my own observations, and from such information as I have been able to gather together, I think the most important points are that sharp bends should be avoided and that the flues should decrease in sectional area rather than increase as they draw near to the chimney. Nothing is more fatal for the purposes of draughting than to suddenly increase the capacity of the flues; by so doing, eddies are set up, and such eddies mean back draught, mixture, and confusion. Keep the gases moving, and increase that movement as far as possible as it advances to the chimney; this can only be done by straight flues, so far as possible, and allowing, for condensation and cooling, a slight reduction in the size of the flue as it approaches the chimney bottom so as to keep up the speed of the gases.

The area of a main flue should, in my opinion, be greater than the area of the chimney at the top or outlet, though no law can be laid down, as so much depends on temperature and the position of the boilers, which are generally the main heat or power-producing factor. In many works the speed in the flue very greatly exceeds the speed in the chimney; this means more work for the chimney.

A few words as to the construction of flues and connections to chimneys. Fig. A shows an arched opening into a chimney that is often used in chemical works, and I would warn the manager against so constructing a connection with the chimney. The whole weight of the chimney above the arch is on the arch, and I have seen dangerous cracks caused by it. If such connections have to be made let a stone be placed over the opening, or the brick work taken out in an inverted V-shape (Fig. B), when the risk of splitting the chimney will be far less. Above all things, the bottom of the chimney should be drained, since wet in the base of a chimney will cause trouble in many ways in a chemical works; this applies quite as much to the flues.

The connection of flues to the main flue is also an important matter. Flues should never be introduced into the main flue at right angles, but always at an angle so that the gases enter in the direction they have to go as far

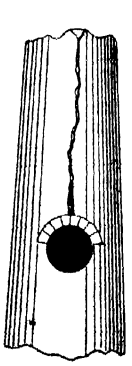


Fig. A.

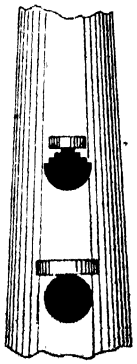


Fig B.

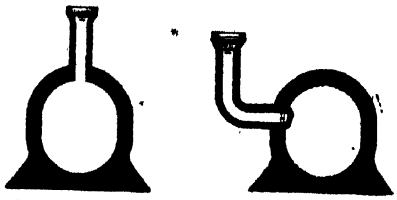


Fig. C. *Fig. D.*

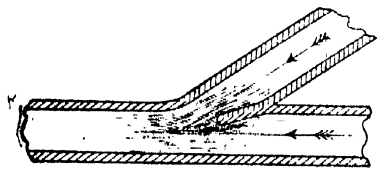


Fig E.

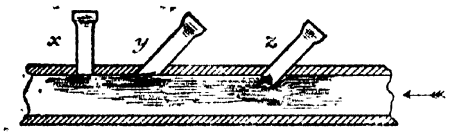


Fig. F.

as possible. In Fig. F, *x*, *y*, *z*, show these pipes, *x* and *y* being examples of wrong construction; in Fig. F *z* shows a small connection as it should be, the side of the pipe projecting into the main flue, and Fig. E shows the junction of two large flues of about the same size, in which will be noticed a partition wall or midfeather.

It is absolutely wrong to connect a flue into the top of the main flue, for at that point the velocity of the main flue gases is greatest, and this will prevent the gases taken from the connection from entering, at least in the proportion they are required to do. (Fig. C.)

Flues draughting cold gases to a hot flue must be of a capacity fully equal to that enjoined by rules to be found in many works on the subject, and such gases should be conducted into the main flue at the side and above the centre line or on it, level with the line of greatest speed, with a connection such as shown in Fig. D.

One most important point should never be lost sight of: never attempt, as is sometimes done, to make cold gases go uphill if you value your chimney draught, or wish to avoid local escape, and do not try to make hot gases go down hill, for the same results will face you. When I say hot gases going downhill I do not mean fire gases in boiler flues, or furnace gases in a *plus* pressure furnace, but the gases from various processes after they have left their point of generation, and are on their way to the main flue, when they are losing their heat or coming in contact with frictional surface.

I hope in the near future to bring forward another paper that will deal more fully with the subject as regards the movement and speed of the gases in chimneys and flues.

Discussion.

Mr. W. H. Coleman could confirm Mr. Porter's statement with regard to the splitting action where a flue had been put in above the ground level. In a chimney which had been treated in that way a considerable crack had developed. He thought Mr. Porter's suggestion of a flat stone above the arch would overcome a difficulty which had not been met before. He also agreed with the author's remarks as to the eddying action and the method of connecting flues.

Mr. Wm. Thomson asked whether it was quite clear that the draught of a chimney was proportional to the square root of its height? The experiment, to show that the velocity of the draught in one flue was largely dependent on the angle at which it joined the main flue, was very interesting. With regard to the worst results being obtained when they joined at right angles, he would like to know how this worked out on a Fletcher's anemometer, where a tube, the opening of which was placed at right angles to the draught, was supposed to produce a partial vacuum in that tube, proportional to the pressure produced in another, the opening in which was turned to face the draught.

Mr. Thorp explained that the reason, why the velocity of gases in a chimney varied as the root of the height only, was that the energy required varied as the square of the velocity, whilst the energy only varied directly as the height. He also gave an explanation of the means adopted to overcome a difficulty in connection with a new type of meter, which bore out Mr. Porter's observations as to the nature of the motion of gases near the walls of a conduit.

Dr. F. H. Bowman had had considerable experience in the construction of chimneys, and he thought it was a great mistake to taper them. They ought to be built wider at the top than the bottom in order that the gases might have a clear outlet. In one case he had fixed baffle plates in boiler flues, and this improved the draught very considerably. It was a great mistake to make the flues at right angles instead of with bends.

Dr. J. Grossmann asked in what way Mr. Porter determined the 2 ins. lining on the side of the chimney?

Mr. Leask said that with regard to the flow of gas in the chimneys he agreed with Mr. Porter. There was a layer between the wall of the chimney and the body of the moving gases. The thickness of the layer was about 2 ins. and was caused by the retarding action of the walls of the chimney. He thought this layer had some motion, but did not think it could be treated mathematically. He agreed with Mr. Thorp as to the velocity of the gases in the chimney, *i.e.*, that they were directly proportional to the square root of the height of the chimney, the mean temperature being constant. With regard to the junction of flues, he always constructed them at an acute angle in the direction of the flow, in the manner indicated by Mr. Porter, and he thought that the reason why flues were often brought in at right angles was to get over the difficulties of construction, which were considerable with acute angles when the gases passing through the flues were of a high temperature. To get over this difficulty he had always constructed the flues at the junction with a flat top.

Mr. Herbert Porter, in reply, said Mr. Thorp had already replied to Mr. Thomson as to the square root question, but in his (Mr. Porter's) opinion there was the question of friction and loss of temperature, for which some allowance must be made. A high chimney with a very low temperature would not be so effectual as a medium chimney at the same temperature. Mr. Thomson also mentioned right angle flues and quoted Petot's experiments. Prof. Unwin had shown that with a larger orifice a correct suction was not obtained. In the "Proceedings of the Institution of Mechanical Engineers," in April, 1904, Mr. Threlfall read a paper on that subject which was well worth perusal. With regard to anemometer tubes, he fully realised the advantage of having a flanged pipe for the suction, which prevented the eddying described by Prof. Unwin. The lining undoubtedly had an upward motion, but what proportion that held to the speed of the gases generally he was not prepared to say, but probably it would be very low. He was also glad to hear Mr. Leask's experience that flat top flues increased the velocity—that there would be more lubricating action, which would give a better result. Dr. Bowman confirmed his method of connecting flues and the advantage of inserting baffle plates. In reply to Dr. Grossmann, the action referred to could be seen in

the exit from vitriol chambers by looking through a three-quarter inch hole in the flue at an angle from its centre. The anemometer showed no velocity just inside the chimney, only a slight oscillation on the surface of the ether. He was glad to hear from Mr. Thorp that by making a lip at the end of the tube the globules were arrested at the sides and accurate delivery was the result. By this means the friction was reduced to a minimum at the point of discharge. As to the width of a chimney necessary to obtain the maximum of 2 ins. of eddying matter inside, the gas lining varied with the size of the chimney. It was generally admitted that 2 ins. was the usual amount in most chimneys of average size.

New England Section.

Meeting held at Boston, on Friday, December 1st, 1905.

MR. HENRY HOWARD IN THE CHAIR.

THE CONTACT PROCESS FOR MANUFACTURING SULPHURIC ACID OF THE VEREIN CHEMISCHER FABRIKEN IN MANNHEIM.

BY WM. WILKE.

This process is based on the following fundamental principles:

1st. To use the heat of the ordinary roasting process for carrying on the catalytic action of the oxide of iron upon the sulphurous acid.

2nd. The purification of the burner gases is a dry process. In all other processes the gases are washed and have to be dried again.

3rd. The conversion or catalytic oxidation of that part of the sulphurous acid which passed through the iron contact, but had not been converted, is brought about by means of platinum and reheated to the proper temperature by means of the waste heat of the burner gases.

4th. The whole process is carried on by moving the gases by means of exhausters only.

The roast gases leave the kilns at a temperature of about 700° C. This is the proper temperature necessary in the iron oxide to produce the conversion or catalytic action to transform the sulphurous acid into sulphuric anhydride. The iron oxide, at the above mentioned temperature, forms iron arsenate, with the arsenious acid which is contained in the roast gases. If roast gases are taken at the temperature of the furnace through the oxide of iron, a large proportion of the sulphurous acid (50—60 per cent.), is converted into sulphuric anhydride while the arsenic contained in these roast gases combines with the oxide of iron.

Water contained in the gases to be converted reduces the catalytic property of the iron oxide; it is, therefore, necessary to produce the roast gases with dried air. The drying of the air necessary for the process is accomplished with sulphuric acid which is produced in the process.

The roast gases are produced in a furnace which is protected with an air-tight iron shell, against any entrance of moist atmospheric air. The air necessary for the roasting process passes through towers which are scrubbed with sulphuric acid and is then conducted through air-tight pipes entering the furnace or kilns below the grate bars. The dry and hot roast gases so obtained are conducted to a shaft which is attached to the furnace and filled with oxide of iron (pyrites cinders). In this shaft part of the convertion takes place, that is, part of the sulphurous acid is converted into sulphuric anhydride, while at the same time the arsenic obtained in the roast gases is retained.

The roast gases therefore are subjected to a dry purification, and are considerably reduced in their contents of sulphurous acid. After the sulphuric anhydride which is formed in this first part of the process has been absorbed, the rest of the sulphurous acid contained in the gases can be converted into sulphuric anhydride by means of a very small amount of platinum. To do this, it is necessary to remove any small quantities of sulphuric acid (monohydrate) which have not been absorbed. This is accomplished by passing the gases through layers of porous material which is not affected by sulphuric acid. The main part of the sulphuric acid which is carried over mechanically is eliminated or retained in this way. The purified gases are now allowed to pass through layers of granulated basic blast-furnace slag.

The gases which have passed through the iron contact mass contain sufficient heat to reheat the filtered gases to the temperature necessary for catalytic action in the platinum contact.

It would be possible to utilise this heat by giving it off to the filtered gases. But the sulphuric acid (monohydrate) must be carried along in the form of vapour. The heat, therefore, must not be reduced too much to keep the monohydrate in a gaseous state. The heat given off in the heater located over the iron contact is not sufficient to raise the filtered gases to the temperature necessary to carry on catalytic action in the platinum contact. It is, therefore, necessary to have a small coal fire to raise these gases to their proper temperature.

The platinum contact apparatus must be built in such a way that it does not offer much resistance to the passage of the gases, in order to move them with an ordinary exhauster. This is accomplished by using a number of platinised asbestos nets, the meshes of which are such that the resistance in the whole apparatus does not represent more than the pressure of a column of water about 30 mm. high. In constructing the platinum contact apparatus in this way, it is possible to exchange a single element during the process in the course of a few minutes without interruption. In this process, it is possible to have a conversion of the roast gases up to 95 per cent.

The first plant in the United States was erected in 1903, in the works of the Schoellkopf, Hartford and Hanna Co., in the city of Buffalo, N.Y. This plant consisted then of one unit with a capacity of about 1600 tons of sulphuric acid or its equivalent. The original plant has since been enlarged to four times its original capacity. Besides this plant, four other firms have adopted this process, and there are now in use twenty-two units with a capacity of about 35,000 tons, and in the course of construction, ten more units with a capacity of 16,000 tons. This is a total capacity of over 50,000 tons per year. This has been accomplished in a little over two years since the process has first been introduced here.

This process does not require complicated or delicate pieces of apparatus, a staff of scientific men, nor any special apparatus for the purification of the roast gases, as this is done in the furnace itself. The amount of fuel consumed and motive power required is smaller than in any other known process, and the plant can be built up gradually on account of the units being small and being easily arranged in groups. The cost of repairs is very low.

New York Section.

Meeting held at Chemists' Club, on Friday, November 24th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

THE EXISTENCE OF BROMOUS ACID ($HBrO_2$).

BY A. H. RICHARDS.

The following experiments were conducted in the laboratory of the Telluride Mill, at Colorado Springs, Colo.:—

The effect of adding a cold aqueous solution of silver

nitrate, in excess, to bromine water is the formation of hypobromous acid, silver bromide and nitric acid—

$$Br_2 + AgNO_3 + H_2O = HBrO + AgBr + HNO_3.$$

The effect of adding liquid bromine, in excess, to a concentrated solution of silver nitrate, gives a different reaction, as is shown by the following experiments:—To about two litres of an almost saturated solution of silver nitrate, liquid bromine was added in large excess. After stirring well and filtering, 18 equal portions of solutions were taken and put into flasks, which were numbered from 1 to 18. From portions numbered 1, 2, 3 and 4 the bromine was blown out by means of an air blast. From portions numbered 5, 6, 7 and 8 the bromine was removed by means of carbon bisulphide. Numbers 9 to 18 were set aside for other tests.

Portions 1, 2, 5 and 6 were made alkaline with sodium hydroxide, potassium iodide added, and then the solution made slightly acid with sulphuric acid. The iodine (which was liberated by the oxygen from the acid bromine compound) was titrated with standard sodium thiosulphate. The following amount of oxygen was found to be present:—

No. 1 = 0·1495 grms. of oxygen.
„ 2 = 0·1497 „ „ „
„ 5 = 0·1504 „ „ „
„ 6 = 0·1503 „ „ „

Average = 0·149975 „ „ „

Portions numbered 3, 4, 7 and 8 were reduced by means of sulphurous acid, the excess of sulphurous acid being oxidised with potassium permanganate, and, after making the solution alkaline with sodium bicarbonate, the bromide was titrated with N/10 silver nitrate solution and chromate indicator. The following results were obtained:—

No. 3 = 0·3745 grms. of bromine.
„ 4 = 0·3742 „ „ „
„ 7 = 0·3747 „ „ „
„ 8 = 0·3746 „ „ „

Average = 0·3745 „ „ „

From these eight tests the proportion between the oxygen and the bromine in the acid bromine compound was established as O : Br : : 0·149975 : 0·3745. This shows that the acid bromine compound contains two atoms of oxygen to one of bromine, and is presumably bromous acid ($HBrO_2$).

To further establish the existence of bromous acid in the solution, portions of the solution numbering 9, 10, 11 and 12 were used. These experiments were conducted on the supposition that bromous acid would react with hydrobromic acid in a manner analogous to the reaction between bromic acid and hydrobromic acid, and between hypobromous acid and hydrobromic acid, the reaction being $3HBr + HBrO_2 = 2H_2O + 2Br_2$.

After removing the free bromine from the four portions by means of an air blast, the solutions were made alkaline with sodium hydroxide, and an excess of sodium bromide was added. The solution was now transferred into a three-necked Woulff bottle. Dilute sulphuric acid was added through a stopcock funnel and the bromine, liberated by the action of hydrobromic acid on the supposed bromous acid, was blown into a solution of potassium iodide. The iodine liberated was titrated with standard sodium thiosulphate. The bromine found to have been liberated from the four tests were as follows:—

No. 9 = 1·496 grms. bromine.
„ 10 = 1·499 „ „
„ 11 = 1·497 „ „
„ 12 = 1·498 „ „

Average = 1·4975 „ „

As was shown in tests numbering 3, 4, 7 and 8, the bromine existing in the solution was 0·3745 grm. Subtracting 0·3745 grm. from 1·4975 grm. leaves 1·1230 grm. of bromine, which is the bromine liberated from the hydrobromic acid. Dividing 1·123 by 0·3745 gives the quotient of 2·9987. This gives the ratio between the bromine liberated from the supposed bromous acid and the bromine liberated from the hydrobromic acid as 1 to 2·9987, compared with the ratio 1 : 3 found from the equation $3HBr + HBrO_2 = 2Br_2 + H_2O$.

After removing free bromine from solutions numbering 13, 14, 15 and 16 and making alkaline with sodium hydroxide, the theoretical amount of sodium bromide was added, the solution made slightly acid as in previous tests (9, 10, 11 and 12), and the bromine blown into a solution of potassium iodide. The bromine liberated was found to be:—

No. 13 = 1·495 grm. bromine.
„ 14 = 1·497 „ „
„ 15 = 1·497 „ „
„ 16 = 1·496 „ „

Average = 1·49625 „ „

The solution, to which the sodium bromide had been added, and from which the bromine had been liberated, was tested for excess bromide and only a faint trace could be detected in numbers 13 and 16. This, together with the bromine found to have been liberated in tests 9, 10, 11, 12, 13, 14, 15 and 16, showed that bromous acid probably did exist in the solution, and that the reaction is $3HBr + HBrO_2 = 2H_2O + 2Br_2$.

From the results which are given above, it must be concluded that by the addition of liquid bromine, in excess, to a concentrated solution of silver nitrate, a bromine acid is formed which contains two atoms of oxygen to one atom of bromine. Whether this was bromous acid or a mixture of one part of hypobromous acid and one part of bromic acid was next investigated. If it were proven that hypobromous acid did not exist in the solution, then it could not be a mixture of one part of bromic acid and one part of hypobromous acid. To satisfy this point, the following facts were made use of, *viz.*:—Silver nitrate added to solutions of hypobromites with bromides, precipitates the bromide at first, leaving hypobromites in solution, while the soluble silver hypobromite decomposes with the precipitation of bromide and formation of bromate of silver. The bromate of silver gradually changing to the bromide—$3AgBrO = 2AgBr + AgBrO_3$.

Portions numbering 17 and 18 were prepared by removing the free bromine and then making just alkaline with sodium hydroxide, a small crystal of sodium bromide added. Silver nitrate was added in excess, and the solution rapidly filtered. The solution was allowed to stand for some time and no more precipitation of AgBr took place, showing that no silver hypobromite had been formed, and consequently no sodium hypobromite present. If no sodium hypobromite was present, after making the solution alkaline with sodium hydroxide, it is evident that no hypobromous acid was present in the acid solution and the bromine acid was not a mixture of one part of bromic acid and one part of hypobromous acid.

From the above experiments, the author's conclusions are, that bromous acid does exist and can be formed by adding liquid bromine, in excess, to a concentrated solution of silver nitrate. The first formation is probably hypobromous acid, which is oxidised by the excess bromine to bromous acid. From a few experiments made to determine the equation governing the formation of bromous acid, the following seems to be most probable:—

$$Br_2 + AgNO_3 + H_2O = HBrO + AgBr + HNO_3$$
$$2AgNO_3 + HBrO + Br_2 + H_2O = HBrO_2 + 2AgBr + 2HNO_3$$

Several attempts to isolate the anhydride (Br_2O_3) proved unsuccessful. A few tests, made by adding liquid bromine, in excess, to sodium hydroxide solution, seemed to indicate an oxidation of the sodium hypobromite to sodium bromite.

the exit from vitriol chambers by looking through a three-quarter inch hole in the flue at an angle from its centre. The anemometer showed no velocity just inside the chimney, only a slight oscillation on the surface of the ether. He was glad to hear from Mr. Thorp that by making a lip at the end of the tube the globules were arrested at the sides and accurate delivery was the result. By this means the friction was reduced to a minimum at the point of discharge. As to the width of a chimney necessary to obtain the maximum of 2 ins. of eddying matter inside, the gas lining varied with the size of the chimney. It was generally admitted that 2 ins. was the usual amount in most chimneys of average size.

New England Section.

Meeting held at Boston, on Friday, December 1st, 1905.

MR. HENRY HOWARD IN THE CHAIR.

THE CONTACT PROCESS FOR MANUFACTURING SULPHURIC ACID OF THE VEREIN CHEMISCHER FABRIKEN IN MANNHEIM.

BY WM. WILKE.

This process is based on the following fundamental principles:

1st. To use the heat of the ordinary roasting process for carrying on the catalytic action of the oxide of iron upon the sulphurous acid.

2nd. The purification of the burner gases is a dry process. In all other processes the gases are washed and have to be dried again.

3rd. The conversion or catalytic oxidation of that part of the sulphurous acid which passed through the iron contact, but had not been converted, is brought about by means of platinum and reheated to the proper temperature by means of the waste heat of the burner gases.

4th. The whole process is carried on by moving the gases by means of exhausters only.

The roast gases leave the kilns at a temperature of about 700° C. This is the proper temperature necessary in the iron oxide to produce the conversion or catalytic action to transform the sulphurous acid into sulphuric anhydride. The iron oxide, at the above mentioned temperature, forms iron arsenate, with the arsenious acid which is contained in the roast gases. If roast gases are taken at the temperature of the furnace through the oxide of iron, a large proportion of the sulphurous acid (50—60 per cent.), is converted into sulphuric anhydride while the arsenic contained in these roast gases combines with the oxide of iron.

Water contained in the gases to be converted reduces the catalytic property of the iron oxide; it is, therefore, necessary to produce the roast gases with dried air. The drying of the air necessary for the process is accomplished with sulphuric acid which is produced in the process.

The roast gases are produced in a furnace which is protected with an air-tight iron shell, against any entrance of moist atmospheric air. The air necessary for the roasting process passes through towers which are scrubbed with sulphuric acid and is then conducted through air-tight pipes entering the furnace or kilns below the grate bars. The dry and hot roast gases so obtained are conducted to a shaft which is attached to the furnace and filled with oxide of iron (pyrites cinders). In this shaft part of the convertion takes place, that is, part of the sulphurous acid is converted into sulphuric anhydride, while at the same time the arsenic obtained in the roast gases is retained.

The roast gases therefore are subjected to a dry purification, and are considerably reduced in their contents of sulphurous acid. After the sulphuric anhydride which is formed in this first part of the process has been absorbed, the rest of the sulphurous acid contained in the gases can be converted into sulphuric anhydride by means of a very small amount of platinum. To do this, it is necessary to remove any small quantities of sulphuric acid (monohydrate) which have not been absorbed. This is accomplished by passing the gases through layers of porous material which is not affected by sulphuric acid. The main part of the sulphuric acid which is carried over mechanically is eliminated or retained in this way. The purified gases are now allowed to pass through layers of granulated basic blast-furnace slag.

The gases which have passed through the iron contact mass contain sufficient heat to reheat the filtered gases to the temperature necessary for catalytic action in the platinum contact.

It would be possible to utilise this heat by giving it off to the filtered gases. But the sulphuric acid (monohydrate) must be carried along in the form of vapour. The heat, therefore, must not be reduced too much to keep the monohydrate in a gaseous state. The heat given off in the heater located over the iron contact is not sufficient to raise the filtered gases to the temperature necessary to carry on catalytic action in the platinum contact. It is, therefore, necessary to have a small coal fire to raise these gases to their proper temperature.

The platinum contact apparatus must be built in such a way that it does not offer much resistance to the passage of the gases, in order to move them with an ordinary exhauster. This is accomplished by using a number of platinised asbestos nets, the meshes of which are such that the resistance in the whole apparatus does not represent more than the pressure of a column of water about 30 mm. high. In constructing the platinum contact apparatus in this way, it is possible to exchange a single element during the process in the course of a few minutes without interruption. In this process, it is possible to have a conversion of the roast gases up to 95 per cent.

The first plant in the United States was erected in 1903, in the works of the Schoellkopf, Hartford and Hanna Co., in the city of Buffalo, N.Y. This plant consisted then of one unit with a capacity of about 1600 tons of sulphuric acid or its equivalent. The original plant has since been enlarged to four times its original capacity. Besides this plant, four other firms have adopted this process, and there are now in use twenty-two units with a capacity of about 35,000 tons, and in the course of construction, ten more units with a capacity of 16,000 tons. This is a total capacity of over 50,000 tons per year. This has been accomplished in a little over two years since the process has first been introduced here.

This process does not require complicated or delicate pieces of apparatus, a staff of scientific men, nor any special apparatus for the purification of the roast gases, as this is done in the furnace itself. The amount of fuel consumed and motive power required is smaller than in any other known process, and the plant can be built up gradually on account of the units being small and being easily arranged in groups. The cost of repairs is very low.

New York Section.

Meeting held at Chemists' Club, on Friday, November 24th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

THE EXISTENCE OF BROMOUS ACID ($HBrO_2$).

BY A. H. RICHARDS.

The following experiments were conducted in the laboratory of the Telluride Mill, at Colorado Springs, Colo.:—

The effect of adding a cold aqueous solution of silver

man discussed some of the various systems of costing. Companies and private firms often fell victims to unsound book-keeping and faulty balance sheets. Here the neglect of sound principles led to trouble. He gave an instance of partnership in which an old partner was joined by a new man. Plenty of profit appeared in the balance sheet for division at the end of the year, but there was a deficiency in the money at the bank. There was no suspicion of dishonesty, and an independent expert was asked to investigate. It was then found that all repairs and renewals had been charged at full cost, and even such items as a wall rebuilt and a yard re-paved had been taken into stock. Depreciation and its influence on future profits, percentages, and the antiquation-factor had all to be carefully considered in determining the position of a business concern. In particular, as regards depreciation, experts were now pointing out that the deduction under this head should be increased as the plant became older.

Mr. Paton then touched upon such expenses as advertising, exhibitions, &c., also on the bearing of the cost of law on industrial enterprise, the effects of trusts and the working of monopolies. Time pressing, he had to bring his address to a close without giving all the illustrations he had intended.

Journal and Patent Literature.

I—PLANT, APPARATUS & MACHINERY.

ENGLISH PATENTS.

Cooling or Heating Liquids; Apparatus for ——. A. S. Barham, London. Eng. Pat. 26,578, Dec. 6, 1904.

THE coil, through which the cooling or heating medium is circulated, is hung on pivots, and is rocked to and fro in the liquid to be cooled or heated, by means of an eccentric and suitable gearing.—W. H. C.

Autoclave and Hydraulic Press; Combined ——. E. Decauville, Paris. Eng. Pat. 28,539, Dec. 28, 1904. Under Int. Conv., Sept. 10, 1904.

SEE Fr. Pat. 350,167 of 1904; this J., 1905, 1217.—T. F. B.

Drying and Screening Sand, Minerals and other Substances; Apparatus for ——. E. Robinson, London. Eng. Pat. 28,684, Dec. 29, 1904.

A HORIZONTAL revolving cylinder is fitted with a continuous internal spiral, each turn of which is provided with lifting plates to assist in agitating the material to be dried. The cylinder is enclosed in a suitable heating chamber, built above a furnace, and has a perforated cylindrical prolongation beyond the end of the heating chamber. This serves to sift the dried material as it leaves the apparatus. The furnace chimney has a concentric jacket, and air is drawn by a fan through the annular space thus formed, and is heated by the hot waste gases. The hot air is then driven through the drying cylinder in the opposite direction to that taken by the material under treatment.—W. H. C.

Separating Solid Substances from Liquids [Drying Beet Slices]; Apparatus for Mechanically ——. H. Heucke, Berlin. Eng. Pat. 29,358, Dec. 31, 1904.

THE apparatus consists of a rotating drum connected to a suction apparatus, and upon the surface of the drum the material to be treated is fed continuously. The liquid portion passes through the porous surface of the drum, and the solid matter is removed from the exterior. The claims are for applying the suction to only a portion of the surface of the drum so that the part at which the material is fed or removed is not subjected to suction. Further, an auxiliary suction drum, situated just before the withdrawal scraper, loosens the material from the main drum, and a brush applied just after the withdrawal scraper, cleanses the filter surface of the drum, both the loosening and cleaning being facilitated by the absence of suction at these points. The material is fed from a hopper, provided with regulating blades, between the surface of the main drum and an auxiliary suction drum, which spreads out the material on to the main drum, so that when the main suction comes into play, as the drum rotates, the surface of the main drum is covered with a continuous layer of material. Further claim is made for a washing trough, provided with cleansing openings for the withdrawal of sediment, in which that portion of the surface of the main drum which is not covered with material may be cleansed. By means of pipes in the bottom of this trough, material for treatment may be supplied at the lowest point of the drum if desired.—W. H. C.

Separators; Centrifugal ——. C. Schuler, Grevenbroich, Germany. Eng. Pat. 19,894, Oct. 2, 1905. Under Int. Conv., Nov. 26, 1904.

THE claim is for a centrifugal machine in which the bottom of the basket can be lowered away from the body. The bottom only is attached to the rotating shaft and imparts its motion to the rest of the drum by forming the joint between them as a friction ring. When the bottom, which continues to rotate, is lowered, the upper portion of the basket seats itself on the bottom of the outer casing and comes to rest, the contents of the basket falling out through the annular space left between the bottom of the basket and the casing.—W. H. C.

Oil contained in [Boiler] Feed Water; Estimation of the Quantity of ——. W. H. Martin, Flushing, Holland. Eng. Pat. 11,067, May 26, 1905.

THE invention relates to the approximate determination of the amount of oil present in condensed steam intended for boiler feed-water. Several devices are described and claimed for this purpose, all of which are based upon the observation of an object through a column of the water (which is more or less opaque according to the quantity of oil contained in it), and determination of the point at which this object is only just visible.—A. S.

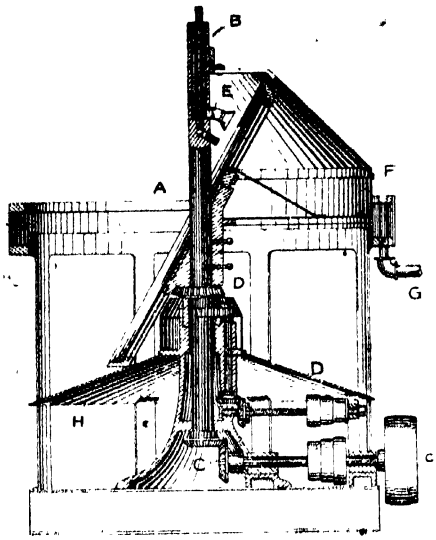
Furnaces; Impts. in ——. E. Lane, Kansas City, U.S.A. Eng. Pat. 13,763, July 4, 1905. Under Int. Conv., July 5, 1904.

SEE U.S. Pat. 773,328 of 1904; this J., 1904, 1079.—T.F.B.

UNITED STATES PATENTS.

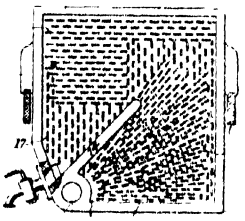
Filter; Centrifugal ——. L. C. Trent, Vantrent, Cal. U.S. Pat. 806,213, Dec. 5, 1905.

THE screen A, supported on the shaft B, at an angle to the horizontal, is rotated in a horizontal plane by the mechanism C C, and is at the same time rotated by the mechanism D D in a plane at right angles to its own axis. The liquid to be filtered is fed on to the upper surface of the screen A from the delivery pipe E; the liquid portion passes through and flows away by the



trough F and the pipe G, whilst the solid matter is delivered on to the platform H.—W. H. C.

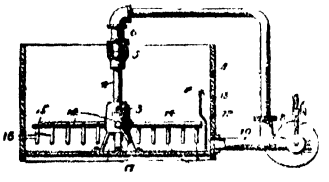
Filter-Press. R. Pick, Buffalo, N.Y. U.S. Pat. 806,491, Dec. 5, 1905.



A FILTER-PRESS comprising a frame with filter-plates and spacing-frames, with filter-cloth clamped between them, has the plates constructed with projections as shown in the figure. Claim is made for these projections 17 and for the arms 14 which extend upwards at an acute angle from the lower front corners of the plates.—W. H. C.

Agitating and Mixing Apparatus ——. L. C. Trent, Vantrent, Cal. U.S. Pat. 806,214, Dec. 5, 1905.

THE material to be treated is contained in the vessel 1,



and is withdrawn by the rotary pump 8, through the passage 13, 12 and the pipe 10, and returned under pressure through the pipe 6, the junction-piece 5 and the pipe 4 into the rotating reservoir 3. It then passes through the hollow arms 14, and out of the hollow tubes 15, 16, which are set at an angle to the arms 14, as shown at 17. Air may be admitted to the pump for the purpose of aërating the material under treatment.—W. H. C.

Heating-Furnace. W. N. Best, Los Angeles, Cal. Assignor to J. H. and E. Best, Quincy, Ill. U.S. Pat. 806,628, Dec. 5, 1905.

THE furnace consists of a metallic casing lined with refractory material in which there is a longitudinal opening, contracted at each end, which forms the furnace-chamber. The furnace has two "vents"; one of these forms the outlet for the heating flame, and is directly opposite the inlet at the other end of the furnace-chamber, whilst the second rises through the roof of the furnace near the outlet. The furnace is suspended by an adjustable sling, and is provided with hydrocarbon burners at the inlet end.—W. H. C.

Lixiviation Processes; Apparatus for ——. A. W. Constans, Nelson, Canada. U.S. Pat. 805,635, Nov. 28, 1905.

THE claim is for the combination, in a tank, of a central well and elevator with a filter of cloth and wire gauze supported on slats.—W. H. C.

Desiccating Process. J. C. McLachlan, Assignor to International Desiccating Co., Chicago, Ill. U.S. Pat. 806,747, Dec. 5, 1905.

THE claim is for the process of obtaining the solid contents of liquids in the form of a dry powder. The liquid is "atomised" by heated air, free from products of combustion, and the spray is discharged into and allowed to fall through a tall chamber, the air in which is heated by a jacket or coil, in such a way that it is not contaminated by products of combustion. As the particles of spray fall, the liquid portion is evaporated by contact with the heated air, which should not have a temperature higher than 150° F., and passes away from the top of the vessel whilst the solids collect at the bottom as a practically dry powder.—W. H. C.

FRENCH PATENTS.

Filter. H. Lieberich. Fr. Pat. 357,208, July 25, 1905 Under Int. Conv., Oct. 8, 1904.

SEE Eng. Pat. 13,247 of 1905; this J., 1905, 1055.—T. F. B

Fire-Resisting Covering of Felt for the Heat Insulation of Pipes, Conduits, &c. H. Kumpf. Fr. Pat. 357,044 Aug. 5, 1905.

THE heat-insulating covering for pipes, conduits, &c. described, consists of shells or other hollow objects of felt, of any required form, which are soaked in a solution of magnesium chloride, or magnesite with aluminium chloride, or a "solution" of cement or other agglomerant after which the objects are pressed into the desired form and on drying become hard, preserve their form, and at the same time are rendered fire-resisting.—W. C. H.

Cooling of Fluids; Apparatus for the Methodical and Fractional ——. C. Lambert. Fr. Pat. 356,737 Aug. 7, 1905.

THE apparatus consists of two systems of coil coolers or condensers worked in series. In the first the fluid is partially cooled by means of water or other liquid at the ordinary temperature, and in the second the cooling to the desired extent is completed by using cooled brine or a similar liquid. A smaller quantity of specially cooled liquid is required, as the greater part of the cooling is effected by a liquid at the ordinary temperature.
—W. H. C.

Evaporating, Distilling and other similar Apparatus Process for Obtaining a Multiple Utilisation of Heat in ——. E. Theisen. Fr. Pat. 356,752, Aug. 8, 1905 Under Int. Conv., Nov. 9, 1904.

FANS or other aspirating and blowing apparatus are placed, either in the evaporating chambers, or in the connections between the vaporising chamber of one pair and the heating chamber of the next. The pressure in the vaporising chamber is thus reduced, and the gases and vapours are aspirated and delivered, under pressure into the heating chamber of the next unit of the series.
—W. H. C.

Distillation; Apparatus for Continuous ——. J. E. L. Rouaix and O. Simon. Fr. Pat. 356,925, Aug. 14, 1905.

THE apparatus consists of two stills 1, 1, used alternately

Fig. 1.

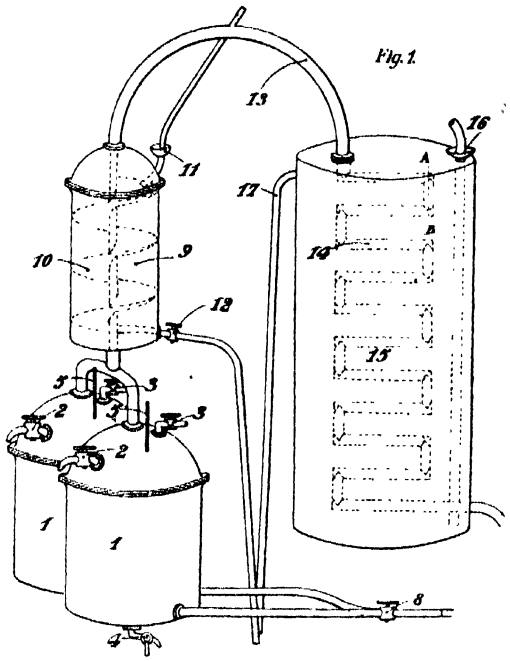


Fig. 2.

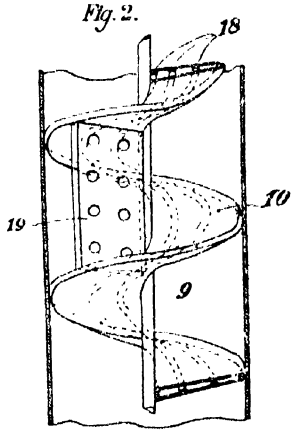
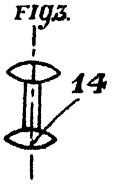


FIG 3.



and provided with charging taps 3, 3, run-off pipes 4, air valves 2, 2, thermometers 5, 5, and steam heating coils, supplied with steam through 8. The vapours pass from the still 1, into the fractionating column 9, provided with a flattened hollow spiral 10, through which a current of cooling water flows, entering at 11 and leaving by 12. This column, which is a special feature of the invention, is shown in greater detail in figure 2. The spiral 10 has internal gutters 18 in order to distribute the cooling water over the surface, and the column is provided with baffles formed of perforated plates 19, to delay the upward passage of the vapours and to force them into more intimate contact with the cooling spiral, which acts as a partial reflux condenser. The uncondensed vapours pass from 9 by the swan-neck 13 to the special rectangular condenser worm 14 contained in the tank 15, which is fed with cooling water at 16 and has an overflow 17. The section of the worm 14 on the line A-B is shown in figure 3. The horizontal pipes are of the flat oval section shown in order to give a large surface, and they are connected by the smaller pipes of circular section so as to produce a constriction at each bend of the coil. From 14 the condensed vapours pass through a hydrometer box to one of two receivers, which are connected to an air pump and used alternately.—W. H. C.

Centrifugal Machines for Separating Solids from Liquids. Aktiebolaget Separator. Fr. Pat. 356,916, Aug. 12, 1905. Under Int. Conv., Nov. 18, 1904.

THE claim relates to centrifugal machines in which the solids are withdrawn from the periphery of the drum and transported across the layer of liquid to the outlets near the centre, by means of wheels provided with rakes. The invention consists in introducing additional scrapers, carried on a cross-piece, attached to the shaft which rotates the rake-wheels. The function of these additional scrapers is to carry the solids around the periphery of the drum and to bring them within reach of the rakes on the wheels.
—W. H. C.

Centrifugal Machines for Separating Solids from Liquids. Soc. Aktiebolaget Separator. Fr. Pat. 357,065, Aug. 19, 1905.

IN machines similar to those referred to in the preceding abstract, the rakes on the wheels are constructed in the form of cups, which are either fastened to rotating arms, or are held between annular discs. The bottom of the cup is made lower than the edge to facilitate the collection of the solid particles.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Incandescent Mantle as a Catalyst and its Application to Gas Analysis. J. E. Mason and J. Wilson. Chem. Soc. Proc., 1905, 18, 296.

THE method described by Lewes (this J., 1905, 124) for demonstrating the incandescence of the ordinary gas mantle in a cold mixture of coal gas and air may also be employed with a mixture of ammonia vapour and air. The authors describe a modification for showing the incandescence of the mantle in an unburnt mixture of alcohol vapour and air. Although less effective, the mantle may be used as a substitute for platinised asbestos in the ordinary lecture experiments for preparing formaldehyde from methyl alcohol vapour and air, and sulphur trioxide from sulphur dioxide and oxygen.

Fragments of mantle in a hard glass or preferably quartz tube may be used in place of palladium or palladium-asbestos, for the estimation of hydrogen and carbon monoxide in gas analysis by combustion with excess of air or oxygen. Methane and mixtures of methane and hydrogen may be estimated similarly by passing these gases mixed with excess of oxygen over fragments of mantle heated in a quartz tube, and measuring the contraction after combustion, and subsequent treatment with caustic potash solution. The results agree well with those obtained by the customary explosion methods. Good results may also be obtained by passing the gases mixed with oxygen over asbestos heated in a small quartz tube. Hydrogen, and less readily methane, may be determined by passing the gas mixed with oxygen through narrow tubes of heated Jena glass alone.

ENGLISH PATENTS.

Furnaces; Regenerative Gas ——. G. Hatton, Brierley Hill, Staffs. Eng. Pat. 29,610, Dec. 31, 1904.

THE furnace is constructed with two regenerator chambers provided with a slide-valve. The gas and air always enter the furnace at the same end, and the waste gas passes through the regenerators alternately. The air is heated by being drawn through that regenerator through which the gas is not passing, and by altering the position of the slide-valve the directions in which the currents of waste gas and air flow can be reversed.—W. H. C.

Air, Gas, or the like Fluids, for Gasifying Hydrocarbons; Pressure-raising Apparatus for —— or for other Purposes. W. S. Gillie, Edinburgh. Eng. Pat. 25,477, Nov. 23, 1904.

THE bell of a gas-holder is connected, by means of a lever, with a small external hydraulic pump, which causes the bell to rise and fall, thus delivering air into a second gas-holder, from which the air is supplied to a carburetter. The water supply to the pump is controlled by the rising or falling of the second gas-holder, so that the pump ceases to operate when the holder is full. The first holder may be single-acting, in which case the surrounding cylinder is open at the top, or the cylinder may be closed to render the holder double-acting, the inlet and outlet valves for the air being arranged accordingly. An automatic three-way cock on the water-supply pipe brings about the reversals of the pumping strokes when due.
—H. B.

Gases; Purification of Furnace ——. W. Schwarz, Dortmund, Germany. Eng. Pat. 29,360, Dec. 31, 1904.

SEE Fr. Pat. 350,592 of 1905; this J., 1905, 794.—T. F. B.

UNITED STATES PATENTS.

Briquette Fuel from Coal Mine Waste or Dust Coal; Manufacture of ——. T. Rouse and H. Cohn, London. U.S. Pat. 806,845, Dec. 12, 1905.

SEE Eng. Pat. 9071 of 1904; this J., 1905, 611.—T. F. B.

Gases; Apparatus for Cleaning Manufactured ——. L. P. Lowe, San Francisco. U.S. Pat. 805,653, Nov. 28, 1905.

THE apparatus consists of a circular shell or chamber, into which the gas-inlet pipe descends vertically, at the centre, for some distance. The inlet pipe is constricted near its lower end, and a steam-pipe discharges into the constricted portion. A certain amount of water is allowed to collect at the bottom of the chamber, the level of the water being maintained constant by an overflow pipe on the side of the chamber, provided with a water seal. The gas-inlet discharges directly downwards towards the surface of the water, but the discharge aperture is wholly above the water level. By this arrangement, and the steam supply, the heavier particles are projected into contact with the water, whilst the lighter gaseous particles escape contact with it, and pass up through the upper portion of the chamber to the gas-outlet near the top. Means are provided for subjecting the gas to a continual discharge or spray of water in the upper portion of the chamber.—W. C. H.

Gas-Purifier. M. F. McNelly, Chicago. U.S. Pat. 805,985, Nov. 28, 1905.

THE purifier consists of several chambers, one of which contains a liquid and receives the flow of gas. From this chamber the gas passes into a recess or pocket, provided with finely-perforated walls, and arranged within a dry chamber. The gas passes into this dry chamber, which is filled with circular or cylindrical pieces of material, having a pitted or rough surface, around and over which the gas passes, and also a pith-like surface through which the gas is forced to pass on its way to the point of consumption.—W. C. H.

Ammonia and Hydrocyanic Acid; Process of Recovering —— [from Gas]. W. Feld, Hönningen-on-the-Rhine. U.S. Pat. 806,467, Dec. 5, 1905.

SEE Fr. Pat. 341,614 of 1904; this J., 1904, 861.—T. F. B.

Incandescent Mantles; Machine for Manufacturing ——. J. L. Muller, Sannois, and J. Bonnet, Paris. U.S. Pat. 805,930, Nov. 28, 1905.

SEE Eng. Pat. 24,218 of 1901; this J., 1902, 461.—T. F. B.

FRENCH PATENTS.

Agglomeration [Briquetting] of Anthracite Dust; Process for the ——. A. Exbrayat. Fr. Pat. 350,258, Oct. 25, 1904.

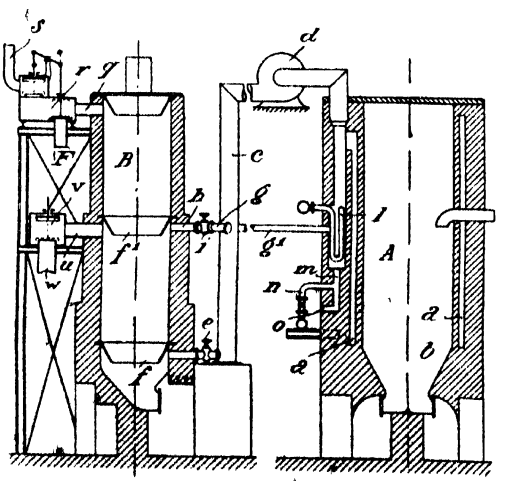
SEAWEEDS (fucus) or lichens are treated with hot or cold water, either with or without the addition of an alkali, and the gelatinous mass obtained is mixed and heated with resin. The product is then mixed with anthracite dust and briquetted.—W. H. C.

Agglutinant and Combustible Agglomerant; Process for the Manufacture of a New —— and Briquettes formed with such Agglutinant. R. A. Le Maitre, J. A. Badjou, and M. V. F. Bekaert. Fr. Pat. 356,961, Aug. 18, 1905. Under Int. Conv., May 2, 1905.

THE products resulting from the action of a mixture of nitric and sulphuric, or of nitric and hydrochloric acids on organic bodies of animal origin, such as blood, fæces, suint, cholesterol, crude lanoline, products from the treatment of waste water from wool washing, &c., are caused to act, in the presence of a "condensing agent" such as baryta, caustic lime or sodium hydroxide, zinc or aluminium chloride—on heavy hydrocarbons, or the residues of the distillation of such bodies. For instance, 100 parts of suint are treated with 2 parts of a mixture of 2/5 sulphuric and 3/5 nitric acid, and the reaction is stopped by the addition of an alkaline solution when red vapours of the oxides of nitrogen begin to be evolved. The product is dried and heated in an autoclave with 1000 parts of heavy mineral oil and 10 parts of baryta until resinification of the mass takes place. The resulting product is mixed with powdered coal, coke, charcoal, &c., to form briquettes, or it may be moulded and used as an agglomerant for other purposes. Claim is also made for the preliminary heating of coal dust in a reducing atmosphere and for the use of wood charcoal saturated with combustible gases to form briquettes.—W. H. C.

Peat and other Similar Combustible Matters, Rich in Water; Process and Kiln for the Semi-Carbonisation of ——. Oberbayerische Kokswerke und Fabrik Chem. Prod. Akt.-Ges. Fr. Pat. 357,174, Aug. 24, 1905.

THE peat is charged into the kiln B, provided with the



funnels *f* and f^1, to better distribute the gases introduced by the pipes *h* and *e*. In the upper part of the kiln B, the peat is treated either with gaseous and smoke products aspirated by the fan *d* from the flues *a* of the retort furnace A, and delivered by the pipes *c*, *g*, the valve *i* and the pipe *h*, just below the funnel f^1; or through g^1 with steam, superheated in the coil *l*, in the auxiliary furnace *m*, fed with gas by the pipe *n* and with air through *o*. The steam and other products escape by the pipe *q*, to the valve-box *r*, from which they either escape by *s*, or pass to a condenser. In the lower part of B, the peat which has been dehydrated in the upper portion of the kiln, is treated with the smoke-gases from A, which are brought by the pipe c and the valve *e*, below the funnel *f*. The peat is semi-coked, and the products given off in the lower part of B, escape by the pipe *u* and the valve *v*, either to the air, or to a condenser through *w*.—W. H. C.

Furnace; Rotary —— for the Production of Gas, or for Roasting [Ores, &c.]. S. E. Sieurin. Fr. Pat. 356,615, Aug. 3, 1905.

THE furnace consists of an inclined cylinder that can be rotated, and is provided with a number of separating partitions, arranged transversely to its axis. The separate compartments thus formed communicate with one another through apertures in the partitions. By this means the passage of the materials through the furnace is prolonged, and the gases are forced to pass through and not only over the materials, the reaction zone being thus increased, whilst the continuous mixing of the materials ensures more complete treatment. The materials are fed into a hopper forming part of a casing which is fixed gas-tight upon the upper end of the cylinder, and the ash passes out into a casing fixed gas-tight at the lower end and falls into a water chamber. Air is forced into the casing at the lower end, and gas escapes from the upper casing.—W.C.H.

Gas-Retorts; Furnace for Vertical ——. J. Bueb. Fr. Pat. 356,974, Aug. 18, 1905.

THE retort furnace comprises a gas generator, recuperators for heating the air for combustion, and a series of vertical retorts placed one behind the other, in one or more rows. The burning gases enter the retort chamber horizontally at the bottom, and are caused to pursue a zig-zag upward course round the retorts, by means of horizontal baffles in which the retorts are set, and by means of dampers or the like the retorts can be heated in each zone proportionately to their cross-section. The furnace is designed particularly for vertical retorts the diameter of which gradually decreases towards the top (see Fr. Pat. 339,534, ; this J., 1904, 709).—H. B.

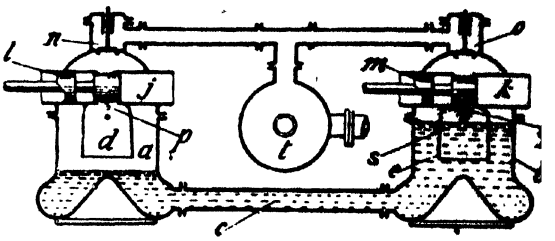
Gas and Air; Process for Accelerating the Combustion of Mixtures of ——. Gas-Motoren Fabrik Deutz. Fr. Pat. 356,599, Aug. 2, 1905. Under Int. Conv., Aug. 5, 1904.

THE process described for accelerating the combustion of mixtures of gas and air, and rendering the combustion as rapid as possible, and consists in bringing two currents of gaseous mixtures separately to the point of combustion; one of the two currents is composed of a quantity of air insufficient for combustion of the gas with which it is mixed, and the other of a quantity of gas insufficient for combustion of the air with which it is mixed. The actual combustion takes place in a combustion chamber to which these gaseous mixtures are brought by two separate pipes, controlled by valves. The requisite mixtures are obtained in the parts of the pipes on the sides of the valves away from the chamber; and the mixture is effected by connecting the air-supply pipe by a small off-take pipe, controlled by a valve, with the gas-supply pipe and by a similar arrangement allowing a small amount of gas to pass into the air-supply pipe. Thus two separate mixtures, in any desired ratio, can be obtained separately and brought to the combustion chamber.—W. C. H.

Carburetter applicable to Fixed or Movable Motors, working with Tar Oils, Petroleum or Mixtures of these Bodies. A. Canera di Salasco and E. Manassero. Fr. Pat. 356,603, Aug. 2, 1905.

THE principle on which the apparatus acts, is that a current of air, divided into very fine streams and driven at a high speed, encounters over a large surface, a very small volume of oil or other liquid. The essential components of the apparatus are a float, together with a spherical plug and arrangements for producing the very fine division of the liquid and its intimate mixture with the air to be carburetted. When connected with the reservoir, the carburetting liquid raises the plug and then the float and escapes up a vertical pipe, through a fine nozzle, and the float then sinks and the plug closes the entrance for the liquid. The aspirating stroke of the piston at the same time causes air to enter through a number of fine holes, and this air is simultaneously mixed with the fine jet of carburetting liquid.—W. C. H.

Compressed Gas; Method of Producing —— for use as Motive Force. A. P. Elten. Fr. Pat. 356,949, Aug. 16, 1905. Under Int. Conv., Aug. 17, 1904.



Two similar explosion cylinders communicate with each other by means of the pipe *c*, and are charged with water or other suitable liquid; they also communicate with a receiver *t*, for the compressed gas. The accompanying figure shows the state of affairs at the beginning of the cycle of operations; the air in *a*, and in the bell-shaped chamber *d* is under atmospheric pressure, the slide-valve *l* closes the openings into the tube *j*, and the valve *n* is kept closed by the compressed gas in *t*, whilst the air in *b* and *e* is under compression. Combustible gas is now injected into *e* at *q*, ignition of the charge takes place at *s*, and the gaseous products of the explosion, raising the valve *o*, are discharged into receiver *t*, whilst giving at the same moment an impulse to the water that drives it partly into *a* and *d*, compressing the air therein. The water thus acts as a piston. As the water continues to fall in *b* and *e*, air is drawn in at the top of *e*, the slide-valve *m* having moved in tube *k* so as to open communication with the atmosphere. When the water has reached its lowest level in *b*, the state of affairs is the same as it was in *a* at the outset; combustible gas is now injected into *d* at *p*, exploded, the gas collected in *t*, and the water-piston given an impulse towards *b*—and so on.—H. B.

Gas-Washing Apparatus. Comp. pour la Fabrication des Compteurs et Matérial d'Usines à Gaz. Fr. Pat., 356,721, Aug. 7, 1905.

THE object of the invention is to produce a gas washer with a larger surface of material unattackable both by the gas and the liquid, and to give automatically to both fluids a methodical impulse, or to allow their displacement in the same sense. In the simplest form suggested, the apparatus consists of a gas channel in which a cylinder just fits transversely, and rotates on its axis. The channel is half filled with liquid and half with gas. The cylinder is filled with inert material designed to give a large surface of contact. The rotation of the cylinder, through which the liquid flows, causes a depression on one side and a corresponding elevation on the other, and the upper half of the cylinder presents a large surface of contact between the two fluids.—W. C. H.

Naphthalene from Coal Gas; Apparatus, called "Naphthalene Trap," for Removing ——. Comp. Parisienne d'Eclairage et de Chauffage par le Gaz. Fr. Pat. 357,045, Aug. 7, 1905.

THE "naphthalene trap," which is inserted into the gas main, consists of a casing, containing one or more baffles

over which the gas flows. Each baffle is formed of a sort of grill, the closely-set bars of which consist of metallic tubes of small diameter (8 mm.), through which cold water or air can be circulated continuously. A thin metal plate, having a large number of slots, is fixed against the grill and, cooled by conduction, presenting a large cooled surface, upon which the naphthalene is precipitated. When the naphthalene has accumulated sufficiently to obstruct appreciably the flow of the gas, the latter is by-passed, and steam is circulated through the tubes of the grill, whereby the naphthalene is liquefied and flows through a siphon to the exterior of the trap. The trap is then allowed to cool, and the passing of the impure gas is resumed.—H. B.

Incandescent Filaments; Manufacture of ——. A. Frankfurter and H. Kuhlmann. Fr. Pat. 356,999, Aug. 17, 1905.

Electric-lamp filaments, electrodes, anodes for Röntgen apparatus, &c., are made from graphite which has been "purified chemically," the graphite being moulded, in a dry state, into the desired form under "high pressure." —H. B.

Incandescent Lighting; Process of Extracting a Metal for Making Mantles for ——. M. Danziger, W. Kronheim, R. Hochhauser, H. Eisler and H. Reeser. Fr. Pat. 357,077, Aug. 21, 1905.

See Eng. Pat. 16,018 of 1905; this J., 1905, 1218.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum Production of Canada. U.S. Geological Survey, through Board of Trade J., Dec. 28, 1905.

In 1904, the new Leamington oil field produced 25,241 barrels of petroleum, which was an increase of about 24,000 barrels over that of 1903. This field is situated near the former natural gasfield in the south-eastern portion of Essex County. The Moore field, situated in Moore Township, Lambton County, is noted for the first time with a production of nearly 37,000 barrels. A well producing twelve barrels of petroleum per day was drilled in Southern Alberta, near South Kootenay Pass. There are numerous natural developments of petroleum and natural gas on the eastern flank of the Rocky Mountains, extending from the United States line to the Arctic Ocean, which in the future will, in all probability, produce large quantities of petroleum.

There were several new wells drilled in the New Brunswick field that were productive of petroleum suitable for lubricating purposes. For the past three years there have been active operations in New Brunswick, near Memramcook, a few miles south of Moncton. There are two fields now being worked, four or five miles apart, known as the Dover and St. Joseph's College. During 1904 there were from 18 to 25 wells pumped in each of the fields, most of the production being from thirty wells, and amounting to about 50 barrels per day. There are two varieties of petroleum produced, one quite black, and the other dark green. The specific gravity is nearly the same, from 35° to 37° B. The construction of a refinery has been commenced. [T. R.]

Petroleum; Reduction of Egyptian Import Duty on ——. Board of Trade J., *Dec.* 14, 1905.

The Egyptian "Journal Officiel," of Nov. 25, contains the text of a decree, which is already in force, reducing the import duty on petroleum from 8 per cent. to 4 per cent. *ad valorem*. [T. R.]

English Patents.

Coke Ovens; Impts. in ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 25,527, Nov. 23, 1904.

The coke oven is provided with vertical combustion-flues, having the gas and air supply from below; the masonry at the top of the flues, which fixes them relatively to each other, is provided with slide-controlled passages through which the hot gases pass into an upper horizontal channel, that leads them to the chimney. —H. B.

Paraffin Wax; Apparatus for Treating ——. N. M. Henderson, Broxburn, N.B. Eng. Pat. 7630, April 11, 1905.

The invention relates to the process described in Eng. Pat. 11,979 of 1891 (this J., 1892, 599). The cells are very high in proportion to their sectional area, and are provided with a vertical draining screen of wire gauze or the like, and with a false bottom of like material, underneath which is a discharge. If the cells are cylindrical, the wire gauze screen is arranged upon a central cylindrical partition. The cells are arranged in pairs in a "sweating" house, the sides fitted with the draining screens being adjacent to each other and separated by a smaller space than the other sides. The draining is effected by the pressure of the superincumbent column of wax, the screens acting as draining wicks, and the solidification of the wax taking place first at the "unscrewed" ("unscreened" in the prov. specif.) surface of the cells.—C. S.

Hydrocarbons such as Petroleum and Benzine; Solidification of ——. W. van der Heyden, Paris. Eng. Pat. 19,540, Sept. 27, 1905. Under Int. Conv., Oct. 26, 1904.

See Addition of Oct. 26, 1904, to Fr. Pat. 346,860 of 1904; this J., 1905, 326.—T. F. B.

United States Patents.

Wood; Apparatus for Treating Resinous —— [*to Extract the Resins, &c.*]. E. B. Weed, Cleveland, Assignor to Weed Distilling and Manufacturing Co., New York. U.S. Pat. 805,174, Nov. 21, 1905.

The apparatus consists of a retort or still for holding the wood to be treated, a boiler heated by a furnace, to contain the preserving and distilling liquid, a pipe, supplied with a pump and valve, connecting the boiler with the retort, and a second valved coiled pipe, passing through a heating apparatus, connecting the pump with the still, so that hot or cold liquid can be supplied to the still as desired; another valved pipe forms a connection between the portions of the inlet pipe on either side of the pump, so that, by suitably adjusting the valves, the liquid can be returned from the still to the boiler without reversing the pump.—T. F. B.

Vaseline; Process for the Preparation of Water Soluble ——. F. Boleg, Cannstatt, Assignor to Ges. zur Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe, Berlin. U.S. Pat. 805,443, Nov. 28, 1905.

See Fr. Pat. 338,640 of 1903; this J., 1904, 655.—T. F. B.

French Patents.

Stones containing Combustible Matter from Mines; Process for Rendering —— *Applicable as Filling Material.* H. Koppers. Fr. Pat. 356,578, Aug. 1, 1905.

The stones containing carbonaceous matter from the sorting and washing of coal, as well as the shale which accompanies coal in the mine, are first distilled in vertical ovens to obtain residual products and gas. The residue is then charged hot into a producer, the gas from which may be used to effect the first treatment. In this way the water and volatile matters are first distilled off, leaving a hot residue which is free from moisture, and which is easily gasified in the producer, the heat stored up in the residue serving to ensure regular and constant work. The yield of residuals, especially ammonia, is said to be high, and the burnt residue from the producer forms good material for filling up the abandoned workings in the mine, as it is free from pyrites and carbonaceous matter. —W. H. C.

Ammonia; Extraction of —— from Gaseous Products of Destructive Distillation. Soc. F. Brunck. Fr. Pat. 356,589, Aug. 1, 1905.

Gases produced by the destructive distillation of coal, wood, peat, &c., are subjected, before being led into an acid for absorption of the ammonia, to centrifugal action, in order to free them from tarry matters. (Compare Eng. Pat. 8287 of 1903; U.S. Pat. 773,784 of 1904; and First Addition to Fr. Pat. 331,077 of 1903; this J., 1903, 795; 1904, 1147; and 1905, 432.)—E. S.

Hydrocarbons [Petroleum, Tar Products, &c.]; Separation of Carbon from ——. H. Koppers. Fr. Pat. 356,351, July 24 1905.

When a spray of liquid hydrocarbon, such as petroleum or a tar product, is introduced into a heated atmosphere of carbon dioxide or a mixture containing it (*e.g.*, furnace gases), carbon is separated from the hydrocarbon, carbon monoxide and water being formed at the same time. The form of carbon produced, depends on the conditions of the reaction; thus, at low temperatures and with an excess of hydrocarbon, the carbon is obtained in the form of soot, whilst at higher temperatures, and especially in presence of "fixed carbon," or inorganic matter such as clay, the carbon tends to separate as graphite. The reaction may be applied to the coating of coke with a deposit of finely divided carbon, by allowing the substances to react in presence of a mass of incandescent coke; this is stated to considerably increase the calorific power of the coke, by diminishing the surface, and is of value in metallurgical processes, preventing premature reactions between the gases and the coke.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

p-Diaminodiphenylamine; New Method of Formation of ——. P. Barbier and P. Sisley. Bull. Soc. Chim., 1905, **33**, 1232—1234.

The authors find that *p*-aminophenylphenylhydrazine can be converted into *p-p*-diaminodiphenylamine, according to the equation:—$C_6H_5.NH.NH.C_6H_4.NH_2 = NH_2.C_6H_4.NH.C_6H_4NH_2$. 23·5 grms. of finely powdered *p*-aminoazobenzene hydrochloride were treated with 350—400 c.c. of a saturated aqueous solution of sulphurous acid and 15 grms. of 65 per cent. zinc dust were added, with stirring, until the liquid was decolorised. It was then poured into a mixture of 50 grms. of sulphuric acid with 50 c.c. of water, and allowed to stand over night. The sulphate of *p*-diaminodiphenylamine separated out in the form of grey crystals, which yielded the base on boiling with a slight excess of sodium carbonate solution. The aminoazo-derivative of *o*-toluidine, when treated in the same manner, yielded a *p*-diamino-base which the authors conclude, from its mode of preparation and reactions, to be *p*-diaminoditolylamine.—E. F.

English Patents.

Dyestuffs; Manufacture of New Compounds of the Anthracene Series and of —— therefrom. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3819, Feb. 23. 1905.

See Addition of Feb. 22, 1905, to Fr. Pat. 349,531 of 1904; this J., 1905, 964.—T. F. B.

Colouring Matter [Dyestuff] of the Anthracene Series; Manufacture of—— and Treatment and Employment thereof for Dyeing and Printing. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine. Germany. Eng. Pat. 10,677, May 22, 1905.

See Fr. Pat. 355,100 of 1905; this J., 1905, 1223.—T.F.B.

Dyestuffs; Manufacture of Anthracene Derivatives and of —— therefrom. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,132, Sept. 21, 1905.

See Fr. Pat. 357,138 of 1905; following these.—T. F. B.

Anthracene Derivatives; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat., 19,199, Sept. 22, 1905. Under Int. Conv., Jan. 3, 1905.

See Fr. Pat. 357,138 of 1905; following these.—T. F. B.

Dyestuffs; Manufacture of New Sulphurised [Sulphide] ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 10,101, May 13, 1905.

See Fr. Pat. 354,307 of 1905; this J., 1905, 1105.—T. F. B.

Anthraquinone Derivatives; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,196, May 29, 1905.

See Fr. Pat. 354,717 of 1905; this J., 1905, 1105.—T.F.B.

Anthracene Derivative [Anthracene Dyestuff]; Manufacture of a New ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,757, June 20, 1905.

See U.S. Pat. 775,369 of 1904; this J., 1904, 1210.—T. F. B.

United States Patents.

Dyestuff and Process of Making Same; Cyanine ——. E. König, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 805,143, Nov. 21, 1905.

A mixture of two quinolinium salts, one of which contains a methyl group in the *a*-position in the pyridine nucleus, and one an alkyl group substituted in the benzene nucleus in the 5-position, is heated with an alkali in a suitable solvent. The resulting cyanine dyestuffs are soluble in hot water, alcohol and chloroform, and insoluble in benzene, ether, and petroleum spirit. The aqueous solutions, which are reddish-violet, are decolorised on adding a mineral acid, the colour returning on addition of alkali.—T. F. B.

Diaminoformyldiphenylamine and Process of Making same. O. Sohst, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on Maine, Germany. U.S. Pat. 805,890, Nov. 28, 1905.

See Eng. Pat. 543 of 1903; this J., 1903, 1343.—T.F.B.

Dyestuff; Monoazo —— and Process of Making same. T. Kroeber, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 805,918, Nov. 28, 1905.

See Fr. Pat. 351,125 of 1905; this J., 1905, 840.—T.F.B.

Dyestuff; Blue Azo —— and Process of Making Same. T. Kroeber, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 806,415, Dec. 5, 1905.

See Addition of May 10, 1905, to Fr. Pat. 351,125 of 1905; this J., 1905, 1168.—T. F. B.

Dyestuff; Brown Azo —— and Process of Making same. T. Kroeber, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 807,289, Dec. 12, 1905.

See Eng. Pat. 25,901 of 1904; this J., 1905, 919.—T.F.B.

Dyestuff; Naphthalene —— and Process of Making same. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 806,053, Nov. 28, 1905.

See Eng. Pat. 9547 of 1905; this J., 1905, 725.—T.F.B.

Colouring Matter [Dyestuff]; Azo ——. E. Fussenegger, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 806,077, Nov. 28, 1905.

See Eng. Pat. 11,205 of 1905; this J., 1905, 840.—T.F.B.

Dyes and Process of Making same; Yellow-Green and Green [Oxazine] ——. C. Oswald, H. Lorétan and C. de la Harpe, Assignors to Dyeworks formerly L. Durand, Huguenin et Cie., Basle, Switzerland. U.S. Pats. 807,181 and 807,182, Dec. 12, 1905.

See Eng. Pat. 3497 of 1905; this J., 1905, 494.—T.F.B.

FRENCH PATENTS.

Dyestuffs; Production of New Nitroalphylacidylaminonaphtholsulphonic Acids. Nitroalphylaminoacidylaminonaphtholsulphonic Acids, Aminoalphylacidylaminonaphtholsulphonic Acids or Aminoalphylaminoacidylaminonaphtholsulphonic Acids and of New Azo —— derived therefrom. Société pour l'Ind. Chim. à Bâle. Second Addition, dated May 29, 1905, to Fr. Pat. 321,640, May 31, 1902 (this J., 1903, 210; see also Eng. Pat. 13,778 of 1902; this J., 1902, 1374).

THE process of the main patent is altered by condensing 1.2-diaminonaphtholsulphonic acids, instead of aminonaphtholsulphonic acids, with nitroalphyl acid chlorides. The substances obtained have the general formula $(NH_2)(NH.CO.R.NO_2)C_{10}H_{5-n}(OH)(SO_3H)_n$, and on reduction are converted into the corresponding aminoalphylacidyldiaminonaphtholsulphonic acids. These substances, like other acidyl-*o*-diamines have a strong tendency to separate a molecule of water, and they are isolated in the form of an inner anhydride.

The new dyestuffs claimed, are prepared (1) by combining these anhydrides with diazo- or tetrazo-bodies; (2) by further diazotising the dyestuffs so produced and combining them with amines or phenols either in substance or on the fibre; (3) by diazotising the anhydrides or the hydrated bases and combining them with amines or phenols, and then combining the monoazo dyestuffs thus obtained, with diazo- or tetrazo-bodies. The following examples are given:—(1) Anhydro-*m*-aminobenzoyl-1.2-diamino-5-hydroxynaphthalene-7-sulphonic acid is prepared by reducing the condensation product of 1.2-diamino-5-hydroxynaphthalene-7-sulphonic acid and *m*-nitrobenzoyl chloride. (2) This substance is combined with diazotised *m*-xylidine in a solution made alkaline with sodium carbonate. The reaction product is stated to dye unmordanted cotton in "blue" shades and to yield a bright scarlet of great fastness to washing after diazotisation and development on the fibre with β-naphthol. (3) Anhydro-*p*-aminobenzoyl-1.2-diamino-5-hydroxynaphthalenesulphonic acid is combined in alkaline solution with diazotised *p*-aminoacetanilide, and yields a bluish-red direct dyestuff, which may be diazotised and developed on the fibre to a bluish scarlet said to possess great fastness to washing. Other diazo-bodies may be employed, such as those of aniline, *o*-and-*p*-toluidine, *p*-xylidine, *m*-phenyleneoxamic acid, α- and β-naphthylamine, dehydrothiotoluidine, &c., or tetrazo-bodies, such as tetrazotised paradiamines, diaminoazoxybenzene, diaminoazobenzene, diaminophenylurea, &c. Other sulphonic acids of 1.2-diaminonaphthol, such as 1.2-diamino-5-hydroxynaphthalene-3.7-disulphonic acid, and also other nitro-alphylacidyl chlorides may be used for preparing the condensation products, such as *o*- and *p*-nitrobenzoyl chloride, and methyl, halogen, or alkyloxy derivatives of the nitrobenzoyl chlorides. Instead of the nitroalphyl acid chlorides the corresponding acetaminoalphyl acid chlorides may be employed, and in this case the condensation products are hydrolysed with dilute mineral acids to obtain the required amino bodies or their anhydrides.—H. L.

Anthracene Derivatives and Dyestuffs [Anthracene Dyestuffs]; Production of a Series of New —— and their Application in Dyeing and Printing. Badische Anilin und Soda Fabrik. Fifth Addition, dated June 22, 1905, to Fr. Pat. 349,531, Dec. 21, 1904. (See this J., 1905, 192, 726, 840, 841, 1010.) Under Int. Conv., Feb. 2, 1905.

IN addition to the substances already claimed, the homologues of the hydroxyanthraquinones, naphthanthraquinones and their reduction products and those of α-aminoanthraquinone may be condensed with glycerol or one of its anhydrides or esters or compound esters.

—H. L.

Anthracene Derivatives and Dyestuffs [Anthracene Dyestuffs]; Production of a Series of New —— and their Application in Dyeing and Printing. Badische Anilin und Soda Fabr. Sixth Addition, dated June 22, 1905, to Fr. Pat. 349,531 of Dec. 21, 1904. (See preceding abstract.) Under Int. Conv., April 14, 1905.

BENZANTHRONES are converted into new "vat" dyestuffs for cotton by the action of alkali. Thus 10 kilos. of α-benzanthronequinoleïne (prepared from α-aminoanthraquinone) are mixed with 50 kilos. of caustic potash and 40 kilos. of absolute alcohol at 160° C., and gradually heated to 220°—230° C. with good stirring. After purification a new product is obtained, which dyes cotton from a hydrosulphite vat in blue shades of great fastness.

—H. L.

Indigo; Production of Leuco Derivatives of ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler. Fr. Pat. 356,569, July 31, 1905. Under Int. Conv., Aug. 13, 1904.

A METHOD of producing leuco-derivatives of indigo by melting certain benzene derivatives, such as phenylglycine, with an alkali amide in presence of alkali hydroxide is already known. According to the present invention the alkali amide is partially or entirely replaced by alkali metal and relatively small amounts of alkali amide or ammonia. The ammonia forms alkali amide, this reacts with the benzene derivative, re-forming ammonia, and the cycle of reactions is repeated indefinitely. The necessary ammonia may be produced by initially adding to the melt some compound, such as urea, which decomposes and yields ammonia under the conditions present in the melt. The most satisfactory method of carrying out the reaction is to pass gaseous ammonia into a melt containing an alkali metal, alkali hydroxide, and a suitable benzene derivative. For example, 1000 grms. of a mixture of sodium and potassium hydroxides are melted in a closed vessel provided with a stirrer; after expelling the air by means of a current of gaseous ammonia, which is passed through the melt, 120 grms. of sodium are added, followed by 425 grms. of the potassium salt of phenylglycine in small quantities. During these operations a slow current of ammonia is maintained. The addition of the phenylglycine takes about 45 minutes. After it is all added the melt is still heated for a short time, in a gentle current of ammonia, until the reaction is completed. The most suitable temperature is 200° C., and about 20 litres of ammonia are introduced altogether. Prolonged contact of the final product with excess of alkali amide is disadvantageous.—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Wool, Goat Hair, and Camel Hair; Sorting, Willying, Washing, Combing and Carding ——. Statutory Rules and Orders, 1905, No. 1293.

A PAMPHLET of regulations, dated Dec. 12, 1905, has been issued by the Secretary of State, relating to processes of sorting, willying, washing, combing and carding wool, goat hair and camel's hair and processes incidental thereto. The regulations came into effect on Jan. 1, 1906. [T.R.]

Wool Rugs; Dyeing and Dressing of ——. J. W. Lamb. J. Soc. Dyers and Col., 1905, 21, 322—326.

Preparation of the Skins.—The skins are first sorted and cleansed from paint or tar marks with turpentine or naphtha.

Soaking and Washing.—After "trimming," the skins are "fleshed" over the beam, and then washed in water to remove blood and dirt. To prevent putrefaction, a little antiseptic should be added to the wash waters. Thorns, &c., are removed by the "burring" machine.

Scouring.—The skins are well scoured by hand, on both sides, with a strong solution of soft soap to which either sodium carbonate or ammonium carbonate is sometimes added. They are then rinsed in tepid water and the scouring repeated if necessary, the skins being finally hydro-extracted.

Leathering.—A mixture of aluminium sulphate or potash alum with common salt, is rubbed into the flesh side until the skin is fairly dry; after leaving over night the process is repeated. In some cases a tepid solution of

alum and salt is painted on. Basic aluminium sulphate gives a tannage which is faster to water.

Bleaching.—For black rugs this is unnecessary, but for light colours the skins are bleached either in a sulphur stove or by means of hydrogen peroxide or potassium permanganate. This is done in a similar manner to the bleaching of ordinary wool, except that a low temperature (not above 40° C.) must be employed. If the skins are to remain white they are well scoured, washed, drained, hydro-extracted, re-tanned if necessary, and degreased by covering the flesh side with a thick paste of whitening and water and drying in a warm room. The whitening absorbs grease. Skins which are to be dyed are usually "chlored" by soaking in a weak solution of bleaching powder and then in dilute sulphuric acid.

Dyeing.—Alum-tanned leather will not stand a temperature above 40°—45° C. without injury, so dyestuffs must be chosen which will dye readily at this temperature. The basic colours are largely used, the dye-bath being heated to 40°—45° C. and a little acetic acid added. The fastness of the colour to rubbing is increased by passing through a solution of some tannin material, such as sumach. By soaking in a tannin solution and then in one of potassium titanium oxalate a good yellowish-brown is obtained. The acid colours are dyed with the addition of a little sulphuric or formic acid. The dyed skins are washed and re-tanned if necessary. To give the wool a gloss, the skins are passed through a hot fat emulsion such as an emulsion of olive oil in soap solution. The skins are dried, softened, combed and beaten, when they are finished. There is at present no satisfactory method of dyeing black on skins with coal-tar dyestuffs and use is always made of logwood. The chief methods used are the "one solution" and the "two solution" methods. For the "one solution" method, 100 lb. of logwood extract, 18 lb. of fustic, and 10 lb. of verdigris are dissolved in 400 galls. of water. The bath is heated to 40° C., the skins entered and soaked for three to four hours, then 3 galls. of acetate of iron are added and the goods are left in until black, which usually requires thirty to forty hours. The above quantities are enough for 5 doz. good-sized skins. In the "two solution" method the goods are soaked first in a solution of logwood and fustic and then in a solution of bichrome, both operations being repeated if necessary. After dyeing black the skins are allowed to oxidise as long as convenient, washed in warm water and scoured with soft soap to give them a gloss; they are again washed and hung up for two to three hours to oxidise, and finally finished like the coloured skins.

The scouring and oxidising processes are of great importance in obtaining a good black.—A. B. S

English Patents.

Wool and other Filamentous Materials; Apparatus for Washing ——. P. Bastin, Roubaix, France. Eng. Pat. 4371, March 2, 1905. Under Int. Conv., Nov. 28, 1904.

See Fr. Pat. 349,243 of 1904; this J., 1905, 671.—T. F. B.

Fibres; Treating Vegetable ——, *chiefly Cotton, Raw or Manufactured, to Render them less Inflammable.* The Calico Printers' Association, Ltd., Manchester, and W. Warr, Staleybridge, Lancs. Eng. Pat. 25,166, Nov. 19, 1904.

Vegetable fibres or fabrics are rendered less inflammable by immersing them in a solution (about 22° T.) of a magnesium salt, preferably the sulphate, and then in a solution of caustic soda of about the same strength, to precipitate magnesium hydroxide in the fibres; the treatment may be repeated twice or more if desired.—T. F. B.

Fibres; Treating Vegetable ——, *chiefly Cotton, Raw or Manufactured, to Render them less Inflammable.* The Calico Printers' Association, Ltd., Manchester, and W. Warr, Staleybridge, Lancs. Eng. Pat. 25,167, Nov. 19, 1904.

An insoluble magnesium salt, other than the hydroxide (see preceding abstract), is precipitated in vegetable fibres or fabrics to render them less inflammable; the fabrics are first impregnated with a solution of magnesium sulphate, and then treated with the second component to precipitate the insoluble compound, *e.g.*, sodium silicate or phosphate may be used.—T. F. B.

Dyeing and Printing [*with Benzanthrone Dyestuffs*]; *Impts. in* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 29,501, Dec. 31, 1904.

To apply in dyeing the dyestuffs of the benzanthrone group, described in Eng. Pats. 16,538 of 1904, and 853, 3819, and 7022 of 1905 (this J., 1905, 494, 541, 669, 726, 796, 1010 and 1167), a vat is prepared by reducing the dyestuffs, in the presence of alkali, with sodium hydrosulphite. In this the textile materials to be dyed are immersed for about three-quarters of an hour, at a temperature varying, according to the dyestuff employed, from 60° to 90° C. They are afterwards washed, dried, treated with acid, and again washed. Cotton tissues, &c., are thus dyed by the dyestuff, prepared from the condensation product of β-aminoanthraquinone and glycerol, in dark violet-blue shades, which, it is stated, are of excellent fastness to light, washing and chlorine. For printing with the dyestuffs of this group, two methods are available:—(1) A thickened alkaline mixture of a benzanthrone dyestuff, stannous hydroxide or a hydrosulphite or other reducing agent, and glycerin, is applied to the textile materials, which are thereupon dried, steamed for five to ten minutes in an atmosphere as free as possible from air, rinsed in water, and washed in a bath of sodium carbonate. (2) The (cotton or linen) tissues, &c., are printed with a thickened mixture of the dyestuff, ferrous sulphate and stannous chloride, dried and passed for about a minute into a bath of caustic soda-lye (containing 10—12 per cent. of sodium hydroxide), heated at 65°—75° C. The tissues, &c., are then washed with water, treated with an acid to remove the iron oxide, and again washed. To prevent the unprinted parts from becoming stained, a little manganese dioxide may be added to the caustic soda bath. (See also this J., 1905, 192.)—E. B.

Carpets; Improved Machine for Washing or Dyeing ——. G. Kolling, Klein-Tschansch, Germany. Eng. Pat. 17,960, Sept. 5, 1905.

Carpets, more particularly those of large dimensions, which are to be washed or dyed, are drawn between a rotary brush-roller and a trough-shaped supporting-table, soap- or dye-liquor being forced into them as they pass along the table, from a perforated pipe mounted in front of the brush. They are thus saturated with the liquor applied to them before they enter the trough, where they are operated upon by the brush, which is revolved in a direction opposite to that in which they are moving, while they are immersed in the liquor which collects in the trough. They are finally passed between squeezing-rollers.—E. B.

Formaldehyde Sulphoxylate [*Discharging Agent*]; *Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 21,538, Oct. 23, 1905.

Formaldehyde sulphoxylate salts are obtained by the following methods, in addition to those already described (this J., 1901, 247; 1904, 369 and 900; 1905, 132, 329 and 330):—(1) Normal zinc sulphite is acted upon, in boiling aqueous solution, with zinc dust and formaldehyde. The difficultly soluble, basic zinc sulphoxylate salt obtained may be converted, in the usual manner, into sodium formaldehyde sulphoxylate. (2) Ammonium sulphite is treated, in aqueous solution, at a temperature of 95°—100° C., with zinc dust and formaldehyde. Ammonia is evolved and zinc formaldehyde sulphoxylate is produced. (See also this J., 1905, 727 and 1300.)—E. B.

United States Patent.

Silk; Process of Bleaching Artificial ——. C. A. Ernst, Lansdowne, Pa., Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 805,456, Nov. 28, 1905.

Filaments of viscose "or similar material" are bleached

FRENCH PATENTS.

Dyestuffs; Production of New Nitroalphylacidylaminonaphtholsulphonic Acids. Nitroalphylaminoacidylaminonaphtholsulphonic Acids, Aminoalphylacidylaminonaphtholsulphonic Acids or Aminoalphylaminoacidylaminonaphtholsulphonic Acids and of New Azo —— derived therefrom. Société pour l'Ind. Chim. à Bâle. Second Addition, dated May 29, 1905, to Fr. Pat. 321,640, May 31, 1902 (this J., 1903, 210; see also Eng. Pat. 13,778 of 1902; this J., 1902, 1374).

THE process of the main patent is altered by condensing 1.2-diaminonaphtholsulphonic acids, instead of aminonaphtholsulphonic acids, with nitroalphyl acid chlorides. The substances obtained have the general formula $(NH_2)(NH.CO.R.NO_2)C_{10}H_{5-n}(OH)(SO_3H)_n$, and on reduction are converted into the corresponding aminoalphylacidyldiaminonaphtholsulphonic acids. These substances, like other acidyl-*o*-diamines have a strong tendency to separate a molecule of water, and they are isolated in the form of an inner anhydride.

The new dyestuffs claimed, are prepared (1) by combining these anhydrides with diazo- or tetrazo-bodies; (2) by further diazotising the dyestuffs so produced and combining them with amines or phenols either in substance or on the fibre; (3) by diazotising the anhydrides or the hydrated bases and combining them with amines or phenols, and then combining the monoazo dyestuffs thus obtained, with diazo- or tetrazo-bodies. The following examples are given:—(1) Anhydro-*m*-aminobenzoyl-1.2-diamino-5-hydroxynaphthalene-7-sulphonic acid is prepared by reducing the condensation product of 1.2-diamino-5-hydroxynaphthalene-7-sulphonic acid and *m*-nitrobenzoyl chloride. (2) This substance is combined with diazotised *m*-xylidine in a solution made alkaline with sodium carbonate. The reaction product is stated to dye unmordanted cotton in "blue" shades and to yield a bright scarlet of great fastness to washing after diazotisation and development on the fibre with β-naphthol. (3) Anhydro-*p*-aminobenzoyl-1.2-diamino-5-hydroxynaphthalenesulphonic acid is combined in alkaline solution with diazotised *p*-aminoacetanilide, and yields a bluish-red direct dyestuff, which may be diazotised and developed on the fibre to a bluish scarlet said to possess great fastness to washing. Other diazo-bodies may be employed, such as those of aniline, *o*-and-*p*-toluidine, *p*-xylidine, *m*-phenyleneoxamic acid, α- and β-naphthylamine, dehydrothiotoluidine, &c., or tetrazo-bodies, such as tetrazotised paradiamines, diaminoazoxybenzene, diaminoazobenzene, diaminophenylurea, &c. Other sulphonic acids of 1.2-diaminonaphthol, such as 1.2-diamino-5-hydroxynaphthalene-3.7-disulphonic acid, and also other nitro-alphylacidyl chlorides may be used for preparing the condensation products, such as *o*- and *p*-nitrobenzoyl chloride, and methyl, halogen, or alkyloxy derivatives of the nitrobenzoyl chlorides. Instead of the nitroalphyl acid chlorides the corresponding acetaminoalphyl acid chlorides may be employed, and in this case the condensation products are hydrolysed with dilute mineral acids to obtain the required amino bodies or their anhydrides.—H. L.

Anthracene Derivatives and Dyestuffs [Anthracene Dyestuffs]; Production of a Series of New —— and their Application in Dyeing and Printing. Badische Anilin und Soda Fabrik. Fifth Addition, dated June 22, 1905, to Fr. Pat. 349,531, Dec. 21, 1904. (See this J., 1905, 192, 726, 840, 841, 1010.) Under Int. Conv., Feb. 2, 1905.

IN addition to the substances already claimed, the homologues of the hydroxyanthraquinones, naphthanthraquinones and their reduction products and those of α-aminoanthraquinone may be condensed with glycerol or one of its anhydrides or esters or compound esters.

—H. L.

Anthracene Derivatives and Dyestuffs [Anthracene Dyestuffs]; Production of a Series of New —— and their Application in Dyeing and Printing. Badische Anilin und Soda Fabr. Sixth Addition, dated June 22, 1905, to Fr. Pat. 349,531 of Dec. 21, 1904. (See preceding abstract.) Under Int. Conv., April 14, 1905.

BENZANTHRONES are converted into new "vat" dyestuffs for cotton by the action of alkali. Thus 10 kilos. of α-benzanthronequinoleïne (prepared from α-aminoanthraquinone) are mixed with 50 kilos. of caustic potash and 40 kilos. of absolute alcohol at 160° C., and gradually heated to 220°—230° C. with good stirring. After purification a new product is obtained, which dyes cotton from a hydrosulphite vat in blue shades of great fastness.

—H. L.

Indigo; Production of Leuco Derivatives of ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler. Fr. Pat. 356,569, July 31, 1905. Under Int. Conv., Aug. 13, 1904.

A METHOD of producing leuco-derivatives of indigo by melting certain benzene derivatives, such as phenylglycine, with an alkali amide in presence of alkali hydroxide is already known. According to the present invention the alkali amide is partially or entirely replaced by alkali metal and relatively small amounts of alkali amide or ammonia. The ammonia forms alkali amide, this reacts with the benzene derivative, re-forming ammonia, and the cycle of reactions is repeated indefinitely. The necessary ammonia may be produced by initially adding to the melt some compound, such as urea, which decomposes and yields ammonia under the conditions present in the melt. The most satisfactory method of carrying out the reaction is to pass gaseous ammonia into a melt containing an alkali metal, alkali hydroxide, and a suitable benzene derivative. For example, 1000 grms. of a mixture of sodium and potassium hydroxides are melted in a closed vessel provided with a stirrer; after expelling the air by means of a current of gaseous ammonia, which is passed through the melt, 120 grms. of sodium are added, followed by 425 grms. of the potassium salt of phenylglycine in small quantities. During these operations a slow current of ammonia is maintained. The addition of the phenylglycine takes about 45 minutes. After it is all added the melt is still heated for a short time, in a gentle current of ammonia, until the reaction is completed. The most suitable temperature is 200° C., and about 20 litres of ammonia are introduced altogether. Prolonged contact of the final product with excess of alkali amide is disadvantageous.—E. F.

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Leathering.—A mixture of aluminium sulphate or potash alum with common salt, is rubbed into the flesh side until the skin is fairly dry; after leaving over night the process is repeated. In some cases a tepid solution of

The machine is said to combine large output with small dimensions. The bobbins 1 are each supported on two rollers 2. Three bands of wool, 3, 4 and 5, formed by the unwinding of three sets of bobbins, pass through guides, 6, over the cylinder, 7, again through guides, 8, between cylinders 9 and 10 and then over 11 and into the washing-bath, where they pass over rollers 13 to 17. They are then passed over roller 18 and pressed between rollers 19 and 20 and proceed to the folder. Roller 20 is covered with wool or felt, and is under pressure. Rollers 13, 15 and 17 are furrowed, and the bands of wool pass along the furrows. The various rollers are driven by suitable gearing.—E. F.

Thread on Bobbins; Treatment of —— for Purposes of Dyeing, Bleaching, Washing, Degreasing, Mordanting and Impregnation; Method and Apparatus for ——. H. Giesler. Fr. Pat. 356,371, July 24, 1905. Under Int. Conv., June 10, 1905.

The bobbins are mounted on perforated spindles in the usual manner, but are traversed by the dye-liquor, under the influence of its own pressure only, from the outside to the inside, and away through the perforated spindle. It is claimed that by this means the liquor passes through the material at an exceptionally high rate of speed, and that for this reason, and also because the pressure exerted is very uniform and relatively very small, very uniform dyeings are obtained. From below the spindles the dye-liquor is pumped up to an open reservoir, where it is reheated to the required temperature, and from which it flows back continuously into the dye-vat. There are arrangements for keeping the liquor in the dye-vat at a constant level, which is varied according to the nature of the material to be dyed and the temperature of the vat. Under a pressure of 600 mm. of dye-liquor, when this is kept at the boil, 2½ to 3 litres pass per minute through each bobbin holding 15 grms. of fine wool. In the case of coarse wool a column of 400—600 mm. only is required, in order to work at the same speed. If, on the contrary, extra-fine wool is to be treated (for example, 78,000 m. per kilo.), the column of liquid must be increased to 700 mm. to obtain the same rate of circulation. It is best to dye at 95°—100° C., but if lower temperatures are employed, the rate of circulation of the liquid decreases.—E. F.

Benzene Employed for Cleaning Textiles; Process and Apparatus for Recovery of the ——. E. Delhotel. Third Addition, dated July 5, 1903, to Fr. Pat. 344,848, July 16, 1901 (this J., 1904, 1213; 1905, 130, 1169).

According to the methods and apparatus described in the original patent, the drying oven can be opened and closed for the removal and entry of textiles under treatment without interruption of the process of recovering the benzene. Advantage is taken of this fact, according to the present addition, by the use of a drying oven, subdivided into many compartments, each of which can be opened and closed separately, and can be shut off, meanwhile, from communication with the other compartments. These compartments can be placed in communication in series, by means of pipes, in any desired sequence, so that the air which circulates, and finally returns to the condenser, may first pass over material from which almost all benzene has been removed, and finally over material fully charged with benzene, thus securing greater efficiency. —E. F.

Dye-vat. J. O. Obermaier. Fr. Pat. 356,187, July 17, 1905.

The vat is intended for dyeing raw materials and threads. It is constructed of wood, and is divided into two portions by a vertical partition. Each portion has a perforated false bottom. The spaces below these communicate with a circulating pump by means of a four-way cock. The vat is closed above by a perforated lid, which rests on the top of the vertical partition. The dye-liquor is circulated, by the action of the pump, up through one compartment, down through the other, back to the pump, and so on. By means of the four-way cock the direction of circulation can be reversed. The dye-liquid may be pumped up into a storage tank by means of a separate pipe connected to the pump.—E. F.

Polychrome Printing; Impts. in ——. J. J. Hart. Fr. Pat. 356,153, July 13, 1905. Under Int. Conv., June 10, 1905.

Blocks of coloured composition loose polychrome printing have hitherto been made by mixing wax, fatty materials, soap, gelatin, or a similar substance with an insoluble substance, such as fullers' earth, kaolin, &c., and then adding to the composition so obtained the necessary colouring matter in the form of powder. When treated with solvents in the process of printing it is found that whilst the wax, &c., dissolves, the colouring matter of such blocks remains behind as an insoluble crust, to the detriment of the process. According to the present patent the colouring matter is dissolved in a suitable medium and this solution then mixed with fullers' earth or other insoluble material. The mixture is then slowly dried, and the dry, coloured mass so obtained is intimately mixed with the wax or other soluble ingredient. For example, 5 kilos. of 20 per cent. Alizarin paste are dissolved in 0·5 kilo. of ammonia solution of "880° Twaddell" and 2·5 litres of water, and then mixed with 0·5 kilo. of kaolin, fullers' earth, or some other suitable, insoluble substance. The mixture is filtered, dried, ground and mixed with 1 kilo. of a composition of wax, soap, gum or some other soluble substance. Colours soluble in fatty substances may be dissolved in the wax or other soluble composition, and then mixed directly with the fullers' earth or other insoluble substance. Suitable mordants may also be dissolved in solvents and mixed with the colouring matter in the kaolin or fullers' earth, and the mixture may then be employed for printing fabrics either with or without the help of the mordant ordinarily employed.—E. F.

Designs on Fabrics; Production of ——. C. W. Fulton. Fr. Pat. 356,188, July 17, 1905.

Fabrics consisting of two or more materials are printed, from an ordinary printing roller, with chemicals which destroy one of the materials of the fabric. The chemicals employed may at the same time change the colour or shade of the undestroyed fabric at the points at which they are applied. If the fabric is made of one material only, part of this, for instance, the warp or the weft only, may be previously coated with a substance which resists the action of the chemical employed. If, in such a case, the warp and weft are coloured differently, a two-coloured effect is thus obtained. From fabrics containing wool and cotton the latter may be removed in places by application of aluminium chloride, followed by the application of a dry heat and removal of attacked cotton by friction. Similar results can be obtained in a fabric composed of threads of wool and silk by the help of alkali hydroxide. —E. F.

Drying Chamber; New —— for Sizing, employing a Current of Hot Air. J. Caquelin. Fr. Pat. 356,579, Aug. 1, 1905.

In this apparatus direct heating of the thread which is to be dried, otherwise than by means of a current of hot air, is avoided. The speed of the current of air can be regulated at will by the operator, who can also stop or start it instantaneously. The air is heated by means of hot pipes in a separate chamber from which it enters the drying chamber, which contains a number of vertical partitions open at top and bottom alternately. The hot air and the thread traverse this chamber in opposite directions, the intensity of the air-current being regulated by means of a valve.—E. F.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

English Patent.

Printing on Leather. M. C. Lamb, Blackheath, Kent, and J. D. G. Rennie, London. Eng. Pat. 17,338, Aug. 28, 1905.

A suitable dyestuff or colour base is dissolved in benzene

or oil of turpentine, and the solution thickened with petroleum jelly, &c. The design to be reproduced on leather is painted or printed on paper or calico or other suitable medium by means of the above preparation. When dry, the transfer is laid upon leather, and the whole pressed with hot irons or passed under hot rollers, whereby the design is transferred to the leather.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Iron Carbonyl; Physical and Chemical Properties of —. Sir J. Dewar and H. O. Jones. Roy. Soc. Proc., 1905, **76A**, 558—577.

The authors have prepared iron carbonyl in a pure state as a yellow liquid boiling at 102·7° C. under 764 mm., and have carried out analyses which show it to have the formula $Fe(CO)_5$. It is more stable towards such reagents as the halogens, iodine chloride, &c., than nickel carbonyl, and it is not attacked by hydrochloric acid, hydrobromic acid, a solution of sulphur in carbon bisulphide, nitric oxide, or sulphuretted hydrogen. Nitric and sulphuric acids, however, rapidly attack it, in the latter case the action being more vigorous than with nickel carbonyl. When heated with benzene and aluminium chloride in a sealed tube at 100° C., benzaldehyde and anthracene are produced. In direct sunlight it is slowly transformed into a solid compound having the formula $Fe_2(CO)_9$. This reaction is more complete, and a purer product is obtained, if the iron pentacarbonyl is in solution in absolute ether, in which the resulting compound is sparingly soluble.

Diferro-nona-carbonyl, $Fe_2(CO)_9$, decomposes at 100° C. with formation of iron, carbon monoxide, and iron pentacarbonyl. Under certain circumstances the above reactions can be made reversible. Thus, tubes containing iron carbonyl alone or in solution, may be left exposed to light till separation of solid takes place, and then, if allowed to stand at the ordinary temperature in the dark for some weeks, the solid is found to have disappeared. When a solution of iron carbonyl in nickel carbonyl—which is much paler in colour than a corresponding solution in ether—is allowed to stand in sunlight, no precipitation occurs unless the solution is concentrated, although with a moderately concentrated solution, separation of solid in the vapour space above the liquid takes place. The author shows that this is not due to the absorption of light by the nickel carbonyl, and suggests that an intermediate double compound $FeNi(CO)_9$, which does not separate, is formed.—B. J. S.

Chlorine; Determination of Density of —. F. P. Treadwell and W. A. K. Christie. Z. angew. Chem., 1905, **18**, 1934—1935.

Calculations of the volume of chlorine from its weight are rendered uncertain because there are no trustworthy determinations of the density of chlorine at ordinary temperatures, and chlorine, being at ordinary temperatures a vapour, not a perfect gas, does not follow Boyle's law with accuracy. The authors have made determinations, by weighing against one another two similar bulbs of about 400 c.c. capacity, each provided with two stopcocks for entry and exit of gas. The capacity of these was accurately determined, and the two were counterpoised after being filled with air at ascertained temperature and pressure. One was then filled with chlorine, and the increase of weight determined; the chlorine was then absorbed by freshly-boiled solution of sodium hydroxide, and the remaining air carefully measured. All the data were thus obtained for calculating the density. The densities thus determined were 2·488 at 20° C. and 730 mm., 2·489 at 10° C. and 725 mm., compared in each case with air at the same temperature and pressure. Calculating by Boyle's and Gay Lussac's laws to N.T.P., the volume of 0·003545 grm. of chlorine, equivalent to 1 c.c. of N/10 solution, works out to 1·1021 and 1·1015 c.c. respectively; by which is meant, not that either of these figures is the volume of that weight of chlorine at N.T.P., but that correction of these volumes by Boyle's and Gay Lussac's laws to 20° and 10° C. respectively, and to pressures not greatly differing from 760 mm. will give the true volume of 0·003545 grm. of chlorine at those temperatures and pressures.—J. T. D.

Borax Production of the United States. Mining World, Dec. 2, 1905.

All the output of borax in the United States continues to come from California, and the larger proportion from the extensive colemanite deposits in San Bernardino county. The total production for the year 1904 amounted to 45,647 tons of the crude material, valued at 698,810 dols. Of this amount 38,000 tons, valued at 508,000 dols., came from San Bernardino county, Cal., the remainder coming from Ventura and Inyo counties. In 1903 the returns gave an aggregate production of crude borax amounting to 34,430 short tons, valued at 661,400 dols. The production in 1902 was 14,700 short tons of refined borax, valued at 2,447,614 dols., of which 862 short tons, valued at 150,000 dols., were stated to be boric acid, and 2600 short tons of crude borax, valued at 91,000 dols., a total of 20,004 short tons, valued at 2,538,614 dols. [T.R.]

Nitrate of Soda Statistics. W. Montgomery & Co. Dec. 30, 1905.

Shipments, Consumption, Stocks, and Prices, from 1898 *to* 1905.

									1903.	1904.	1905.
Shipments from South American Ports to all parts for the six months ending 31st Dec								Tons	885,000	898,000	915,000
Ditto do. for the twelve months ending 31st December								,,	1,435,000	1,476,000	1,604,000
Afloat for Europe on 31st December								,,	499,000	510,000	482,000
Stocks in U.K. ports :—											
	1898	1899	1900	1901	1902.	1903	1904.	1905.			
Liverpool Tons	4,500	6,000	10,000	5,000	6,500	4,500	6,000	8,400	23,000	21,000	18,000
London ,,	2,400	1,800	4,000	2,000	3,600	4,100	2,100	1,400			
Out Ports ,,	9,100	22,200	21,000	18,000	15,900	14,400	12,900	8,200			
Stocks in Continental Ports on 31st December								Tons	132,000	141,000	165,000
Consumption in U.K. for the 6 months ending 31st December								,,	33,000	43,000	34,000
Do. in Continent do.				do.				,,	263,000	261,000	269,000
Do in U.K. for the 12 months				do.				,,	110,000	121,000	101,000
Do. in Continent do.				do.				,,	1,017,000	1,010,000	1,089,000
Do in United States do.				do.				,,	265,000	275,000	320,000
Do. in other Countries do.				do.				,,	20,000	41,000	49,000
Do in the World do.				do.				,,	1,412,000	1,447,000	1,559,000
Visible supply on 31st December (including the quantity afloat for Europe and Stocks in U.K. and Continent)								,,	654,000	672,000	665,000
Price on 31st December								per Cwt.	9/7½	10/10½	10/9

[T.R.]

Sulphuric Acid; Determination of —— by Barium Chloride, in presence of other Substances. G. Lunge and R. Stierlin. XXIII., page 40.

Nitrous Acid; Determination of ——. F. Raschig. XXIII. page 41.

Ammonia; Electrolytic Oxidation of —— and its Dependence on the Nature of the Anode. E. Müller and F. Spitzer. XI., page 27.

Nitrogen; Utilisation of Atmospheric ——. O. N. Witt. XIA., page 27.

Silicon; Determination of —— in presence of Silica. M. Philips. XXIII., page 42.

UNITED STATES PATENTS.

Furnace Gases; Re-heater for ——. [Contact Process for Sulphuric Acid.] H. Howard, Brookline, Mass. U.S. Pat. 801,318, Oct. 10, 1905.

THIS invention relates to the re-heating of furnace-gases obtained in the manufacture of sulphuric acid by the contact process, after these gases have become cooled in the process of purification. In the rear-wall of the ore-roasting chambers is arranged a re-heating chamber divided into a number of deep pockets in which are placed re-heating units, in the form of U-shaped pipes. In a longitudinal chamber above the pockets are two parallel conduits, one of which conducts the cooled gases from the purifier to the re-heating units, which are connected with it in parallel, while the other conduit conducts the re-heated gases from re-heating units to the "contact" chamber. The re-heating units are heated by conduction through the walls of the furnace, without direct contact with the mass of roasting ore. The independent units of the re-heating coils are connected in series with one another, and for ease of repair, &c., are connected with the conduits by means of detachable couplings. The longitudinal chamber containing the conduits is formed by the upper open ends of the pockets.—W. C. H.

Nitrogen Compounds; Process of Forming ——. A. M. Gow, Assignor to G. Westinghouse. U.S. Pat. 801,782, Oct. 10, 1905. XIA., page 29.

Electrolytic Apparatus. F. J. Briggs. U.S. Pat. 802,960, Oct. 24, 1905. XIA., page 28.

Filling Material; Process of Producing ——. J. D. Pennock, Syracuse, Assignor to The Solvay Process Co., New York. U.S. Pat. 805,581, Nov. 28, 1905.

SEE Fr. Pat. 341,355 of 1904; this J., 1904, 866.—T. F. B.

Sulphur; Process of Recovering ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 805,701, Nov. 28, 1905.

THE process consists in continuously "passing sulphur-bearing fumes from a smelting furnace through a travelling combustible screen of waste material and depositing sulphur thereon, and then burning the screen and subliming and collecting the sulphur.—E. S.

FRENCH PATENTS.

Seaweed; Treatment of —— for the Extraction of Mineral and Organic Chemical Matters. Mme. Laureau, *née* J. H. Laureau. Second Addition, dated Aug. 7, 1905, to Fr. Pat. 352,069 of March 6, 1905 (this J., 1905, 892) [First Addition, dated May 24, 1905; this J., 1905, 1172.]

SEAWEED is treated with acids and hydrocarbons, either before, or simultaneously with a treatment with milk of lime. The hydrocarbons proposed are coal tar, benzine (petroleum spirit), or heavy oils, with or without water. The acid solutions are treated with ordinary reagents to extract the iodine.—E. S.

Hydrogen Peroxide [Solutions]; Stable ——. W. Heinrici. Fr. Pat. 356,880, Aug. 8, 1905.

THIS invention relates to a process for preserving dilute solutions of hydrogen peroxide, and consists in the addition to them of small quantities of neutral organic compounds that may be regarded as derivatives of ammonia, such as amides, imides, acetyl derivatives of aromatic bases, and derivatives of urea.—W. C. H.

Carbon Dioxide; Manufacture or Recovery of ——. J. C. Stead. Fr. Pat. 357,163, Aug. 24, 1905. Under Int. Conv., Aug. 30, 1904.

SEE Eng. Pat. 18,710 of 1904; this J., 1905, 132.—T. F. B.

GERMAN PATENTS.

Caustic Alkalis or Alkali Carbonates; Process for the Manufacture of —— by the Action of Quicklime or Calcium Carbonate on Alkali Silicofluorides, with Recovery of the Hydrofluosilicic Acid from the Residues. J. A. Reich. Ger. Pat. 161,795, March 14, 1903.

THE manufacture of alkalis by the action of quicklime or calcium carbonate on alkali silicofluorides, according to either of the following equations: (*a*) $Na_2SiF_6 + 4CaO = Na_2O + 3CaF_2 + CaSiO_3$, or, (*b*) $Na_2SiF_6 + 4CaCO_3 = Na_2CO_3 + 3CaF_2 + CaSiO_3 + 3CO_2$ has not proved successful in practice, since it has not been possible to recover economically the hydrofluosilicic acid from the residues, these latter being only incompletely soluble in hydrochloric acid, very difficult to wash, and giving varying and incomplete yields of hydrofluosilicic acid. To avoid these difficulties, the patentee proposes to intimately mix the residues with a much larger quantity of lime, for example with a quantity of lime (in the form of quicklime, slaked lime or milk of lime) equal to that which was required for the complete decomposition of the alkali silicofluoride. This excess of lime is preferably added before or during the decomposition of the alkali silicofluoride; that is, in mixing the charge, twice the necessary quantity of lime is taken. The above method is for use in order to obtain almost theoretical yields, but, in practice, it would probably be better, in order to reduce the quantity of hydrochloric acid needed for working up the residue, to use about nine parts of lime to five parts of alkali silicofluoride.—A. S.

Alkaline-Earth Sulphides; Process for Obtaining Chlorides and Sulphur or Sulphur Chloride from ——. Konsortium f. Elektrochem. Ind., G.m.b.H. Ger. Pat. 162,913, Feb. 23, 1904.

ALKALINE-earth sulphides are converted into chlorides by the action of chlorine, sulphur or sulphur chloride being also formed. The sulphur formed in the first stage of the reaction reacts with the unattacked sulphide to form polysulphide, which is in turn chlorinated, with separation of sulphur. The first stage of the reaction, which may be represented by the equation: $5BaS + 4Cl_2 = BaS_5 + 4BaCl_2$, proceeds violently and is often accompanied by incandescence, but the second stage: $BaS_5 + Cl_2 = BaCl_2 + 5S$ goes on very slowly. It is now found that the chlorination of the polysulphides (and also monosulphides) can be easily effected by treating them in aqueous solution with sulphur chloride. According to the present patent, therefore, the alkaline-earth sulphide is heated in a current of chlorine until the chlorine present in the distillate, in the form of sulphur chloride, is sufficient for the complete chlorination of the sulphides in the residue. The cooled residue is then dissolved in water, and treated with the distillate consisting of sulphur chloride. The reactions proceed according to the equations: $BaS + S_2Cl_2 = BaCl_2 + 3S$; $BaS_3 + S_2Cl_2 = BaCl_2 + 5S$. If it is desired to obtain finally some of the sulphur in the form of sulphur chloride, the dry chlorination is carried on for a longer time.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

Ceramic Wares; Production of Metallic Lustre and Iridescence on the Surface of ——. L. Franchet. Comptes rend., 1905, **141**, 1020–1022.

The author's plan consists in incorporating metallic salts in a powdered glaze which will melt at the baking temperature of the ware to be treated, and then exposing to a reducing atmosphere. The foundation of the glaze consists of: quartz, 12; *pegmatite*, 12·5; kaolin (Eyzies), 2; sand (Decize), 20; red lead, 30; borax, 19·2; boric acid, 2; potassium carbonate, 2; sodium chloride, 1·8; this mixture is powdered, melted, poured into water, and ground. To glaze the ware, one or other of the following formulæ is used, the above mixture being called A:—

	1.	2	3
Glaze A	100	100	100
Kaolin	10	10	10
Silver carbonate	2	0·5	2
Zinc oxide	—	1	—
Stannous oxide	—	1	—
Bismuth sub-nitrate	—	—	4
Copper oxide	—	3	—
Copper carbonate	—	—	1

The glaze is applied in the usual way (the proportion of kaolin having been reduced or increased if the glaze is to be made more or less readily fusible), and the ware baked in a muffle, the furnace of which can be completely closed. When the baking is complete, the whole is allowed to cool to dull redness, the damper shut, and either: (*a*) Brushwood, wood, coal, resin, oil, tar, or other combustible introduced into the fire, so as to produce a dense smoke which penetrates into the muffle, and the smoke allowed to act, with the furnace closed, for an hour; or (*b*), coal-gas is introduced by tubes into the muffle, say at 3 cb.m. per hour, for a muffle of 0·5 cb.m. content. The reduction is complete in 10 minutes, and the exposure should not exceed 30 minutes. The same result may be obtained, though not so well, by (*c*). Combustion of sugar or similar substances instead of those mentioned in (*a*). The method (*b*) has the advantage that the process can be watched; and with silver, the tint can be varied from white to gold according to the duration of the process. Copper gives its own colour, but with the addition of bismuth, a blue pearly effect is obtained. Formulæ 1 and 3 mixed give a brilliant metallic green. All the colours show better on a matt than on a highly glazed surface.—J. T. D.

Pottery Imports into the United States. Mining World, Dec. 2, 1905.

The imports of pottery into the United States in 1904 were valued at 11,270,241 dols., and the production at 25,158,270 dols.—a total of 36,428,511 dols. After deducting the exports, there appears a net consumption of 35,604,132 dols., of which the domestic production was 70·66 per cent. in 1904, as compared with 70·56 per cent. in 1903, 72·91 per cent. in 1902, 71·39 in 1901, 70·75 in 1900, 69·99 in 1899, and 68·49 in 1898. It will thus be seen that the gradual increase of domestic production as compared with consumption from 1898 to 1902 was checked in 1903 by a fall from 72·91 to 70·56 per cent.; in other words, domestic production did not increase as rapidly as importation. [T.R.]

English Patent.

Enamelled Metal Objects; Machine for the Producing of Coloured Ornamentations on ——. I. Gaensler, Turin, Italy. Eng. Pat. 19,080, Sept. 21, 1905.

On the surface of a horizontal drum, capable of being rotated at varying speeds, are mounted a number of rings, to which are loosely connected a number of wires of the same length but having differently shaped ends. During the rotation of the drum, the centrifugal force causes these wires to fly out from the drum, and to dip into a reservoir containing fluid enamel at the bottom, which is then sprinkled in the form of a spray over the enamelled metallic objects to be decorated. By pushing the metal objects against the wires, whilst the enamel is still fluid, spots with only very fine veinings in between may be obtained. The reservoir at the bottom of the drum may be divided into any number of compartments, corresponding to partitions on the drum, and the objects may thus be treated with differently coloured enamels by the same drum.—A. G. L.

United States Patents.

Glass Tile, Slab, or the like. C. H. Thompson, Stourbridge. Assignor to Maw and Co., Jackfield, England. U.S. Pat. 805,595, Nov. 28, 1905.

The claims include the improved tile produced by the following process:—"Keys" of silicious or granular material are fixed to the back of the tile by applying to it a solution of a double silicofluoride, which after dehydration is insoluble in water; on this coat pieces of silicious material are sprinkled; the whole is then dried, and warmed without fusing the silicofluoride and gradually cooled. For the backing coat a solution in liquid sodium silicate of a double fluoride of sodium and aluminium, calcined dolomite, sodium fluoride, and kaolin, is suggested. The adhesion of the coating to the slab is said to be increased by the roughening of the surface of the slab, caused by the action of the fluorine from the coating when the latter is heated to a point below the fusing-point of the silicofluoride.—W. C. H.

Glass Plates; Manufacture of ——. B. C. White, Mosgrove, Pa. U.S. Pat. 805,609, Nov. 28, 1905.

The method described of making glass plates consists in forming two or more glass sheets, which are deposited in succession, one upon a supporting surface and the other upon the first sheet; between these a metallic web or fabric may be interposed, and the sheets compressed by means of a roller. The claims also include a machine for carrying out this process, which consists of a combination of two or more pairs of rolls, each pair being arranged to form a sheet, with a bed or platen to receive the sheets formed. Either the pairs of rolls or the bed are movable relative to each other. The pairs of rolls are arranged to deposit the sheets of glass in succession on the bed, or on the previously formed sheet or sheets. Means are also provided for interposing a metallic web or fabric between successive sheets, and for compressing the sheets by means of a roll.—W. C. H.

Glass Plates; Manufacture of ——. B. C. White, Mosgrove, Pa. U.S. Pat. 805,610, Nov. 28, 1905.

This method of making glass plates consists in forming and laying a glass sheet upon a suitable surface, and then reversing the direction of the distributing device, that is, without disruption, depositing a second sheet upon the first, the resulting plate being composed of a sheet doubled upon itself. Between the sheets a metallic web or fabric may be interposed, and the sheets, or the sheets and metallic web, may be compressed by a pressure roll. The apparatus described includes a means of forming glass sheets, *e.g.*, a pair of rolls, and a support for the sheets formed, means being provided for imparting a backward and forward movement, either to the arrangement for forming the sheets or to the bed, for placing a metallic web or fabric on the first sheet formed, and for compressing the layers.—W. C. H.

Glass Sheets; Manufacture of ——. J. H. Lubbers, Alleghony, and S. L. Bodine, Berwyn, Assignors to Window Glass Machine Co., Pittsburg. U.S. Pat. 807,298, Dec. 12, 1905.

See Eng. Pat. 22,065 of 1904; this J., 1905, 29.—T. F. B.

FRENCH PATENT.

Enamelling Iron Objects; Process for ——. R. F. Wagner. Fr. Pat. 356,736, Aug. 7, 1905.

THIS process for enamelling iron objects is based on the employment of an alkaline-earth phosphate, in order to increase the refractory properties of the enamel and to render it opaque. Mixtures of enamels containing phosphoric acid with enamels containing alkaline-earth compounds are baked in order to bring about the formation of alkaline-earth phosphates during the baking.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

ENGLISH PATENTS.

Roads and Streets; Method for Preserving and Improving the Surfaces of Macadamised —— and Preventing the Formation of Dust resulting from the Disintegration of Macadamised Surfaces. E. D. de Liebhaber, Wembley Hill. Eng. Pat. 16,400, July 25, 1904.

SEE Fr. Pat. 356,330 of 1905; this J., 1905, 1307.—T.F.B.

Wood; Process of Preparing —— for Polishing Purposes. O. Bohne and J. G. Herrmann, Dresden, Germany. Eng. Pat. 9496, May 5, 1905.

A MIXTURE of an insoluble mineral substance with an organic binding material and a small quantity of potassium bichromate is rubbed into the pores of the wood. The superfluous powder is then removed with a dry cloth and the surface of the wood treated as usual with shellac dissolved in 80 per cent. alcohol. Suitable compositions are: For wood with large pores, *e.g.*, rose wood, 75 parts of plaster of Paris, brick dust, clay, &c.; 25 parts of animal or vegetable glue, or dextrin; and five parts of potassium bichromate. For wood with fine pores, *e.g.*, walnut, 80 parts of the mineral matter, 20 parts of the binding material, and five parts of potassium bichromate. By adding brick dust, &c., the colour of the filling material is suited to that of the wood.—A. G. L.

UNITED STATES PATENTS.

Bricks, Tiles, and other Articles; Apparatus for Producing Vitrified ——. R. Baggaley, Pittsburg, Pa. U.S. Pat., 805,702, Nov. 28, 1905.

MOLTEN slag is fed into moulds carried by a travelling endless chain; covers for the moulds are also arranged "in travelling series," each cover having in its middle a plunger for shaping the article to be formed, and being of "greater gravity than the pressure to be applied to the plunger." After the articles in the moulds have set, they are delivered by suitable conveying mechanism, into an annealing chamber. Before passing into the annealing chamber, a protective coating may be applied to the articles to prevent them from being cooled too rapidly.
—E. S.

Kiln; Cement-Burning ——. G. D. Helmick. Fort Russell, Wyo. U.S. Pat. 805,953, Nov. 28, 1905.

BY this invention the combination is claimed of one or more burning furnaces, with one or more regenerators arranged below the furnaces. A spirally-descending flue connects the furnaces with the regenerators, and controlling means are arranged between it and the regenerators. On the peripheral surface of this flue one or more apertures are arranged, and adjacent to these are dust-collecting boxes, having slanting floors, and exit openings. Between the regenerators and the furnaces are arranged independent flue connections, outside the spiral flue, for returning the heated air to the material being treated.—W. C. H.

Cement; Process for Manufacturing Portland —— E. H. Hurry, Bethlehem, and H. J. Seaman, Catasauqua, Pa. U.S. Pat. 806,146, Dec. 5, 1905.

SEE Eng. Pat. 10,958 of 1901; this J., 1902, 1079.—T.F.B.

FRENCH PATENTS.

Kilns for Burning Bricks. A. A. Gery. Fr. Pat. 356,838, June 27, 1905.

THE kiln consists of one or more long channels through which the articles to be burned are conveyed, on carriages, from one end to the other, and pass successively through the processes of drying, heating, burning, and cooling. In starting the kiln, a "grate-carriage" is required, provided with a vertical refractory wall which just fits the channel, and has a heating opening in it. The middle portion of the length of the kiln forms the burning zone, and is provided with a series of suitably spaced openings for the supply of the combustible body. The fore-part of the channel serves for drying the bricks introduced and is provided with a chimney, by which a current of air is maintained through the channel in the opposite direction to that in which the carriages move. This current is controlled by two series of vertical dampers, one before and one behind the burning zone; the dampers can be adjusted to varying heights above the line of the floors of the carriages, and when inserted to a considerable depth, cause the air to pass to the bottom of the piles of bricks. A second chimney is provided further along the drying zone just in front of an additional damper, to ensure the removal of the moisture and prevent condensation on the bricks. The lateral walls of the channels in the fore-part of the kiln, have deep longitudinal grooves, into which the moisture escapes through openings from the main channels, the deep grooves being controlled by plugs at the top, where they pass into a flue which communicates with the evaporation chimney. The invention includes the improved process of burning bricks, &c., which consists in loading the kiln with unburnt bricks on carriages end to end, causing a current of air to pass in the opposite direction through the kiln, heating the air that enters, combining this with the products of combustion before it comes in contact with bricks which are advanced, in order to heat these just to incandescence; the combustible is supplied to the bricks thus heated, and combustion is maintained by the previously mentioned current of air, which is heated by the burnt bricks as they pass to the rear end of the kiln. The bricks are burned by direct contact with the combustible, and the bricks that enter are dried by indirect contact with the combustible.
—W. C. H.

Agglomerate for Constructional and Public Works. V. Labour. Fr. Pat. 356,901. Aug. 12, 1905.

THE compounded material described is made by agglomerating crystalline or amorphous carborundum with some binding agent used in constructional work, such as the various kinds of cement, "fat" or hydraulic lime, asphalt, &c.—W. C. H.

Wood; Process for Obtaining Artificially the Colour which —— acquires with Age. R. Kornmann. Fr. Pat. 357,083, Aug. 21, 1905. Under Int. Conv., Aug. 22, 1904.

SEE Eng. Pat. 16,316 of 1905; this J., 1905, 1064.—T.F.B.

X.—METALLURGY.

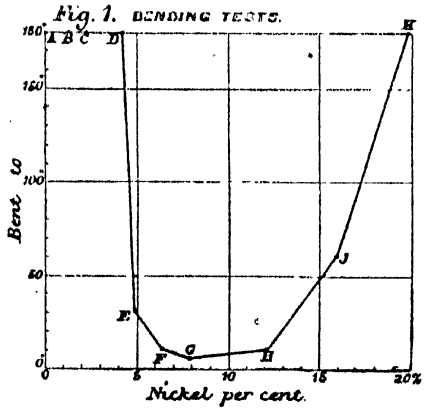
Iron-Nickel-Manganese-Carbon Alloys. H. C. H. Carpenter, R. A. Hadfield, and P. Longmuir. Seventh Report to the Alloys Research Committee. Engineering, 1905, 708—713; 745—750; 779—784.

THE alloys examined, contained the proportions of nickel, carbon and manganese shown in the following table:—

Mark.	Nickel.	Carbon.	Manganese
	Per cent.	Per cent	Per cent
A	*nil*	0·47	0·95
B	1·20	0·48	0·79
C	2·15	0·44	0·83
D	4·25	0·40	0·82
E	4·95	0·42	1·03
F	6·42	0·52	0·92
G	7·95	0·43	0·79
H	12·22	0·41	0·85
J	15·98	0·45	0·83
K	19·91	0·41	0·96

They were prepared with Swedish charcoal iron of special purity, this being melted along with the necessary ingredients, nickel and Swedish white iron. The mechanical tests were carried out on test pieces prepared from the alloys after the latter had been heated to 800° C. This temperature is well above the critical ranges of the alloys and was therefore selected as the most suitable for "normalising" the alloys.

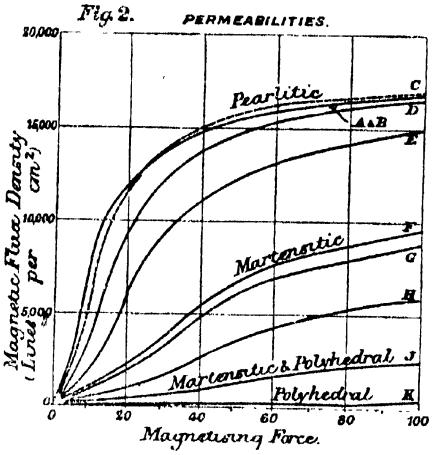
Mechanical Tests of the Forged Alloys.—The results of the different mechanical tests show that with increase of nickel from *nil* up to 4 per cent., the effect on the mechanical properties is gradual. The alloys when under elastic stress yield more to the stress, but after the apparent yield point is passed, the maximum (tensile) stress increases. In nearly all the tests, there was a more or less pronounced kink in the curves between 0 and 4 per cent. of nickel. Between 4·25 per cent. and 4·95 per cent. of nickel, there is a very sudden change in nearly all the properties of the alloys, as is shown by a rapid increase of the maximum stress (reaching its highest value in the alloy containing 6·42 per cent. of nickel), a reduction of ductility and an increase of brittleness. Thus, for industrial nickel-iron alloys, there as "a danger limit for nickel content" at 4¼ per cent., when carbon and manganese are present to the extent of 0·44 and 0·88 per cent. respectively. After this sudden "break," the mechanical properties again change more gradually as the percentage of nickel rises, until about 16 per cent. is present; the brittle zone thus extends from about 5 to 15 per cent. of nickel. With still further increase, the change in properties is more rapid, and in the reverse direction to the preceding rapid change. Fig. 1, which shows the results



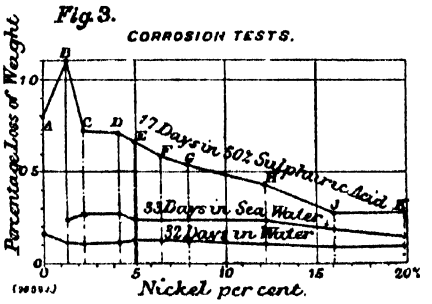
of the bending tests is roughly typical of the other curves representing the mechanical properties of the alloys. It is pointed out that the alloy K, containing 19·91 per cent. of nickel had the lowest yield point, and the highest elongation and reduction of area of all the alloys.

Mechanical Properties of the Cast Alloys.—The results obtained agreed generally with those given by the forged alloys, but the maximum tensile strength was shown by the alloy containing 7·95 per cent. of nickel. The three alloys F, G, H, which in the forged condition are distinctly brittle, show, in the cast "normalised" state, elongations of 6·2, 4·5 and 6·2 per cent. respectively.

Physical Chemical and Metallographical Properties.—The curves representing the electrical resistivity of the alloys afford additional evidence of the sudden change in the properties of the alloys when the proportion of nickel reaches about 4·25 per cent. The results of the magnetic tests show how closely the magnetic permeability is related to the structure of the alloy. In Fig. 2, the results



of the magnetic tests are given, together with the structure of the alloys. Determinations were also made of the amount of corrosion of the alloys at the ordinary temperature in well-aërated fresh water, in sea-water, and in 50 per cent. sulphuric acid. The test-pieces of metal weighed 70—80 grms.; the fresh water was renewed every day, and the sea-water once a week. The results are shown in Fig. 3.



The critical temperatures of the alloys on rising temperatures (heating curves) and falling temperatures (cooling curves) are shown in the following table, alloys Nos. 1 and 9 being included for the purpose of showing the effects of carbon and manganese respectively:—

Mark.	Percentages.			Critical Ranges on Cooling.	Critical Ranges on Heating.
	Nickel.	Carbon.	Manganese.		
1*	*nil*	0·01	trace	900–754° C. (1652–1389° F.) 770–688° C. (1418–1270° F.) Temperature steady at 690° C. (1274° F.)	
9*	,,	0·47	,,	706–658° C. (1303–1216° F.) Temperature steady at 665° C. (1229° F.)	729–755° C. (1344–1391° F.)
A	,,	0·47	0·05	687–646° C. (1268–1195° F.) Temperature steady at 649° C. (1200° F.)	700–721° C. (1292–1330° F.)
B	1·20	0·48	0·79	661–604° C. (1222–1119° F.) Temperature steady at 616° C. (1141° F.)	664–721° C. (1227–1330° F.)
C	2·15	0·44	0·83	646–544° C. (1195–1011° F.) Quickening at 561° C. (1042° F.)	634–705° C. (1173–1301° F.)
D	4·25	0·40	0·82	644–422° C. (1191–791° F.) Quickening at 513° C. (955° F.)	634–693° C. (1173–1279° F.)
E	4·05	0·42	1·03	644–125° C. (1191–257° F.) Quickening at 171° C. (340° F.)	622–684° C. (1151–1263° F.)
F	6·42	0·52	0·92	500–123° C. (932–253° F.) Quickening at 156° C. (313° F.)	586–674° C. (1087–1245° F.)
G	7·95	0·43	0·79	513–78° C. (955–172° F.) Quickening at 100° C. (212° F.)	586–660° C. (1087–1220° F.)
H	12·22	0·41	0·85	623–149° C. (1153–300° F.) Quickening at 240° C. (475° F.)	586–616° C. (1087–1141° F.)
J	15·98	0·45	0·83	600–180° C. (1112–372° F.) With no marked quickening	Nothing found between 400 and 800° C. (752 and 1472° F.)
K	19·91	0·41	0·06	630–280° C. (1166–536° F.) Quickening at 350° C. (662° F.)	342° C. to [?] (647° F. to [?])
Nickel	99·6	—	—		

* *Journal of the Iron and Steel Institute*, 1904, No. 1, Table II., pages 232 and 233.

The metallography of the alloys was also studied and a series of photo-micrographs is given. In the case of alloy K, which was the most suitable one for the purpose, the effect of mechanical treatment on the structure was studied more fully. In the untreated state, this alloy consists of large polyhedra, but mechanical work of various kinds, which stresses it beyond the elastic limit, causes an entirely new type of structure to appear. The polyhedra even after prolonged etching always appear white, whereas the new structural element invariably appears dark after etching. Further, the change of structure is accompanied by the appearance of magnetism. It was found that this new structure induced by (*a*) forging, (*b*) bending, and (*c*) compressing, which deformed the test-bars, without fracturing them, can be removed, and the original structure regenerated by a short heat treatment at 800°–900° C. The structural changes produced by stresses which caused fracture, are not as easy to remove, but by the treatment mentioned, there was an appreciable reversion, in parts, towards the original polyhedral structure, and it is probable that the restoration would be rendered complete by prolonged heat treatment at about 900° C. These results are not in agreement with those of Guillet, who stated that a steel which has once been changed from the polyhedral to the martensitic condition, by whatever method, cannot be regenerated either by annealing or quenching. (See this J., 1896, 905; 1898, 670; 1899, 48, 278, 687; 1900, 150; 1902, 485; 1903, 146, 213, 300, 422, 869, 911, 999.)—A. S.

Iron-Carbon Alloys; Diagram of Equilibrium of ——. G. Charpy. Comptes rend., 1905, **141**, 948—951.

THE author has examined the effects of slow and rapid cooling on the same alloy. He finds that if but little silicon or manganese be present, separation of graphite is never observed unless the total carbon be over 2 per cent. An alloy with 2·9 per cent. of carbon showed no graphite when poured into a metal mould, but when allowed to cool slowly in the crucible, showed 2·21 per cent. of graphite; when slowly cooled to 1100° C. and then rapidly cooled by plunging the crucible into water, the graphite was 0·95 per cent. It seems that at the beginning of solidification, mixed crystals separate, and this goes on till a eutectic of mixed crystals and cementite, or mixed crystals and graphite, is formed. This is the condition of alloys cooled rapidly after complete solidification; but if the cooling be slow, the mixed crystals disappear, cementite or graphite separating above 700° C., and pearlite below that temperature. The solidification of the cementite eutectic begins at 1150° C., not 1050° C., that of the graphite-eutectic about 10°—15° higher; and one or the other is formed according to the conditions (especially the rate) of the cooling, but never both successively. —J. T. D.

Iron and Steel Production in 1904. Eng. and Mining J., Dec. 2, 1905.

THE production of both pig-iron and steel was smaller in 1904, that of pig-iron being 2·2 per cent. less, and that of steel 0·4 per cent. less than in 1903. The ratio of steel to pig-iron production increased slightly, from 0·77 in 1903 to 0·79 last year. The decrease, both in iron and steel output, in 1904 was in great part due to the smaller make in the United States.

Steel Production of the World—Metric Tons.

	1903.	1904.
United States	14,756,691	13,746,051
Germany	8,801,515	8,930,291
United Kingdom	5,114,647	5,107,309
Austria-Hungary	1,146,000	1,195,000
Belgium	981,740	1,069,880
Canada	181,514	151,165
France	1,854,620	2,080,354
Italy	116,000	113,800
Russia	2,410,938	2,811,948
Spain	199,642	196,000
Sweden	317,107	333,522
All others	418,000	415,000
Total	36,298,414	36,150,320

Pig-Iron Production of the World—Metric Tons.

	1903.	1904.
United States	18,297,400	16,760,986
Germany	10,085,634	10,103,941
United Kingdom	8,952,183	8,699,661
Austria-Hungary	1,355,000	1,369,500
Belgium	1,299,211	1,307,399
Canada	269,665	274,777
France	2,827,668	2,999,787
Italy	28,250	27,600
Russia	2,486,610	2,978,325
Spain	380,284	375,250
Sweden	506,825	528,525
All others	625,000	633,000
Total	47,113,730	46,658,751

There is little change in relative rank in the two years. The three chief producers—the United States, Germany and Great Britain—furnished 77·2 per cent. of the world's

pig iron, and 76·9 per cent. of the steel last year. The United States alone made 36·4 per cent. of the pig iron, and 38·3 per cent. of the total steel. [T.R.]

Gold; Solubility of —— in Thiosulphates and Thiocyanates. H. A. White. J. Chem. Metall. and Min. Soc. of S. Africa, 1905, **6**, 109—111.

Solutions of sodium thiosulphate, sodium sulphide, ammonium thiocyanate, ferric sulphate, or ferric chloride, separately, and in the cold, are practically without action on gold (a boiling solution of ferric chloride readily dissolves gold); but sodium thiosulphate and ferric chloride together dissolve it, and the action of ammonium thiocyanate and ferric chloride together is still more marked. Other oxidising agents added to the thiocyanate are also effective, but none more so than ferric salts. Experiments in which gold was suspended in these liquors for some days showed that the action gradually slackened, no doubt from the conversion of ferric into ferrous salt and the consequent lack of oxygen. The presence of ferric salts from oxidation of pyrites, and the formation of thiocyanates from cyanides, no doubt account for the flow of gold from dumps, and the enrichment of the soil below the heap, which have been frequently observed. By means of a process founded on this action of thiocyanates, it may be possible to recover considerable quantities of gold from old residue heaps.—J. T. D.

Platinum; Solubility of —— in Sulphuric Acid. M. Delépine. Comptes rend., 1905, **141**, 1013—1015

The rapidity with which concentrated sulphuric acid attacks platinum (this J., 1905, 1302) varies greatly with the conditions of experiment. When the concentrated acid is boiled with platinum foil in a flask (338° C.), it turns distinctly yellow in half an hour, and the platinum dissolves at the rate of about 0·01 grm. per sq. dcm. per hour. In a basin or other open vessel the attack is much slower, because the temperature is kept down by evaporation. In mixtures of 50 grms. of sulphuric acid with 10 grms. and 20 grms. of potassium sulphate, which boil respectively at 350°—355° and 365°—370° C., the rates of attack are 0·04—0·05 and 0·12—0·13 grm. per sq. dcm. per hour respectively. Traces of nitric acid, up to 0·1 per cent., added to pure sulphuric acid, do not sensibly affect the rate of attack, so that the attack of platinum by ordinary "commercially pure" sulphuric acid is not to be attributed to the traces of nitric acid which it may contain. Ammonium sulphate exercises a marked retarding influence; indeed, if to a sulphuric acid solution of platinum, ammonium sulphate be added, and the solution boiled, practically the whole of the platinum is precipitated, and no more is found in solution until the whole of the ammonium salt is destroyed. Spongy platinum is dissolved more rapidly by sulphuric acid than the compact metal, but the difference is probably one of surface only, and not due to any allotropic difference. The reaction of sulphuric acid on platinum is represented by the equation $4H_2SO_4 + Pt = Pt(SO_4)_2 + 2SO_2 + 4H_2O$; a platinic sulphate being formed.—J. T. D.

Copper Smelting; Constitution of Mattes produced in ——. A. Gibb and R. C. Phalp. Trans. Amer. Inst. Min. Eng., 1905, Nov., 1193—1209.

The mattes produced in modern copper-smelting vary in copper-content from 20 to 80 per cent., but mostly contain about 50 per cent. The amounts of arsenic, antimony, &c., contained in them are usually so small that they may be looked on as impurities simply, the essential constituents being copper, iron, and sulphur. In modern practice, where the work is done in a blast-furnace, the furnace atmosphere is oxidising, and no reduction of iron occurs. Names are given to the mattes according to their appearance:—"Coarse metal," with 35—55 per cent. of copper, hard, compact, dull bronze colour, no visible metallic copper; "Blue metal," 60—70 per cent., bluish purple, with visible "moss copper"; "white metal," 70—76 per cent., white, unevenly plated appearance, usually homogeneous; 78—81 per cent., various names (*e.g.*, "pimple metal," "close regule," "spongy regule," &c., according to appearance), show metallic copper in considerable proportion.

The authors find that, after determining the ultimate composition of a matte, its proximate constitution can in most cases be determined by the reaction upon it of solution of silver nitrate, from which metallic copper separates silver, cuprous sulphide, silver and silver sulphide, cuprous oxide, silver and basic copper nitrate, while ferrous sulphide is without action upon it, and iron acts so slowly that its reaction in any short time is negligible. Aided by this mode of analysis, they find that:—(1) Cuprous sulphide is the only compound of copper and sulphur stable in the melted condition; it will dissolve neither copper nor sulphur; (2) Ferrous sulphide is the only stable compound of iron and sulphur; it will take up no more sulphur, but much more iron, which, however, forms on cooling a solid solution, and not a compound; (3) Iron will decompose cuprous sulphide, and the action is reversible, equilibrium occurring when the mixture contains about 30 per cent. of ferrous sulphide; (4) Ferrous sulphide dissolves large quantities of metallic copper, which remains in solid solution on cooling; (5) Cuprous and ferrous sulphides are miscible in all proportions, but the mixture of highest m. pt. 1121° C., "white metal," containing 90 per cent. of cuprous sulphide, appears to be a compound, $5Cu_2S.FeS$.

An examination of mattes containing rising amounts of copper showed that that corresponding to white metal contained no metallic copper, but all the others contained it, the quantity increasing as the composition of the matte deviated further from that of white metal. While, however, those containing white metal and excess of ferrous sulphide contained the metallic copper in solution, those containing white metal and excess of cuprous sulphide held it mechanically, for when they were melted in a crucible out of contact with air, a button of metallic copper gradually collected at the bottom, and was found on cooling. These mattes all contained small amounts of cuprous oxide, but none was found in the mattes with excess of ferrous sulphide. These results were confirmed by the micrographic examination of the mattes, after etching with silver nitrate or potassium cyanide. Metallic copper seems, therefore, to be formed from cuprous sulphide, but not from white metal, and is thus only produced from a white metal matte as the white metal is broken up by oxidation and separates cuprous sulphide. The effect of ordinary impurities in mattes is to displace sulphur in combination with iron, and thus, by lessening the amount of ferrous sulphide present, lessen the amount of white metal that can be formed, and hence facilitate the separation of metallic copper from a matte of given copper content. An ordinary impure matte containing antimony and arsenic, with 72 per cent. of copper, is made up of 14 per cent. of cuprous sulphide and 83 per cent. of white metal; whilst a pure matte of the same copper content consists of only 2 per cent. of cuprous sulphide and 97 per cent. of white metal. Industrial practice bears out the view that the copper is more readily separated from a matte when it contains a certain amount of impurities.—J. T. D.

Aluminium; Action of Silicon on Pure and Impure ——. Aluminosilicides. E. Vigouroux. Comptes rend., 1905, **141**, 951—953.

Pure silicon and aluminium, whether fused together, or whether the silicon be formed from silica by the thermite process in presence of excess of aluminium, refuse to combine, but when they are in presence of a third metal, double silicides of aluminium and the metal, or *aluminosilicides* of the metal, are formed. These are definite, crystalline substances, with metallic lustre, dense, hard, and brittle; some are attacked by dilute acids, but most of them resist all acids, even when concentrated, save hydrofluoric acid, and none of them is affected by solutions of alkali. They are formed by heating the three elements together in an atmosphere of hydrogen, or by the thermite method from mixtures of silica and metallic oxide, using excess of aluminium, or by acting with aluminium on a mixture of the metal or its oxide or sulphide with potassium silicofluoride. In view of these facts, clay vessels should be avoided in the preparation of metals which can form aluminosilicides (and practically all save lead, tin, and antimony do form them).—J. T. D.

Manganese Deposits in Cape Colony. Board of Trade J., Dec. 21, 1905.

THE discovery of rich deposits of manganese ore is reported in the Paarl district, situated at about 36 miles from Cape Town on the main railway line to the Orange River Colony and the Transvaal. The ore obtained is stated to be of a quality as good as any yet discovered in South Africa, and compares favourably with that obtained in Southern Russia and Japan. An analysis of the ore taken from the surface showed it to contain 71·5 per cent. of manganese dioxide, and it is consequently considered of a suitable quality for export. The Government analyst found 56·0 per cent. of manganese in the specimen submitted to him. [T.R.]

Mineral Deposits in Cumberland. Chem. Trade J., Dec. 16, 1905.

A NEW discovery of wolfram, also Scheelite (tungstate of lime) is reported in the Borrowdale district of Cumberland. The magnesian limestone deposits near Whitehaven are to be reopened at an early date. Greater activity is now being shown in blende and lead mining in Cumberland than for some years past, and the old lead mines of the Pennine ranges in Westmoreland are being reopened. [T.R.]

Oxygen; Determination of —— in Copper. L. Archbutt. XXIII., page 42.

Silicon; Determination of —— in presence of Silica. M. Philips. XXIII., page 42.

ENGLISH PATENTS.

Ores or like Material; Apparatus for Use in Separating Certain Constituents of Subdivided ——. [Flotation by means of a Vacuum.] F. E. Elmore, London. Eng. Pat. 29,282, Dec. 31, 1904.

THE apparatus consists of a vessel, the horizontal cross-section of which diminishes in area from below upwards, *e.g.*, in a vat with conical cover. This cover has an outlet at the top communicating with a chamber, preferably of glass, from which the air is exhausted, and also with a pipe dipping into a vat, through which pipe, liquid and any floated material escapes from the main vat. At the bottom of the main vat there is a circumferential trough with an exit pipe dipping into a small vat; through this pipe liquid and unfloated material escape from the main vat. The material in the latter is kept in motion by a rake or stirrer on the bottom of the vat; two of the teeth of the stirrer also dip into the circumferential trough. From a third smaller vat the ore, in the state of pulp mixed with water, is fed into the main vessel through a siphon or other pipe at such a rate that some of the liquid must overflow through the opening at the top of this vessel. The latter may be heated, if necessary, by a jacket or by coils placed inside. If the electrolytic process described in Eng. Pat. 13,578 of 1904 (this J., 1905, 932) is to be used, the vat is made of conducting material and forms one electrode, whilst the stirrer, which in this case is insulated from the vat, forms the other. The length of the inlet and exit pipes must be calculated so as to work with the reduced pressure inside the vat; otherwise, valves, &c., may be used.—A. G. L.

Blast Furnaces, Converters, or the like; Means for Treating Air for Supply to ——. E. Hesketh, London, and F. A. Willcox, Sunderland, Durham. Eng. Pat. 3420, Feb. 18, 1905.

FOR the purpose of drying the hot air coming from the blowing engines, the air is passed up a vertical cylindrical vessel in which it meets a spray of cold water or other liquid, which escapes at the bottom through a trap, whilst the air is made to pass tangentially through another vessel, the drops of condensed moisture being deposited on the walls of this vessel, whilst the air leaves by a central pipe, on its way to the heater and blast-furnace, &c. The first cylinder may be fitted with baffle-plates, and two, or more, vessels may be used in conjunction so as to effect the cooling in stages.—A. G. L.

Iron; Treatment of Chromiferous ——. H. H. Campbell, Steelton, U.S.A. Eng. Pat. 12,652, June 19, 1905.

SEE U.S. Pat. 795,193 of 1905; this J., 1905, 893.—T.F.B.

Aluminium or its Alloys; Process for Casting ——. A. F. Cothias, Ivry-Port, France. Eng. Pat. 15,649, July 31, 1905. Under Int. Conv., Sept. 27, 1904.

THE aluminium or alloy is cast in a metal mould, preferably of cast-iron, previously heated to a temperature above the fusing point of the aluminium or alloy, and the whole is then allowed to cool slowly and gradually, whereby the metal is caused to fit the mould exactly.—A. G. L.

UNITED STATES PATENTS.

Steel; Apparatus for Making ——. F. E. Young, Canton, Ohio. U.S. Pat. 801,500, Oct. 10, 1905.

THE invention relates to a converter for the manufacture of malleable iron or steel from molten iron. The converter consists of a vessel longer in one direction than in the other, and wider in the middle than at the ends. It is lined with refractory material such as fire-brick, and the top is covered over by fire-brick slabs set on edge. At one end of the converter is an opening into which the blast-pipe is inserted, and at the opposite end is an outlet opening, preferably about the same size as the inlet; both of the openings are located at or near the surface of the molten iron contained in the converter, and the cover of the converter is only a short distance above this surface. The object of the invention is, it is stated, to oxidise the molten metal slowly, more perfectly and without agitation, and to utilise the blast for removing the slag from the surface of the metal; and it is claimed that in the apparatus described, all the distinctive features of the Bessemer, the hand-puddling and open-hearth processes can be combined. The method of working, which has been claimed in a separate patent (see U.S. Pat. 724,770 of 1903; this J., 1903, 557), consists in projecting the blast, which can be made oxidising, reducing or neutral at will, under constant pressure directly across the entire surface of the molten metal, whereby all slag or scoria is removed by the blast as soon as it rises; setting the metal into a rolling motion by the mechanical action of the blast on its surface; and "holding the air in close contact with the metal in proportion to the pressure of the blast."—A. S.

Steel; Manufacture of ——. H. W. Lash, Assignor to the Garrett-Cromwell Engineering Co., Cleveland, Ohio. U.S. Pat. 805,563, Nov. 28, 1905.

SEE Eng. Pat. 8026 of 1903; this J., 1904, 325.—T. F. B.

Steel; Manufacture of ——. H. W. Lash, Cleveland, Ohio. U.S. Pat. 805,564, Nov. 28, 1905.

SEE Eng. Pat. 8026 of 1903; this J., 1904, 325.—E. S.

Cast-Steel Ingots; Process of Perfecting ——. R. W. Hunt, Chicago. U.S. Pats. 805,728 and 805,729, Nov. 28, 1905.

SEE Eng. Pat. 23,821 of 1903; this J., 1904, 374.—T. F. B.

Iron; Method of Producing ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 805,836, Nov. 28, 1905.

THE fumes from metallurgical furnaces, in which ores or mattes containing iron and sulphur are treated, are passed through a screen of combustible material, which thereby becomes encrusted with substances containing iron and sulphur. The screen is subsequently burned to sublime the sulphur, and the iron is recovered from the residue. —A. S.

Iron; Compound for Hardening ——. C. A. Burns and C. E. Raab, Pittsburg, Pa. U.S. Pat. 806,066, Nov. 28, 1905.

THE compound contains sodium chloride (3 parts), alum (3), ammonium carbonate (3), potassium carbonate ("salt of tartar") (3), potassium cyanide (1), potassium nitrate (3), potassium ferricyanide (1), and potassium ferrocyanide (1 part).—E. S.

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vided on its exterior with longitudinal ribs parallel to the shaft. The annular space within the drum is divided into compartments by radial partitions, and the outer wall of the drum has openings or tuyères between the longitudinal ribs. Into each open end of the drum projects a conical casing, through which passes a pipe ending in a perforated ring opposite the end of the drum. The molten slag is delivered through a shoot directly from the blast-furnace on to the outer surface of the drum, which is made to rotate at great speed. Aqueous solutions are forced, under pressure, through the pipes and perforated rings into the compartments within the drum, whence, mixed with air, drawn in through the conical casings, they issue through the openings in the outer wall of the drum, and effect the granulation of the slag. It is stated that the small proportion of water in the aqueous solutions is immediately vaporised, and that the granulated slag does not need subsequent drying.—A. S.

Furnace; Rotary —— for the Production of Gas, or for Roasting [Ores, &c.]. S. E. Sieurin. Fr. Pat. 356,615, Aug. 3, 1905. II., page 11.

Ores; Process and Apparatus for the Mechanical Preparation of Powdered ———. F. Windhausen. Fr. Pat. 357,120, Aug. 22, 1905.

THE finely-powdered ore is carried by a current of air or gas into a hollow cylinder or drum rotating rapidly on a horizontal, inclined or vertical axis, or into a fixed drum in which a shaft carrying blades or wings is rapidly rotated. The heavy particles of ore are thrown against the inner wall of the drum, whilst the lighter particles are carried away, entrained by the air. The air charged with the ore may be passed through two or more rotating drums in succession rotating at different speeds, or the centrifugal force may be varied in other ways. Claim is also made for the introduction of a liquid such as water into the drum or drums, to assist in retaining the heavy particles on the wall of the latter, or it may be introduced in sufficient quantity to continuously remove the heavy particles.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Nitrogen; Utilisation of Atmospheric ——. O. N. Witt. Chem. Ind., 1905, 28, 699–707.

THE author reviews the processes which have been devised for the utilisation of atmospheric nitrogen. Frank's method (this J., 1903, 809) appears to have met with a certain amount of success, but it depends upon the cheap production of electrical power and also of pure nitrogen. At the present time the most promising process appears to be that of Birkeland and Eyde (Fr. Pat. 335,692 of 1903; U.S. Pat. 772,862 of 1904, and Eng. Pat. 3525 of 1905; this J., 1904, 193, 1097; 1905, 895; also this J., 1904, 1096), which is in operation at Notodden, Norway. The nitrogen compounds are absorbed in towers, and the weak acid is used over and over again in the towers until it attains a strength of 50 per cent. The gases, leaving the absorbing towers, are next passed through milk of lime and then over dry lime, calcium nitrite being chiefly produced. This is treated with nitric acid, and the nitrous acid evolved is oxidised, the nitric acid formed being absorbed in the absorbing-towers. At present, the whole of the nitric acid is fixed as calcium nitrate. (For the utilisation of calcium nitrate as a fertiliser, see this J., 1905, 628, 1245.) In accordance with a suggestion by R. Messel, the normal calcium nitrate is converted by addition of quicklime or calcium sulphate, into basic nitrate, which forms a practically non-hygroscopic powder of great value as a fertiliser. The final product may, however, be obtained as nitric acid, or other nitrates, or nitrites. The daily production now amounts to 1500 kilos. of anhydrous nitric acid, and an output of 500—600 kilos. of nitric acid per kilowatt-year can be regularly maintained. The production will be greatly increased as more water-power is brought under control. The total amount of water-power available for the production of electrical energy is estimated at over 350,000 h.p., and it is stated that it will be possible to generate electrical power at the low price of M.12 per horse-power year.—A. S.

Ammonia; Electrolytic Oxidation of —— and its Dependence on the Nature of the Anode. E. Müller and F. Spitzer. Z. Elektrochem., 1905, 11, 917–931.

AQUEOUS solutions of ammonia containing sodium hydroxide were submitted to electrolysis in cells in which the anode and cathode chambers were separated by a diaphragm. In some cases metallic salts were added to the anode solution. The main results may be summarised as follows:—The course of the oxidation varies considerably according to the nature of the metal used for anode. Upon platinum anodes the potential is high, and the chief products are gaseous nitrogen and some nitrate, only traces of oxygen and nitrite being detected. In this case, however, some 23 per cent. of the current is also used up in effecting some other oxidation, the nature of which has not been discovered. With anodes of copper, nickel, iron and cobalt, the potential is lower and the products are gaseous oxygen and nitrogen and nitrite; in the case of cobalt, nitrate is also formed.

When a platinum anode is employed, and salts of copper, nickel, cobalt or silver are added to the solution, the resulting products are similar to those obtained with anodes of these metals.

In most cases, with the addition of metallic salts to the solution, the oxide of the metal is deposited upon the anode, and it is probable that the results are to be attributed not only to the difference in anode potential, but also to the catalytic effect of such oxide films.—R. S. H.

Chlorine; Analysis of Electrolytic ——. F. P. Treadwell and W. A. K. Christie. XXIII., page 42.

ENGLISH PATENTS.

Thermo-Electric Generators; Couples for Sulphide of Copper ——. Comp. Thermo-Electrique (System Hermite) Soc. Anon., Paris. Eng. Pat. 11,301, May 30, 1905. Under Int. Conv., May 3, 1905.

THIS invention relates to a method of manufacturing bodies of sulphide of copper for thermo-electric couples in an annular or other form, the sulphide being first pulverised, and then compressed in moulds for the purpose of insuring a uniform electrical resistance in the bodies. The sulphide is compressed in a mould, after placing within the latter the inner and outer metal casings, which are to carry the sulphide. After compression, the annular metal casings project beyond the body of the sulphide, and the projecting parts are cut and unrolled so as to form the conductors. Finally, the metal casings are riveted over mica and steel rings in order to form a tight joint. Metal rods or threads may be embedded in the compressed sulphide during the moulding, and the sulphide may be moulded in sectors, these being separated by plates of mica.—B. N.

Ozonisers and like Apparatus for Treating Gases Electrically. R. F. Wood-Smith, London. Eng. Pat. 6872, March 31, 1905.

THIS invention relates to ozonisers in which the electrodes have points or projections on their surfaces. The dielectrics are provided on both sides with cup-shaped or like depressions, these being arranged opposite to the projections on the electrodes.—B. N.

Electrolytic Apparatus; Impts. relating to ——. C. N. Rüber, Christiania, Norway. Eng. Pat. 20,898, Oct. 16, 1905. Under Int. Conv., Oct. 15, 1904.

THE apparatus is provided with a diaphragm, and filtering sheets are arranged on both sides of it, the liquid to be electrolysed entering continuously between the filtering sheets and the diaphragm.—B. N.

Electrodes; Impts. in —— [for Electrolytic Manufacture of Alkali]. M. Yasuda, Tokyo, Japan. Eng. Pat. 22,460, Nov. 3, 1905. Under Int. Conv., Jan. 21, 1905.

THE principal object of this invention is to provide a cathode, and casing for the same, for use in the electrolytic

pig iron, and 76·9 per cent. of the steel last year. The United States alone made 36·4 per cent. of the pig iron, and 38·3 per cent. of the total steel. [T.R.]

Gold; Solubility of —— in Thiosulphates and Thiocyanates. H. A. White. J. Chem. Metall. and Min. Soc. of S. Africa, 1905, **6**, 109—111.

Solutions of sodium thiosulphate, sodium sulphide, ammonium thiocyanate, ferric sulphate, or ferric chloride, separately, and in the cold, are practically without action on gold (a boiling solution of ferric chloride readily dissolves gold); but sodium thiosulphate and ferric chloride together dissolve it, and the action of ammonium thiocyanate and ferric chloride together is still more marked. Other oxidising agents added to the thiocyanate are also effective, but none more so than ferric salts. Experiments in which gold was suspended in these liquors for some days showed that the action gradually slackened, no doubt from the conversion of ferric into ferrous salt and the consequent lack of oxygen. The presence of ferric salts from oxidation of pyrites, and the formation of thiocyanates from cyanides, no doubt account for the flow of gold from dumps, and the enrichment of the soil below the heap, which have been frequently observed. By means of a process founded on this action of thiocyanates, it may be possible to recover considerable quantities of gold from old residue heaps.—J. T. D.

Platinum; Solubility of —— in Sulphuric Acid. M. Delépine. Comptes rend., 1905, **141**, 1013—1015

The rapidity with which concentrated sulphuric acid attacks platinum (this J., 1905, 1302) varies greatly with the conditions of experiment. When the concentrated acid is boiled with platinum foil in a flask (338° C.), it turns distinctly yellow in half an hour, and the platinum dissolves at the rate of about 0·01 grm. per sq. dcm. per hour. In a basin or other open vessel the attack is much slower, because the temperature is kept down by evaporation. In mixtures of 50 grms. of sulphuric acid with 10 grms. and 20 grms. of potassium sulphate, which boil respectively at 350°—355° and 365°—370° C., the rates of attack are 0·04—0·05 and 0·12—0·13 grm. per sq. dcm. per hour respectively. Traces of nitric acid, up to 0·1 per cent., added to pure sulphuric acid, do not sensibly affect the rate of attack, so that the attack of platinum by ordinary "commercially pure" sulphuric acid is not to be attributed to the traces of nitric acid which it may contain. Ammonium sulphate exercises a marked retarding influence; indeed, if to a sulphuric acid solution of platinum, ammonium sulphate be added, and the solution boiled, practically the whole of the platinum is precipitated, and no more is found in solution until the whole of the ammonium salt is destroyed. Spongy platinum is dissolved more rapidly by sulphuric acid than the compact metal, but the difference is probably one of surface only, and not due to any allotropic difference. The reaction of sulphuric acid on platinum is represented by the equation $4H_2SO_4 + Pt = Pt(SO_4)_2 + 2SO_2 + 4H_2O$; a platinic sulphate being formed.—J. T. D.

Copper Smelting; Constitution of Mattes produced in ——. A. Gibb and R. C. Phalp. Trans. Amer. Inst. Min. Eng., 1905, Nov., 1193—1209.

The mattes produced in modern copper-smelting vary in copper-content from 20 to 80 per cent., but mostly contain about 50 per cent. The amounts of arsenic, antimony, &c., contained in them are usually so small that they may be looked on as impurities simply, the essential constituents being copper, iron, and sulphur. In modern practice, where the work is done in a blast-furnace, the furnace atmosphere is oxidising, and no reduction of iron occurs. Names are given to the mattes according to their appearance:—"Coarse metal," with 35—55 per cent. of copper, hard, compact, dull bronze colour, no visible metallic copper; "Blue metal," 60—70 per cent., bluish purple, with visible "moss copper"; "white metal," 70—76 per cent., white, unevenly plated appearance, usually homogeneous; 78—81 per cent., various names (*e.g.*, "pimple metal," "close regule," "spongy regule," &c., according to appearance), show metallic copper in considerable proportion.

The authors find that, after determining the ultimate composition of a matte, its proximate constitution can in most cases be determined by the reaction upon it of solution of silver nitrate, from which metallic copper separates silver, cuprous sulphide, silver and silver sulphide, cuprous oxide, silver and basic copper nitrate, while ferrous sulphide is without action upon it, and iron acts so slowly that its reaction in any short time is negligible. Aided by this mode of analysis, they find that:—(1) Cuprous sulphide is the only compound of copper and sulphur stable in the melted condition; it will dissolve neither copper nor sulphur; (2) Ferrous sulphide is the only stable compound of iron and sulphur; it will take up no more sulphur, but much more iron, which, however, forms on cooling a solid solution, and not a compound; (3) Iron will decompose cuprous sulphide, and the action is reversible, equilibrium occurring when the mixture contains about 30 per cent. of ferrous sulphide; (4) Ferrous sulphide dissolves large quantities of metallic copper, which remains in solid solution on cooling; (5) Cuprous and ferrous sulphides are miscible in all proportions, but the mixture of highest m. pt. 1121° C., "white metal," containing 90 per cent. of cuprous sulphide, appears to be a compound, $5Cu_2S.FeS$.

An examination of mattes containing rising amounts of copper showed that that corresponding to white metal contained no metallic copper, but all the others contained it, the quantity increasing as the composition of the matte deviated further from that of white metal. While, however, those containing white metal and excess of ferrous sulphide contained the metallic copper in solution, those containing white metal and excess of cuprous sulphide held it mechanically, for when they were melted in a crucible out of contact with air, a button of metallic copper gradually collected at the bottom, and was found on cooling. These mattes all contained small amounts of cuprous oxide, but none was found in the mattes with excess of ferrous sulphide. These results were confirmed by the micrographic examination of the mattes, after etching with silver nitrate or potassium cyanide. Metallic copper seems, therefore, to be formed from cuprous sulphide, but not from white metal, and is thus only produced from a white metal matte as the white metal is broken up by oxidation and separates cuprous sulphide. The effect of ordinary impurities in mattes is to displace sulphur in combination with iron, and thus, by lessening the amount of ferrous sulphide present, lessen the amount of white metal that can be formed, and hence facilitate the separation of metallic copper from a matte of given copper content. An ordinary impure matte containing antimony and arsenic, with 72 per cent. of copper, is made up of 14 per cent. of cuprous sulphide and 83 per cent. of white metal; whilst a pure matte of the same copper content consists of only 2 per cent. of cuprous sulphide and 97 per cent. of white metal. Industrial practice bears out the view that the copper is more readily separated from a matte when it contains a certain amount of impurities.—J. T. D.

Aluminium; Action of Silicon on Pure and Impure ——. Aluminosilicides. E. Vigouroux. Comptes rend., 1905, **141**, 951—953.

Pure silicon and aluminium, whether fused together, or whether the silicon be formed from silica by the thermite process in presence of excess of aluminium, refuse to combine, but when they are in presence of a third metal, double silicides of aluminium and the metal, or *aluminosilicides* of the metal, are formed. These are definite, crystalline substances, with metallic lustre, dense, hard, and brittle; some are attacked by dilute acids, but most of them resist all acids, even when concentrated, save hydrofluoric acid, and none of them is affected by solutions of alkali. They are formed by heating the three elements together in an atmosphere of hydrogen, or by the thermite method from mixtures of silica and metallic oxide, using excess of aluminium, or by acting with aluminium on a mixture of the metal or its oxide or sulphide with potassium silicofluoride. In view of these facts, clay vessels should be avoided in the preparation of metals which can form aluminosilicides (and practically all save lead, tin, and antimony do form them).—J. T. D.

Insulating and other Purposes; Manufacture of Materials Suitable for ——. W. R. Whitney, Boston, Assignor to General Electric Co., New York. U.S. Pat. 806,608, Dec. 5, 1905.

See Eng. Pat. 12,312 of 1903; this J., 1904, 717.—T. F. B.

Insulating; Method of ——. W. S. Moody, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 806,696, Dec. 5, 1905.

The conductors of an electrical apparatus having an enclosing casing are insulated by heating oil while passing dry air through it, and then introducing the oil into the casing while maintaining a vacuum within the apparatus. —R. S. H.

Nitrogen Compounds; Process of Forming ——. A. M. Gow, Allegheny, Pa., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 801,782, Oct. 10, 1905.

The production of hydrocyanic acid by the action of an electric arc upon mixtures of methane and air is claimed. In practice ammonia and ammonium cyanide are also produced.—R. S. H.

Milk and other Liquids; [Electrical] Process and Apparatus for Sterilising ——. R. C. Turner. U.S. Pats 806,600 and 806,601, Dec. 5, 1905. XVIII.A., page 36.

French Patents.

Accumulator Plates; Regeneration of Negative —— of Reduced Capacity; or Prevention of Diminution of Capacity of New Plates. R. Kieseritzky. First Addition, dated July 26, 1905, to Fr. Pat. 346,760, Oct. 3, 1904.

Instead of placing the prepared wood between the positive and negative plates of an accumulator, as described in the principal patent (this J., 1905, 243), it may be placed in the midst of the acid, the form and size of the pieces being appropriate to the receptacle of the accumulator. The wood may be employed as thin boards, or in a disintegrated state within a perforated lead envelope, or within any other permeable material resisting the action of the acid.—B. N.

Incandescent Filaments; Manufacture of ——. A. Frankfurter and H. Kuhlmann. Fr. Pat. 356,999, Aug. 17, 1905. II., page 12.

Wines, Brandies, Spirits and Liqueurs; [Electrical] Process for Ageing ——. J. M. L. Desvignes. Fr. Pat. 350,279, Oct. 31, 1904. XVII., page 36.

(B.)—ELECTRO-METALLURGY.

Gold; Distillation of ——, *and of its Alloys with Copper and with Tin. New Method of Producing Purple of Cassius.* H. Moissan. Comptes rend., 1905, **141**, 977—983.

Gold can be easily distilled in the electric furnace, with a similar disposition of apparatus to that used by the author in distilling copper (this J., 1905, 1312). It boils at a higher temperature than copper and at a lower temperature than lime. It condenses on the cold tube in filiform masses and microscopic crystals, which have all the characters of ordinary gold in fine division. In alloys of gold and copper, or gold and tin, the copper or tin distils before the gold. In distilling gold-tin alloys, a finely divided mixture of stannic oxide, lime, and gold is obtained, having the colour and properties of purple of Cassius. Similar deposits of varying tint can be obtained by substituting for lime other oxides (silica, zirconia, magnesia, alumina).—J. T. D.

English Patent.

Metals; Process for Extracting —— from Ores and other Metalliferous Material by Electrolytic Means and Apparatus therefor. Ganz und Co., Eisengiesserei und Maschinenfabr., Act.-Ges., Ratibor, Germany. Eng. Pat. 15,055, July 21, 1905. Under Int. Conv., Aug. 26, 1904.

See Fr. Pat. 356,825 of 1905; following these.—T. F. B.

United States Patents.

[Electrolytic] Separation of Metals [Nickel and Copper]. N. V. Hybinette, Westfield, N.J. U.S. Pat. 805,969, Nov. 28, 1905.

The process is for the separation of nickel from copper, and consists in making an alloy of the two metals the anode in an electrolyte consisting of a solution of nickel sulphate and a "weak acid," contained in a cell divided into anode and cathode compartments by a porous diaphragm. The process is so conducted that the solution in the cathode compartment contains only nickel, whilst that in the anode compartment contains both nickel and copper, and the passage of copper through the diaphragm is prevented by causing the electrolyte to circulate from the cathode to the anode, and by maintaining a pressure in the cathode compartment. The anode solution is regenerated, *i.e.*, freed from copper, by "cementation" on nickel or a nickel-copper alloy refined at least to the point at which carbon, silicon and sulphur are practically eliminated, and is then returned to the cathode compartment.—A. S.

Calcium; Process of Manufacturing ——. O. Ruff, Berlin, and W. Plato, Colberg, Germany. U.S. Pat. 806,006, Nov. 28, 1905.

A fused mixture of calcium chloride with calcium fluoride or some other calcium salt which will lower the melting-point is electrolysed. The temperature is maintained above the melting-point of metallic calcium.—R. S. H.

French Patents.

Iron; Manufacture of Molten Decarburised ——. Soc. Electro-Métallurgique Française. Fr. Pat. 356,714, Aug. 5, 1905.

Molten steel (soft) is caused to cool, either by radiation or by addition of a certain proportion of cold iron, until it is partially or wholly solidified. During this process, the carbon in those portions of the metal that remain liquid longest (the mother-liquor) is oxidised at the expense of the iron oxide, thus leading to escape of carbon in combination with oxygen as a gas. The metal is then remelted without addition, and may be cast in ingots without becoming porous by disengagement of gases. Iron thus decarburised, may be deoxidised by fusion with such a metal as aluminium, and is then suitable for making forgings, plates or castings for mechanical or electrical purposes. It is preferred to carry out the process in an electric furnace, in which any carburetting influence may be guarded against, and reference is made to the furnaces described in Fr. Pats. 298,656 and 305,317 of 1900, as suitable.—E. S.

Metals; Process and Arrangement for Extracting ——, *from Ores and other Metalliferous Materials, by Solution and Electrolysis.* Soc. Ganz et Cie. Fr. Pat. 356,825, Aug. 11, 1905. Under Int. Conv., Aug. 26, 1904.

The apparatus consists of a vessel divided into two portions by a false bottom E, thus forming an electrolytic chamber F, and a lixiviating chamber H. The electrolyte, consisting of an alkali salt or a mixture of this with a metallic salt, is supplied through the tubes K in connection with *c*, the latter also serving to connect the source of current with the anodes *b*. The latter, preferably of graphite, form a kind of grid through which the electrolyte passes, and immediately above the anodes is a series of diaphragm tubes *d*. The latter are connected together in sets of eight to a common pipe *f*, so that the cathode liquid in the tubular diaphragms may traverse them uniformly. The tubular diaphragms *d* are inclined or horizontal, and constructed of alkali-resisting material, containing the cathodes *h* advantageously constructed of iron or nickel. A suitable piece of metal connects the cathode with the source of current *j*, which is made tight in a branch tube *i* fixed in the head-piece *g*. The latter is connected by a union at *h* with the collecting vessel I for the alkali; an alkali salt is passed, by means of *f*, through the tubular diaphragms, and the mixture of alkali salt, alkali hydroxide,

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Fig 1

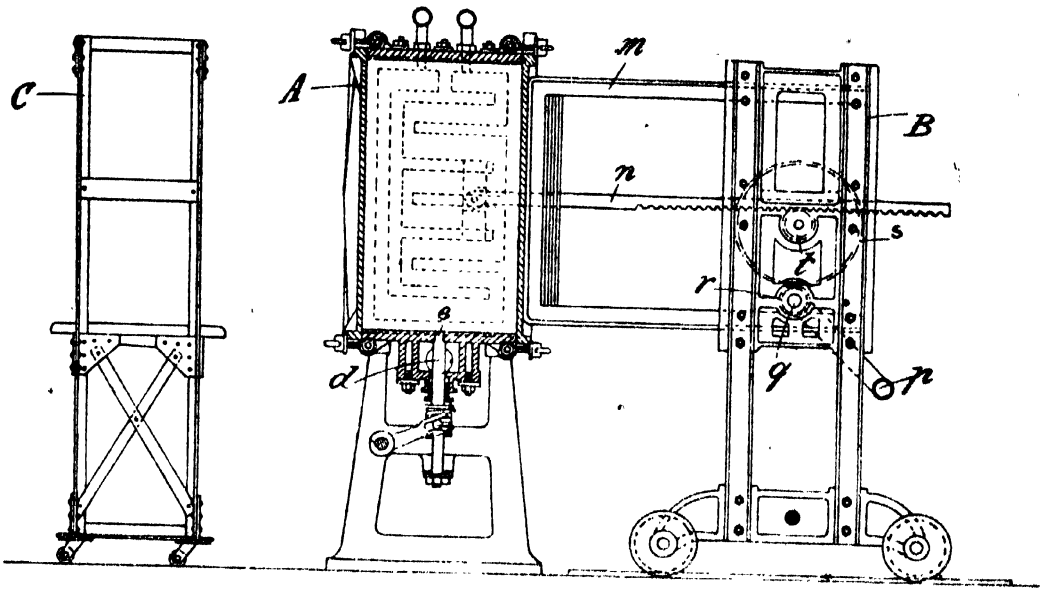
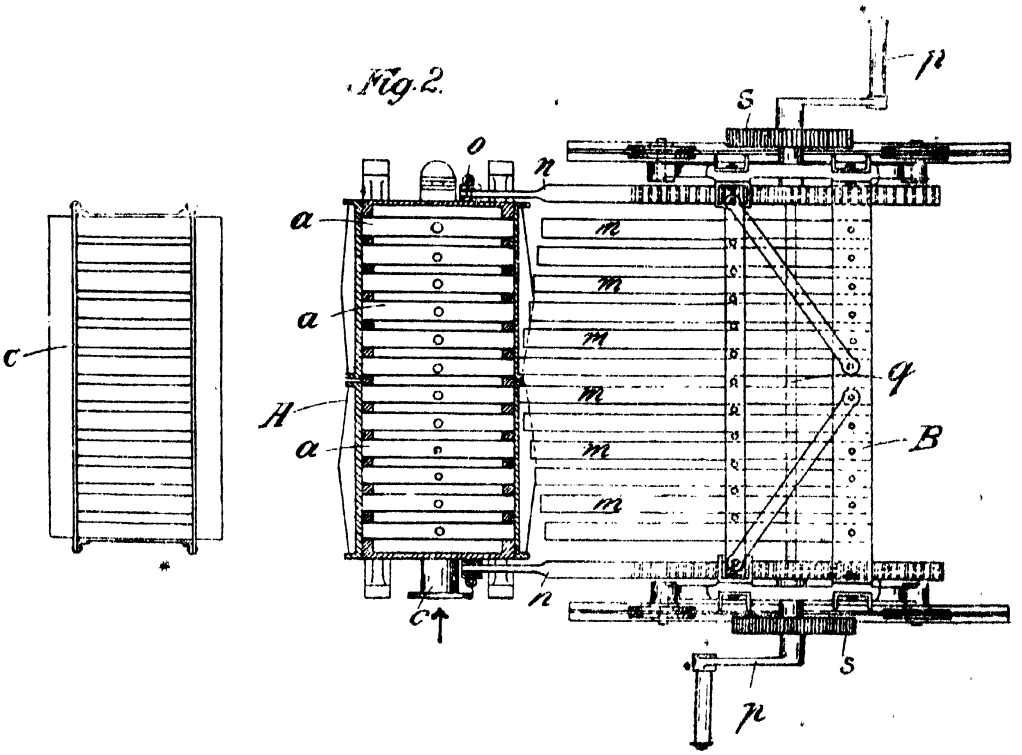


Fig. 2.



id soap is supplied from below through the conduit ig. 2), which is in connection with the mould chambers by connecting apertures, closed by longitudinally laceable rods *d* (Fig. 1). The latter have chamd upper ends *e* (Fig. 1), entering these connecting rtures, and completely filling them when they are ed, thus preventing the soap from collecting and ing in them. The plates of soap, which set in the tical separate cooling chambers *a*, are ejected in orizontal direction by means of a displaceable apparatus the "knock-outs" *m* entering the mould chambers delivering the soap on to a movable stand C. The es of soap may be divided simultaneously with their tion by means of cutting wires, knives, or the like, unted on A or C. The "knock-outs" *m* (Fig. 2) are anged step-wise, so that the plates of soap are attacked succession and not simultaneously. The ejecting aratus B is moved against the cooling apparatus A by ans of racks *n*, the latter being fixed to A and guided 3, and engaging with winding gear, *p*, *q*, *r*, *s*, *t*, mounted B.—B. N.

shing Powder Containing Alkali Superoxide; Method f Packing and Storing ——, *and Device therefor.* V. P. Thompson, Liverpool. From Königswarter and Ebell, Linden, Germany. Eng. Pat. 19,809, Sept. 30, 1905.

external, preferably cylindrical, vessel is filled with p powder, or a mixture of soap powder and stearic or er suitable fatty acid. A second tube, arranged contrically with this, attached to its lid and reaching ost to the bottom which is fitted upon both, contains ium peroxide, or other "alkali superoxide." The rging of the two tubes is done after the lid has been ured to the outer tube and before the bottom is put on. lischarging appliance may be placed in the inner tube, ng attached to the bottom by means of a wire, for the rpose of retaining the sodium peroxide and aiding in its xture with the soap powder when the lid is withdrawn. e object is to keep these compounds, which form the e chief ingredients of a washing powder, apart from h other, until the powder is about to be used, the omposition of the sodium peroxide, which occurs en it is mixed with moist soap powder, being thus ided, and the two substances being mixed at the ment when the package containing them is opened. e also this J., 1905, 1011.)—E. B.

United States Patents.

ulating Wires and Electrical Conductors. C. H. Rupley, Assignor to Gen. Electric Co. U.S. Pats. 806,574—7 XIA., page 28.

ulating; Method of ——. W. S. Moody, Assignor to Gen. Electric Co. U.S. Pat. 806,696, Dec. 5, 1905. XIA., page 29.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc

(A.)—PIGMENTS, PAINTS.

White and Red Lead.

E following is an abstract of a memorandum issued by White Lead Corroders' Trade Section of the London amber of Commerce:—

t has come to the knowledge of the Section that users white and red lead, especially small buyers, have been ded in buying as "Best," "Genuine," or other term icating the highest quality, a pigment which on analysis been found to be adulterated, and the Section desire draw attention to the fact that it is a distinct breach the Merchandise Marks Act, 1887, to describe and sell "Best," "Genuine," or other similar term any white red lead which contains any adulterant such as barytes, e or any other foreign added matter. The penalties aching to the use of misleading terms under the Merchandise Marks Act are heavy, so that it behoves everyone in the trade to take due precautions against their offering, or having in their possession for sale, white or red lead which bears a misleading description within the meaning of the Act. In this connection the White Lead Section of the Chamber are prepared to examine and report on, free of charge, any sample of white or red lead bought as "Best," "Genuine," or other term indicating the highest quality, if a small sample of the same is sent to "The Inspector," White Lead Corroders' Trade Section, London Chamber of Commerce, Oxford Court, London, E.C. A half-pound sample will be sufficient for the purpose of analysis. [T.R.]

English Patent.

[*Antimony Oxide*] "*White Antimony*" *Pigment; Manufacture of* ——. L. Brunet, Brioude, France. Eng. Pat. 16,490A, Aug. 14, 1905. Under Int. Conv., April 15, 1905.

Antimony oxide is mixed with a solution of barium salts or hydroxide, or with a milk of barium or calcium carbonate, these latter compounds being converted into the corresponding sulphites by treating them with the sulphurous gases from the roasting of antimony ore.—C. S.

United States Patents.

Calcimine [*Distemper*] *Compositions; Process for Preparing* ——. H. H. Church, Bellows Falls, Vt., Assignor to Casein Co. of America, New Jersey. U.S. Pat. 805,712, Nov. 28, 1905.

Soap is added to a warm aqueous solution of glue and the mixture dried in the form of films. The latter are then powdered and mixed with a suitable proportion of a pulverised mineral or earthy base, such as talc or whiting, or both.—W. P. S.

Paint; Process of Treating ——. M. E. McMaster, Monroe City, Mo. U.S. Pat. 805,984, Nov. 28, 1905.

The process consists in adding a solution of mercuric chloride to sweet milk, thoroughly incorporating and heating the mixture, and stirring it into the paint.—W. C. H.

French Patents.

Colour [*Compound*] *Resistant to Light and to Weather Changes.* W. Hoffmeistor, H. Hundt, C. Eiler, and A. Winther. Fr. Pat. 356,663, July 27, 1905.

The colouring matter is composed of an agglutinant, such as potassium silicate, or, in some cases, casein or the like, mixed with finely-powdered coloured materials, such as glass, porcelain or sand, or a suitable coloured mineral. Surfaces treated with a paste thus prepared may be washed with acids, chloride of lime, or alcohol, to prevent an efflorescence.—E. S.

Paint with Resin Base. F. Büttner Pfänner zu Thal. Fr. Pat. 356,988, Aug. 19, 1905.

The pigment is incorporated with finely-divided, soft oleml resin, the resulting mass, which keeps in good condition for a long time, being thinned down with some more or less volatile solvent for use.—C. S.

(B.)—RESINS, VARNISHES.

United States Patent.

Wood; Apparatus for Fiberising and Deriving other Products from ——. A. W. Handford, Evanston, Assignor to Wood Distillates and Fibre Co., Chicago. U.S. Pat. 806,253, Dec. 5. 1905.

The apparatus consists of a device for comminuting the wood, a digester for the comminuted wood, pairs of rollers enclosed in a suitable casing, for expressing the liquid from the pulp, and a pump connected with the last two receptacles, for leading the liquids containing the resinous products of the wood to an apparatus for working them up. Endless conveyors are provided for conveying the product at each stage of the process to the succeeding operation.—T. F. B.

(*C.*)—INDIA-RUBBER, Etc.

Caoutchouc; Existence of Vessels Bearing ——, *in a Genus of Menispermaceæ.* J. Maheu. Comptes rend., 1905, **141**, 958—959.

Most of the known species of *Tinomiscium* (Miers) contain lactiferous vessels in their parenchyma, which contain a considerable proportion of caoutchouc. No menispermaceous plant has hitherto shown the presence of caoutchouc.—J. T. D.

Caoutchouc from the Bark of "Mascarenhasia longifolia." H. Jumelle. "Le Caoutchouc et la Gutta Percha," 2 [8]; through Gummi-Zeit., 1905, **20**, 232—233.

The author has made experiments on the extraction of rubber from the bark of the Madagascar rubber plant *Mascarenhasia longifolia* by the following three processes:—

1. *Deiss Process of Treatment with Sulphuric Acid* (see Eng. Pat. 12,538 of 1899; this J., 1899, 927).—After freeing the rubber from acid and bark by washing between rolls with hot water, or grinding wet in a porcelain mortar, washing and sifting, a yield of 4·6 per cent. on the weight of bark used was obtained.

2. *Hamet's Method.*—The crushed bark was heated for two hours at 130° C. in an autoclave with a 15 per cent. solution of sodium carbonate, and the product was washed on a sieve. The yield was again 4·6 per cent. on the weight of bark used. The rubber obtained by this and the preceding process rapidly darkens in colour.

3. *Process of Arnaud, Verneuil and Godefroy-Lebœuf* (see this J., 1900, 256; also Eng. Pat. 9906 of 1900; this J., 1901, 373).—The yield obtained by this process was only 3 per cent. on the weight of bark used, but the rubber was not so dark coloured as that obtained by the other processes.

From *Haucornia speciosa* Arnaud obtains by his process 5 per cent., from *Landolphia Heudelotii* 5·8 per cent. of commercial rubber.

The following table contains the results of comparative analyses of rubber: (1) from the latex and (2) from the bark of *Mascarenhasia longifolia*, the former being prepared by sulphuric acid coagulation:—

	Rubber from latex.	Rubber from bark.		
		Deiss.	Hamet.	Arnaud.
	Per cent.	Per cent	Per cent.	Per cent.
Moisture	5·66	0·20	3·30	11·02
Rubber soluble in ether	65·93	62·70	61·79	62·00
Resins soluble in ether-alcohol	4·27	—	—	—
Foreign substances	28·41	—	—	—
Ash*	0·75	1·87	2·92	2·63
Rubber soluble in ether, calculated on dry substance	69·88	66·84	69·66	63·89

* Ash in bark = 1·31 per cent.

—E. W. L.

Caoutchouc: Study of Different Kinds of ——. *The Relation between the Hydrocarbons of Caoutchouc and Gutta-Percha.* C. Harries. Ber., 1905, **38**, 3985—3989.

The author has extended his method of determining the chemical nature of Para-caoutchouc (ozone-method, Ber., 1904, **37**, 2708; this J., 1904, 830; Ber., 1905, **38**, 1195; this J., 1905, 448) to the hydrocarbons from gutta-percha, which Ramsay (this J., 1902, 1367) and Tschirch (Annalen, 1905, **243**, 114) agree in describing as a white, crystalline mass of the composition $C_{10}H_{16}$, which is oxidised more readily by the oxygen of the air than caoutchouc. It has already been shown that pure gutta-percha gives a nitrosite $C_{10}H_{15}N_3O_7$, similar to that derived from caoutchouc (Ber., 1903, **36**, 1938; this J., 1903, 875), and it is now found to give a quantitative yield of diozonide, $C_{10}H_{16}O_6$, on treatment with ozone. The ozonide has the same molecular weight and yields on hydrolysis the same products, *viz.*, levulinic aldehyde or acid and levulinic aldehyde-diperoxide, as the caoutchouc ozonide. The proportions of aldehyde to acid in the products of hydrolysis are, however, reversed in the two cases, being 1·3 to 2·9 in the case of the gutta ozonide, and 2·3 to 1·0—1·5 in the case of the caoutchouc derivative. The author considers that the ozonide molecule probably splits up in a different way in each case, and he illustrates these by graphic formulæ of some complexity.

The reason for the difference in the way in which the two molecules break down is probably to be sought for in a *cis-trans* isomerism of the two ozonides, having its origin in a stereochemical isomerism of the two parent hydrocarbon molecules.—E. W. L.

United States Patent.

Rubber; Method of Dissolving and Recovering ——. G. A. L. Clift, Assignor to Robinson Bros., Ltd., West Bromwich. U.S. Pat. 805,903, Nov. 28, 1905.

See Eng. Pat. 6471 of 1904; this J., 1905, 449.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Sodium Sulphide; Use of —— *for Unhairing Hides.* W. Eitner. Gerber, 1905, **31**, 349—351.

The use of sodium sulphide, although advocated 35 years ago by the author, has only during the last ten years been generally adopted, and is specially favoured by tanners of heavy leather. The depilation can be done either by painting or by liming in pits. By painting the hair side with the paste prepared in the following way, unhairing can be effected in four hours:—One part of sodium sulphide is dissolved in 5 parts of hot water, and the solution is poured into milk of lime prepared by slaking 3 parts of lime with 15 parts of water. 1·0 per cent. of sodium sulphide, calculated upon the weight of the green hide, should be used. Pastes which will act even more quickly than this can be prepared, by dissolving small quantities of realgar in the sodium sulphide solution and mixing it with milk of lime. By taking 0·3—0·4 per cent. of sodium sulphide and mixing it in the proportions of 1 part to 10 parts of lime and 60 parts of water, a paste can be prepared which will remove the hair from skins in 15 to 20 hours.

When liming in pits, 0·3—0·4 per cent. of sodium sulphide (calculated upon the weight of green hide) is used, together with 2 parts of lime for each part of sulphide, as there is no advantage gained by adding more lime. The hides can be unhaired after two days.

A solution of sodium sulphide containing 3 parts in 100 of water destroys hair very rapidly, and unhairing can be effected after three to four hours. It was, however, found that by prolonged treatment of hides with this solution, say, for 24 hours, brittle leather resulted. The author found that the addition of a small quantity of lime to the sulphide solution considerably increased its unhairing property; he, therefore, advocates the use of an unhairing liquor prepared as follows:—Thirty kilos. of sodium sulphide are dissolved in 100 litres of hot water and 3—6 kilos. of slaked lime are added and well stirred up with the solution. A white precipitate is formed, which settles quickly; the clear liquor is drawn off and diluted with water to 10 hectolitres. The liquor is free from lime and should be of 1·021 sp. gr., or 3° B. when diluted. The hides are laid flat in a pit containing this liquor for one hour, and are then "horsed" for one to one and a-half hours. The spent liquor is made up to 3° B. and used over again. The unhairing can be done effectively by drumming in a wash-wheel, or by brushing. The remaining operations do not differ from the customary ones. The suspender liquor should be slightly acid, and should contain mild tannins. This method of liming being more costly, economy has to be strictly observed, although the higher leather-weight, which is obtained by the use of this method, will alone compensate for the increased costs.

Sodium sulphide, as brought on to the market, varies much in strength; the author's results were obtained with the dry crystallised product.—F. K. K.

XV.—MANURES, Etc.

Soil; Effect of Plant Growth and of Manures on the Retention of Bases by the ——. A. D. Hall and N. H. J. Miller. Roy. Soc. Proc. B., 1905, **77**, 1—32.

Arable soils containing over 1 per cent. of calcium carbonate normally lose in the drainage water about 800 to 1000 lb. of calcium carbonate per annum. This loss is increased by the use of ammoniacal manures by an amount equivalent to the combined acid of the manure, but is diminished when sodium nitrate or organic *débris* is employed. A large portion of the bases of the neutral salts, provided by the soil for the nutrition of plants, is returned to the soil during the growth of the plant. The calcium oxalate and other organic calcium salts present in plant residues are converted into carbonate by bacterial action in the soil. This return of base to the soil by plant-growth and production of calcium carbonate by decay are sufficient to maintain neutral, soils which are poor in calcium carbonate, and to replace the bases which have been consumed in nitrification and similar changes.—F. F. B.

Nitrogen; Utilisation of Atmospheric ——. O. N. Witt. XIA., page 27.

German Patent.

Nitrogen Compounds from Alkaline-Earth Carbides; Process for the Manufacture of ——. Ges. fur Stickstoffdünger, G.m.b.H. Ger. Pat. 163,320, Nov. 1, 1901.

The carbide is mixed with a chloride of an alkali, alkaline-earth or other metal, and ignited in an atmosphere of nitrogen. For example, 62 grms. of calcium carbide are mixed with 18·7 grms. of calcium chloride and heated to bright redness in an atmosphere of nitrogen. It is stated that 100 grms. of a product containing 19·3 per cent. of nitrogen are obtained in a short time.—A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Scammony Root; Presence of Pentoses and Methylpentoses in ——. P. Requier. XXIV., page 44.

"*Redo*" [*Calcium Hydrosulphite*]; *Employment of* —— *in Sugar Factories and Refineries.* E. Vasseur. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 541—545.

Calcium hydrosulphite or "redo" is soluble in water to the extent of 3—4 grms. per litre, and the solutions have a neutral or slightly alkaline reaction. This reducing agent is now prepared in a technically pure state, and used both in sugar factories and refineries, for decolorising juices, increasing the quotient of purity and reducing the viscosity of the syrups. In sugar factories this compound can be added to the diffusion liquors, to the carbonatated juices, to the concentrated syrups, and to the spun syrups. In the last case, especially, the use of it enables larger quantities of molasses to be returned to the boiling syrups than is usually practicable, consequently third-jet products are dispensed with and a fully exhausted molasses is said to be produced. In sugar refining, "redo" is added to the melted syrup after defecation by lime; the temperature is then raised to 80° C. and the syrup is filtered. The action of the hydrosulphite is represented by the equation $CaS_2O_4 + Ca(OH)_2 = 2CaSO_3 + H_2$. The calcium sulphite, being nearly insoluble at a high temperature, is readily removed by filtering hot. In sugar factories the quantity of the calcium hydrosulphite added to the juice after the second carbonatation may, it is stated, be 20 grms. per hectolitre.—J. F. B.

Starch; Liquefaction of ——. *Mineral Compounds possessing Properties similar to those of the Liquefying Diastase of Malt.* J. Wolff and E. Roux. Comptes rend., 1905, **141**, 1046—1048.

A peculiar modification of starch is prepared by treating 25 grms. of potato starch at the ordinary temperature with 50 c.c. of a 0·1 per cent. solution of potassium permanganate containing 10—15 per cent. of sulphuric acid or 6—7 per cent. of hydrochloric acid. After about two hours the liquid becomes colourless, the starch is filtered off, washed and dried at 30° C. A similar product is obtained by the use of bichromate or chlorine instead of permanganate. The modified starch apparently retains all its original properties; its 5 per cent. pastes, if made with distilled water, are scarcely less viscous than those of ordinary starch, and they are capable of undergoing reversion and diastatic coagulation in the ordinary way. But if the pastes of the modified starch be treated at about 70° C. with traces of a body possessing a basic reaction, *e.g.*, with ammonia, the hydroxides or carbonates of the alkalis or alkaline-earths, or with secondary phosphates, they are immediately liquefied. The same effect is brought about by the basic matters in ordinary water if the latter be employed for making the paste. The liquefying action of these bodies at the ordinary temperature is almost *nil*; it increases rapidly with rise of temperature and reaches a maximum at 70°—75° C.; it differs from the liquefying action of malt by continuing at temperatures above 80° C. The liquefied starch pastes gradually revert to the gelatinous state when kept at the ordinary temperature, but the jelly so produced is readily soluble on heating and gives limpid solutions. The degree of liquefaction, the permanency of the liquefied solutions, and the solubility of the amylocellulose precipitated after saccharification, all depend on the intensity of the original oxidising treatment.—J. F. B.

Starch, Glycogen and Cellulose. Z. H. Skraup and others. XXIV., page 43.

English Patents.

Separating Solid Substances from Liquids [*Drying Beet Slices*]; *Apparatus for Mechanically* ——. H. Honcke. Eng. Pat. 29,358, Dec. 31, 1904. I., page 7.

Food for Animals [*Peat and Molasses*]; *Manufacture of* ——. F. Livingstone. Eng. Pat. 27,597, Dec. 17, 1904. XVIIIA., page 36.

Starch; Sieves for Washing —— *out of Disintegrated Materials.* W. H. Uhland, Leipzig-Gohlis, Germany. Eng. Pat. 425, Jan. 9, 1905.

See Fr. Pat. 348,992 of 1904; this J., 1905, 629.—T. F. B

United States Patents.

Liquids [*Sugar Solutions*]; *Apparatus for Cooking* ——. E. Shaw, London. U.S. Pat. 806,848, Dec. 12, 1905.

See Eng. Pat. 4112 of 1904; this J., 1905, 245.—T. F. B.

Sugar from Cellulose; Manufacture of ——. C. F. Cross, London. U.S. Pat. 807,250, Dec. 12, 1905.

See Eng. Pat. 8544 of 1904; this J., 1905, 340.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Seeds; Germination of —— J. Effront. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 508—522.

The following additional points are incorporated, in a more complete paper, with those already dealt with (see this J., 1905, 1183). The author has studied the operation of malting from the distillery point of view, *i.e.*, the production of maximum diastatic power. It is difficult, if not impossible, to combine the maximum saccharifying power with the maximum liquefying power in the same malt; and the author concludes that the liquefying power of the malt is a better measure of its value in practice than the saccharifying power. The determination of saccharifying power is complicated by the influence of foreign matters (such as salts and amino-acids) in the medium, and the results are not always a measure of the true quantity of diastase present. In order to avoid this influence, it is necessary to produce very profound saccharifications. For this purpose, varying quantities of malt were added to equal quantities of boiled starch and allowed to saccharify at 60° C for one hour; all the tests were

then fermented under equal conditions, and the yields of alcohol were determined. It was found that the quantity of a given malt necessary to produce a given quantity of alcohol was a function of the liquefying power of the malt, and bore no relation to its saccharifying power. The quantity of diastase developed is in direct relation to the time of floor treatment and to the development of the plumule. At 15° C., the time of germination should be at least 10 days, and the external plumule should have attained at least twice the length of the corn, for the production of the maximum quantity of diastase. A malt with a long plumule does not contain a maximum amount of diastase if the growth has been forced. On the other hand, a malt with a short plumule has not the maximum diastatic power even if the floor treatment has been very prolonged. Practically the whole of the diastase, both saccharifying and liquefying, remains in the corn itself; the migration of diastase into the radicles and plumules is insignificant.—J. F. B.

Yeast; Growth of —— in Mineral Nutrient Media. T. Chrzaszcz. Cent. Bakt. [Abth. 2], 1904, **13**, 144; through Z. ges. Brauw., 1905, **28**, 825—826.

The author prepared nutrient media containing sugar and mineral salts. A precipitate of calcium phosphate was formed, which in some cases was filtered off, and in other cases was allowed to remain. The unfiltered solutions were more favourable to the development of the yeast, especially when only a few cells were sown. Oxygen is favourable to the development. Traces of impurities in the salts employed, and also the use of distilled water, retard the growth of the yeast; sulphuric acid and strychnine salts are also unfavourable. The smaller the amount of phosphoric acid (or otherwise of lime and magnesia) in the solution, the worse is the development of the yeast. Different races of yeast vary as to behaviour in these solutions. The addition of calcium salts is only favourable when these are added in the form of the soluble phosphate; ferric chloride has no influence on the development of the yeast.—J. F. B.

Beer; Sarcina Sickness of —— : Symptoms and Measures for Preventing. H. Will. Z. ges. Brauw., 1905, **28**, 817—820, 833—836.

Sarcina sickness attacks pale beers more frequently than dark, but very seldom occurs in strongly hopped beers; the organisms exist in beer, as a rule, only in the pediococcus form. Sarcina sickness causes alterations in the odour and flavour of the beer, which may or may not become turbid. In rarer cases, changes in the colour of the beer and ropiness may be observed. A strong growth of sarcina in beer does not always produce sickness, hence the idea of varying degrees of virulence has arisen. The symptoms of the sickness nearly always make their appearance only in the later stages of the process of manufacture, *e.g.*, in the lager cellar, the transport casks and bottles; the sickness is frequently accompanied by the separation of a gluten "haze." In all cases, the germs propagated in the brewery itself, being more or less acclimatised, are more dangerous than those introduced from outside. The first steps to be taken in dealing with the sarcina sickness are to ensure thorough cleanliness in all the above respects. Next, the predisposition of the beer may be reduced by brewing only thoroughly modified malt made from barley not too rich in protein, by allowing a more complete saccharification of the wort, aërating thoroughly and increasing the proportion of hops. The wort should be pitched at once with a sufficient quantity of a rapidly multiplying, highly attenuative yeast. The yeast should be well washed and as fresh as possible; it should be developed with strong aëration, and should be changed rather frequently. In the lager cellar, the beer should mature without disturbance or "frets," and at as low a temperature as possible. The addition of a small proportion of raw hops together with strongly hopped "Kräusen," and immediately closing the cask, will sometimes cure sarcina sickness if not too far advanced. In racking, filtering and bottling, scrupulous cleanliness must be exercised, and all losses of carbon dioxide must be prevented; attention should be paid to the condition of the filter and filtering pulp.
—J. F. B.

Fermenting Liquids; Influence of Metals on ——. III. L. Nathan, A. Schmidt and W. Fuchs. Centr. Bakt. [Abth. 2], 1905, 349; through Woch. f. Brau., 1905, **22**, 764 (see also this J., 1904, 876 and 1905, 745).

In working with yeast-propagating apparatus tinned internally, the fermentation proceeds more slowly, especially during the budding stage, and the yeast so obtained shows a modified granular structure, and possesses a lower fermentative power as compared with yeast grown in non-metallic vessels under similar conditions. The yeast propagated in metallic vessels frequently imparts an abnormal bitter metallic flavour to the beer fermented by it. These peculiarities generally disappear after the yeast has been used two or three times. The tin coating of the vessels tends to disappear somewhat rapidly. Fermentations in presence of iron give beers with a grey or black tint; tin and tinned iron change the brown colour of the wort to yellow during sterilisation, and produce a milky turbidity during fermentation; lead causes milkiness, and zinc imparts a dirty green shade to the liquid. Further experiments were made with the simultaneous presence of two metals, but the results were no worse than with one metal; the metallic couples behaved approximately like the alloys. Only glass appears to be entirely without influence on the fermentation, yield of yeast and appearance of the beer; gold and silver cause a small decrease in the yeast-crop; copper and nickel cause a darkening of the colour, whilst the other metals tend to turn the shade paler. Iron, tin, zinc, bronze, lead, aluminium and brass are to be regarded as powerful yeast poisons.—J. F. B.

Formaldehyde as a Disinfectant in the Brewery. H. Schnegg. Z. ges. Brauw., 1905, **28**, 807—810, and 820—824.

As the result of a large number of practical tests, the author concludes that formaldehyde is a most efficient disinfectant for general brewery use, and that it gives satisfaction when applied to pipes, whether of metal or rubber, wooden vessels, walls and floors. The solution should contain at least 0·5 per cent of formaldehyde, at which concentration it is cheap, and its odour is harmless. When applied after a thorough mechanical scouring with water, a duration of two hours' contact with a 0·5 per cent solution of formaldehyde is generally sufficient, although longer contact, up to 24 hours, is advantageous when possible. The action of the formaldehyde is so thorough, that a disinfection once a week is generally sufficient. Owing to the great capacity of formaldehyde for inhibiting growth, any serious accumulation of organisms is prevented, so that, after a long period of disinfection with formaldehyde, the pipes of the brewery become free from organisms. Continued use of formaldehyde produces no deterioration of metal, rubber, wood or tanlacquer. In the case of pipes, the same solution of formaldehyde may be used at least twice, whilst in other cases, it may be used several times over without losing its disinfectant action.
—J. F. B.

Alcohol in France for Industrial Purposes. D. Sidersky. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 545—548.

The total consumption of denatured spirits in France has risen from 374,598 hl. in 1903 to 423,561 hl. in 1904, in spite of a considerable rise in price. Of this increase, 27,712 hl. related to spirits for heating and lighting purposes.

The consumption of spirits for dyestuffs, varnishes, &c., has varied between the limits of about 13,000 and 19,000 hl. in the last 15 years; until the year 1903, the consumption of spirits for collodions, plastic masses and artificial silk never rose beyond 9750 hl., but, in 1903, it suddenly increased to over 20,000 hl., falling to 19,000 in 1904. In 1903, the quantity of spirits used for chemical and pharmaceutical products showed an increase of 50 per cent. over the previous year, rising to 12,944 hl., but falling again to 9041 hl. in 1904. The increase in consumption for others and explosives has been fairly continuous during the last 15 years; the quantity used for these purposes being 89,917 hl. in 1904. The quantity

of spirit issued free of duty for vinegar manufacture has not varied greatly during 15 years; in 1904 the consumption was 53,298 hl.—J. F. B.

Spirits and Brandies; Uniform Methods for Analysis of ——. E. Barbet. XXIII., page 43.

ENGLISH PATENT.

Beer; Pasteurising —— in Barrels. C. Thiel and Söhne, Lübeck, Germany, and H. Gronwald, Berlin. Eng. Pat. 17,419, Aug. 29, 1905.

THE apparatus consists of a metal beer barrel, which is completely filled with beer, and an expansion vessel or receiver, which is filled with carbon dioxide. These two vessels are connected with each other, the receiver being undermost, by means of special valved pipes and connections, which permit a free interchange of gas and liquid between the two vessels whilst preventing the escape of any gas. The combined apparatus is clamped in a frame and is subjected to the pasteurising treatment. After cooling, the apparatus is thoroughly agitated to promote the re-absorption of the carbon dioxide; it is then removed from the frame and placed with the barrel undermost. The beer thus runs from the expansion vessel, filling the cask, and the excess of gas collects in the receiver.
—J. F. B.

UNITED STATES PATENT.

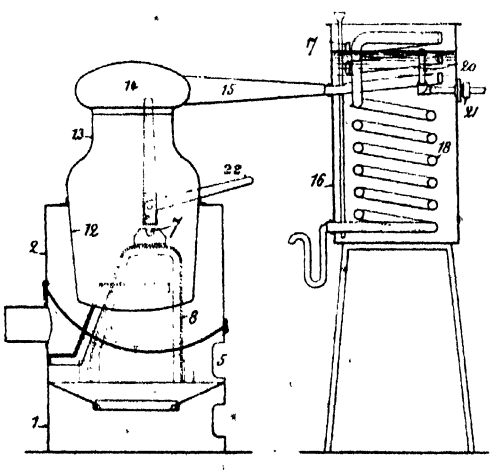
Malt Decoctions; Process for Producing Tasteless Roasted ——. M. Weyermann, Bamberg, Germany. U.S. Pat. 805,607, Nov. 28, 1905.

SEE Eng. Pat. 6796 of 1902; this J., 1902, 923.—T. F. B.

FRENCH PATENTS.

Still. Soc. Nordon Frères. Fr. Pat. 355,691, June 28, 1905.

THE still body 12 is constructed in one piece with the upper part of the furnace casing 2, the whole being supported by the trunnions 7, on the brackets 8, fixed to the lower part of the furnace casing 1. The upper part of the still 13 is made of such a shape that the contents are completely emptied when the still head 14 is removed, and the upper part of the furnace 2 along with the still 12 is tilted on the trunnions 7, by the handle 22. The upper coils 17 of the condenser have an inclination towards the still and the level of the cooling water in the condenser tank 16 can be adjusted by inclining the elbow pipe 20 attached to the overflow 21. If it is desired to obtain strong spirit, the pipe 20 is turned into the vertical position, and consequently the upper coils of the condenser being cooled, most of the aqueous vapour is condensed there and flows back to the still 12 through the pipe 15, whilst the alcohol vapours pass on alone and are condensed in the lower part of the coil 18. If weaker spirit is wanted, the pipe 20 is turned down and the upper coils allowed to get warm, when the water vapour passes on with the alcohol vapours to the lower coils 18, where they are condensed together.
—W. H. C.



Wines, Brandies, Spirits and Liqueurs; [Electrical] Process for Ageing and Improving ——. J. M. L. Desvignes. Fr. Pat. 350,279, Oct. 31, 1904.

A CONTINUOUS current of electricity is passed through the liquid to be treated, the positive electrode being placed in the liquid, whilst the negative electrode is separated therefrom by a porous membrane, which permits the passage of the current whilst preventing, as far as possible, the mixture of the liquids surrounding the two electrodes.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

ENGLISH PATENTS.

Food for Animals [Peat and Molasses]; Manufacture of ——. F. Livingstone, London. Eng. Pat. 27,597, Dec. 17, 1904.

To prevent fermentation of mixtures of peat and molasses, the patentee adds from 0·5 to 1 lb. of salicylic acid to every ton of the mixture. Boric acid and other similar substances may be used instead of salicylic acid. A product is also claimed, consisting of a mixture of peat with a combination of cane molasses and beetroot molasses, with or without the addition of salicylic acid.—W. P. S.

Milk Powder; Manufacture of ——. C. Haccius, Geneva, Switzerland. Eng. Pat. 27,718, Dec. 19, 1904.

THE milk is projected in the form of a fine spray on to the surface of a rotating drum heated to a temperature above 120° C. A number of simple jets or a single flat jet may be employed. The film of dry milk is removed from the drum by means of a scraper, the drum being rotated at such a speed that the film is removed within 10 seconds after the milk has been sprayed on to the drum. A longitudinal motion may be imparted to the scraper to increase its action on the surface of the drum.—W. P. S.

Milk, Cream, Casein and their Derivatives; Desiccation and Preservation of ——. B. J. B. Mills, London. From P. Bévenot and E. de Neveu, Paris. Eng. Pat. 29,367, Dec. 31, 1904.

THE milk, &c., is projected upwards by means of an atomiser into a drying chamber through which a current of hot air is passed. The drying chamber consists of a cylindrical vessel, in which is placed a central heated tube surrounding the jet of the atomiser. The air which is blown through the chamber is previously heated to a temperature below 100° C., but sufficiently high to ensure pasteurisation of the milk. An opening is provided at the top of the chamber through which the air leaves, a plate or screen being placed below this opening to prevent the escape of any milk-spray. The dry milk falls in the form of a fine powder to the bottom of the chamber.
—W. P. S.

UNITED STATES PATENTS.

Flour; Apparatus for Bleaching ——. P. A. Leperche, V. A. Salvadori and V. Denis, Paris. U.S. Pat. 805,652, Nov. 28, 1905.

SEE Fr. Pat. 349,198 of 1904; this J., 1905, 632.—T. F. B.

Milk and other Liquids; [Electrical] Process and Apparatus for Sterilising ——. R. C. Turner, Columbus, Ohio. U.S. Pats. 806,600 and 806,601, Dec. 5, 1905.

THE milk is caused to flow through a series of vessels arranged in steps one below another. From the uppermost vessel the milk overflows from a flat spout into the

next lower one and so on. A horizontal electrode is placed at the bottom of each vessel, the electrodes in every two adjacent vessels being connected with an electric circuit so that each pair is in series. The current flows from the electrode at the bottom of a vessel, up through the stream of milk flowing from the spout of the next higher vessel and leaves by the electrode at the bottom of the latter. —W. P. S.

Pepsin Preparation. J. Altschul, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 806,615, Dec. 5, 1905.

See Fr. Pat. 355,560 of 1905; this J., 1905, 1249.—T. F. B.

FRENCH PATENT.

Threads and Sheets from the Protein Substances of Milk; Process of Making Textile ——. H. Timpe. Fr. Pat. 356,508, July 28, 1905. V., page 16.

(*B.*)—SANITATION; WATER PURIFICATION.

UNITED STATES PATENT.

Water Purifier. P. Bastian, Grovenbroich, Germany. Assignor to Maschinenfabrik-Grovenbroich, Germany. U.S. Pat. 806,234, Dec. 5, 1905.

The water to be purified is received in a circular vessel, which is surrounded by a second vessel, the upper edge of the circular partition common to both vessels being horizontal. The second vessel is divided by means of a movable radial partition into two chambers, one of which chambers discharges into a tank containing a supply of precipitant and the other into a heater. A constant percentage of the water issuing from the heater is separated and made to operate a tipping arrangement consisting of two buckets, which in their turn work a dipping vessel fitted in a lye tank. Means are provided for re-uniting all the separate portions of water, &c., and conducting them to a precipitating tank. The latter consists of a vertical cylinder surrounded by a series of conical guide-plates and enclosed by an outer wall, a valve at the bottom allowing the deposited solids to be removed. —W. P. S.

FRENCH PATENTS.

Water; Process for the Purification of ——. L. Maiche. Fr. Pat. 350,264, Oct. 26, 1904.

The water is passed through a vessel or filter filled with powdered sulphur, preferably flowers of sulphur. Any convenient form of vessel may be employed, and it is claimed that the sulphur destroys all bacterial life. —W. P. S.

Water and other Liquids; Process and Apparatus for Destroying the Pathogenic Organisms in ——. P. G. Griffith. Fr. Pat. 356,946, Aug. 16, 1905. Under Int. Conv., Aug. 18, 1904.

See Eng. Pat. 17,984 of 1904; this J., 1905, 811.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Celluloid Goods; Liability of ——, *to fire.* J. Bronn. Z. angew. Chem., 1905, **18**, 1976—1977.

The author gives an account of researches made by F. Gervais in the laboratory of the Ministry of Finance in St. Petersburg. Gervais' conclusions are as follows:—1. Celluloid wares, remaining in contact with a source of heat at 100° C., decompose spontaneously. 2. This decomposition is accompanied by evolution of heat, which may raise the temperature much above that of the original source of heat, but will not cause ignition of the goods. 3. The temperature may, however, rise high enough to cause the packing-paper to smoulder, and, in presence of air, to take fire. 4. Celluloid goods inflame only when brought into contact with a vigorously burning body. Smouldering wood, or a red hot wire or glass rod, will not inflame them.

In the course of the research, the ignition-temperature of various celluloid articles was determined at from 355° to 457° C.—J. T. D.

Wood Pulp Production of Norway. Bd. of Trade J., Dec. 21, 1905.

According to the statistical report of the Norwegian Pulp-makers' Association, the unsold quantity of wood-pulp for 1905 was a very small one. The calculated total production is about 10,000 tons less than in 1904, and 60,000 tons less than in 1902. This decrease is due to the fact that several pulp mills have gone over to the production of paper. A further decrease of about 20,000 tons may be anticipated for the year 1906. The market is consequently very firm. [T.R.]

Starch, Glycogen and Cellulose. Z. H. Skraup and others. XXIV., page 43.

ENGLISH PATENT.

Paper; Apparatus [Beating-Engine] for Treatment of Fibrous Materials for Manufacture of ——. D. N. Bertram and S. Milne, Edinburgh. Eng. Pat. 1727, Jan. 28, 1905.

The apparatus consists of two vertical chambers or chests, one constituting an up-take, and the other a down-take duct for the pulp. Between these two ducts, at the upper end, the beater-roll and bed-plate are supported, whilst at the bottom end is placed a circulating device which is also provided with toothed or cutting edges which chop up any large pieces of material which would tend to clog the device. The two vertical ducts are so strengthened as to carry the beating portion of the engine without further support, but the internal diameter of the up-take duct is made considerably smaller than that of the down-take duct, whilst the interior of both ducts may be suitably shaped and tapered so as to offer the minimum resistance to circulation.—J. F. B.

UNITED STATES PATENTS.

Paper Yarn; Process for Improving ——. M. Hölken, Barmen-Rittershausen, Assignor to F. G. von Donnorsmarck, Neudeck, Germany. U.S. Pat. 805,553, Nov. 28, 1905.

See Fr. Pat. 353,997 of 1905; this J., 1905, 1081.—T.F.B.

Insulating Electric Conductor. I. Kitsee. U.S. Pat. 806,348, Dec. 5, 1905. XI*A*., page 28.

Silk; Process of Bleaching Artificial ——. C. A. Ernst, Assignor to S. W. Pettit. U.S. Pat. 805,456, Nov. 28, 1905. V., page 15.

FRENCH PATENTS.

Paste-board; Process and Apparatus for Manufacture of ——. R. Kron. Fr. Pat. 356,898, Aug. 12, 1905.

A compound paste-board having one or both of its surfaces coated with an "art" or chromo composition is prepared by making two webs of paper on two independent machines placed end to end, so as to deliver their products at a common point. These webs of paper are partly dried before they arrive at the meeting point and the exterior surface of one or both of them is coated with the composition required. When the two webs meet each other, a cementing agent is applied, and the two webs are then pressed together and dried on a third set of drying cylinders.—J. F. B.

Silk; Process of Making Artificial ——. G. Dieth. Fr. Pat. 356,323, July 21, 1905. V., page 16.

GERMAN PATENTS.

Wood for Paper Manufacture; Process of Treating ——. E. Bergerhoff. Ger. Pat. 163,070, June 2, 1904.

Comminuted wood is treated with water alone to prepare wood pulp for paper manufacture. The wood is moistened,

with water and steam is introduced, at a pressure of five atmospheres, for six to eight hours. It is stated that the temperature rises to about 125° C. The pulp thus produced is stated to be suited to paper making without further treatment of any kind.—T. F. B.

Cellulose Products Soluble in Ammonia; Process of Preparing ——. J. P. Bemberg, A.-G. Ger. Pat. 162,866, Sept. 29, 1900.

It is claimed that a "copper hydroxide cellulose," readily soluble in ammonia, is obtained by the action of alkalis on a mixture of cellulose and copper, or the mixture may be treated with a solution of copper sulphate, and an alkali chloride, or with ammonia and atmospheric oxygen. For example, a mixture of cotton and copper is wetted with water (100—150 per cent. of the weight of the cotton), and ammonia is either added as a solution, or the gas is passed over the mixture. The resulting blue mixture is said to be readily soluble in ammonia, giving highly concentrated cuprocellulose solutions.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Sparteine. Hydroxides of Methyl-, Dimethyl- and Trimethylsparteinium. C. Mourcu and A. Valeur. J. Pharm. Chim., 1905, 22, 529—531.

The action of methyl iodide on sparteine has been studied with a view of elucidating the problem as to the molecular structure of the base. It was thought that the iodide would act, at least chiefly, on the nitrogen atom to which it is originally fixed as sparteine iodomethylate, and thus obviate the difficulty which arises from the presence of two nitrogen atoms in the molecule $C_{15}H_{26}N_2$.

Methyl-sparteine. Methyl-sparteinium Hydroxide.—The α-iodomethylate of sparteine was converted by means of silver hydroxide into methyl-sparteinium hydroxide. On heating this to 175° C. *in vacuo*, it is decomposed into a mixture of isomerides of the formula $C_{15}H_{25}N_2.CH_3$, separable by fractional distillation *in vacuo* into fractions boiling between 171° and 175° C. under 11·5 mm., and with rotations between $[\alpha]_D = -19°\ 67'$ and $-40°$ in absolute alcohol.

Dimethylsparteine. Dimethyl-sparteinium Hydroxide.—On leaving equal weights of methyl iodide and methyl sparteine in contact, at the normal temperature, for several days, and then heating on the water-bath for several hours, a reddish translucent mass was obtained. When this was dissolved in tepid water and treated with silver hydroxide, dimethylsparteinium hydroxide separated. This, when heated to 175° C. *in vacuo*, gave dimethylsparteine $C_{15}H_{24}N_2.(CH_3)_2$.

Trimethylsparteinium Hydroxide; hemisparteine.—Dimethyl-sparteine was converted into iodomethylate, then into trimethyl-sparteinium hydroxide. This gave off trimethylamine even on distillation at ordinary pressure; on completing the distillation, the residue was heated to 200°—210° C., when abundance of trimethylamine was given off. At the same time an oily body, b.pt. 135°—153° C. under 13 mm. was obtained which responds to the formula $C_{15}H_{23}N$ and is, therefore, hemisparteine.

Methylsparteine, dimethylsparteine and hemisparteine are all unsaturated tertiary bases, which energetically reduce permanganate in acid solution. They are evidently not definite bodies, but mixtures of isomerides, the products of successive dehydration. These results obtained with sparteine are similar to those of R. Willstaetter and E. Fourneau (Ber., 1902, 35, 1910; this J., 1902, 871) obtained with lupinine $C_{10}H_{19}ON$, and point to an analogous constitution of the two bases, which, moreover, are found in the same plant; since R. Willstaetter and W. Marx have shown lupinidine and sparteine to be identical.—J. O. B.

Prulaurasin; A Crystallised Cyanogenetic Glucoside from Cherry-Laurel Leaves. H. Hérissey. Comptes rend., 1905, 141, 959—961.

The author has extracted this glucoside from cherry-laurel leaves. It crystallises in fine, flexible, colourless needles, has a slightly bitter taste, and melts at 120°—122° C. It dissolves readily in water, alcohol, or ethyl acetate, but not in ether. It is lævorotatory ($\alpha_D = -52°{\cdot}7$). It is hydrolysed by emulsin, yielding dextrose, hydrocyanic acid, and benzaldehyde. It is thus ($C_{14}H_{17}NO_6$) isomeric with Fischer's amygdonitrile glucoside, and with Bourquelot and Danjou's sambunigrin.
—J. T. D.

Essential Oils; Sicilian ——. J. C. Umney and C. T. Bennett. Pharm. J., 1905, 75, 860—862.

Peppermint Oil.—Three samples of oil from Mitcham black peppermint plants, cultivated in Sicily, distilled in July, 1904, December, 1904, and July, 1905, had the following characters:—*July*, 1904, *oil*: Sp. gr. at 15° C., 0·908; $\alpha_D = -14°$; total menthol, 40 per cent.; free menthol, 36·4 per cent.; esters as menthyl acetate, 4·8 per cent.; solubility, 1 : 4 in 70 per cent. alcohol. *December*, 1904, *oil*: Sp. gr. at 15° C., 0·920; $\alpha_D = -23°$; total menthol, 70·5 per cent.; free menthol, 47·8 per cent.; esters as menthyl acetate, 29·4 per cent.; solubility, 1 : 2 in 80 per cent. alcohol. *July*, 1905, *oil*: Sp. gr. at 15° C., 0·906; $\alpha_D = -21°$; total menthol, 41·6 per cent.; free menthol, 36·9 per cent.; esters as menthyl acetate, 6·0 per cent.; solubility, 1 : 3 of 70 per cent. alcohol. It is evident from these figures that the two specimens of oil distilled in July in successive years differ very slightly in characters, while the oil distilled in December has an abnormally high ester value. The results indicate the influence of climate, soil, and culture on the characters of the oil formed in the plant and confirm the observations of Charabot, that esters increase with the development of the green parts of the plant. This increase would appear also to be associated with slow growth.

Origanum oils.—Sicilian origanum oil, probably distilled from *Origanum creticum*, had the following characters:—Sp. gr. at 15° C., 0·920; α_D=nil, or very slightly lævogyre; phenols, 44 per cent., chiefly carvacrol; solubility, 1 : 2 of 80 per cent. alcohol, but not in 70 per cent. alcohol. This was compared with the following origanum and thyme oils from other sources. *Cyprian origanum oil.*—Sp. gr. at 15° C., 0·963; α_D=nil; carvacrol 81·5 per cent. by volume; solubility in 70 per cent. alcohol, 1 : 2. *Trieste origanum oil*, probably distilled from *Origanum hirtum*.—Sp. gr., 0·940 to 0·980; α_D, slightly lævogyre; carvacrol, 60 to 85 per cent. *Smyrna origanum oil.*—Sp. gr. at 15° C., 0·915 to 0·945; $\alpha_D = -3°$ to $-12°$; carvacrol, 25 to 60 per cent. *French thyme oil.*—Sp. gr. at 15° C., 0·905 to 0·920; thymol, 20 to 35 per cent. or more; solubility, 1 : 2 in 80 per cent. alcohol. This oil is derived from *Thymus vulgaris*. *Spanish thyme oil*, of doubtful botanical origin, sp. gr. 0·930 to 0·950; carvacrol, 50 to 70 per cent.; thymol, none; solubility, 1 : 3 in 70 per cent. alcohol The antiseptic properties of the oils of origanum and thyme have been found by Chamberland and others to be practically identical.

Geranium oil.—The plants, grown on dry soil yielded only 0·07 per cent. of dark green oil; sp. gr. at 15°, 0·894; esters as geranyl tiglate, 35·6 per cent.; total geraniol, 71·9 per cent.; solubility in 80 per cent. alcohol, 1 : 2; insoluble in 70 per cent. alcohol. From the low yield the oil is not likely to acquire commercial importance, notwithstanding its fine quality.

Pennyroyal oil, distilled from *Mentha pulegium*, had the following characters:—Sp. gr. at 15° C., 0·927; $\alpha_D = +35°$; pulegone, distilling between 212° and 220° C., 75 per cent.: solubility, in 70 per cent. alcohol, 1 : 2.

Lemon leaf oil.—Named "petitgrain citronnier." The oil is quite distinct in odour and characters from ordinary petitgrain oil derived from orange leaves. It contains a considerable amount of citral. Sp. gr. 0·873 at 15° C.; $\alpha_D = +26°$; esters, 9·4 per cent.; "acetylisable constituents," 38·9 per cent.; aldehyde, chiefly citral, 29 per cent. Thirty per cent. of the oil, probably limonene, distils between 175° and 180° C. It is suggested that possibly this oil might prove to be a remunerative source of citral.

Nepeta oil.—The characters of the oil so named—sp. gr. 0·927 at 15° C.; $\alpha_D = +12°$; alcohols (as menthol),

22·2 per cent.; esters (as menthyl acetate), 3·3 per cent. —are quite distinct from those of the oil of the American catmint, *Nepeta cataria*; or from those of the ground ivy oil, from *Nepeta glechoma*. The Sicilian oil may possibly be derived from *Mentha requieni*.—J. O. B.

Cinnamic Acid from Storax. E. Erlenmeyer, jun. Ber., 1905, **38**, 3891—3892.

THE cinnamic acid prepared from storax gives a quantitative yield of brucine salt melting at 135° C. with not a trace of lower melting salts, and shows, in 5 per cent. solution, the ordinary dextro-rotation. On crystallisation from ether, synthetic cinnamic acid gives measurable crystals only with difficulty, whilst the acid from storax is obtained in large crystals having the same appearance as the acid prepared from the salt melting at 135° C. These observations are in accord with those of Simon (Annalen., 1839, **31**, 265), who found that the cinnamic acid obtained from storax by means of sodium hydroxide, crystallises in a form quite different from that of the acid prepared by hydrolysing the styracin of storax.—T. H. P.

[*Saccharin*] *Benzoyl Sulphonic Imide; Contribution to the Chemistry of* — —. F. D. Chattaway. Chem. Soc. Proc., 1905, **21**, 284.

WHEN chlorine is passed into a solution of saccharin in aqueous potassium or sodium hydroxide, a sparingly soluble substituted nitrogen chloride may be precipitated, or the solution may remain clear according as an equivalent quantity of caustic alkali or an excess, has been employed. In the latter case, on the addition of a mineral acid, a compound is precipitated which may be a sulphondichloroamino- or a sulphonmonochloroamino-acid, according as the chlorine has or has not been used in excess. When chlorine is passed into a solution of the sodium salt of saccharin, *o*-benzoyl-*N*-chlorosulphonic imide or chloroiminosaccharin is precipitated in accordance with the following equation:—

$$C_6H_4<\begin{matrix}CO\\SO_2\end{matrix}>NNa + Cl_2 = C_6H_4<\begin{matrix}CO\\SO_2\end{matrix}>NCl_2Na =$$

$$C_6H_4<\begin{matrix}CO\\SO_2\end{matrix}>NCl + NaCl.$$

This readily dissolves in an excess of caustic alkali, forming a salt of *o*-sulphonchloroaminobenzoic acid, thus:—

$$C_6H_4<\begin{matrix}CO\\SO_2\end{matrix}>NCl + 2KOH =$$
$$CO_2K.C_6H_4.SO_2(OK):NCl + H_2O;$$

the latter, when treated with an excess of chlorine, is converted into the corresponding salt of *o*-sulphondichloroaminobenzoic acid, thus:—

$$CO_2K.C_6H_4.SO_2(OK):NCl + Cl_2 =$$
$$CO_2K.C_6H_4.SO_2.NCl_2 + KCl.$$

Both of the acids can be liberated from their salts as sparingly soluble crystalline bodies on addition of dilute mineral acids.

Alypin, Benzoyl-tetramethyldiamino-ethyldimethyl-carbinol Hydrochloride. [*A New Anæsthetic.*] O. Neustätter. Münch. Med. Wochenschr. **52**, 2015. Pharm. J., 1905, 869.

ALYPIN has been introduced as a substitute for cocaine, for producing local anæsthesia. It occurs in crystals, m. pt. 189° C., readily soluble in water. Its aqueous solutions may be sterilised by boiling for five or ten minutes, and without undergoing decomposition; they are neutral, and are not precipitated by moderate amounts of sodium bicarbonate.—J. O. B.

Scammony Root; Presence of Pentoses and Methylpentoses in ——. P. Requier. XXIV., page 44.

ENGLISH PATENTS.

Salicylic Acid Glycerine Formal Ester; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Action, vorm. E. Schering, Berlin. Eng. Pat. 6948, April 1, 1905.

SEE U.S. Pat. 801,484 of 1905; this J., 1905, 1188.—T.F.B.

Radium, Surfaces. H. Lieber, New York. Eng. Pat. 11,926, June 7, 1905. Under Int. Conv., July 30, 1904.

SEE Fr. Pat. 355,098 of 1905; this J., 1905, 1189.—T. F. B.

UNITED STATES PATENTS.

Δ-4-Cyclogeranic Acid and Process of Making same. G. Merling, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 805,924, Nov. 28, 1905.

MONOCHLORODEHYDRO-Δ.2.4-CYCLOGERANIC acid, produced by treating isophorone-carboxylic acids with phosphorus pentachloride, and saponifying the product, is converted into Δ-4-cyclogeranic acid by reduction. The latter compound crystallises from ethyl acetate in colourless prisms of m. pt. 103° C., b. pt. 123° C. (6 mm.) It is easily soluble in alcohol, ether, benzene and acetone. —T. F. B.

Formic Acid; Process of Making Concentrated ——. M. Hamel, Grünau, Germany. U.S. Pat. 806,660, Dec. 5, 1905.

SEE Fr. Pat. 341,764 of 1904; this J., 1904, 411.—T.F.B.

Anhydrides; Process of Making Organic Acid ——. R. Sommer, Vienna. U.S. Pat. 806,932, Dec. 12, 1905.

SEE Fr. Pat. 354,742 of 1905; this J., 1905, 1125.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

ENGLISH PATENT.

Sensitising Layers of Gelatin, Gum or the like for the Pigment and like Photographic Processes. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9324, May 3, 1905.

SEE Fr. Pat. 354,220 of 1905; this J., 1905, 1084.—T.F.B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosions; The Pressure of ——. *Experiments on Solid and Gaseous Explosives.* J. E. Petavel. Roy. Soc. Proc., 1905, **76A**, 492—494.

THE author gives an abstract of his investigations on the rise of pressure which takes place during the explosion of gases such as a mixture of coal gas and air, and also of cordite. The measurements were made by means of a specially constructed manometer which recorded photographically on a revolving cylinder. The maximum pressures obtained with cordite are in close agreement with those given by Noble; and it appears that the rate at which the flame travels toward the centre of each particle of explosive is proportional to the pressure under which combustion takes place. The time required for complete combustion decreases with the diameter of the cordite, but the shape of the curve representing the rise of pressure remains unaltered. It follows, therefore, that even if the cordite were in the finest state of division, and the combustion became nearly instantaneous, the effect would be quite distinct from that of a detonation When the surface of the explosion chamber is large compared with its volume, the diameter of the cordite has a marked influence on the maximum pressure obtained, a large diameter causing a considerable decrease. With long vessels wave action is frequently set up.

The rate of cooling of the gas is shown to depend essentially on the thermal conductivity of the vessel, not

on that of the gas; and with the massive vessels used, it was found to vary approximately in proportion to the square of the surface.—B. J. S.

Explosives; Researches on ——. III. Supplementary Note. Sir A. Noble. Roy. Soc. Proc. 1905, 76*A*, 512—514 (See also this J. 1905, 940.)

SINCE the author's paper was published, Holborn and Austin (Preuss. Akad. Wiss. Berlin, Sitz. Ber., 1905, **5**, 175) have shown that the specific heat of carbon dioxide increases with rise of temperature, the increments gradually getting smaller. It is assumed from exterpolation that the specific heat at constant volume becomes constant at 1300° C., *viz.*, 0·2111. The temperatures of explosion of cordite, M.D., and nitrocellulose powders have therefore been recalculated on this basis, and also from the pressure assuming the following law to hold:—$t = \frac{p - p_0}{0{\cdot}00367 p_0}$

The values are given in the following table:—

Density of Charge.	Cordite.		M.D.		Nitrocellulose.	
	Temp. from Pressure.	Temp. from Sp. Heat.	Temp. from Pressure.	Temp. from Sp. Heat.	Temp. from Pressure.	Temp from Sp. Heat.
0·50	5275	5263	—	—	—	—
0·45	5090	5090	4713	4624	4305	3954
0·40	4902	4970	4404	4411	4007	3890
0·35	4710	4860	4200	4215	4630	3795
0·30	4480	4800	3920	4070	3320	3670
0·25	4165	4770	3585	3945	3060	3530
0·20	3838	4760	3240	3870	2835	3425
0·15	3490	4760	2890	3840	2680	3345
0·10	3140	4790	2530	3830	2520	3295
0·05	2775	4800	2160	3860	2400	3255

It will be observed that, although for high densities the temperatures obtained by both methods agree fairly well, the values for low densities show marked discrepancies. This is probably due to the low rate of burning with rapid cooling, but the author also suggests that the carbon dioxide and aqueous vapour dissociate at low pressures, but cannot at higher pressures.

Substances such as carbon, platinum, tantalum, &c., when placed in the charge, were all fused.—B. J. S.

ENGLISH PATENTS.

Priming Compositions, Charges for Shells and Torpedoes and the like; Manufacture of ——. C. Claessen, Berlin. Eng. Pat. 13,340, June 28, 1905.

SEE Fr. Pat. 355,695 of 1905; following these.—T. F. B.

Explosives and Process of Manufacturing the Same. J. C. Smith, Lovington, Ill., U.S.A. Eng. Pat. 19,112, Sept. 21, 1905.

SEE U.S. Pat. 795,940 of 1905; this J., 1905, 941.—T.F.B.

UNITED STATES PATENTS.

Fuses; Composition for —— and Process of Making same. W. T. Unge, Stockholm. U.S. Pat. 806,025, Nov. 28, 1905.

SEE Fr. Pat. 336,266 of 1903; this J., 1904, 385.—T.F.B.

Powder; Process of Making Smokeless ——. G. W. Gentieu and R. S. Waddell, Peoria, Ill. U.S. Pat. 806,131, Dec. 5, 1905.

NITROCELLULOSE, whilst being agitated, is treated first with jets of compressed air to break it up into porous grains, and then with a solvent in addition to the compressed air, to uniformly gelatinise the grains. After this treatment, heated air under pressure and at a comparatively low temperature is forced into the mass to expel the excess of solvent and to dry the grains.—A. S.

Powder; Smokeless ——. R. D. Peck, Danville, Wis. U.S. Pat. 806,564, Dec. 5, 1905.

THIS powder is composed of granulated sugar (14 parts by weight), potassium nitrate (4 parts), powdered potassium chlorate (4 parts), magnesium oxide (1 part) and "water (6 parts)."—A. S.

FRENCH PATENTS.

Priming Compositions and Charges for Shells and Torpedoes; Process of Preparing ——. C. Claessen. Fr. Pat. 355,695, June 28, 1905.

THE detonating and explosive power of priming compositions for detonators and charges for shells and torpedoes is considerably increased by using tetranitromethylaniline or tetranitroethylaniline instead of picric acid or trinitrotoluene.—T. F. B.

Dynamite; Process for the Preparation of a Fire Damp ——. C. E. Bichel, Germany. Fr. Pat. 356,845, July 10, 1905.

IT is claimed that a dynamite which has a low velocity of detonation, is easy to use, and gives off inoffensive products of combustion, may be prepared as follows:—An intimate mixture (about 80 parts) is made of ammonium nitrate, potassium perchlorate, and sodium chloride, the proportions of each being subject to variation at will. To this there are added 6—10 parts of trinitrotoluene dissolved in 4—10 parts of nitroglycerin or dinitroglycerin, and finally a small quantity of starch, powdered wood, or flour in order to facilitate the absorption of the nitroglycerin. The resulting explosive is stated to be easy of manipulation, and insensitive to shock, and is very suitable for use in presence of fire-damp.—B. J. S.

Explosives; Process for Modifying the Velocity of Detonation of ——, so as to diminish their Bursting Effect. C. E. Bichel, Germany. Fr. Pat. 356,864, Aug. 2, 1905.

IT is possible to vary the velocity of detonation of explosives by altering their state of aggregation; thus, trinitrotoluene when compressed so as to have a sp. gr. of 1·55, gives a velocity of 7185 metres per sec., but in the form of grains of 2·6 mm diameter gives only 4470 mm. per sec. In actual practice the explosive may be utilised in the form of grains with air interstices or surrounded by powdered charcoal, graphite, aluminium powder, shellac, &c.

—B. J. S.

Explosive Powder for Coherers. F. Schneider. Fr. Pat. 357,350, Aug. 30, 1905. Under Int. Conv., Oct. 27, 1904.

SEE Eng. Pat. 17,741 of 1905; this J., 1905, 1256.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Sulphuric Acid; Determination of ——, by Barium Chloride, in presence of other Substances. G. Lunge and R. Stierlin. Z. angew. Chem., 1905, **18**, 1921—1930.

THE authors have examined the influence of various substances said to affect the accuracy of the determination of sulphates by precipitation with barium chloride. Their conclusions are as follows:—

1. *Copper.* When present in pyrites, even in considerable amount, copper introduces no error into the determination of sulphur when this is carried out exactly according to Lunge's directions. 2. *Zinc* in small proportion, as, for example, in zinciferous pyrites, does not affect the sulphur determination; but in larger proportion, for example in blendes, the results are always too low, from the solubility of barium sulphate in the ammonium salts necessary to hold the zinc in solution. The modification of the method suggested by Hintz and Weber (see below) gives accurate results in presence of zinc, through the compensating error of co-precipitated barium chloride. 3. The authors confirm a statement of Hintz and Weber, in a paper shortly to be published, that, in presence of salts of potassium, sodium, or ammonium, the barium sulphate precipitate always contains sulphate of the alkali metal. In the case of ammonium sulphate, this is vola-

tilised on ignition; in the other cases the alkali sulphate is weighed as barium sulphate. In any case, therefore, the precipitate is too light, and the sulphur result in consequence too low. Hintz and Weber find that if the barium chloride solution be added at once, instead of gradually, the error introduced by the co-precipitation of barium chloride with the sulphate almost exactly compensates the loss due to the cause just mentioned, so that the sulphur calculated from the weight of the crude barium sulphate precipitate agrees very accurately with that actually present. The authors, therefore, propose to modify Lunge's directions for precipitation, in the determination of sulphur in pyrites, as follows:—20 c.c. of 10 per cent. barium chloride solution are diluted with 100 c.c. of water, heated to boiling, and poured rapidly into the solution to be precipitated.—J. T. D.

Nitric and Nitrous Acids; Determination of ——. J. Meisenheimer and F. Heim. Ber., 1905, **38**, 3834—3837.

The determinations are based respectively on the reactions:—

$$HNO_2 + HI = NO + I + H_2O$$
$$HNO_3 + 3FeCl_2 + 3HCl = NO + 3FeCl_3 + 2H_2O.$$

For nitrites, the slightly alkaline solution containing 0·1—0·2 grm. of nitrite, is introduced into a 50 c.c. flask, the stopper of which carries a tube for the introduction of a current of carbon dioxide, a delivery tube with drawn-out end, and a funnel. The drawn-out end of the delivery tube is placed in a 12 per cent. solution of sodium hydroxide, and carbon dioxide is passed through the apparatus till all air is expelled, say, for ten minutes. The stream is slackened, a measuring tube filled with sodium hydroxide solution is placed over the end of the delivery tube, and by means of the funnel (the tube of which has been previously filled with water) there are added, first, 10—15 c.c. of 5 per cent. solution of potassium iodide, and then, gradually, an equal volume of dilute hydrochloric acid. When the evolution of gas slackens, the flask is heated by a small flame to incipient boiling, and the residual nitric oxide driven over by the stream of carbon dioxide, increased for that purpose. When the volume of gas in the eudiometer ceases to increase, the tube is removed, well shaken, immersed in a levelling vessel, and the volume of gas read.

If nitrates are to be determined in the residue, another measuring tube is placed in position, and 10—20 c.c. of concentrated ferrous chloride solution, rendered strongly acid by hydrochloric acid, are introduced through the funnel. The operation is concluded exactly as in Spiegel's modification of the Schulze-Tiemann method (this J., 1890, 896).

This method is rapid, allows of determining both nitrous and nitric acids in the same liquid, and gives in each case a direct determination.—J. T. D.

Nitrous Acid; Determination of ——. F. Raschig. Ber., 1905, **38**, 3911—3914.

The author considers the sulphanilic acid method and the permanganate method of determining nitrous acid to be the best and most convenient where they can be applied; but in some cases, where for example nitrous acid and hydroxylamine temporarily exist together, those methods are not applicable, and in such cases he has used the reaction applied by Meisenheimer and Heim (see preceding abstract). He prefers, however, to titrate the iodine rather than to measure the nitric oxide. The solution (which must not be acid), about 100 c.c. contained in a 200 c.c. conical flask, is placed under the thiosulphate burette, 5—10 c.c. of 10 per cent. potassium iodide solution are added, and a stream of carbon dioxide is led through by a tube reaching to the bottom of the flask. After two to three minutes, about 1 c.c. of N/10 sulphuric acid is poured down the side of the tube, and after two minutes more, the titration is carried out, the thiosulphate solution being also allowed to glide down the side of the tube. The flask must not be taken up and shaken; the gas-bubbles ensure the mixture of the liquids, and the surface of the liquid is thus never exposed to air, which of course would, on mixing with the escaping nitric oxide, lead to errors in titration. Titration must not be begun too early, or too much thiosulphate will be needed; the author thinks that, on acidifying, nitrosyl iodide NOI, is first formed, and that this requires time to decompose.

In using the permanganate method, the author pours the solution to be tested into N/10 permanganate solution, taking care that at least 20 per cent. excess of the latter be present, then acidifies (if necessary), and after two minutes, the reaction on the nitrous acid is complete. He then adds 5 c.c. of 10 per cent. solution of potassium iodide, which instantaneously dissolves any precipitate of manganese peroxide that may have formed, and titrates with thiosulphate.—J. T. D.

Bismuth; Determination of ——, *and its Separation from Copper, Cadmium, Mercury, and Silver.* A. Staehler and W. Scharfenberg. Ber., 1905, **38**, 3862—3869.

Bismuth can be accurately determined by precipitation as phosphate, even in presence of hydrochloric acid, provided a sufficiency of sodium phosphate be added to substitute phosphoric for the hydrochloric acid. The bismuth solution, containing 0·1—0·2 grm. of bismuth, is diluted to 300—400 c.c., and heated to boiling, any precipitate of basic salt being redissolved by cautious addition of nitric acid. Boiling 10 per cent. solution of trisodium phosphate (the disodium salt may be used, but in acid solutions so much of it may be needed as to make an inconveniently large bulk of liquid) is now gradually added, stirring constantly. An excess of sodium phosphate does no harm, so long as it is not sufficient to produce alkaline reaction in the liquid. The boiling and stirring are continued for a few minutes, and the precipitate allowed to settle so far that the completeness of precipitation can be tested by adding more of the precipitant. When complete, the hot liquid is filtered through a Gooch crucible (the filtrate being again tested with the precipitant) and washed with 1 per cent. nitric acid containing a little ammonium nitrate (the washing must not be too long continued, or the precipitate has a tendency to become colloidal), dried at 120° C., ignited over a good flame for five or ten minutes, and weighed as $BiPO_4$.

Separation from Copper.—The bismuth is precipitated from the mixed solution exactly as above, and the copper in the filtrate thrown down as sulphide and weighed as cuprous sulphide. In presence of chlorides, electrolysis was found not to yield good results.

Separation from Cadmium.—The bismuth is precipitated as above; then, if chlorides be absent, the solution is rendered ammoniacal, a little potassium cyanide added, and the cadmium determined electrolytically. If chlorides be present, the cadmium is precipitated as sulphide, the sulphide washed, dissolved in weak nitric acid, potassium hydroxide in excess and potassium cyanide added, and the solution electrolysed.

Separation from Mercury.—After precipitating the bismuth, hydrochloric acid is added, followed by excess of ammonia. If there be any precipitate, more hydrochloric acid and ammonia are added, and so on, till the amount of ammonium salt present suffices to keep the mercury dissolved in presence of excess of ammonia. The solution is then heated to boiling and saturated with hydrogen sulphide. In five or ten minutes the precipitation is complete, and the sulphide, quite free from excess of sulphur, is filtered through a Gooch crucible, washed with hot water, alcohol, and ether, dried at 105° C., and weighed.

Separation from Silver.—The bismuth is precipitated as above, and the silver in the filtrate determined either as chloride or by titration with ammonium thiocyanate.

—J. T. D.

Bismuth; Determination of ——, *and its Separation from the other Heavy Metals by Precipitation as Phosphate.* H. Salkowski. Ber., 1905, **38**, 3943—3944.

The author many years ago suggested this as an accurate method of determining bismuth, and has lately, with his pupils, taken up the matter again. They find that satisfactory separations from all the heavy metals can be

effected in this way, but that hydrochloric acid and chlorides interfere. Details of the methods are not given. —J. T. D.

Silicon; Determination of —— in Presence of Silica. M. Philips. Z. angew. Chem., 1905, **18**, 1969—1972.

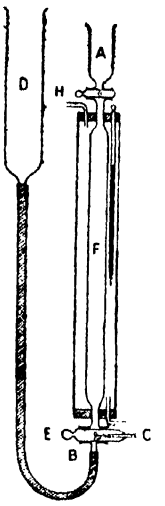
THE older methods of determining silicon in presence of silica, all involving ignition of a mixture of the two substances in the air, and treatment of the residue with hydrofluoric acid, are inaccurate, for the author has shown that silicon, even at low red heat, absorbs oxygen from the air fairly rapidly, and that it is sensibly attacked and volatilised by hydrofluoric acid. His method consists in dissolving the silicon in potassium hydroxide solution, and measuring the hydrogen evolved ($Si+4KOH=K_4SiO_4+2H_2$), then determining the total silica, and calculating by difference the silica existing as such. The mixture, powdered extremely fine, is introduced into a small flask containing 30 per cent. potassium hydroxide solution, and standing in a water-bath at the temperature of the air. The flask is then connected with the upper three-way stopcock of a 200 c.c. Bunte burette, the cock being left open to the air for a few minutes till the temperature throughout is uniform. Connection to the burette is then made, the water-bath removed, and the flask heated gently over a flame till all silicon is dissolved. Then the bath is replaced, the whole allowed to regain the temperature of the air, the levels adjusted, and the volume of the gas read. The solution in the flask may be evaporated down with hydrochloric acid to determine the total silica; but as the alkali may dissolve silica from the glass, it is safer to fuse another portion of the substance with alkali carbonate and nitrate, and determine the total silica in that.—J. T. D.

Oxygen; Determination of —— in Copper. L. Archbutt. Analyst, 1905, **30**, 385—394 (this J., 1906, 1148).

IT was stated by Dickson (this J., 1905, 638) that in order to expel the whole of the oxygen by heating copper to redness in hydrogen, it was essential to have the metal in a very fine state of division. The author, however, finds that the thickness of the copper has little, if any, influence upon the accuracy of the method, but that it chiefly affects the time required for a determination. Thus closely concordant results (0·17 to 0·18 per cent.) were obtained in the determination of oxygen in copper whether in the form of strips $\frac{1}{16}$ to $\frac{1}{8}$ in. in thickness, in fine turnings and sawings, or in rough $\frac{1}{4}$ in. cubes, the time required for the strips being two hours, and for the cubes five hours. Similarly a solid copper cylinder yielded the whole of its oxygen when heated to redness for nine hours in a current of hydrogen in a combustion tube of Jena glass. In the case of copper containing an unusually high percentage of oxygen (over 0·2 per cent.), the turnings yielded 0·224 to 0·226 per cent., whilst a cylinder $\frac{3}{8}$ in. in diameter gave 0·21 per cent. after being heated for eight hours, or only $\frac{1}{4}$ of the difference found by Dickson when working with wire 0·035 in. in diameter. The cylinder, when broken in the vice, had the same appearance from the core to the outside edge of its fracture. Copper deoxidised in hydrogen is very brittle, and frequently shows fissures on its outer surface. It also shows a considerable amount of expansion—as much as $\frac{1}{10}$ in. in the case of a cylinder of $\frac{1}{2}$ in. diameter. Examined under the microscope the surface fissures are seen to extend some way into the interior, passing between the crystalline grains, which, it is stated, increase in size during the annealing in hydrogen, whereas the junctions between them are loosened. Hence it is not surprising that the copper becomes brittle, nor that the whole of the oxygen is gradually expelled from the interior of a thick piece of the metal.—C. A. M.

Chlorine; Analysis of Electrolytic ——. F. P. Treadwell and W. A. K. Christie. Z. angew. Chem., 1905, **18**, 1930—1934.

THE analysis of electrolytic chlorine consists practically in determining actual chlorine and carbon dioxide. The method formerly proposed by Treadwell (absorption of a measured volume of the dried gas by 5 per cent. solution



of sodium hydroxide, determination of hypochlorite by N/10 arsenious oxide, calculation of the corresponding volume of chlorine, and subtraction from the total to get the carbon dioxide) gives results always 0·7—0·77 per cent. too low, from formation of chlorate; and the method of Adolph (absorption as above, destruction of hypochlorite by hydrogen peroxide, and titration or measurement of the carbon dioxide) is difficult to work, as the hydroxide must be absolutely free from carbonate, whilst that of Offerhaus (absorption as above in one burette, reaction of gas in another burette on potassium iodide and titration of liberated iodine) requires two burettes, and is costly where many determinations must be made, from the amount of potassium iodide used. The method now proposed consists in absorbing the chlorine in solution of alkali arsenite free from carbonate, and then the carbon dioxide by alkali hydroxide. The arsenite solution is made by dissolving 4·95 grms. of arsenious oxide in dilute potassium hydroxide solution, adding phenolphthalein and exactly neutralising with sulphuric acid, and diluting to a litre. The chlorine is allowed to stream through the burette F from below, till all air is displaced, cock E is closed, then cock H, and the barometer and temperature of the surrounding water are read. D is now filled with distilled water, which is allowed to run out at C, so as to displace all air or chlorine from the rubber tube or B; then 100 c.c. of the arsenite solution are delivered into D and allowed to enter the burette, the complete absorption of the chlorine being aided by shaking. Next, 10 c.c. of strong potassium hydroxide (1 : 2) solution are placed in A, and cautiously drawn down into the burette and well shaken. The levels are adjusted, and the volume of the unabsorbed gas, the barometer, and the temperature, are read. The liquid from burette and levelling-tube is now run into a conical flask, and the apparatus thoroughly rinsed into the flask; to the liquid in the flask are successively added phenolphthalein, hydrochloric acid to neutrality, and 60 c.c. of solution of sodium bicarbonate (40 grms. per litre), and the unoxidised arsenite is titrated with N/10 iodine solution and starch. From the weight of chlorine thus determined, its volume is calculated (1 c.c. of N/10 solution = 0·003545 grm. of chlorine = 1·1015 c.c. at N.T.P.), and the difference between this and the total volume of gas absorbed, gives the carbon dioxide. Experiments with pure chlorine and with known mixtures have shown that the method is accurate, and that no chlorate is formed.

The authors have also devised a modification of Offerhaus' method, using only one burette—the same apparatus as already described. The chlorine is absorbed by 5 per cent. solution of potassium iodide, then the carbon dioxide by 10 c.c. of potassium hydroxide as above, and

the total volume of absorbed gas determined. The excess of hydroxide converts the liberated iodine into iodide and iodate; and when the liquid from the apparatus is now run into a beaker containing 10 c.c. of strong hydrochloric acid, the iodine is again liberated and is titrated with thiosulphate. The results are accurate, but the method presents no advantage over the arsenite method.—J. T. D.

ORGANIC—QUANTITATIVE.

Picric Acid Additive Compounds; Determination of ——. F. S. Sinnatt. Chem. Soc. Proc., 1905, **18**, 297.

KNECHT and Hibbert's method (this J., 1903, 762) for the determination of picric acid by means of titanous chloride has been found to be applicable to other picrates, and also to picric acid additive compounds.

Twenty-five c.c. of a solution of 0·200 grm. of naphthalene picrate in 250 c.c. of alcohol were titrated with titanous chloride, and gave 99·49 per cent. of naphthalene picrate. Pyridine and strychnine picrates yielded 100·19 and 99·69 per cent. respectively.

In many cases it is convenient to dissolve the picrate in hydrochloric acid. The method has been applied to the estimation of naphthalene in coal gas; the naphthalene picrate is separated by the usual process (Colman and Smith, this J., 1900, 128), washed, dissolved in a small volume of alcohol, and titrated with titanous chloride. If a standard solution of picric acid be used in the wash-bottles, the filtrate and washings may also be titrated. The results compare with those obtained by Colman and Smith's method.

Brandies and other Spirits; Uniform Methods for Analysis of ——. E. Barbet. Ann. Brass et Dist., 1905 [19]; through Z. Spiritusind, 1905, **28**, 466—469.

THE following methods have been selected by the author in conjunction with other chemists as the basis of a general agreement in the analysis of spirits.

Acidity.—The determination of the total free acidity is important as a preliminary to the determination of the esters. 100 c.c. of the spirit should be diluted to a strength of 50 per cent. of alcohol and titrated with standard calcium sucrate solution (100 c.c. = 1 grm. of acetic acid) using litmus as an indicator. The neutral tint should be established by comparison with a mixture of the same quantities of litmus and neutral distilled water.

Esters.—The saponification should be effected by means of calcium sucrate solution, which does not resinify the aldehydes; the following points are of importance:—The flask should be of hard glass, and connected to the reflux condenser by ground joints, without cork or rubber; three times the theoretical quantity of alkali should be used; the sample should not contain more than 50 per cent. of alcohol and should be boiled slowly for two hours. Volatile bases should be absorbed in a Will's apparatus at the upper end of the condenser. Coloured spirits must be diluted to a strength of 20 per cent. of alcohol, and distilled before saponification.

Aldehydes.—Three colorimetric methods are available: Rosaniline-bisulphite, *m*-phenylenediamine, and quinol-(hydroquinone-) sulphuric acid. Preference is given to the last:—2 c.c. of the sample are mixed with 1 c.c. of the purest sulphuric acid, and 0·02 grm. of powdered quinol is added. A scale of standards is prepared from pure aldehyde-ammonia and matched by dyed gelatin.

Higher alcohols.—Rocques' method:—The spirit is diluted so as to contain 50 per cent. of alcohol; the aldehydes are destroyed in 100 c.c. of the product by boiling with *m*-phenylenediamine hydrochloride; exactly 75 c.c. are then distilled off. 10 c.c. of the distillate are mixed with 10 c.c. of sulphuric acid monohydrate (H_2SO_4) and the mixture is heated in a calcium chloride bath at exactly 120° C. for one hour. The coloration so obtained is compared with that developed by isobutyl alcohol under similar conditions. If the results are to be expressed in terms of amyl alcohol they must be multiplied by 1·6.

Furfural is determined colorimetrically by aniline acetate; the furfural is no guide to the origin of the spirit.—J. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Lithium; Iodomercurates of ——. A. Duboin. Comptes rend., 1905, **141**, 1015—1018.

ON cooling a hot saturated solution of mercuric iodide and lithium iodide, of sp. gr. 3·28, needle-shaped crystals were obtained of the composition $2LiI.HgI_2.6H_2O$. The crystals were very dense (sp. gr. 3·26), readily decomposed by water, soluble in many alcohols and esters, in formic and acetic acids, aldehyde, acetone, &c., but not in benzene or methyl iodide. The mother liquor at a still lower temperature deposits large prisms of $2LiI\ HgI_2.8H_2O$, very soft and readily melted, especially in presence of traces of water, and having, generally, similar solubilities to the other salt.—J. T. D.

Bromine Fluoride. P. Lebeau. Comptes rend., 1905, **141**, 1018—1020.

BROMINE and fluorine combine at the ordinary temperature with evolution of heat, forming a compound of the formula BrF_3. This is a colourless liquid, freezing to a solid, which melts again at about 4° C. It reacts on silicon in the cold, producing vivid incandescence, and its reactions on most other elements and many compound substances resemble those of fluorine in their vigour.
—J. T. D.

Starch, Glycogen and Cellulose. Z. H. Skraup and others. Monatsh. f. Chem., 1905, **26**, 1415—1472.

THE authors have studied the action of acetic anhydride saturated with gaseous hydrogen chloride on three representative polysaccharides: starch, glycogen and cellulose. They have endeavoured, by determinations of the minimum stochiometrical ratios in which chlorine enters into the chloracetylated derivatives so obtained, to assign minimum values for the molecular weights of these colloid carbohydrates, on the assumption that combination takes place in the first instance, without degradation of the aggregate, an assumption not wholly verified by the experimental results. The carbohydrates were suspended in acetic anhydride, the liquid was saturated at a low temperature with hydrogen chloride, and the mixtures were allowed to remain in contact for various lengths of time. A large number of chloracetylated products have been isolated and purified by fractional solution and precipitation. These products were also converted into the corresponding acetyl compounds by replacing the chlorine atom by acetyl through the action of silver acetate. These acetates, on saponification, all proved to be triacetates on the C_6 unit for the three polysaccharides; the saponified residues were also examined as to the relation they bore to the parent substances. The following chloracetyl derivatives are those which are regarded as being definite individuals with the closest approximation to the state of molecular aggregation of the original carbohydrates and as possessing 1 atom of chlorine in combination with each aggregate:—(1) From soluble starch, 0·268 per cent. of chlorine, indicating a molecular weight of 7440 = $(C_6H_{10}O_5)_{46-50}$ for soluble starch; (2) from glycogen, 0·15 per cent. of chlorine indicating a molecular weight of 16350 = $(C_6H_{10}O_5)_{100}$ for the saponified carbohydrate which was probably a degradation product of glycogen; (3) from cellulose, 0·36 per cent. of chlorine, indicating a molecular weight of 5508 = $(C_6H_{10}O_5)_{34}$ for the saponified carbohydrate, regarded as being nearly equivalent to the original cellulose.

Longer periods of action gave chloracetylated derivatives of degradation products of the parent carbohydrates, with percentages of chlorine increasing as the molecular aggregates became more simple. In the case of starch, chloracetyl derivatives of erythrodextrin ($C_6H_{10}O_5$)$_x$, maltose and finally glucose were obtained. In the case of cellulose, a reaction lasting 14 days yielded a chloracetyl derivative of cellobiose which is fully described.—J. F. B.

Scammony Root; Presence of Pentoses and Methyl-pentoses in ——. P. Requier. J. Pharm. Chim., 1905, 22, 540—542.

In addition to saccharose, previously recorded (this J., 1905, 1246) as a constituent of scammony root, the presence of pentoses and methyl-pentoses is now established.

Saccharine constituents of fresh root.—These, calculated on the dry root, are:—Reducing sugars, as dextrose, 2·70 per cent.; saccharose, 6·80 per cent.; methyl-pentose, 0·95 per cent.; pentose, traces.

Saccharine constituents of dried root.—Reducing sugars as dextrose, 1·11 to 1·81 per cent.; saccharose, 2·08 to 3·36 per cent.; methyl-pentose, 0·226 to 0·253 per cent.; pentose, 0·05 to 0·065 per cent.—J. O. B.

Trade Report.

NEW ZEALAND; EXPORT TRADE OF ——.

Bd. of Trade J., Dec. 28, 1905.

In the following table are given the values of exports of certain articles from New Zealand in the years ended Sept. 30, 1904 and 1905:

	Year ended 30th September	
	1904.	1905.
	£	£
Wool	4,331,000	5,542,000
Tallow	371,000	345,000
Butter	1,360,000	1,418,000
Sheep skins	406,000	465,000
Gold	2,052,000	2,035,000
Kauri gum	542,000	508,000
Timber	247,000	310,000

AUSTRALIAN CUSTOMS DECISIONS.

Bd. of Trade J., Dec. 21, 1905.

Decisions have been rendered by the Commonwealth Department of Trade and Customs, fixing the rates of import duty on the following substances: Algin (as glue, gelatin), 20 per cent. *ad valorem*; black-lead and plumbago in bulk, free; colours, soluble water, 20 per cent.; manures, including ammonium sulphate and phosphate rock, free; neutrex (cocoa butter substitute), 1*d.* per lb.; levulose (as glucose), 8*s.* per cwt.

NORWAY; CUSTOMS TARIFF OF ——.

Further portions of the new customs tariff of Norway appear in the issues of the Board of Trade J. for each week, the concluding portion being in the issue for Dec. 14 last. Each of these numbers may be obtained from Messrs. Wyman and Sons, Fetter Lane, E.C. Price 1d.

SWITZERLAND; TRADE OF ——.

For. Off. Ann. Series, No. 3520.

The value of the total imports of mineral products amounted to 3,499,000*l.*, the share of the United Kingdom in these imports being only a small one (29,600*l.*, of which 22,000*l.* was for coals). The value of coals imported from all countries amounted to 1,861,000*l.* (an increase of 122,000*l.* on the imports of 1903), of which Germany supplied 80 per cent.

The total imports of druggists' sundries, chemicals and colouring materials in 1904 amounted to 1,715,800*l.* (an increase of 68,800*l.* on the imports of 1903), of which 1,563,900*l.* was for manufactured chemical products. The increase was principally in drugs, alcohol, anthracene and benzoin, sulphate of iron, copper and zinc, and sulphuric ether. The total imports from the United Kingdom amounted to 66,700*l.* The principal imports from all countries, together with the share of the United Kingdom, were as follows:—

Articles.	From—	
	All Countries.	United Kingdom.
	£	£
Drugs	125,500	5,300
Anthracene, benzoic acid, benzene, carbolic acid, &c.	99,400	4,500
Aniline colours	66,300	400
Aniline	65,800	1,000
Pharmaceutical preparations	52,600	4,600
Sulphate of iron, copper and zinc	49,300	15,900
Arsenical acid	46,700	4,500
Starch and dextrin	39,600	1,000
Caustic potash and caustic soda	35,900	2,600
Varnishes (not oil)	33,400	9,500
Stearine	29,000	3,000
Boracic, pure carbolic, phosphoric acids	27,500	900
Alkaloids	23,900	1,400
Extract of quinine and refined camphor	22,600	700
Bromide, iodine, carbonate of magnesia, &c.	14,000	2,300
Perfumes and cosmetics	13,900	600
Colouring materials	259,200	1,800

The total imports of varnishes in 1904 amounted to 33,400*l.*, of which the United Kingdom supplied 9,500*l.*, or an increase of 500*l.* on the preceding year. The principal supply came from Germany, representing a value of 14,500*l.*

The total import of oils, soaps, and fats in 1904 amounted to 546,000*l.*, or a decrease of 45,000*l.* on the imports of the previous year. This decrease is accounted for mainly by the reduced imports of oils. The principal articles imported from all countries and from the United Kingdom were as follows: Various oils and liquid greases, 117,000*l.* (from the United Kingdom, 13,900*l.*); linseed oil, 72,000*l.* (United Kingdom, 3,600*l.*); ordinary and scented soaps, 42,400*l.* (United Kingdom, 1,700*l.*); candles, 2,200*l.* (United Kingdom, 500*l.*).

The imports of food articles amounted to 13,449,000*l.*, as against 12,739,000*l.* in 1903; the imports included spirituous liquors, 35,000*l.*; and extract of meat, 21,000*l.*

The United Kingdom continues to be Switzerland's principal market for her manufactured goods, and in 1904 she took 21·9 per cent. of the Swiss exports, including ironware and machinery, 186,800*l.*; condensed milk, 695,800*l.*; chocolate, 451,600*l.*; pharmaceutical preparations, chemicals and colouring materials, 146,700*l.* The total export of chemicals from Switzerland in 1904 was valued at 1,375,000*l.*

New Books.

ELEMENTS OF QUANTITATIVE ANALYSIS. By G. H. BAILEY, D.Sc., Ph.D. Senior Demonstrator of Chemistry, and Lecturer in the Victoria University of Manchester. Macmillan & Co., Ltd., London. The Macmillan Co., New York, 1905. Price 4s. 6d.

SMALL 8vo volume, containing a preface, 241 pages of subject matter, and an alphabetical index. The text contains 47 illustrations, and is sub-divided as follows and for the following purposes:—Chapters I. to IV. contain introductory remarks and instructions of general application; V. to VI., the methods of preparation and analysis of well-defined compounds such as may provide a training in manipulation; Chapters VII. to XIII. are devoted to Volumetric and Gas Analysis; XIV. to XIX., to Methods applicable to the Analysis of Minerals, duly classified; XX., to Processes specially employed in investigating Minerals containing the rarer elements; XXI. to XXIII., to the Technical Analysis of (i) Water and Fuel, (ii) Products of the Alkali Industry, and (iii) Materials containing Organic Matter.

JOURNAL OF THE

Society of Chemical Industry.

No. 2.—Vol. XXV. SUPPLEMENT. January 31, 1906.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

Members are reminded that the subscription of 25*s.* for 1906, payable on January 1st, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

EXTRAORDINARY GENERAL MEETING.

The attention of members of the Society is drawn to the notice which accompanies this issue of the Journal, of an extraordinary general meeting of the Society to be held at 3.30 p.m. on Tuesday, the 27th March, 1906, at the House of the Society of Arts.

The meeting is convened under Bye-Law 40, in pursuance of a requisition received by the Council, for the purpose of considering and, if approved, adopting a resolution in favour of taking steps to procure the grant of a Royal Charter of Incorporation.

List of Members Elected.

January 23rd, 1906.

Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W, Chemist.

Ash, Charles S., 661, 3rd Street, San Francisco, Cal., U.S.A., Chemist.

Bailey, Ralph W., c/o Messrs. Stillwell & Gladding, 55, Fulton Street, New York City, U.S.A., Chemist.

Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.

Bowen, Ralph A., c/o National Aniline & Chemical Company, 36, Purchase Street, Boston, Mass., U.S.A.

Bradley, R. H., Wellington Foundry, Newark-on-Trent, Engineer.

Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.

Buckie, Robert H., c/o The British Uralite Co., Ltd., Higham, near Rochester, Kent, Works Chemist.

Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Manufacturing Chemist.

Carey, William G., 65, Ickburgh Road, Upper Clapton, London, N.E., Chemist.

Chaplin, Wm. H., 13, Penywern Road, Earl's Court, S.W., Wine Merchant.

Scammony Root; Presence of Pentoses and Methyl-pentoses in ——. P. Requier. J. Pharm. Chim., 1905, 22, 540—542.

In addition to saccharose, previously recorded (this J., 1905, 1246) as a constituent of scammony root, the presence of pentoses and methyl-pentoses is now established.

Saccharine constituents of fresh root.—These, calculated on the dry root, are:—Reducing sugars, as dextrose, 2·70 per cent.; saccharose, 6·80 per cent.; methyl-pentose, 0·95 per cent.; pentose, traces.

Saccharine constituents of dried root.—Reducing sugars as dextrose, 1·11 to 1·81 per cent.; saccharose, 2·08 to 3·36 per cent.; methyl-pentose, 0·226 to 0·253 per cent.; pentose, 0·05 to 0·065 per cent.—J. O. B.

Trade Report.

NEW ZEALAND; EXPORT TRADE OF ——.

Bd. of Trade J., Dec. 28, 1905.

In the following table are given the values of exports of certain articles from New Zealand in the years ended Sept. 30, 1904 and 1905:

	Year ended 30th September	
	1904.	1905.
	£	£
Wool	4,331,000	5,542,000
Tallow	371,000	345,000
Butter	1,360,000	1,418,000
Sheep skins	406,000	465,000
Gold	2,052,000	2,035,000
Kauri gum	542,000	508,000
Timber	247,000	310,000

AUSTRALIAN CUSTOMS DECISIONS.

Bd. of Trade J., Dec. 21, 1905.

Decisions have been rendered by the Commonwealth Department of Trade and Customs, fixing the rates of import duty on the following substances: Algin (as glue, gelatin), 20 per cent. *ad valorem*; black-lead and plumbago in bulk, free; colours, soluble water, 20 per cent.; manures, including ammonium sulphate and phosphate rock, free; neutrex (cocoa butter substitute), 1*d.* per lb.; levulose (as glucose), 8*s.* per cwt.

NORWAY; CUSTOMS TARIFF OF ——.

Further portions of the new customs tariff of Norway appear in the issues of the Board of Trade J. for each week, the concluding portion being in the issue for Dec. 14 last. Each of these numbers may be obtained from Messrs. Wyman and Sons, Fetter Lane, E.C. Price 1d.

SWITZERLAND; TRADE OF ——.

For. Off. Ann. Series, No. 3520.

The value of the total imports of mineral products amounted to 3,499,000*l.*, the share of the United Kingdom in these imports being only a small one (29,600*l.*, of which 22,000*l.* was for coals). The value of coals imported from all countries amounted to 1,861,000*l.* (an increase of 122,000*l.* on the imports of 1903), of which Germany supplied 80 per cent.

The total imports of druggists' sundries, chemicals and colouring materials in 1904 amounted to 1,715,800*l.* (an increase of 68,800*l.* on the imports of 1903), of which 1,563,900*l.* was for manufactured chemical products. The increase was principally in drugs, alcohol, anthracene and benzoin, sulphate of iron, copper and zinc, and sulphuric ether. The total imports from the United Kingdom amounted to 66,700*l.* The principal imports from all countries, together with the share of the United Kingdom, were as follows:—

Articles.	From—	
	All Countries.	United Kingdom.
	£	£
Drugs	125,500	5,300
Anthracene, benzoic acid, benzene, carbolic acid, &c.	99,400	4,500
Aniline colours	66,300	400
Aniline	65,800	1,000
Pharmaceutical preparations	52,600	4,600
Sulphate of iron, copper and zinc	49,300	15,900
Arsenical acid	46,700	4,500
Starch and dextrin	39,600	1,000
Caustic potash and caustic soda	35,900	2,600
Varnishes (not oil)	33,400	9,500
Stearine	29,000	3,000
Boracic, pure carbolic, phosphoric acids	27,500	900
Alkaloids	23,900	1,400
Extract of quinine and refined camphor	22,600	700
Bromide, iodine, carbonate of magnesia, &c.	14,000	2,300
Perfumes and cosmetics	13,900	600
Colouring materials	259,200	1,800

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The total import of oils, soaps, and fats in 1904 amounted to 546,000*l.*, or a decrease of 45,000*l.* on the imports of the previous year. This decrease is accounted for mainly by the reduced imports of oils. The principal articles imported from all countries and from the United Kingdom were as follows: Various oils and liquid greases, 117,000*l.* (from the United Kingdom, 13,900*l.*); linseed oil, 72,000*l.* (United Kingdom, 3,600*l.*); ordinary and scented soaps, 42,400*l.* (United Kingdom, 1,700*l.*); candles, 2,200*l.* (United Kingdom, 500*l.*).

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Hunt, Bertram, l/o Taylor Street; 604, Montgomery Street, San Francisco, Cal., U.S.A.

Kalbfleisch, F. H., l/o Burling Slip; Metropolis Building, Broadway and 16th Street, New York City, U.S.A.

Kirkland, John, l/o Brixton, 2, Holmdene Avenue, Herne Hill, S.E.

Lennard, F.; all communications to 29, Adelaide Crescent, Hove.

Levinstein, Dr. H.; all communications to 21, Minshull Street, Manchester.

Liddle, W. T., l/o Lytham; Lacovia P.O., Jamaica.

Macdonald, Peter, jun.; Journals to c/o Mazapil Copper Co., Ltd., Concepcion del Oro, (Apartado No. 5), Saltillo, Zacatecas, Mexico.

McDougall, Hugh, l/o Gateshead; c/o Caledonian Portland Cement Co., Cousland, Dalkeith, N.B.

Markel, Dr. K. E., l/o Lodge Lane; Tower House, Bewsey, Warrington.

Marshall, Arthur, l/o Loughton; The Cottage, Dartford, Kent.

Miller, Dr. H. von; all communications to Beatrixgasse 32, Vienna, Austria.

Morris, Edgar F., l/o Altrincham; The Rectory, Cheadle, Cheshire.

Napper, S. S.; all communications to c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry.

Noyes, Henry, l/o Melbourne; c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C.

Oberländer, Dr. O., l/o Crumpsall; 4, Parkwood, Daisy Bank Road, Victoria Park, Manchester.

Ohlenschlager, J. G., jun., l/o Tower Street; 20, St. Dunstan's Hill, London, E.C.

Patterson, W. Hamilton; all communications to Ostendstrasse 6, Karlsruhe i/B., Germany.

Perkins, F. G., l/o New York; 136, Newton Street, Waltham, Mass., U.S.A.

Platten, Frank, l/o Barnsley Road; 12, Montague Road, Edgbaston, Birmingham.

Popplewell, J. M., l/o Millerston; Provan Chemical Works, Provanmill, Glasgow.

Radcliffe, L. G., l/o Old Trafford; 431, Stretford Road, Manchester.

Rawson, Christopher, l/o Bedford; 2, Melbourne Place, Bradford.

Schneider, Dr. F. G.; Journals to 32, India Street, Boston, Mass., U.S.A., Chemist (Continental Color and Chemical Co.).

Scott, Ernest; Journals to 67, Lord Street, Liverpool.

Skowronski, S., l/o Youngstown; c/o American Smelting and Refining Co., Perth Amboy, N.J., U.S.A.

Smith, H. Ewing, l/o Washington Street; 153, St. Vincent Street, Glasgow.

Stoddart, F. W.; all communications to Grafton Lodge, Sneyd Park, Bristol.

Takamatsu, T., l/o University; 13, Nishikatamachi, Hongo, Tokyo, Japan.

Thompson, Alf. J., Bernina, Friern Lane, Whetstone, N., and (Journals) 42, Snow Hill, London, E.C.

Thornley, Thos., l/o Falkirk; 19, Hope Street, Glasgow.

Tilden, Philip S., l/o Burling Slip; c/o Franklin H. Kalbfleisch Co., Metropolis Building, Broadway and 16th Street, New York City, U.S.A.

Walker, H. V., l/o Park Place; 586, St. Mark's Avenue, Brooklyn, N.Y., U.S.A.

Young, Chas. C., all communications to c/o Continental Color and Chemical Co., P.O. Box 734, Charlotte, N.C., U.S.A.

Member Omitted from List.

1904. Jones, G. Poole, c/o Sinnamahoning Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemical Engineer.

Deaths.

Bartsch, Chas., A., 6803, Woodland Avenue, Philadelphia, Pa., U.S.A.

Sprengel, Prof. Hermann J. P., F.R.S., 54, Denbigh Street, London, S.W. Jan. 14th.

Williams, Harvey, L., Bristol, Tenn., U.S.A.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 83. Gobbi. Apparatus for filtering liquids and fluids. [Fr. Appl., Jan. 11, 1905.]* Jan. 1.

„ 87. Cooke and Kelly. Apparatus for dehydrating vegetable and animal substances.* Jan. 1.

„ 94. Godwin. Hydro-extractors. Jan. 1.

„ 363. Jäger. Apparatus for filtering liquids. Jan. 5.

„ 958. Hargreaves. Appliances for mixing liquids in proportional quantities. Jan. 13.

„ 989. Stubbs. Apparatus for heating or cooling fluids. Jan. 13.

[C.S.] 149 (1905). Lomas. *See under* X.

„ 1606 (1905). Spooner (Aktiebolaget Separator). Centrifugal separators. Jan. 10.

„ 8340 (1905). Barter. Apparatus for heating liquids. Jan. 17.

„ 12,716. (1905). Milne. Filters for purifying fluids. Jan. 17.

„ 14,092 (1905). Liddiard. Construction of acid-proof vessels for distilling and other purposes. Jan. 10.

„ 14,327 (1905). Moll. *See under* VII.

„ 17,844 (1905). Weiss. *See under* X.

II.—FUEL, GAS, AND LIGHT.

[A.] 38. Stillesen. Manufacture of artificial fuel.* Jan. 1.

„ 120. Green and Mieville. Apparatus for generating gas for lighting and heating purposes. Jan. 2.

„ 185. Anderson and Snell. Apparatus for supplying gas or air under pressure for combustion. Jan. 2.

„ 228. Still and Adamson. Manufacture of mantles for incandescent lamps. Jan. 3.

„ 529 Fitton. Hydrocarbon oil burners. Jan. 8.

„ 753. Thompson (Wurts). *See under* III.

„ 788. Goldschmidt. Thermic mixtures.* Jan. 11.

„ 805. Capron. Separation of industrial gas mixtures. [Ger. Appl., Jan. 12, 1905.]* Jan. 11.

„ 929. British Thomson-Houston Co. (Gen. Electric Co.). Filaments for incandescent electric lamps. Jan. 12.

„ 955. Cole. Materials for generating heat. Jan. 13

„ 968. Wielandt, and Torfkoks G.m.b.H. Method of and apparatus for producing coke from peat, lignite and the like.* Jan. 13.

[C.S.] 580 (1905). Bowing. *See under* III.

„ 2684 (1905). The Chalk Power Gas Syndicate, Ltd., and Stoneham. *See under* VII.

„ 3408 (1905). Eveno. Gas maker for heavy oils. Jan. 17.

„ 3427 (1905). Shave. Liquid fuel burners. Jan. 17.

„ 7324 (1905). Cutler. Gas purifiers. Jan. 10.

[C.S.] 11,413 (1905). Assmann. Process for preparing compressed gas for power purposes. Jan. 17.

„ 24,828 (1905). Carpenter. *See under* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 175. Harvey and Simpson. Decomposition of organic bodies. Jan. 2.

„ 495. Az. Refining paraffin wax. Jan. 8.

„ 753. Thompson (Wurts). Process and apparatus for distilling coals and other hydrocarbonaceous substances. Jan. 11.

[C.S.] 580 (1905). Bowing. Destructive distillation of coal and other substances and apparatus therefor. Jan. 10.

„ 4925 (1905). Buchanan. Kilns for making or revivifying animal or other charcoal or carbonising or charring other substances. Jan. 17.

„ 21,708 (1905). Rattray. Apparatus for filtering heavy or other oils for lubricating purposes. Jan. 17.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 82. Johnson (Badische Anilin und Soda Fabrik). *See under* XIIIA.

„ 352. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Jan. 5.

„ 678. Tompkins. Manufacture of indigo and indigo producing substances. Jan. 10.

[C.S.] 10,022 (1905). Imray (Soc. Chem. Industry in Basle). Manufacture of azo dyestuffs. Jan. 10.

„ 13,950 (1905). Lake (Oehler) Manufacture of brown sulphur dyes. Jan. 10.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS AND FIBRES.

[A.] 81. Johnson (Badische Anilin und Soda Fabrik). Manufacture of zinc formaldehyde-hydrosulphite.* Jan. 1.

„ 393. Dyson. Apparatus for treating pile fabrics for the production of designs or effects thereon. Jan. 6.

„ 830. Jeffrey. Sizing and washing machines. Jan. 12.

„ 868. Martin. Electrical bleaching and apparatus therefor. Jan. 12.

„ 900. Kleinjung. Machines for steeping, washing and rinsing wool and other textile fibres. Jan. 12.

[C.S.] 533 (1905). Fulton. Production of patterns, designs, &c., on fabrics. Jan. 17.

„ 4647 (1905). Imray (Meister, Lucius und Brüning). Manufacture of preparations of Indigo White. Jan. 17.

„ 9683 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging agents. Jan. 10.

„ 15,372 (1905). Douge. Regaining the solvents of nitrocellulose in the manufacture of artificial silk. Jan. 10.

„ 17,218 (1905). Singer, and Bradford Dyers' Association, Ltd. Production of Aniline Black on vegetable fibres, yarns and fabrics. Jan. 17.

„ 17,389 (1905). Détré. Method of winding silk to facilitate scouring, degumming, dyeing, bleaching, &c. Jan. 10.

„ 26,173 (1905). Meister, Lucius und Brüning. Manufacture of hydrosulphite preparations. Jan. 10.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 67. Holloway. Production of zinc oxide from solutions of zinc salts. Jan. 1.

„ 84. Davis. Utilisation of galvanisers' spent pickle. Jan. 1.

„ 503. Johnson (Deutsche Gold und Silber-Scheide Anstalt, vorm. Roessler). Manufacture of sodium perborate.* Jan. 8.

„ 915. Digby and Marshall. Means for manufacturing hypochlorite solutions. Jan. 12.

[C.S.] 23,915 (1904). Scott. *See under* XIIIA.

„ 2684 (1905). Chalk Power Gas Synd., Ltd., and Stoneham. Apparatus for lime burning and the recovery of a power gas as a by-product. Jan. 10.

„ 3346 (1905). Lake (Helbig). *See under* XI.

„ 13,447 (1905). Swayze. Process of making potassium sulphide. Jan. 10.

„ 14,327 (1905). Moll. Apparatus for evaporating brine and producing high-pressure steam. Jan. 10.

„ 16,151 (1905). Heinrici. Process of preparing a stable solution of hydrogen peroxide. Jan. 10.

„ 24,458 (1905). Majert and Majert. Method of making artificial carbonic acid baths. Jan. 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 110. Wood. Muffle kilns for firing earthenware. Jan. 2.

[C.S.] 23,149 (1905). Dobler. *See under* IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 796. Dodd and Callender. Bricks. Jan. 11.

„ 831. Rosebottom. Manufacture of acid- and fireproof ware. Jan. 12.

[C.S.] 577 (1905). Eissrich. Fire and acid proof material and process of making same. Jan. 10.

„ 5209 (1905). Baxter. Solution for fireproofing. Jan. 10.

„ 13,085 (1905). Hansen. Process of hardening dry-moulded cement castings. Jan. 10.

„ 23,149 (1905). Dobler. Process for finely comminuting mica or Muscovy glass. Jan. 10.

X.—METALLURGY.

[A.] 60. King. Desulphurising and nodulising substances containing iron compounds.* Jan. 1.

„ 324. Bates and Peard. Annealing metals. Jan. 5.

„ 494. Delporte. Refining iron in a Siemens-Martin furnace. [Belg. Appl., Jan. 9, 1905.]* Jan. 8.

„ 500. Cole. Reduction of metallic oxides. Jan. 8.

„ 630. Ogle. Treatment of complex sulphide ores. Jan. 9.

„ 717. Hodgkinson, Hardcastle and Coote. Removal of metal plating or coating from metallic or other surfaces. Jan. 10.

„ 729. Hughes. Heat treatment of metals during manufacture. Jan. 10.

„ 809. Findlay. Antifriction metal. Jan. 11.

„ 842. Jessop. Method of coating cast iron or steel with non-corrosive metals or the like. Jan. 12.

„ 896. Simpson. Process and apparatus for treating ores, minerals and mineral products. Jan. 12.

„ 994. Gillies. Plant for leaching ores or metallurgical products and the subsequent separation of the liquids from the solids. Jan. 13.

„ 1004. Gillies. Treatment of zinciferous ores and metallurgical products. Jan. 13.

[C.S.] 149 (1905). Lomas. Apparatus for separating liquids from solids, especially for the treatment of ores. Jan. 10.
„ 792 (1905). Buttenshaw. Manufacture of bronze. Jan 10.
„ 3191 (1905.) Savelsberg. Smelting ores. Jan. 17.
„ 7154 (1905). Parry. Smelting of tin slags. Jan. 17.
„ 8221 (1905). Gin. *See under* XI.
„ 15,367 (1905). King. Purifying and nodulising metalliferous materials. Jan. 17.
„ 16,385 (1905). Hadfield. Manufacture of steel. Jan. 10.
„ 17,844 (1905). Weiss. Method of producing solid hard pieces from pulverulent material. Jan. 17.
„ 17,844A (1905). Weiss. Method of producing iron briquettes. Jan. 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 52. Jeantaud. Active material for manufacturing accumulators. [Fr. Appl., Jan. 5, 1905.]* Jan. 1.
„ 131. Pettit. Electric furnaces. Jan. 2.
„ 132. Pettit. Electric furnaces. Jan. 2.
„ 146. Ashcroft. Process and apparatus for the electrolysis of alloys, fused salts, solutions, ores or chemical compounds.* Jan. 2.
„ 234. Femerling and Pörschke. Galvanic cells. Jan. 3.
„ 516. Benson and Co., Ltd., and Leaver. Electro-plating apparatus. Jan. 8.
„ 642. Cowper-Coles. Electro-deposition of iron. Jan. 10.
„ 923. Cowper-Coles. Electro-deposition of copper. Jan. 12.
„ 926. Goldschmidt. The Goldschmidt or alumino-thermic process.* Jan. 12.
[C.S.] 521 (1905). Mousnier and Mounier. Secondary batteries. Jan. 17.
„ 839 (1905). Boult (Smith). Storage battery negative plates. Jan. 10.
„ 3346 (1905). Lake (Helbig). Method and apparatus for electrically oxidising atmospheric nitrogen. Jan. 10.
„ 8221 (1905). Gin. Electro-metallurgical manufacture of metals or alloys free from carbon. Jan. 10.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 312. Heron and Scott. Fish liver oil extractor. Jan. 5.
[C.S.] 4092 (1905). Krebitz. Manufacture of insoluble soap. Jan. 17.
„ 17,999 (1905). Heys. Detergents and the manufacture thereof. Jan. 17.
„ 18,667 (1905). Bernard. Apparatus for extracting by means of carbon tetrachloride fatty substances from products. Jan. 17.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 82. Johnson (Badische Anilin und Soda Fabrik). Production of red colour lakes.* Jan. 1.
„ 589. Ullrich. Lime colour.* Jan. 9.
[C.S.] 23,915 (1904). Scott. Machine for the manufacture of white lead. Jan. 17.

(*C.*)—INDIA-RUBBER.

[A.] 798. Ducasble. Regeneration or reclaiming of india-rubber. Jan. 11.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 135. Harrison (Turner Tanning Machine Co.). Machines for unhairing or otherwise treating hides, skins and leather.* Jan. 2.
„ 310. Pim. Drying leather. Jan. 5.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 37. Tonnaer, Keersmaecker, and Keersmaecker. Manufacture of beer.* Jan. 1.
„ 367. Somló. Preparation of malt for brewing and the like.* Jan. 5.
[C.S.] 8371 (1905). Crossman and Selg. Apparatus for fermenting, maturing and storing worts, beers, stout and the like. Jan. 10.
„ 25,495 (1905). Loew. Processes for pasteurising beer and apparatus therefor.* Jan. 17.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—FOODS.

[A.] 612. Volz. Process for making concentrated fruit syrups or extracts. [Ger. Appl., Jan. 10, 1905.]* Jan. 9.
„ 616. Chapman. Preservation of meat.* Jan. 9.
„ 715. Sichler. *See under* XXIII.
[C.S.] 890 (1905). Telford, Grier and Mackay. Sterilising milk and the like. Jan. 17.
„ 12,206 (1905). Barker (Janssens Bros.). Artificial food for animals. Jan. 17.
„ 17,623 (1905). Kathreiner's Malzkaffee Fabr. Manufacturing from grain or malt a product resembling coffee. Jan. 10.
„ 24,245 (1905). Royer. Apparatus for automatic acetification. Jan. 10.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 744. Allen. Treating liquids to destroy their micro-organisms. Jan. 11.
[C.S.] 276 (1905). Adams. Apparatus for sewage purification. Jan. 10.

(*C.*)—DISINFECTANTS.

[A.] 88. Schulz. Insecticide and germicide compounds.* Jan. 1.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 916. Pulbrook and Pulbrook. Making paper opaque. Jan. 12.
[C.S.] 248 (1905). Matas y Rodes. Manufacture of cork composition. Jan. 17.
„ 248A (1905). Matas y Rodes. Manufacture of compositions or agglomerates of cork. Jan. 17.
„ 505 (1905). Des Varannes and De Vains. Manufacture of paper pulp. Jan. 17.
„ 12,765 (1905). West and Co., Ltd., and Chew. Means and apparatus for cleansing and sterilising pulp and like materials. Jan. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 80. Johnson (Badische Anilin und Soda Fabrik). Manufacture of a new therapeutical compound.* Jan. 1.
„ 239. Ellis (Merck). Manufacture of a substance from ergot. Jan. 3.

[C.S.] 11,413 (1905). Assmann. Process for preparing compressed gas for power purposes. Jan. 17.

„ 24,828 (1905). Carpenter. *See under* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 175. Harvey and Simpson. Decomposition of organic bodies. Jan. 2.

„ 495. Az. Refining paraffin wax. Jan. 8.

„ 753. Thompson (Wurts). Process and apparatus for distilling coals and other hydrocarbonaceous substances. Jan. 11.

[C.S.] 580 (1905). Bowing. Destructive distillation of coal and other substances and apparatus therefor. Jan. 10.

„ 4925 (1905). Buchanan. Kilns for making or revivifying animal or other charcoal or carbonising or charring other substances. Jan. 17.

„ 21,708 (1905). Rattray. Apparatus for filtering heavy or other oils for lubricating purposes. Jan. 17.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 82. Johnson (Badische Anilin und Soda Fabrik). *See under* XIIIA.

„ 352. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Jan. 5.

„ 678. Tompkins. Manufacture of indigo and indigo producing substances. Jan. 10.

[C.S.] 10,022 (1905). Imray (Soc. Chem. Industry in Basle). Manufacture of azo dyestuffs. Jan. 10.

„ 13,950 (1905). Lake (Oehler) Manufacture of brown sulphur dyes. Jan. 10.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS AND FIBRES.

[A.] 81. Johnson (Badische Anilin und Soda Fabrik). Manufacture of zinc formaldehyde-hydrosulphite.* Jan. 1.

„ 393. Dyson. Apparatus for treating pile fabrics for the production of designs or effects thereon. Jan. 6.

„ 830. Jeffrey. Sizing and washing machines. Jan. 12.

„ 868. Martin. Electrical bleaching and apparatus therefor. Jan. 12.

„ 900. Kleinjung. Machines for steeping, washing and rinsing wool and other textile fibres. Jan. 12.

[C.S.] 533 (1905). Fulton. Production of patterns, designs, &c., on fabrics. Jan. 17.

„ 4647 (1905). Imray (Meister, Lucius und Brüning). Manufacture of preparations of Indigo White. Jan. 17.

„ 9683 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging agents. Jan. 10.

„ 15,372 (1905). Douge. Regaining the solvents of nitrocellulose in the manufacture of artificial silk. Jan. 10.

„ 17,218 (1905). Singer, and Bradford Dyers' Association, Ltd. Production of Aniline Black on vegetable fibres, yarns and fabrics. Jan. 17.

„ 17,389 (1905). Détré. Method of winding silk to facilitate scouring, degumming, dyeing, bleaching, &c. Jan. 10.

„ 26,173 (1905). Meister, Lucius und Brüning. Manufacture of hydrosulphite preparations. Jan. 10.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 67. Holloway. Production of zinc oxide from solutions of zinc salts. Jan. 1.

„ 84. Davis. Utilisation of galvanisers' spent pickle. Jan. 1.

„ 503. Johnson (Deutsche Gold und Silber-Scheide Anstalt, vorm. Roessler). Manufacture of sodium perborate.* Jan. 8.

„ 915. Digby and Marshall. Means for manufacturing hypochlorite solutions. Jan. 12.

[C.S.] 23,915 (1904). Scott. *See under* XIIIA.

„ 2684 (1905). Chalk Power Gas Synd., Ltd., and Stoneham. Apparatus for lime burning and the recovery of a power gas as a by-product. Jan. 10.

„ 3346 (1905). Lake (Helbig). *See under* XI.

„ 13,447 (1905). Swayze. Process of making potassium sulphide. Jan. 10.

„ 14,327 (1905). Moll. Apparatus for evaporating brine and producing high-pressure steam. Jan. 10.

„ 16,151 (1905). Heinrici. Process of preparing a stable solution of hydrogen peroxide. Jan. 10.

„ 24,458 (1905). Majert and Majert. Method of making artificial carbonic acid baths. Jan. 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 110. Wood. Muffle kilns for firing earthenware. Jan. 2.

[C.S.] 23,149 (1905). Dobler. *See under* IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 796. Dodd and Callender. Bricks. Jan. 11.

„ 831. Rosebottom. Manufacture of acid- and fireproof ware. Jan. 12.

[C.S.] 577 (1905). Eissrich. Fire and acid proof material and process of making same. Jan. 10.

„ 5209 (1905). Baxter. Solution for fireproofing. Jan. 10.

„ 13,085 (1905). Hansen. Process of hardening dry-moulded cement castings. Jan. 10.

„ 23,149 (1905). Dobler. Process for finely comminuting mica or Muscovy glass. Jan. 10.

X.—METALLURGY.

[A.] 60. King. Desulphurising and nodulising substances containing iron compounds.* Jan. 1.

„ 324. Bates and Peard. Annealing metals. Jan. 5.

„ 494. Delporte. Refining iron in a Siemens-Martin furnace. [Belg. Appl., Jan. 9, 1905.]* Jan. 8.

„ 500. Cole. Reduction of metallic oxides. Jan. 8.

„ 630. Ogle. Treatment of complex sulphide ores. Jan. 9.

„ 717. Hodgkinson, Hardcastle and Coote. Removal of metal plating or coating from metallic or other surfaces. Jan. 10.

„ 729. Hughes. Heat treatment of metals during manufacture. Jan. 10.

„ 809. Findlay. Antifriction metal. Jan. 11.

„ 842. Jessop. Method of coating cast iron or steel with non-corrosive metals or the like. Jan. 12.

„ 896. Simpson. Process and apparatus for treating ores, minerals and mineral products. Jan. 12.

„ 994. Gillies. Plant for leaching ores or metallurgical products and the subsequent separation of the liquids from the solids. Jan. 13.

„ 1004. Gillies. Treatment of zinciferous ores and metallurgical products. Jan. 13.

Deaths.

Bartsch, Chas. A., 6803, Woodland Avenue, Philadelphia, Pa., U.S.A.
Sprengel, Prof. Hermann J. P., F.R.S., 54, Denbigh Street, London, S.W. Jan. 14th.
Williams, Harvey L., Bristol, Tenn., U.S.A.

Birmingham Section.

Meeting held at the University, on Thursday, December 14, 1905.

PROF. FRANKLAND, F.R.S., IN THE CHAIR.

A METHOD OF DETERMINING THE TURBIDITY OF WATER.

BY J. F. LIVERSEEGE, F.I.C.

In the practice of water analysis it is often useful to observe the turbidity of samples of water in a glass tube 2 ft. long. For some years I used the following scale:—

"Clear."
"Very slightly turbid—small print legible
"Slightly turbid"—small print visible, but not legible.
"Turbid"—all print invisible, end of tube visible.
"Very turbid"—end of tube invisible.

This scale had the disadvantage of using words instead of numbers, of having too few steps between "clear" and "very turbid," and of the indefiniteness of "small print."

I thought that greater precision might be obtained by the use of the tintometer, or by observing a vertical column of water, the height of which could be varied according to the turbidity of the sample, but the rapidity with which some waters deposit their sediment made it necessary that the observation tube should be closed and periodically shaken.

As the tube must be closed, it is convenient to vary the size of the type and keep the length of the tube constant. Test type as used by oculists is suitable for the purpose. The type is mounted on a board attached to a cord running over a pulley, and is arranged about 6 in. from the end of the tube, or about 2·5 ft. from the eye. The type is raised or lowered till the set is found which can be easily read. When type for 2·5 ft. normal vision can be read through the 2 ft. of water, the turbidity is expressed as "0"; when type which should be read at 4 ft. can just be read at 2·5 ft. with 2 ft. of water between, the turbidity is expressed as (4—2·5=) 1·5; and so on, subtracting 2·5 in each case from the number of feet for normal vision of the particular set of type. Proceeding in this way the approximate numerical value of "very slightly turbid" is 0·5 to 1·5, of "slightly turbid" 2·5 to 4·5, of "turbid" 6 to 38, and of "very turbid" over 38. I describe these numbers as "turbidity expressed in feet of distance to read standard type." The set of test type I use was designed by G. Cowell, and is published by Messrs. Nitsche and Günther, 66, Hatton Garden,; the range is from 2 to 40 ft. of normal vision.

When the water is so turbid that 2 ft. of it obscures the type entirely, a tube 1 ft. in length may be used, still reading at 2·5 ft. from the type. I expected that the numbers of the 1 ft. tube would be one-half, or perhaps one-quarter, of those found with the 2 ft. tube, but the proportion is nearer one-tenth. In these circumstances, it is better not to attempt to calculate from one tube to the other, but to give the turbidity numbers and the length of the tube as well.

To make the illumination as constant as possible, I obtained light from a window facing north and take readings in the morning only. During the year I have used this method regularly and have found it advantageous in comparing a series of waters from month to month.

DISCUSSION.

Dr. T. S. PRICE asked if the amount of turbidity would depend on some power of the length of the tube?

The CHAIRMAN said that the determination of the different degrees of turbidity in water was a matter of very great importance, for the reason that the filtration of water, which was probably carried on with the object of removing bacteria, could not be controlled by bacteriological examination without some considerable delay. Two days at least were required before the operation of the filters could be satisfactorily checked. Any method of determining the turbidity rapidly became, therefore, of immense importance in engineering. It was impossible that any bacteriological method could throw such rapid light on the subject as the determination of the turbidity, or otherwise, of water.

Mr. LIVERSEEGE, in reply, said he knew of no law which had been formulated to give the relation between the amount of light passing and the length of the turbid liquid. The proportion between 1 ft. and 2 ft. being about one to ten suggested the amount of light that might vary inversely as the cube of the length. He was not sure that the method would be exact enough for testing bacteriological filtration. Probably the difference between 0 and 0·5 would be a serious difference, bacteriologically. The method would be more useful for unfiltered waters.

THE INFLUENCE OF SMALL QUANTITIES OF ELEMENTS IN COPPER UPON ITS REACTIONS WITH NITRIC ACID.

BY J. H. STANSBIE, B.SC., F.I.C.

The character of the reactions which take place when pure metals are dissolved in nitric acid has been the subject of many investigations, and the general effects of diluting the acid and of varying the temperature at which the dissolution takes place, are well known. Also, the effects of the presence of nitrous acid in the nitric acid solution, and of nitrates formed during the dissolution of the metals in it have received much attention. Acworth, Armstrong, Gladstone and Divers are among those who have done much work in this direction, but very little seems to have been done in the direct investigation of the effects of impurities in the metals themselves upon their general reactions with the acid, and it is to this end that the work described in this paper is directed.

Given a sample of the pure metal and a solution of nitric acid it may be stated that the volume and composition of the gas liberated by the dissolution of a given weight of the metal in a given volume of the acid will depend upon the dilution of the acid and the temperature at which the reaction takes place. If, however, any one of these conditions is allowed to vary, a variation in the result may be looked for. The work now to be described has for its object the detection and measurement of variations in the volume and composition of the evolved gas caused by the introduction of small quantites of elements into pure copper.

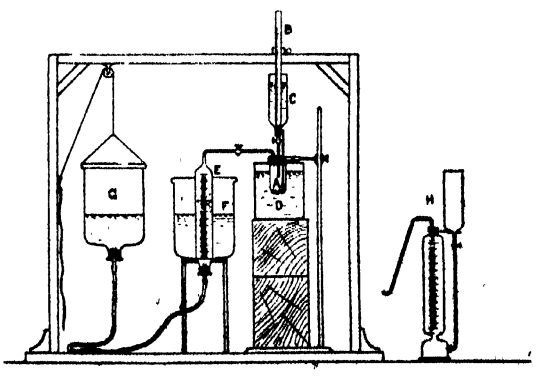


FIG. 1.

The apparatus used is of simple form and readily controlled. It is shown in Fig. 1. The reaction is carried out in a small beaker A fitted with a rubber bung through which pass an angle tube for the escape of the gas, a delivery tube with a narrow bore for the addition of the acid, and a thermometer to determine the temperature of the reaction. The bottom of the bung is cut away at a small angle near the gas tube, and the under surface coated with a thin film of paraffin wax. The acid delivery tube is connected with the burette B, from which the measured quantity of the acid solution is run into the beaker. The lower part of the burette is surrounded by a water jacket C, for raising the temperature of the acid, and the lower part of the beaker is immersed in a water bath D. A graduated cylinder, fitted with an angle tube and stopcock, and standing in an inverted bell jar F, is used for collecting and measuring the evolved gas. A second bell jar G is connected with the first jar by a flexible tube, and is so arranged that it can be raised or lowered to regulate the level of the water in the first jar to the requirements of the experiment in hand.

The oxygen apparatus consists of an ordinary drying cylinder, having a tap funnel connected to the tubulure at the bottom of the cylinder by a flexible tube. The cylinder is graduated and is fitted with a rubber bung and delivery tube.

An experiment is carried out as follows :—The metal is reduced to filings, which are sifted through brass gauze with 64 meshes to the linear inch, and the sifted portion is carefully magneted to remove particles of iron derived from the file. One grm. of the filings is transferred to the dry beaker. The rubber bung, to which the burette is attached, is held in position by a retort clip, the acid run into the burette and levelled. The beaker is then pressed on to the bung, the measuring cylinder attached, and a water lute run between the rim of the beaker and the side of the bung to ensure the apparatus being gas tight when in position. Hot water is poured into the water-jacket surrounding the portion of the burette containing the acid. The hot water bath in which the beaker is to be partly immersed is now prepared and brought into position, and one minute allowed for the beaker to come to the temperature of the bath. The acid is then allowed to run in slowly, and the temperature noted. When the action is finished water is poured into the burette, and allowed to run into the beaker. In this way the whole of the gas is transferred to the measuring cylinder. The water is levelled and the volume of the gas read off. The level of the water in the bell-jar is then raised, its temperature taken, and a measured volume of oxygen added to the gas in the cylinder. The cylinder is shaken to remove the last traces of nitric peroxide, allowed to stand for a minute, and the volume of gas again read off. The height of the barometer is then taken, and the experiment is finished.

The water over which the gas is collected and the oxygen apparatus are allowed to come to the same temperaure before use.

The following example shows the method of working :—Volume of air in apparatus before the addition of acid = 45 c.c. ; volume of gas in cylinder = 215 c.c. ; volume of oxygen added = 125 c.c. ; volume of residual gas = 73 c.c. ; temperature = 20·9°C. ; pressure = 756 mm.

From the data thus obtained it is easy to find the volume of nitric oxide originally present in the collected gas, and this, together with the volume of nitric oxide already removed by the oxygen of the air present in the apparatus at the beginning of the experiment, gives the total volume of nitric oxide liberated from the acid solution. The volume of the gases other than nitric oxide is also readily determined.

In the experiment in which the above measurements were made the volume of nitric oxide, corrected to the dry gas at N.T.P., obtained by the dissolution of 1 grm. of pure copper in 15 c.c. of nitric acid (sp. gr., 1·2) at 65° C. was 176 c.c., and the volume of the other gases 1 c.c.

The standard copper used in the experiments was obtained by fusing the electro-deposited metal under charcoal in a carbon crucible, and well agitating the molten metal in contact with the charcoal. The metal was then allowed to solidify under charcoal so as to prevent absorption of oxygen during solidification, and gave on electrolytic assay Cu = 100·04 per cent.

Variations in Temperature.—A number of experiments were made to determine the general effect of varying the temperature at which the reaction takes place. One grm. of copper was dissolved in 15 c.c. of nitric acid (sp. gr. 1·2). The experiment was carried out exactly as described above, and the temperature was regulated by the water-jacket and water-bath. The time required for complete dissolution was noted. The results are given in the following table, and are also plotted on the curves, Fig. 2 :—

Time in min.	Temperature in °C.	Volume of Nitric Oxide.	Total Volume of Gas Liberated.
		c.c.	c.c.
56	25	137·5	142·0
30	35	139·5	145·5
16	45	153·0	157·0
6	55	163·0	167·0
5	65	176·0	179·0
5	75	182·0	185·0
4	85	185·0	186·0
3	95	192·0	193·5

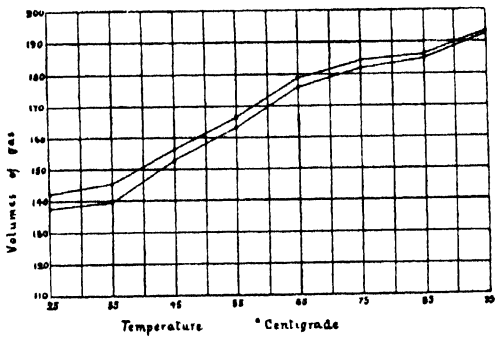


FIG. 2.

Reference to the curves makes it clear that increase in the temperature at which the reaction takes place causes a considerable increase in the volume of nitric oxide liberated, and a slight decrease in the volume of gas other than nitric oxide.

Dilution of the Acid.—Nitric acid of sp. gr. 1·2 contains 5·8 grms. of nitric acid in 15 c.c. of the solution. In determining the effect of dilution on the volume and composition of the evolved gas, it was arranged that the volume of acid solution used for each experiment should contain 5·8 grms. of nitric acid. The other conditions were kept as constant as possible and the temperatures actually observed varied little from 70° C. One grm. of standard copper was used for each experiment, and the results are embodied in the following table :—

Volume of Acid Solution.	Volume of Nitric Oxide.	Total Volume of Gas.
c.c.	c.c.	c.c.
20·0	158·5	159·5
15·0	177·5	178·5
12·5	167·5	170·0
8·5	130·0	133·0
6·5	74·0	80·0

It was evident from the last two experiments that the quantity of nitric peroxide in the apparatus largely exceeded that which would be formed by the union of nitric oxide with the oxygen of the air present in the beaker at the beginning of the reaction. Therefore, nitric peroxide is clearly a product of the reaction when the acid solution exceeds a certain strength. From

several considerations it was decided to use nitric acid of 1·2 sp. gr. for the general experiments, and to keep the temperature of the reaction about 65° C.

Varieties of Commercial Copper.—The following results show the necessity of using pure copper for the standard experiments :—

Varieties of Copper.	Volume of Nitric Oxide.	Total Volume of Gas.
	c.c.	c.c.
Copper for electrical work	177·0	179·5
Dry copper	158·5	160·0
Rod copper (rolled)	152·0	162·5
Sheet copper (hard rolled)	148·5	162·0

The ordinary impurities in commercial copper thus affect the volume and composition of the gas liberated by the dissolution of the metal in nitric acid. The sample of dry copper given in the above table was prepared by melting pure copper in contact with air ; so that oxygen, which is generally present in the commercial metal, has the same general effect as other impurities.

Pure Copper.—In a number of experiments with the pure standard copper and nitric acid (1·2) at a temperature of 65 °C., 1 gram of the metal gave 175 to 177 c.c. of nitric oxide, and it was decided to take 176 c.c. as the standard volume for the nitric oxide liberated under the above conditions, and 177 for the total volume, so that the liberated gas is practically all nitric oxide. From the equation commonly accepted, it is found that 1 grm. of pure copper should liberate 234 c.c. of nitric oxide. Therefore, there is a deficiency of 25 per cent. in the volume of gas actually collected. As nitric oxide is only slightly soluble in water, and as the gas is delivered on to the surface of the water in the collecting cylinder, and is only in contact with it for about 10 minutes, this source of error may be neglected. But nitric oxide is somewhat freely soluble in nitric acid and nitrate solution, and some experiments were made to determine how far this solubility would account for the deficiency noticed above, assuming the equation to be correct.

The absorption apparatus consists of a short glass cylinder of 25 c.c. capacity, fitted with a rubber bung and two angle tubes. The longer of the two tubes has a narrow bore, and is expanded at one end into a flat disc which, when the tube is in position, presses on to a pad of glass wool at the bottom of the cylinder. This arrangement breaks up the bubbles as they escape from the tube, and brings the gas well into contact with the absorbing liquid in the cylinder. Also, no difficulty is experienced in displacing the whole of the gas in the apparatus at the end of the experiment.

The only difference in the arrangement of the apparatus for these experiments, and that already described, is in the introduction of the absorption tube between the beaker and the collecting cylinder. A second water-bath is used to bring the absorption tube to the required temperature.

A number of experiments were carried out as follows :—One grm. of standard copper was dissolved in 15 c.c. of nitric acid (1·2) at 65° C., and the gas passed through the absorption tube into the collecting cylinder. The gas remaining in the apparatus was then driven into the cylinder and the nitric oxide estimated.

Fifteen c.c. of the absorbing solution at 65° C. were used for each experiment.

Absorbing Solution.	Volume of Gas absorbed.
	c.c.
Nitric acid (1 2) alone	59·0
,, ,, with 1 grm. of copper dissolved in it and the solution gently boiled for 5 mins.	35·0
,, ,, with 1 grm. of copper dissolved in it and a current of air blown through the solution	30·5
,, ,, with 1 grm. of copper dissolved in it	2·5
Neutral solution of copper nitrate	12·0

These experiments simply confirm the well-known facts that nitric acid and copper nitrate in solution absorb nitric oxide, and further that this absorption accounts, largely at any rate, for the difference between the volume of the gas actually collected, and that indicated by the usual equation. For it is worthy of notice that the volume of nitric oxide absorbed by nitric acid at 65° C., added to the volume liberated by the copper at 65° C., gives roughly the volume calculated from the equation.

Influence of Arsenic, Antimony, and Bismuth.—The part of the work now to be described is a systematic examination of the effects of arsenic, antimony, and bismuth when introduced separately into copper, upon the reaction of the latter metal with nitric acid. From what has been said already in connection with the effects of the impurities present in commercial copper, it is clear that considerable care must be exercised in the preparation of the alloys so as to ensure that only the two metals under consideration shall be present in them. In the preparation of these alloys, it was found convenient to prepare a rich alloy of copper and the other metal, and to use weighed portions of this alloy to introduce the second metal into fresh portions of pure copper. The preparation of an alloy was carried out as follows :—

The weighed quantity of copper was melted under charcoal in a carbon crucible, and well agitated in contact with the charcoal ; the weighed quantity of rich alloy was then dropped in and the metal well agitated to ensure perfect mixture. The pot was withdrawn from the fire and allowed to cool with the lid on, the surface of the alloy being further protected from the atmosphere by the layer of charcoal. In this way, complications due to the absorption of oxygen by the solidifying alloy were avoided. The button of alloy was weighed when cold, and its weight compared with the weight of metal used in its preparation. The buttons usually prepared weighed 200 grains, and the loss during preparation was generally less than 0·2 grain. The alloys containing arsenic and antimony showed no signs of liquation, and their composition was taken as prepared ; but those containing bismuth showed signs of liquation even below 1 per cent. of bismuth. Above 1 per cent. the liquation was very marked, small globules being extruded through the surface of the buttons. A number of these globules were detached from the buttons and analysed. The analysis gave 99·7 per cent. of bismuth, and the ammoniacal solution, from which the bismuth was precipitated, had a faint blue colour due to the presence of a trace of copper. But, since it would be practically impossible to detach the globules from the buttons without bringing away a little of the alloy, this trace of copper must be regarded as adventitious. Therefore, a solidifying alloy of copper and bismuth rejects pure bismuth, and this is so even when the content of bismuth exceeds 50 per cent. It was, therefore, necessary to analyse the series of copper-bismuth alloys prepared for the experiments to be described later, and, as the amount of liquation could not be controlled, the composition of the series is not as uniform as that of the antimony and arsenic series.

The arsenic antimony, and bismuth used in the preparation of the alloys were specimens of the ordinary pure metals, and as not more than 3 per cent. was put into an alloy, only the merest traces of impurities would be thus introduced.

In order to make the comparison as complete as possible, 1 grm. of each of these metals was dissolved in 15 c.c. of nitric acid (1·2), the gas collected and determined. The arsenic and bismuth dissolved readily at 65° C., but the antimony was oxidised slowly even at 94° C. The following tables gives the volumes of the dry gas at N.T.P. :—

	Nitric Oxide.	Total Gas.	Temperature.
	c.c.	c.c.	°C.
Arsenic	327·0	330·0	67
Antimony	188·0	199·5	94
Bismuth	79·5	81·0	67

Reference to the table renders it evident that nitric oxide is the principal gaseous product of the dissolution of arsenic and bismuth in the 1·2 acid, for 99 and 98 per

The apparatus used is of simple form and readily controlled. It is shown in Fig. 1. The reaction is carried out in a small beaker A fitted with a rubber bung through which pass an angle tube for the escape of the gas, a delivery tube with a narrow bore for the addition of the acid, and a thermometer to determine the temperature of the reaction. The bottom of the bung is cut away at a small angle near the gas tube, and the under surface coated with a thin film of paraffin wax. The acid delivery tube is connected with the burette B, from which the measured quantity of the acid solution is run into the beaker. The lower part of the burette is surrounded by a water jacket C, for raising the temperature of the acid, and the lower part of the beaker is immersed in a water bath D. A graduated cylinder, fitted with an angle tube and stopcock, and standing in an inverted bell jar F, is used for collecting and measuring the evolved gas. A second bell jar G is connected with the first jar by a flexible tube, and is so arranged that it can be raised or lowered to regulate the level of the water in the first jar to the requirements of the experiment in hand.

The oxygen apparatus consists of an ordinary drying cylinder, having a tap funnel connected to the tubulure at the bottom of the cylinder by a flexible tube. The cylinder is graduated and is fitted with a rubber bung and delivery tube.

An experiment is carried out as follows :—The metal is reduced to filings, which are sifted through brass gauze with 64 meshes to the linear inch, and the sifted portion is carefully magneted to remove particles of iron derived from the file. One grm. of the filings is transferred to the dry beaker. The rubber bung, to which the burette is attached, is held in position by a retort clip, the acid run into the burette and levelled. The beaker is then pressed on to the bung, the measuring cylinder attached, and a water lute run between the rim of the beaker and the side of the bung to ensure the apparatus being gas tight when in position. Hot water is poured into the water-jacket surrounding the portion of the burette containing the acid. The hot water bath in which the beaker is to be partly immersed is now prepared and brought into position, and one minute allowed for the beaker to come to the temperature of the bath. The acid is then allowed to run in slowly, and the temperature noted. When the action is finished water is poured into the burette, and allowed to run into the beaker. In this way the whole of the gas is transferred to the measuring cylinder. The water is levelled and the volume of the gas read off. The level of the water in the bell-jar is then raised, its temperature taken, and a measured volume of oxygen added to the gas in the cylinder. The cylinder is shaken to remove the last traces of nitric peroxide, allowed to stand for a minute, and the volume of gas again read off. The height of the barometer is then taken, and the experiment is finished.

The water over which the gas is collected and the oxygen apparatus are allowed to come to the same temperaure before use.

The following example shows the method of working :—Volume of air in apparatus before the addition of acid = 45 c.c. ; volume of gas in cylinder = 215 c.c. ; volume of oxygen added = 125 c.c. ; volume of residual gas = 73 c.c. ; temperature = 20·9°C. ; pressure = 756 mm.

From the data thus obtained it is easy to find the volume of nitric oxide originally present in the collected gas, and this, together with the volume of nitric oxide already removed by the oxygen of the air present in the apparatus at the beginning of the experiment, gives the total volume of nitric oxide liberated from the acid solution. The volume of the gases other than nitric oxide is also readily determined.

In the experiment in which the above measurements were made the volume of nitric oxide, corrected to the dry gas at N.T.P., obtained by the dissolution of 1 grm. of pure copper in 15 c.c. of nitric acid (sp. gr., 1·2) at 65° C. was 176 c.c., and the volume of the other gases 1 c.c.

The standard copper used in the experiments was obtained by fusing the electro-deposited metal under charcoal in a carbon crucible, and well agitating the molten metal in contact with the charcoal. The metal was then allowed to solidify under charcoal so as to prevent absorption of oxygen during solidification, and gave on electrolytic assay Cu = 100·04 per cent.

Variations in Temperature.—A number of experiments were made to determine the general effect of varying the temperature at which the reaction takes place. One grm. of copper was dissolved in 15 c.c. of nitric acid (sp. gr. 1·2). The experiment was carried out exactly as described above, and the temperature was regulated by the water-jacket and water-bath. The time required for complete dissolution was noted. The results are given in the following table, and are also plotted on the curves, Fig. 2 :—

Time in min.	Temperature in °C.	Volume of Nitric Oxide.	Total Volume of Gas Liberated.
		c.c.	c.c.
56	25	137·5	142·0
30	35	139·5	145·5
16	45	153·0	157·0
6	55	163·0	167·0
5	65	176·0	179·0
5	75	182·0	185·0
4	85	185·0	186·0
3	95	192·0	193·5

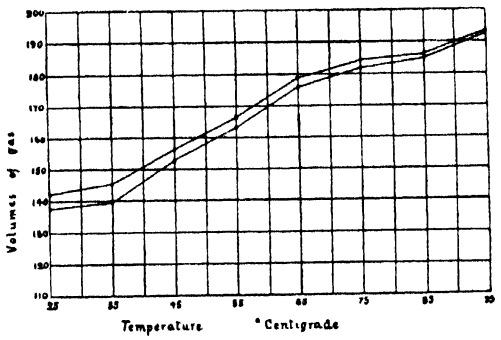


FIG. 2.

Reference to the curves makes it clear that increase in the temperature at which the reaction takes place causes a considerable increase in the volume of nitric oxide liberated, and a slight decrease in the volume of gas other than nitric oxide.

Dilution of the Acid.—Nitric acid of sp. gr. 1·2 contains 5·8 grms. of nitric acid in 15 c.c. of the solution. In determining the effect of dilution on the volume and composition of the evolved gas, it was arranged that the volume of acid solution used for each experiment should contain 5·8 grms. of nitric acid. The other conditions were kept as constant as possible and the temperatures actually observed varied little from 70° C. One grm. of standard copper was used for each experiment, and the results are embodied in the following table :—

Volume of Acid Solution.	Volume of Nitric Oxide.	Total Volume of Gas.
c.c.	c.c.	c.c.
20·0	158·5	159·5
15·0	177·5	178·5
12·5	167·5	170·0
8·5	130·0	133·0
6·5	74·0	80·0

It was evident from the last two experiments that the quantity of nitric peroxide in the apparatus largely exceeded that which would be formed by the union of nitric oxide with the oxygen of the air present in the beaker at the beginning of the reaction. Therefore, nitric peroxide is clearly a product of the reaction when the acid solution exceeds a certain strength. From

Similar series of experiments were made with mixtures of copper and arsenic, copper and antimony, and copper and bismuth, to determine the effect of simply mixing two metals as compared with alloying them. The copper and bismuth were used in the form of sifted filings; the arsenic and antimony were powdered in an agate mortar, and the powder sifted. In preparing a given mixture, the required quantity of the other metal was weighed on a watch glass and then made up to 1 grm. with copper. The mixture was treated in exactly the same manner as the corresponding alloy. The results are tabulated below, and are also plotted on the corresponding curve diagrams:—

Mixtures of Copper and Arsenic.

Mixture.		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Arsenic per cent.	0·00	0·05	0·10	0·25	0·50	0·75	1·00	1·50	2·00	2·50	3·00
Vol. of nitric oxide	176·0	174·5	174·0	175·0	175·0	175·0	176·0	174·0	174·0	175·0	174·0
Total vol.	177·0	179·0	179·0	177·5	175·5	177·5	176·5	178·0	177·5	179·0	178·0

Mixtures of Copper and Antimony.

Mixture.		1.	2	3.	4.	5.	6.	7.	8.	9.	10.
Antimony per cent.	0·00	0·05	0·10	0·25	0·50	0·75	1·00	1·50	2·00	2·50	3·00
Vol. of nitric oxide	176·0	174·5	174·0	175·0	175·0	175·0	176·0	174·0	174·0	175·0	174·0
Total vol.	177·0	177·0	176·5	177·5	177·5	178·0	178·5	175·5	177·0	177·5	176·0

NOTE.—Up to 1 per cent. the antimony dissolved completely, beyond that the solution became milky, and a slight dark sediment showed that the antimony was not completely oxidised under the conditions of the experiment.

Mixtures of Copper and Bismuth.

Mixture.		1.	2.	3.	4.	5.	6.
Bismuth per cent.	0·00	0·05	0·25	0·75	1·50	2·00	3·0
Vol. of nitric oxide	176·0	173·5	174·0	174·0	173·5	173·0	171·0
Total vol.	177·0	176·5	177·0	176·0	175·5	175·0	174·0

It has been shown by the foregoing experiments that the presence of impurities in copper, even in very small proportions, modifies the reaction of the metal with nitric acid, and that this effect is altogether out of proportion to the quantity of impurity present. When oxygen is the impurity, the falling off in the volume of gas liberated may be due to part of the metal being already oxidised at the commencement of the acid attack. But the explanation of the action of arsenic and antimony must be looked for in quite another direction. In a pure copper-arsenic alloy, containing an excess of copper the arsenic is present as arsenide, and it is the relation of the arsenide to the excess of copper that confers upon the alloy its characteristic properties. When the alloy is in the molten state it is without doubt a solution; but during solidification this simple composition may be modified, and a number of changes may take place, such as the crystallisation of pure copper, the formation of eutectics, and the segregation of the arsenide itself. But as all or any of these changes would result in the more or less complete separation of the main bulk of the copper from the arsenide, it is difficult to see how the presence of arsenic in such a mixture could seriously affect the action of nitric acid upon it.

It would appear that a much more intimate relation of the arsenic with the whole mass of the copper is required, and the condition of most intimate relation of the arsenic with the whole of the copper would be furnished by a perfect solid solution. Thus, the minimum action would be given by the alloy containing the percentage of the added metal which gave the most perfect solid solution. If this view is correct the point is reached for copper-arsenic when the arsenic equals 0·25 per cent., and for copper-antimony when the antimony equals 0·5 per cent. Also, the behaviour of the copper-bismuth alloys seems to indicate the absence of solid solutions from their compositions.

The investigation furnishes another example of the marked influence of small quantities of elements, both metals and non-metals, upon the properties of metals, about which there is still much to be said. A more extended research is in progress, and may throw further light on the subject.

It may be suggested that, in carrying out this research, it would have been more complete if the composition of the residual gas had also been determined; but as the chief aim of the present work was rather to prove a differential action than to give complete analytical details, this was not attempted. Nitric oxide is the principal gas liberated by the metals present in the alloys under consideration, and is readily estimated with sufficient accuracy for the purpose. It is here regarded as an indicator of variations in the chemical change due to variations in the composition of the metal producing it.

Refinements in the methods employed have been left for future work.

DISCUSSION.

Dr. T. S. PRICE said that many investigations had already been carried out as to the action of nitric acid on different metals, and the action varied very much with the strength of nitric acid used. The presence of nitrous acid had been found by Veley and others to have great influence. Did Mr. Stansbie investigate to see if there were other substances present which might affect the results? The presence of nitrous acid and other substances in the nitric acid was so very important that he should have thought it would have been taken into account at the very beginning of the investigation. The subject was a very complicated one. He had had occasion recently to look up accounts of the action of nitric acid on metals, and they seemed to be very contradictory.

The CHAIRMAN did not quite agree with Dr. Price regarding the influence of nitrous acid, because of the great consistency of the results which Mr. Stansbie appeared to have obtained. If it were due to accidental impurities of that kind such uniform results would not be expected. The two tables seemed to him to contain the pith of the matter, and the results were extremely remarkable—the influence of the limited proportion of arsenic and the nature of the gas evolved. With regard to the other gases, he supposed they were largely nitrogen and nitrous oxide. The discrepancies between the amounts obtained, *viz.*, 137 c.c. at 25° C., and 192 c.c. at 95° he supposed was due to the insolubility of nitric oxide in hot nitric acid and copper nitrate solution.

same way as in what is termed martensite. With 0·8 per cent. of manganese, the needle-shaped crystals are smaller and the segregated portions more extended and more continuous, tending to enclose spaces composed of the needle-shaped crystals and the dark ground work. With 1·5 per cent. the needle-shaped crystals are very small and very fine. Evidently they are of the same composition as the segregated portions, which now form continuous boundaries to the dark groundwork, in some parts narrow and in others very wide and massive.

With further increase of manganese, the segregated portions get larger and larger, the needle-shaped crystals almost disappear, and the whole field is composed of two portions—the double carbide of iron and manganese forming the hard white prominent boundary masses and the dark ground, containing very small but irregular needle-shaped crystals, giving it the appearance of a eutectic nature.

Fig. 7 illustrates this structure. The sample contains 2·3 per cent. of manganese. Manganese has a more powerful influence on the condition of carbon than silicon, for with equal parts of silicon and manganese there is much more combined carbon than graphite, and a total absence of large flakes of graphite. This is probably due to the fact that manganese readily unites with carbon, while silicon does not, and that a double carbide of iron and manganese is produced in cast iron in the absence of sulphur and silicon. When silicon is present, the manganese can unite with it, and thus neutralise any power the silicon may possess of causing the separation of graphite.

To further test the effect of manganese on cast iron, a cast iron, practically free from silicon, was taken, and 1·5 per cent. of manganese added. This alloy, when thoroughly melted, was kept some time in the molten state, then transferred, in a covered crucible, to a muffle, as before described and kept at a temperature of 1100° C. for some hours and allowed slowly to cool. Notwithstanding the slow cooling the metal was white, hard, and had the same structure as the preceding ones.

Effect of Phosphorus.—Our present knowledge of the effect of phosphorus on iron is largely due to the researches of Mr. J. E. Stead, whose work on the subject is known to all iron metallurgists. When the action of phosphorus on iron is considered his results may be taken as conclusive and almost exhaustive. He pertinently remarks ("Jour. Iron and Steel Inst.," No. II., 1900) "the study of binary alloys is comparatively easy compared with the research relating to compounds of iron with carbon and phosphorus."

In such compounds the carbide and phosphide often exist side by side, and mere etching is often insufficient to distinguish one from the other. The method of heat tinting has been found by Osmond and Stead to be most effective in indicating the phosphide and carbide areas, because the carbide takes the deeper hue on heating to a given temperature. Both the carbide and the phosphide are intensely hard, but Stead considers the carbide the harder of the two. On heating cast iron containing phosphorus at 900° C. and cooling moderately rapidly, the phosphide passes into solid solution, and is, on cooling, distributed between the newly-formed pearlite grains, and, therefore, behaves in a similar manner to that of steel free from phosphorus. As the carbon increases the phosphorus is thrown out of solution and exists as a free phosphide.

In order to ascertain the effects of varying proportions of phosphorus on cast iron, practically pure iron was melted with phosphorus, from 0·25 to 2·0 per cent. First, a rich phosphoric cast iron was made and analysed to get the percentage of phosphorus. From this rich alloy, when added to the iron and carbon were obtained the above-mentioned alloys.

The alloys were prepared in the same way as the previously mentioned alloys, kept at a high temperature for a long time, and slowly cooled. The alloy with 0·25 per cent. of phosphorus was found to consist of two chief parts—a massive, hard, white portion of cementite of very irregular shape and a mixture of a fine structure forming the eutectic. In this eutectic a number of white needle-shaped crystals crossed the ground in different directions, and are probably cementite.

With 0·5 to 1·0 per cent. of phosphorus, the eutectic matrix is divided into elongated grains, the boundaries of which are composed of the phosphide eutectic in some parts and massive cementite in others. The cementite also segregated in large structureless masses in other parts of the section. The ground mass was of a eutectic nature, but the phosphide was evidently largely concentrated in the boundaries of the grains. This structure is shown in Fig 8, which contains 1·0 per cent. of phosphorus.

With higher percentages, as in Fig. 9, which contains 2 per cent. of phosphorus, the ground mass is entirely perlitic and probably contains some phosphorus, but the greater part is in the portions of the boundaries parallel with the cementite masses, which are white and structureless. This would not be the case if they contained any notable quantity of phosphorus. They may contain some phosphorus in solid solution, but the quantity is probably very small.

The question may now be asked: Does phosphorus in any way influence the condition of carbon in iron? This is a difficult thing to prove absolutely. In the first place, the fractured surface of pure cast iron (iron and carbon), when allowed to cool slowly in the same way and at the same rate as phosphoric cast irons, was found to be of a grey colour, while all those containing phosphorus were white. This would seem to indicate that phosphorus induces combined carbon; but the phosphide of iron is also white, and the light colour may be due to the phosphide. On the other hand, the polished and etched sections show very much greater portions of massive cementite than in the case of pure cast iron, the structure of which was finer and the crystal grains smaller. This is, in accordance with Mr. Stead's observation, that phosphorus promotes the formation of large crystals.

An interesting sample of the combined effect of phosphorus and silicon was brought to me some time ago by Mr. Buchanan, the analysis of which is as follows:—Combined carbon, 0·2; graphite, 2·0; phosphorus, 2·1; manganese, 0·3; silicon, 1·95 per cent. The structure is shown in Fig 10. In this case the phosphorus is exceptionally high, and is in excess of the silicon. The fractured surface was grey, and the metal close grained, but, on trying to drill it, it was found to be too hard for the drill to cut it. The micro-section contains large plates of graphite like ordinary grey iron. The phosphorus eutectic is abundantly evident in all parts, and there is also the usual eutectic matrix.

Now, in this case, the phosphorus did not make the iron white, and the silicon did not make portions of it grey. I consider that, in this case, the silicon and phosphorus tendencies were moperative, and that the natural tendency to form graphite by the slow rate of cooling predominated. The iron is grey due to the graphite, and a portion is white due to the combined carbon and combined phosphorus.

The presence of phosphorus in cast iron lowers the percentage of total carbon, and this effect increases proportionately with the increase of phosphorus. The amount of carbon in cast iron with 2 per cent. of phosphorus is probably not more than 2 per cent., so that as regards the carbon, the metal is more like steel than cast iron. Now the more steel-like the metal is the less is the tendency to form graphite, and the greater the tendency to form combined carbon. In this respect the influence of phosphorus acts indirectly, if not directly, towards the formation of combined carbon.

Effect of Sulphur.—Sulphur, even when present in small quantities, exerts a considerable influence on cast iron. It is generally agreed that sulphur exists in iron as a sulphide of iron, and when manganese is present, as sulphide of manganese. The former is readily fusible and decomposed at high temperatures, the consequence being that when the metal is slowly cooled from a high temperature a large proportion of the sulphur escapes as a gaseous compound, giving the metal a very spongy texture. With the presence of manganese the sulphur combines with that element in preference to the iron, and as this manganese sulphide has a high melting point and a high dissociation point, the sulphur is not liberated in the gaseous form, so that blowholes and red shortness are avoided to a great extent.



Fig. 1.—Cast Iron.



Fig. 2.—Cast Iron 0·3 % Mn.



Fig. 3.—Cast Iron 1 % Si.



Fig. 4.—Cast Iron 2 % Si.



Fig. 5.—Cast Iron, Quick Cooled, Si = 1 %.



Fig. 6.—0·5 % Mn.

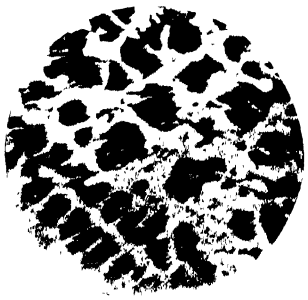


Fig. 7.—Cast Iron 2 % Mn.



Fig. 8.—Cast Iron, Slow, 1 % P.



Fig. 9.—Cast Iron 2 % P.



Fig. 10.—White Iron. Buchanan.



Fig. 11.—Cast Iron 1 % S. Slow Cool.

Endeavours were made in vain to get a good clear section by slowly cooling cast iron, into which had been introduced from 0·25 to 2·0 per cent. of sulphur, in consequence of the volatility of the sulphur compound. On quickly cooling a sulphury iron a better surface may be obtained, but blowholes are even then abundant. The structure is somewhat similar in each case, but the quickly cooled sample is finer in grain and the constituents more evenly arranged.

Fig. 11 is a section of pure cast iron to which 1 per cent. of sulphur has been added, and cooled very slowly. The fractured surface was white. The polished and etched surface had the appearance of high carbon steel, with grains of perlite and boundaries of cementite, and across the grains ran needle-shaped crystals of cementite in various directions. There were no flakes of graphite. The sulphide of iron appears to have been located in the boundaries, as the blowholes follow the contour of these boundaries. Some sulphide still remained and had a bluish-grey colour after etching in dilute nitric acid. Also, on etching, the well-known odour of sulphuretted hydrogen may be perceived. It may be incidentally remarked that very dilute nitric acid also causes the liberation of sulphuretted hydrogen.

Sulphur appears to act in the same way as manganese in causing the carbon to assume the combined form, or, rather, to prevent the carbon in solution from separating as graphite.

Discussion

Prof. Thos. Turner said that the question of the separation of graphite from cast iron was one which was of very great interest both from the practical and theoretical point of view. It was only within the last few years that anything really accurate or definite had been learned on the subject, and, as Mr. Hiorns had pointed out, the first step in that knowledge was due to Ledebur's recognition of temper carbon or temper graphite as being distinct from the ordinary form of graphite. Following that came microscopical observations, and it was soon recognised that graphite was of different sizes and different kinds. A good deal of work in connection with that branch of the subject had been done in the laboratory of the University of Birmingham by Mr. O. F. Hudson. He (Prof. Turner) had followed up that line of argument also by separating the pure graphite from a considerable weight of iron and sifting the graphite, as obtained from the various grades of iron, through a series of sieves, and it was found that the size of the graphite determines the grade of the iron. It was not the quantity of the graphite, but the actual size of the separate flakes, that determined the "number" of the iron. They had also recently had experiments in progress bearing on the rate and the temperature at which the graphite separated. These experiments had to do with the volume alterations of cast iron, and with the determination of the temperature at which these volume changes occurred. There were two chief expansions in the iron as it cooled, and also two arrests in the temperature during cooling. One of these corresponded to the separation of the ordinary flake graphite and the other to the formation of temper graphite. The size of the graphite varied according to the temperature, at which it was produced. The higher the temperature the larger were the flakes of graphite. Kish, which separated from fluid cast iron, was the largest form of graphite. As the metal solidified when the large graphite separated out, the operation was not complete in a single moment, but it was a process requiring time. In the same way, when the temper graphite was produced, some time was required, and he was of opinion that Mr. Hiorns was quite correct when he stated that the amount of graphite, and the kind of graphite, were largely a function of time and temperature. At the same time the importance of other conditions must be recognised, particularly that of the constituents which were present. It was extremely difficult to say how much silicon was necessary in order to produce graphitic carbon, and it would vary very much with the proportion of other elements. Grey cast iron could be produced on a large scale with less than half per cent. of silicon. That, of course, was quite exceptional, but in the ordinary way and under ordinary circumstances some silicon was essential to the production of graphitic carbon. The purer the iron the less silicon was required, but that some silicon was required seemed to be proved by constant experience.

Mr. Buchanan said he had no doubt whatever that, with phosphorus, hardening was attained directly and not necessarily from the combined carbon, and he had yet to see a phosphoric iron with high sulphur. He had never seen a cinder pig with a high sulphur content so long as it had a high percentage of phosphorus. It was a singular fact that manganese and sulphur, which separately hardened iron by causing combined carbon, had the effect of softening it when together in the same iron, and so lowering the combined carbon. A case was brought to his notice recently in which large quantities of cast iron had been spoiled in the melting; it contained a high percentage of sulphur and was perfectly white. It was melted with scrap and a pig containing somewhere over 2 per cent. of manganese, and a grey pig was obtained. As regards manganese sulphide, he had seen a number of micro-sections: the manganese sulphide in the cementite was of rectangular form. In one case the manganese sulphide was to be seen in the pearlite as well as in the cementite. The sulphur present was 0·25 per cent., probably due to the large quantity of manganese sulphide present: some of it found its way into the pearlite. If pearlite was a eutectic, how could phosphorus eutectic be found in the cementite? He took it that the phosphorus eutectic was in a fluid condition and that the cementite was set. How was it that the phosphorus eutectic had been driven into the cementite areas? As regards the effect of cooling on the separation of graphite, the time element was most important. In the micro-section of a piece of cast iron which has been annealed, it could be seen that the annealing carbon had come up to the surface of what had been cementite. That separation of annealing carbon could hardly be due to the silicon present unless the silicon had an expellent effect on the carbon after the metal was in a solidified form. His own idea as regards the separation of graphite through the influence of silicon was that it took place when the iron was in a pasty condition, very little below its setting point. But with the ordinary annealing, where the iron had retained its solidified form, it externally changed when the annealing carbon separated from the cementite. It must be due to the temperature, as it seemed improbable that it could be due to the influence of the silicon when the iron was in the solid form. The temperature was not high enough to allow the silicon to act in the way it was usually supposed to do.

Mr. W. Rosenhain referred to the process of heat tinting to which Mr. Hiorns had alluded in connection with the detection of the presence and distribution of phosphorus. This process was a most useful one, and was consequently much recommended in the literature of the subject. For that reason the speaker wished to sound a note of warning as to certain very serious obstacles which had to be overcome in connection with the method. When a polished section of metal was exposed to the oxidising action of the atmosphere at a high temperature, only the actual surface of the metal was exposed; and this actual surface very often did not represent the real structure of the metal, because the very act of polishing tended to spread the softer constituents over the harder, and in all cases produced a definite layer of altered material. When such a surface was etched, the altered layer was removed, and if the etching was to show the true structure of the metal it must be carried deep enough to remove the altered layer entirely. Merely exposing the surface to oxidation did not remove the altered layer, and it had consequently been found necessary to etch the surface first and heat-tint afterwards. Another difficulty in heat-tinting arose from the difficulty of obtaining the surfaces in a perfectly clean state; whatever solutions were used for washing or etching, some residue was always liable to remain on the surface and to affect the rate of oxidation. Two very serious difficulties had thus to be overcome before heat-tinting could yield satisfactory results.

Dr. A. Findlay said he had listened to the paper from the theoretical side with great pleasure, more especially on account of its bearing on the phase-rule representation of the equilibria in the iron-carbon alloys. The diagram of Roozeboom was drawn up on the assumption that below, say, 1100° C. the stable system was martensite *plus* cementite, and not iron *plus* graphite. That, however, failed to account for the fact that on slow cooling, and more especially in presence of small quantities of silicon, it was found that graphite separated from the mixture. The question, therefore, arose as to whether Roozeboom's curve was to be discarded altogether, or whether some modification could be made to interpret facts which had been met with in studying the cooling of iron carbon alloys. Under certain conditions the curves of Roozeboom did actually represent what was found, but with the slow cooling of the alloys and the presence of silicon they no longer represented the conditions which obtained. Undoubtedly, Roozeboom was wrong in his assumption that martensite and cementite formed the stable system. It appears quite certain from what Mr. Hiorns had said, and his results had been confirmed by other workers, that the stable system was formed by ferrite and graphite. Roozeboom's curves could still be applied to represent the conditions met with in the presence of manganese, by supposing that they represented metastable systems. That is to say, all the curves below the temperature of say, 1100° would represent conditions similar to what occurred in the case of glass, a supercooled liquid; and slow cooling, or the presence of silicon, prevented this supercooling, just as in slow cooling glass became crystalline or devitrified. It must be assumed that even in the absence of silicon, if the cooling were sufficiently slow, a mixture of ferrite and graphite could be obtained, since that was the stable system. Manganese, however, appeared to have the property of promoting supercooling, so that when manganese was present, the metastable system martensite *plus* cementite was obtained, and in that case Roozeboom's curves could be applied. Silicon acted in the opposite way, by practically preventing the supercooling. It acted catalytically and produced the stable system. Mr. Hiorns objected apparently to that explanation of the action of silicon by saying that he thought it required the formation of carbon silicide. That was not necessarily an objection, because it begged the question as to how the catalysis was effected. Almost infinitesimally small quantities of certain substances could produce marked effects, so that silicon present in less that 0·05 per cent. might produce a marked effect in facilitating the separation of the graphite. As far as the investigation has gone at present, Roozeboom's diagram could still be accepted if it were assumed, as had been pointed out by Heyn, that all the lines below the temperature of 1100° represented metastable conditions, i.e., they referred to supercooled carbon-iron alloy.

Dr. T. S. Price supported what Dr. Findlay had said with regard to Roozeboom's curve. At the annual meeting of the German Bunsen Society in 1904, Prof. Heyn read a paper in which he criticised Roozeboom's views, and brought forward a number of practical details which did not agree with Roozeboom's curve. Even above 1100 °C. the metastable condition existed, as represented by martensite. He would also like to emphasise what Dr. Findlay had said about catalytic action. The theories of catalysis brought forward were often nothing but theories, and a way of getting out of a difficulty.

Mr. O. F. Hudson said that when iron was cooled very slowly and a large quantity of graphite was obtained, that was the condition most favourable for the separation of graphite, which was very slow cooling through the eutectic point. Once graphite was separated in cast iron it was very rare for the amount of graphite to decrease. Indeed, slow cooling below the eutectic point (1130° C.) caused a further separation of graphite.

Mr. A. H. Hiorns, in replying, said with regard to what Prof. Turner had said about the quantity of graphite, he referred to the large flakes, which might be looked upon as the proper form of graphite. With regard to Mr. Buchanan's point about the effect of sulphur and manganese, it was easy to understand that by adding manganese pig to sulphur pig a soft grey iron was produced, because the manganese united with the sulphur and both were then thrown out of the way. The iron might be cooled as slowly as desired with very little alteration below 1000°; it was by keeping the metal at a temperature somewhere between the dotted line and the black line of Roozeboom's curve that separation of the graphite was caused. That was the condition in the case of many large castings, which remained beyond 1000° C. for a considerable time and were a very long time in cooling; and the casting would be at the temperature at which the graphite could naturally separate. It could only be concluded that phosphorus was in solid solution, but iron phosphide in solid solution separated out during cooling. The separation of graphite must take place below the 1130° C., but on annealing cast iron for malleable castings, for example, the temperature was not raised to that degree. That was somewhere about 900° C.; graphite carbon separated out then, but never in the large flakes, only in the finely divided state. Mr. Rosenhain had given us some valuable information with regard to heat-tinting. He agreed entirely with Dr. Findlay as to the metastable condition of cast iron. He thought he had brought out sufficiently clearly that if iron *plus* graphite was the stable condition all other forms were metastable or unstable conditions, therefore true equilibrium was only obtained when the cast iron was in the form of iron and graphite. He agreed with Dr. Price that the word catalysis could be used to explain many things, and with the very small quantities present, such as he had referred to, further evidence was needed before the view that the changes were due to catalytic action could be accepted.

Liverpool Section.

Meeting held on Wednesday, Dec. 13th, 1905.

MR. E. CARLY IN THE CHAIR.

FLOUR MILL EXPLOSIONS AND DANGEROUS DUSTS.

BY WATSON SMITH.

The investigation of dangerous dusts, that is, dusts composed of organic or carbonaceous matter in a fine state of division, was commenced by Faraday and Lyell in 1844, after the great explosion in the Haswell Collieries in September, 1844. They presented their report to the Home Secretary in 1845, and in this report they clearly indicate that an explosion of fire-damp, which in itself would not have been specially disastrous, might be exalted into a terrible and far-reaching catastrophe through the coal dust raised and carried along by the incipient fire-damp explosion. On Jan. 17, 1845, Faraday delivered a discourse in the Royal Institution, and he used these words:—"The ignition and explosion of the (fire-damp) mixture would raise and then kindle the coal dust which is always pervading the passages, and these effects must in a moment have made the part of the mine which was the scene of the calamity glow like a furnace." In spite of this discourse, and the report to the Home Secretary, and the fact of the report being published in the *Philosophical Magazine*, and followed by a letter from Faraday, in which he made suggestions as to the methods for ventilating the mines, but little, if anything, was done until further disasters in later years forced the subject into considerable prominence, and a Royal Commission was appointed, in which the late Sir Frederick Abel figured so prominently.

But there are many kinds of carbonaceous dusts besides coal dust; for example, flour dust, rice dust, soot, and lamp-black, also the dusts of sugar, and rosin, and finely divided

cotton, Garancine, &c. Mr. B. E. R. Newlands informs me that he has himself witnessed a sugar dust explosion in a sugar works. (See also Engler: this J., 1885, 486 and 487.) Engler bears testimony to the explosive character of soot and lamp-black when mixed with air. An explosion occurred in 1878, at the Garancine Mills at Sorgues, consequent on the ignition of a mixture of air with the Garancine dust. Cork, pulverised and sifted for linoleum manufacture, forms with air a mixture so inflammable and explosive that Mr. W. F. Reid declares he would rather handle dynamite in bulk than ground cork in a loose state (this J., 1896, 76). Cotton mills have become rapidly fired by the ignition of mixtures of cotton dust and air. As a partially carbonaceous substance, the dust of Prussian Blue, when mixed with air, has been known to flash off, whilst the cakes of blue were being ground by iron rollers, probably the presence of pebbles or stones causing sparks to be struck. As a non-carbonaceous substance it may be interesting to note that the inflammation of sulphur dust and air in pulverising chambers, has caused explosions. It only needs the use or occurrence on a sufficiently large scale of any of these or similar substances, dry and in a fine state of division, to give rise under suitable conditions to dangerous explosions. The truth of this remark is borne out in the case of flour dust, which, in the flour mills of this and other countries, has caused very many disastrous explosions. There were two reasons why these flour mill disasters were not earlier understood. The first was that their cause was obscure. The bare idea that flour might explode, on the face of it, appeared absurd. The second reason was that, until the larger flour mills of more modern times were erected, the explosions and fatalities were not sufficiently great, the ruin of life and property not on a sufficiently large scale to attract special public attention. But just prior to 1872, in Frideat (Germany) and Budapest (Hungary) where flour mills are specially numerous, so many serious fires and explosions had occurred, that the attention of a few scientists had been drawn to the subject; but little was done, and no authoritative or weighty publication made.

On July 9, 1872, a violent explosion took place at the Tradeston Flour Mills, near Glasgow, followed by a destructive fire. Eighteen persons were killed and 16 injured. The damage to property amounted to £70,000. A full report appeared in the *Glasgow Herald* of July 10, 1872. The *Herald* stated that at first it was supposed that the boilers had exploded, but subsequent investigation showed that some part of the machinery had gone, and the report adds, "probably the millstones, which were of great power and liable to explosion through excessive friction." This explosion, it is added, was characterised by the fire following, being of excessive ferocity, the flames shooting up 100 ft. high at times. Adjoining property was much injured. A surviving workman said "he had carried a lamp," so it is clear that open lights might at that time be used without any idea of danger, showing the ignorance then of any risk from the firing of a mixture of flour and air. The correspondence column of the *Glasgow Herald* also contributed additional proof of this ignorance. After seeing the announcement of the Tradeston explosion and having just read an anonymous article in *Dingler's Polyt. Journal*, I made an experiment and found that dry flour and air would fire like a mixture of lycopodium and air, and communicated my conclusions on July 10th to the *Glasgow Herald* (issue of July 12th), thus giving the true cause of flour mill explosions for the first time in English speaking countries. The Royal Society of Edinburgh recognised my priority in framing the letter referred to, and it was established by Sir F. A. Abel, F.R.S., in his lecture at the Royal Institution in 1882.

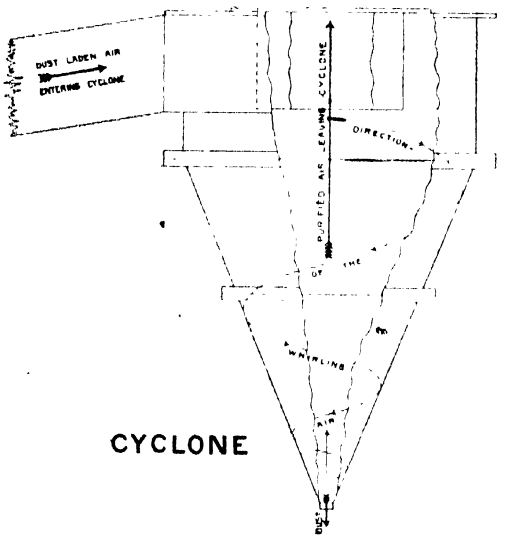
Immediately following my letter, the whole subject was investigated by Rankin and Macadam. The origin of the explosion was conclusively traced to the striking of fire by a pair of millstones through the stopping of the feed, and the consequent friction of their bare surfaces against each other. The flame thus produced, was quickly communicated to the mixture of dust and air filling the conduits connected with the exhaust box; this being the common receptacle into which the mixture of dust and air is drawn by an exhaust fan through the conduit communicating with the several mills. From the exhaust box, where a portion of the suspended flour dust was deposited, the air, still laden with dust, passed in the Tradeston, as in other flour mills, to another room, called the stive room, where a further quantity of the flour would deposit. Hence, as Sir Frederick Abel clearly showed in his lecture at the Royal Institution in 1882, on "Some of the Dangerous properties of Dusts," there were here a connected series of channels and larger enclosed spaces filled with a dust-laden atmosphere, through which flame was so rapidly transmitted from the millstones, where the first ignition occurred, that violent explosive effects were produced, succeeding each other with great rapidity in different parts of the building. The production of the blaze at the millstones was observed to be at once succeeded by a crackling noise as the flame quickly spread through the conduits to the exhaust box upon an upper floor, whence a loud report almost at once proceeded. Rankin and Macadam's inquiries elicited the fact that other flour-mill explosions had been attended by a similar succession of effects to those just indicated. Sir Frederick Abel then points out that Rankin and Macadam ascertained that accidents of this nature at flour mills were of frequent occurrence, especially since the exhaust arrangements had been applied to the larger flour mills, and in their report it is added, that "it seems scarcely possible to guard against such accidents, though their frequency may be reduced by adopting efficient precautions for avoiding the stoppage of the feed to the millstones and the access of nails or other iron particles to the stones; also by prohibiting the employment of naked lights in the vicinity of the mills or dust passages." Various other suggestions are given of a similar character. But Sir Frederick makes now this important statement, *viz.*, that "Since the publication of Messrs. Rankin and Macadam's valuable report, the accidents at flour mills appear to have been scarcely less numerous or disastrous than before the date of the Tradeston catastrophe." He then gives a series of illustrations of this fact both in America and in this country. Amongst these a great explosion occurred in 1878, at Minneapolis, Minnesota, where 18 lives were lost and six corn mills destroyed. The cause of the explosion was then traced by Professor Lawrence Smith to the same cause as that already given.

In 1881, the statement of Rankin and Macadam that "It seems scarcely possible to guard against such accidents," &c., seems still be verified, for in September, 1881, a fatal flour mill explosion occurred at Macclesfield, Cheshire, and a report thereon was made to the Home Secretary by Mr. T. J. Richards, of the Board of Trade. The cause here was traced to (1) the use of a very dry grain, and (2) the accidental stoppage of the feed. The year after the Macclesfield explosion, February, 1882, an explosion occurred at Rochdale, in the exhaust room, through the stones striking fire. A fire followed, doing damage to the extent of £33,043.

Rankin and Macadam, and Prof. Lawrence Smith and T. J. Richards, only go so far as to show how disaster is liable to haunt any arrangement of flour mill plant known, up to 1882, and even later, and Sir Frederick Abel, in his lecture before the Royal Institution, goes no further than this. Even at this day, there still exist flour mills, conducted on the old type, and overshadowed by the same risks as in, and prior to, the year 1882. In the case of these the old statement of Rankin and Macadam, that "It seems scarcely possible to guard entirely against such accidents," is as true as ever.

But a further step has been more recently taken which enables flour to be milled with perfect immunity from danger, and this was taken by the late Henry Simon, C.E., of Manchester, through his introduction of the iron roller grinding system for flour into this country in place of stone grinding, and of applying the "cyclone" system of collecting flour dust, whereby he not only produced purer flour, but recovered in the dust—formerly causing danger of explosion and injury to the health of the workpeople inhaling it, besides waste,—a useful by-product serving as cattle-food. In a word, he abolished the old dust chambers or stive rooms for

collecting dust, and substituted a "cyclone" dust separator, which separates air and dust in a manner analogous to that by which the chemist separates a suspended solid from a liquid by decantation. By means of the centrifugal action of the "cyclone," the dust is thrown to the side of the cone, and glides down to the bottom, where it escapes into a suitable receptacle, whilst the air free from dust passes out, as shown in the diagram, at the top, and up a cowl in the roof.



CYCLONE

To give a clearer idea of the thoroughly modern system of wheat cleaning prior to grinding, I have separated it into six numbered stages. Only the stage No. 3* was used in the old system.

(1) The grain, fresh from the threshing process, is at once sent over a separator, which mechanically removes foreign matters. Through this separator the grain passes to storage bins.

(2) Later on, when the wheat is to be used, it is drawn and passes over another separator, and thence through "cockle and barley cylinders," to remove all the so-called "cockle-seeds" and barley, and also small stones and gravel.

*(3) It next passes through a wheat-scouring machine, working by suction, and through which the wheat is further asprated and the fibre rubbed off the kernel and carried away ("bran").

(4) The wheat now passes through a washer and "stoner," where it is thoroughly washed and rinsed with water, and all stones, &c., removed, when it passes to a "whizzer," which, by centrifugal action, removes the bulk of the water still adhering to the outer cuticle of the wheat.

(5) The grain then passes into the drying and conditioning machine, where the remaining moisture is removed.

(6) Having passed through all these dry and wet cleansing processes, the wheat is finally sent through a double-brush machine, wherein, by means of the brushing action, a final mechanical polish is given to it, after which it passes to the magnetic separator, containing magnets which remove all metallic (iron) particles.

From the magnetic apparatus it passes to the first process of grinding; not by stones, however, but by specially hard and tough chilled iron rollers, fluted and smooth, and about 10 in. and 9 in. in diameter.

The fluted rollers, termed "break-rolls," are used to break down the wheat, and by means of the roller flutes, to scrape out the contents of the grains and separate them from the bran. The smooth rollers are used to crush into flour the particles of pure kernel detached by the fluted rolls. The proportion of fluted rolls to smooth rolls is generally about four to six.

Now each individual machine referred to is subject to the action of strong currents of air so nicely adjusted as to energy, that whilst the kernels at any point remain or are balanced, the dust is carried away. Each machine is also covered in, and connected with the "cyclone" dust collector, which is constructed of iron and has air-tight joints. It will thus be seen that the "stive room," or dust-chamber, with its dangers, has vanished with the advent of the "cyclone dust separator." The dust from the "cyclone" is used, mixed with other bran or dust, as cattle food. Previous to this, such dust was a nuisance, a source of injury to health, and one of danger by fire or explosion. Flour mill insurance companies are fully awake to this, and reduce their insurance on the average to the extent of 2s. 6d. per cent., when such a "dust separating arrangement as that described is used instead of dust-chambers.

In Liverpool, this spring, there was a flour-mill explosion of considerable magnitude, followed by a fire, although the improved iron-roller system was in use, but instead of a "cyclone" or similar dust separating arrangement, there was, I am informed, a dust chamber or stive-room, and it was in this chamber that the explosion occurred. The system must be completed by the substitution of the cyclone separator for the dust chamber, to ensure freedom from peril, and preferably the whole mill should be electric lighted, and also furnished with automatic water-sprinklers, or similar water extinguisher, to at once stop any slight outbreak of fire.

I have referred to other dangerous dusts, and I may now add that any of these, in any of the industries concerned, may, as in flour mills, be suitably drawn off by exhaust arrangements, and then be driven into a cyclone separator and collected. Sir F. A. Abel's address to the Royal Institution on "Dangerous Dusts" was made in 1882, and Henry Simon's patent for utilising the cyclone separator for flour dust in flour mills was published in 1886. Simon also applied the "cyclone" system for the removal of emery dust and lamp-black from the atmosphere of certain of our largest furniture and "blacking" works, and for the economic recovery of the material.

H. Simon's patents are as follows:—

For roller mills and flour mills, Eng. Pats 3725 of 1877; 2556 of 1879; and 2576 of 1879.

For cyclone dust collector, Eng. Pat. 9423 of 1886.

For roller mills and flour mill apparatus, Eng. Pats. 9746 of 1891; 28,716 of 1902; and 9704 of 1904.

Discussion.

Prof. Campbell Brown said he could corroborate the date which Mr. Watson Smith had assigned to the beginning of their knowledge of the causes of explosions in flour mills. He had himself read a paper on the same subject to the Literary and Philosophical Society of Liverpool, after some rather bad explosions in large flour mills at the North End, an abstract of which was printed in the Journal of that Society dated 1873. He had illustrated the paper by means of large glass tubes and a box with Lycopodium seed. All they knew then was that flour dust mixed with air played the same part as a mixture of air and coal-gas, or other inflammable gas, and one explosion in a flour mill was distinctly traced to the stoppage of the feed, which allowed the stones to come into contact with each other, to strike fire, and, in fact, act like a lucifer match lighted in a fiery coal mine. But among things they did not know then was how a length of pipe in the exhaust, or a series of chambers, or even of rooms through which the explosion passed caused a very great increase in the violence of the explosion as it went on from point to point, due to the successive impulses given to the explosion by the successive waves of vibration, each vibration being added on to the sum of the impulses of those behind them. Rankin and Macadam believed explosions to be inevitable, and wanted to prevent them becoming serious and to confine them to certain channels and get them out into the open air as

soon as possible. He was glad to hear that the use of the cyclone had been so effective in stopping explosions, for, long after the matter had been reported on by Rankin and Macadam, explosions in flour mills and coal mines went on as gaily as before, because people did not take the precautions sufficient to prevent them. Were there any statistics showing to what extent there had been a reduction in the number of explosions in places where one might expect to have them?

Mr. E. J. Baty said he had heard Prof. Bedson lay great stress on the point that coal dust explosions took place so readily because of the occlusion of gases on the surface of the coal. He himself thought that the tendency of an organic dust to explosion depended upon the united circumstances of, first, its fineness, and second, the volume of gases it could occlude upon its surface. Some dusts did not seem to occlude gases nearly as much as others. He would like to know if any one had ever tried to measure the amounts of gases which dusts of different degrees of fineness could occlude?

Mr. H. B. Stocks having inquired whether Mr. Watson Smith could give them any particulars of ways of separating stive dust, other than those of the old stive room and the "cyclone" method, he proceeded to describe a method of passing the material by means of a fan into filter chambers, which were really long canvas bags, or, in some cases, a canvas receptacle shaped like a balloon. In the case in point, the dust remained practically in the canvas bags, just as though they were filters, and the air passed out through the canvas. Regarding the moistening of the grain, that was not done for the purpose of damping the dust, but to get the grain into good condition for grinding ("conditioning"). When the grain was too dry, the friction on the stones caused them to become glazed, and they did not grind nearly so well. If a certain amount of moisture was added to the grain, the grinding was very much easier, but the amount of moisture must not be excessive, or the stive flour then became a kind of pulp and spread itself round the casing of the stones. In grinding cereals, if this product was too moist to begin with, the moisture driven out of the grain formed a sour cake with some of the stive flour; if this was not cleared out of the casing of the stones from time to time, it eventually dried and fell back between the stones, and was ground up with the flour. When flour of that kind was stored in sacks out of contact with the air it fermented, and became sour in a very few hours.

Mr. Charles Burne said he thought that in most modern mills at the present time two methods of dust separating were carried out, (1) the cyclone dust collector, largely confined to cleaning operations, and (2) the method of collecting the stive from the stones. The latest machine, of which numbers were now coming into this country, was of foreign make, and consisted of long canvas sleeves, which had been chemically fire-proofed. These were connected at the top with a box, sometimes metal lined and sometimes not, and the "stive" from the stones came into this top box, and was automatically made to go down into the canvas sleeves, whence it fell into a similar box at the bottom. There it was received and automatically conveyed to a sack—the sacks being removed as filled. He thought this machine had been found to supply a want; certainly amongst modern millers—and he had gone through some of the most modern mills, where it was recognised to be the most economical machine. The centrifugal action of the cyclone dust collector did not deposit the very finest stive; the canvas filters seemed to take out almost every particle of stive that was in the air. Reference had also been made to explosions being set up by friction due to stoppage of the feed. In one modern mill, where he had been quite recently, an ingenious device had been adopted for checking that danger. If the feed got below its proper amount, an alarm bell rang. If this bell were not attended to, the rollers were automatically thrown apart. With respect to the moistening of the grain, it might be of interest to know that there were some mills where the moistening was done by the injection of steam. He understood also, from enquiries he had made from time to time, that the flour from this moistened or damped grain, was of better quality for baking purposes than flour which was not moistened at all; this was, of course, a reason for moistening in addition to that of lessening of friction between the rollers.

Mr. W. Roscoe Hardwick asked whether the production of a damper flour materially mitigated the explosibility of that flour?

Mr. A. Carey referring to what Mr. Watson Smith had shown them with Japanese coal dust, asked whether experiments had shown how far the liability of coal dust to explosion varied with the per cent. of volatile matter present.

Mr. Watson Smith, in reply to Prof. Campbell Brown, said that only comparatively few flour mills in this country were now without the cyclone apparatus, and that a flour mill explosion to-day might be regarded as phenomenal. He could certainly say that where the stive room, &c., had been abolished, and the cyclone apparatus and iron rollers had together been adopted, no explosion had ever occurred. As he had already pointed out, he had been assured that the insurance companies reduced their terms to flour millers using the modern apparatus described. As to Mr. Hardwick's question about damping the flour, the true reason for this had been admirably explained by Mr. Stocks, and Mr. Burne. Beyond this, no doubt damp flour was less likely to fire than dry flour; its rising in dust would also be more limited. Also as regards the action of the old millers, prior to 1872, damping the grain before grinding, as he had mentioned, this was not to prevent explosions (about the nature and cause of which they knew nothing) but to "condition" the grain. He ought to add that any other dry carbonaceous powder, such as that of bran, was liable to explosion with air. In answer to Mr. A. Carey's question, he would say that in ordinary coal, *i.e.*, the coal of the coal measures, the percentage of bituminous matter, soluble in benzene or naphtha, is so small, that the slight variations in different varieties would make no sensible difference in the inflammability of the dusts. There was no doubt in his mind that the Miiké coal, the dust of which he had fired that evening, mixed with air, would explode more readily than any other coal dust. That Japanese coal was a lignite and contained upwards of 10 per cent. of resinoid matter, soluble in benzene, whilst ordinary coal never contained even as much as 1 per cent. (this J. 1891, 976). But no experiment with its dust like this, had been tried with the Miiké coal before. The Miiké mines were damp, lying, as they did, chiefly under the sea, but might be extended landwards where dry dust would abound and of a very dangerous nature. Prof. Bedson's idea about the occlusion of oxygen was a suggestive and interesting one, and he felt the probability of much truth in it, especially where the dust lay in the workings, with air continually passing over it by means of the ventilating system.

In reply to Mr. Burne, he said that whatever were the methods adopted, whether it were a cyclone arrangement or any other, mattered not, so long as the dust was effectively removed and disposed of. But how long would the bags referred to, continue to act as air-filters before getting choked? He would like to be sure that the porosity of the fire-proofed canvas of the bags in the new system referred to, was not, in part, choked by the fire-proofing mixture, and thereafter by the flour dust itself. As to the warning bell to automatically record a failure in feed-supply, and other automatic arrangements to separate the stones, automatic gear had often a trick of sticking fast or failing at a critical moment, and he preferred, in cases where human life, as well as property, was concerned, a revolutionising of the system to ensure safety.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 7.)

ENGLISH PATENTS.

Atomising Liquid and Gaseous Fluids; Means for ——. C. F. de Kierzkowski Steuart, London. Eng. Pat. 27,618, Dec. 17, 1904.

A PLUG of truncated conical form, having on its face longitudinal grooves, is fitted into a conical seat at the outlet of a chamber into which the liquid to be atomised is supplied under pressure. The liquid issues from the grooves in a number of jets, which intersect at a common point, and becomes atomised. A modification is claimed in which the plug has in addition a central orifice, controlled by a needle-valve. The chamber may be divided into compartments so that two or more liquids may be mingled in the same jet. Further claim is made for an internal valve mechanism adapted to shut off the flow of liquid close to the point of discharge; and for a casing lined with refractory material and provided with air inlets, for use when the jet is employed as a burner for liquid fuel. W. H. C.

Heating, Cooling and Similar Purposes; Apparatus for ——. J. W. Claridge, London. Eng. Pat. 28,197, Dec. 23, 1904.

THE claim is for the construction of heating or cooling boxes, which are divided by internal diaphragms into two or more compartments, through which the cooling or heating medium circulates successively. Two or more boxes may be connected together to form a system and placed in a chamber containing the material to be treated, or the material may be placed in the boxes and the medium circulated in the chamber. Further claim is made for constructing the boxes with external corrugations or projections, to increase the heating surface, or to assist in dislodging any deposit that may be formed on them, and for setting the boxes at an angle in the chamber, to promote circulation of the surrounding contents.—W. H. C.

Separation of Solids from Liquids; Impts. in ——. J. J. Crosfield, Frodsham, and K. E. Markel, Warrington. Eng. Pat. 5108, March 11, 1905.

THE mixture to be separated is caused, by means of deflecting plates or baffles, to pass alternately up and down, but chiefly in a horizontal manner, through a passage or passages which are of increasing cross-sectional area. In this way the flow of the liquid becomes slower, as the heavier portions of the solids are deposited, and time is allowed for the lighter portions to settle out.
—W. H. C.

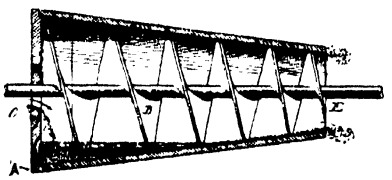
Solvents; Process for Recovering Vapours of Volatile ——. Soc. Jules Jean et Cie., and G. Raverat, Paris. Eng. Pat. 13,603, July 1, 1905. Under Int. Conv., Sept. 1, 1904.

SEE Fr. Pat. 350,149 of 1904; this J., 1905, 1161.—T.F.B.

UNITED STATES PATENTS.

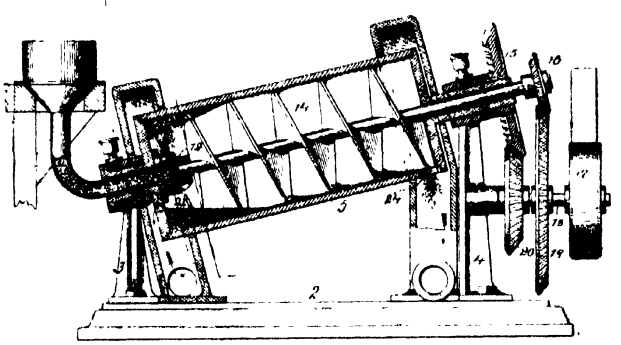
Separator; Centrifugal ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, N.Y., and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 807,055, Dec. 12, 1905.

THE liquid to be separated is fed into a rotating separator through the annular opening C. The liquid portion escapes through the passage A formed between the end wall of the vessel and an annular lining piece, and the



solids are transported by the worm conveyor B to the other end of the separator, where they are discharged at E.
—W. H. C.

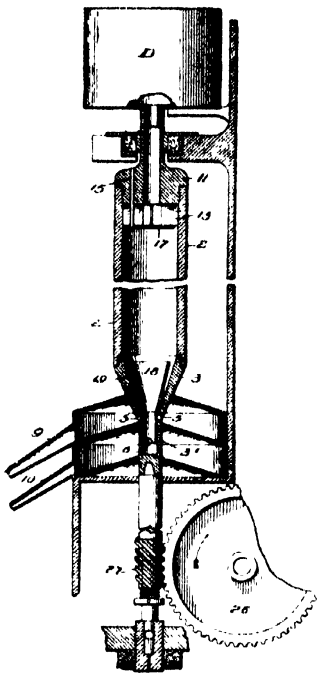
Separator; Centrifugal ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, N.Y., and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 807,056, Dec. 12, 1905.



THE claim is for a cylindrical separating vessel 5, mounted on supports 2, 3, 4, so that the feed-inlet 12 is situated in a lower plane than the outlet 24 for the solids. The separated liquid escapes through the opening 21 formed in the lower end of the cylinder and the solids are transported by the worm conveyor 14 to the upper end of the cylinder and discharged through the opening 24. Both the cylinder and the drum are rotated at different speeds by the differential gearing, shown in the figure at 15, 16, 17, 18, 19, 20.—W. H. C.

Liquid-Separator; Centrifugal ——. C. M. Ketcham, Carthage, Mo. U.S. Pat. 808,092, Dec. 26, 1905.

THE separator consists of a long cylinder 2, having separable top and bottom pieces 11 and 3, which is mounted in an upright position in journals and rotated at a high speed by the wheel 26 and the worm gear 27. The liquid to be separated is fed from the store-tank D through the tube below, on to the spreader-plate 17, and is forced to partake of the rotation of the drum 2 by the action of the distributing vanes 13; 15 is a vent tube. When the liquids reach the bottom of the cylindrical portion of the drum 2, the heavier one passes down the annular space between the detachable cone 3 and the inner skimming funnel 19, out of the openings 5 and away by the spout 9. The lighter liquid flows over the edge of the funnel 19, down the central space 18, into the hollow cylindrical



prolongation 3', out of the opening 6 and away by the spout 10.—W. H. C.

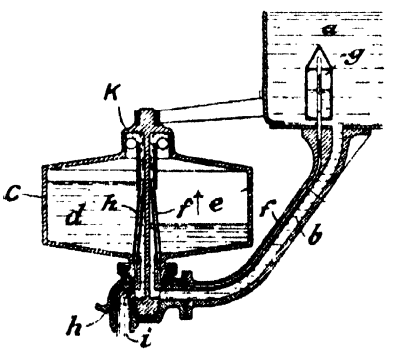
Filtering Liquids; Device for ——. G. Stade, Berlin. U.S. Pat. 807,513, Dec. 19, 1905.

SEE Fr. Pat. 340,322 of 1904; this J., 1904, 779.—T.F.B.

Distilling Apparatus. J. Pernat, Cleveland, Ohio. U.S. Pat. 807,577, Dec. 19, 1905.

A STILL, resting in a water-bath, is supported over a furnace, the joint between the still and the water-bath being made by a turned down flange on the still. The still has a still-head communicating with a condenser and formed by a dome-shaped piece and an inverted cone, which fits over the outside of the neck of the still. A diaphragm is fastened across the still-head, underneath the dome, and has a vapour-pipe which telescopes into the neck of the still. The claim is for the combination of the foregoing parts to form the whole distilling apparatus as described.—W. H. C.

Measuring Vessel for Liquids ——. H. C. Dehn. Hamburg, Germany. U.S. Pat. 807,665, Dec. 19, 1905.



THE liquid to be measured is stored in a reservoir *a*, which communicates by the conduit *b* with the measuring vessel *c*. The latter is a rotatable tank, divided into a number of separate chambers, two of which, *d* and *e*, are shown. The liquid flows down the pipe *b* and rises up into the chamber *e*, the air escaping by the pipe *ff* into the hooded outlet *g* in the reservoir *a*. Simultaneously the opposite chamber *d* is being emptied, the liquid flowing out through *i*, and air entering through *h* to displace the liquid. At each turn these operations are continued, one chamber being emptied while the opposite one is filling. The measuring chambers have overflows *k*, covered by an inspection dome on the top of the measuring vessel. —W. H. C.

Evaporating Apparatus; Vacuum ——. C. Ordway, New York, N.Y. U.S. Pat. 807,767, Dec. 19, 1905.

THE concentrated liquor is withdrawn from the bottom of the evaporating chamber by a pump, and is delivered into the upper part of one or other of several closed settling vessels, care being taken, by guarding the inlet, to avoid disturbing the contents of the settler. The settled liquor is withdrawn from the upper part of the settler and is either returned to the evaporator, or is delivered to another vessel for subsequent treatment. The settlers are provided with screens to receive any deposited solids, with taps for breaking the vacuum, and with valved drain pipes at the bottom to draw off the liquor when it is necessary to remove the deposited solids.—W. H. C.

Drying Apparatus. F. M. Schaffer, Indianapolis, Ind. U.S. Pat. 808,481, Dec. 26, 1905.

THE apparatus consists of a horizontal cylinder through which the material to be dried is passed by an internal worm conveyor. The cylinder is suspended and rotated in a chamber above a furnace by means of chains, which pass round sprocket-wheels fixed to the cylinder, and over corresponding sprocket-wheels attached to a horizontal driving shaft situated above the chamber. The feed end of the cylinder is provided with a "breeching" which carries the feed hopper and shoot. The gases from the furnace may pass through the cylinder or direct to the flue as desired, and the driving-chains are protected by covers from the action of the fire and hot gases.—W.H.C.

GERMAN PATENT.

Drying Process, in which the Material to be Dried is Subjected to the Action of Light Rays. A. Junghans. Ger. Pat. 162,696, Sept. 23, 1904.

THE claim is for drying substances while exposing them to suitable coloured rays, in order to avoid injurious effects (decomposition, discoloration, &c.), and to accelerate the drying. It is stated that the drying process is sometimes slow with white light, and that injury is occasionally caused, the reason being that many of the light rays are inactive so far as drying effect is concerned, whilst some rays may cause decomposition. For example, sugar which is nearly dry becomes liquid again on exposure to red light. In the drying process, light of a suitable colour should be used for each kind of material; frequently the most suitable colour is that which is reflected to the greatest degree by the material in question. For example, sugar can be rapidly dried in blue light, without liquefying or being injured in any way. Blue enamel-paint dries rapidly without alteration of colour in the mixed light from "white and blue incandescence lamps," whereas in the light from an arc lamp, the drying proceeds more slowly and the colour is said to change to green.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 12.)

Naphthalene from Coal Gas; Removal of ——. A. H. White and D. H. Clary. J. Gas Lighting, 1905, **92**, 388—393; 466—468.

IN studying the question of naphthalene removal in gas-works, experiments were made on the absorptive power

of various tars for naphthalene at different temperatures. About 1 grm. of the tar was placed in a 1 oz. wide-mouthed bottle, in which also a small glass thimble containing naphthalene was placed on a wire tripod. The bottle, with the stopper wired on, was kept at a constant temperature until the tar was fully saturated with naphthalene. It was found that tars of different origin vary considerably in their power of absorbing naphthalene, and also that the amount of naphthalene taken up by a given tar increases with rise of temperature. For example, the averages of all the tests showed the following percentages of naphthalene in the fully saturated tars:—25° C., 9·1; 35° C., 16·7; 45° C., 21·1; and 72° C., 48·7 per cent.

Further experiments were made as to the proportions of naphthalene in the tar and in the gas at the top of the stand-pipe, before and after passing the Pelouze and Audouin tar-separator, and before and after passing the scrubbers. From the results obtained, the authors conclude that in the hot stand-pipes and warm hydraulic and foul mains, the naphthalene is readily absorbed by the tar, and, provided enough time is given to this stage of the process, the gas will arrive at the tar-separator free from any measurable amount of naphthalene other than that held dissolved by the suspended tar. In the tar-separators, the particles of tar still exert a solvent action on the naphthalene in the gas, but not to so great an extent as in the hotter stand-pipe and mains. In the scrubbers, the water removes the last of the suspended tar and likewise the ammonia, and some other constituents. But the ammonia, as was proved by direct determinations, dissolves some of the phenols from the tar, and since these phenols are good solvents of naphthalene, some of the naphthalene dissolved in the tar becomes liberated and is then taken up mechanically or as vapour by the gas. This liberation of naphthalene by the action of ammonia in the scrubbers is considered to be the most frequent source of naphthalene trouble.

For the prevention of naphthalene stoppages, the authors suggest that the foul main be made large so that the gas will be kept hot until the tar has had time to remove the naphthalene; and also that care be taken to remove the tar as completely as possible before the gas passes to the scrubbers. If the gas after leaving the scrubbers still contain naphthalene, probably the most convenient method for its removal is that of scrubbing with tar or tar distillates.—A. S.

Naphthalene from Coal Gas; Removal of ——. H. G. Colman. J. Gas Lighting, 1905, **92**, 526, 596 and 672

In their recent investigation of this subject, White and Clary (see preceding abstract), among other conclusions, put forward the hypothesis that a more complete removal of naphthalene from gas is effected by washing the latter with hot tar, than by the action of the same tar when cold, basing their view on direct determinations of the amount of naphthalene taken up by tar at varying temperatures, and also on the results obtained from the estimation of the amount of naphthalene in crude coal gas at various points in the condensing system of gas works. The first-named experiments, however, under the conditions employed by White and Clary, simply show that hot tar will absorb more naphthalene from gas than the cold tar, provided that the gas is saturated with naphthalene at the same temperature, and in no way indicate that the amount of naphthalene left in the gas is less when the tar is hot, but rather the reverse. The method adopted to determine the amount of naphthalene vapour in the crude gas, as distinct from the naphthalene contained in the tar mechanically suspended in the gas, gives figures below the true value, inasmuch as the filter used for separating the tar-fog also absorbs some of the naphthalene present as vapour in the gas, and no valid conclusions can therefore be drawn from these experiments.

Further, White and Clary's hypothesis is quite inconsistent with other known facts. If true, it would follow that the vapour pressure of naphthalene dissolved in coal-tar must decrease with increasing temperature, and, therefore, that gas free from naphthalene passed through such tar would take up smaller quantities of naphthalene with rising temperature, and also that on distillation, the quantity of naphthalene in the distillate would decrease as the temperature of distillation rose towards the boiling point of naphthalene. In actual practice, however, exactly the reverse is the case.—H.G.C.

Naphthalene from Coal Gas; Removal of ——. W. Young. J. Gas Lighting, 1905, **92**, 742—743.

White and Clary (see preceding abstract) state that the weight of naphthalene that can be dissolved by tar is about five times as great at 72° C. as at 21° C., and they conclude, therefore, that for the purpose of naphthalene removal, it is more advantageous to scrub the gas with hot than with cold tar. The author points out, however, that the rate at which naphthalene vapour is taken up by coal gas increases with rise of temperature much more rapidly than does the absorptive power of the tar. Since, therefore, the relative proportions of naphthalene in the gas and in the tar at a given temperature, depend upon the equilibrium between the powers of the gas and tar respectively of taking up naphthalene, the capacity of tar to absorb the naphthalene from the gas must fall with increase of temperature, and not rise as stated by White and Clary.—A. S.

Gases; Portable Apparatus for the Analysis of Flue ——. C. J. Wilson. XXIII., page 91.

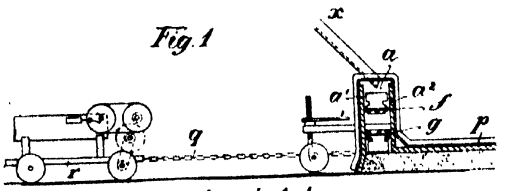
Acetylene; Reaction of —— on Iodic Anhydride. G. F. Jaubert. XXIII., page 91.

Tantalum; Production and Properties of ——. I. Nordenskjöld. XI*B*., page 79.

English Patents.

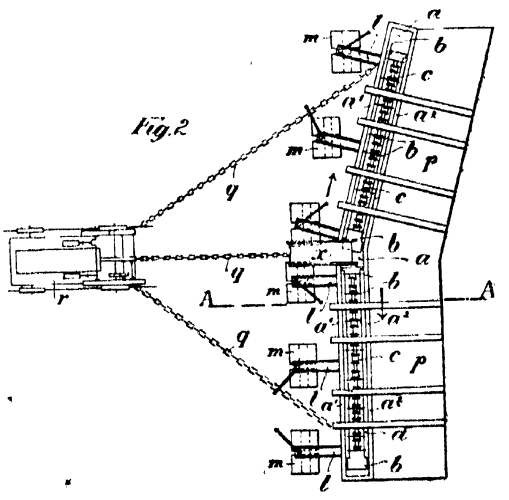
Peat Briquettes and the like; Process of and Apparatus for the Manufacture of ——. O., W. K., J. W., and G. O. Strenge, Elisabethfehn, Germany. Eng. Pat. 1947, Jan. 31, 1905.

Fig. 1



Section through A A.

Fig. 2

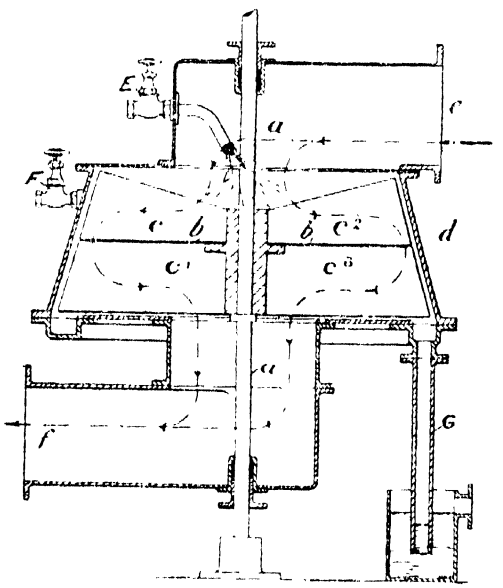


The peat, after being thoroughly mixed so that it is uniformly moist, is delivered by the trough *x* into the

space between two channels *a*, *a*, which have conveyor bands *c* provided with plates *b*. The conveyors spread out the peat along the channels *a*, *a*, in the direction indicated by the arrows, and the whole machine is moved forward in a direction at right angles to its length by the motor *r*, to which it is fastened by the chains, *q*, *q*, *q*, leaving the mass of peat spread out uniformly over the ground. The conveyor plates *b*, are bent slightly back at their lower ends and are guided by the projections shewn at *f*, *g*, (Fig. 1), so that the chain may not sag and cause the layer of peat to be of variable thickness. The front walls a^1 of the channels are attached to carriages *m* by the arms *l*, and are deeper than the rear walls a^2. These carriages serve to support the channels, and they are provided with screws and nuts to enable the height of the channels above the ground to be regulated. The layer of peat after being spread out is compressed by the heavy platform *p*, attached to the rear walls a^2 of the channels *a*.—W. H. C.

Atomising Liquid and Gaseous Fluids; Means for ——. [*Burner for Liquid Fuel.*] C. F. de Kierzkowski Steuart. Eng. Pat. 27,618, Dec. 17, 1904. J., page 58.

Gases; Centrifugal Apparatus for the Purification of ——, *Applicable also for the Absorption of Gas by Liquids, and for other purposes.* P. Kestner and A. J. Liversedge, London. Eng. Pat. 29,178, Dec. 31, 1904.



A HORIZONTAL disc *b*, provided with vanes *c*, c^1, c^2, c^3, and mounted on the spindle *a*, is rotated in the casing *d*, which has preferably the form of a truncated cone. The gas enters the apparatus at *e*, and, following the direction indicated by the arrows, leaves at *f*. Any liquid contained in the gas, or steam or liquid introduced through F or E for the purpose of purifying it, is driven by the centrifugal action of the vanes on to the walls of the casing *d*, and escapes by the pipe G. The claim is for the use of the revolving disc and vanes for separating and not for propelling the gas, and several modifications are claimed. The disc *b* may be fixed by brackets to the casing and the vanes only attached to the spindle; two or more sets of discs and vanes may be used in series, and a disc, having studs on its upper surface which revolve among other studs projecting from the top of the casing, may be used to ensure the contact of the gas and liquid. The distribution of the treating liquid may be effected either by feeding directly on to the vanes or it may be directed into a distributing pan or dish with perforated sides or on to a flat disc or discs, the dish or discs being fixed on the rotating spindle above the separating vanes. An ordinary fan or its equivalent may be employed to produce the necessary movement of the gas.—W. H. C.

Photometers or Apparatus for Testing the Intensity of Light, comprising the use of a Selenium Cell. T. Torda and V. Bornand. Eng. Pat. 4020, Feb. 27, 1905. XXIII., page 91.

UNITED STATES PATENTS.

Fuel; Artificial —— [*from Garbage*]. E. C. May, Assignor to National Garbage Fuel Co., Chicago. U.S. Pat. 807,629, Dec. 19, 1905.

By this invention, the stock made from prepared garbage is combined with an agent consisting of "oil" and hydrochloric acid, combined in the proportions of about 3 per cent. of "oil" and 0·5 per cent. of acid.—W. C. H.

Peat [*for Making Fuel*]; *Process of Treating Raw* ——. C. Schliekeysen, Steglitz, Germany. U.S. Pat. 807,688, Dec. 19, 1905

SEE Eng. Pat. 4995 of 1904; this J., 1904, 1204.—T. F. B.

[*Fuel*] *Briquettes; Manufacture of* ——. W. Simpkin, London, and J. B. Ballantine, Twickenham. U.S. Pat. 808,483, Dec. 26, 1905.

SEE Eng. Pat. 14,213 of 1904; this J., 1905, 189.—T. F. B.

Coke and Gas Plant. V. G. Apple, Dayton, Ohio. U.S. Pat. 807,532, Dec. 19, 1905.

THE plant described, consists of two batteries of horizontal retorts arranged side by side, with sufficient space between them for a boiler and steam engine, the power of the engine being employed in driving the mechanical feeding arrangements. The material to be introduced into the retorts is delivered from a source of supply arranged centrally relative to the retorts, and means are provided for transferring the material to each retort. The inlet openings of the retorts are provided with receptacles which are kept full by the transfer mechanism and means are provided for passing the material from the receptacles to the retorts, and passing it through them to the outlet openings. The outlet openings of the retorts for the coke communicate with a water-jacketed coke receiver, and the steam generated in the jacket can be supplied to the engine. The retorts are adapted to constantly receive carbonaceous material at one end, and discharge it at the other; a primary ascension-pipe communicates with the retort adjacent to the receiving end, and a secondary ascension-pipe communicates with the retort at a point relatively remote from it, and a pipe connects the primary ascension-pipe with the retort at a point relatively remote from the receiving end. To this connecting pipe, between the gas outlet and gas inlet of the retort, steam may be supplied from the water-jacket of the coke-receiver, and air under pressure may also be supplied. The retorts, with their heating means, are mounted upon a built-up base, in which is a transverse flue, substantially below the outlet ends of the heaters. Passages conduct heated air from the retort furnaces to the flue, provided with a central outlet, by which the heated air escapes and communicates its heat to a boiler arranged in its path. —W. C. H.

Gas-Producer. B. Graupe, Cologne-Deutz, Germany. U.S. Pat. 807,071, Dec. 12, 1905.

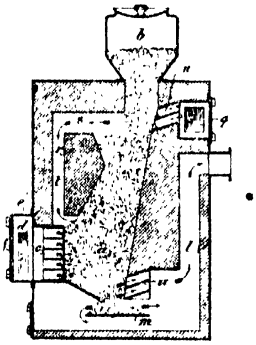
THE producer described is one with upper and lower combustion zones, and with means for withdrawing the gas from an intermediate point. A vertical grating, composed of vertical bars, forms part of the producer walls, through which gases are led off. Two annular evaporating chambers are arranged, one surrounding the top, and the other the bottom of the grating; one of the chambers is connected to an air supply, and means are provided for connecting the other with the interior of the producer, and for connecting the two chambers. The

producer may have an open hand-hole at the top through which air enters it, and by which access may be had to the grating.—W. C. H.

Gas-Producer. W. H. Bradley, Bellevue, Pa. U.S. Pat. 807,594, Dec. 19, 1905.

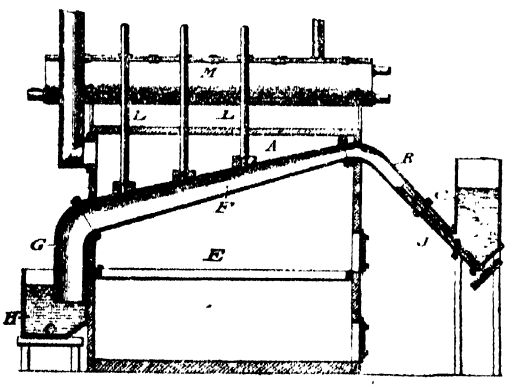
THE producer described is provided with a water-trough, across which is an inclined wall, and above this one or more wind-pipes extending along the producer in the direction of the trough; each pipe has clearance spaces on both sides for the removal of ashes. The wind-pipe is composed of cast-metal sections, having a horizontal top and both internal and external strengthening flanges.—W. C. H.

Gas-Producer. E. Körting, Hanover, Germany. U.S. Pat. 808,244, Dec. 26, 1905.



THE body of the producer *a* is fed with fuel from the hopper *b*, which is kept partly full to prevent the introduction of air at this point. The main air supply is furnished through the opening *d* in the door *c*, *f*, and enters the generator through the vertical grate *e* in the front of the producer; an auxiliary vertical grate *n*, supplied with air through *q*, is situated near the top of the producer. Any gas generated near the top passes along the channel *s*, *r*, *t*, to the main body of fuel just above the grate *e*. The producer-gas leaves the generator at the bottom by a vertical grate *u*, situated well below the horizontal plane of the grate *e*, and also by the openings at the sides of the ash plate *m*; it then passes along *l* to the outlet.—W. H. C.

Gas-Generator. H. A. Hartman, Philadelphia, Pa. U.S. Pat. 808,365, Dec. 26, 1905.



A TAPERING elbow-shaped retort A is set in a furnace E, and is connected with the hydraulic main M by the pipes L. The fuel is fed into the "water-receiving" hopper B, and introduced into the charging end B of the retort A by the conveyor J. The main portion F of the retort passes through the furnace E in an inclined direction as shown, and is continued downwards outside the furnace by the pipe G, which dips into the water in the discharging tank H.—W. H. C.

Gases; Centrifugal Apparatus for Treating ——. E. Theisen, Baden, Germany. U.S. Pat. 807,695, Dec. 19, 1905.

SEE Eng. Pat. 8671 of 1903; this J., 1904, 434.—T. F. B.

Wicks; Process for the Treatment of —— for Increasing their Inflammability. A. Haase, Hanover, Germany. U.S. Pat. 807,553, Dec. 19, 1905.

SEE Eng. Pat. 3438 of 1905; this J., 1905, 666.—T. F. B.

FRENCH PATENTS.

Carburetting Air; Apparatus for ——. A. Louis. Fr. Pat. 357,347, Aug. 30, 1905. Under Int. Conv., Oct. 11, 1904.

THE apparatus described consists of a vessel, open at the top, and filled with "liquid." Inside the vessel is mounted a rotatable drum on a horizontal axis, the means for driving which are arranged inside the vessel, *e.g.*, a pair of bevel-wheels, the driving shaft of which passes vertically up through the open top of the vessel, thus dispensing with gas-tight stuffing-boxes, &c. The drum is separated from the atmospheric air by a cover which dips into the liquid in the vessel.—W. C. H.

Barium Carbide and Metallic Manganese; Reduction of Barium Manganite in order to obtain ——. C. M. J. Lamb. First Addition, dated Aug. 22, 1905, to Fr. Pat. 304,720, Oct. 20, 1900. VII., page 72.

Carbon Filaments for Incandescence Lamps; Manufacture of ——. Cie Franç. pour l'Exploitation des Procédés. Thomson-Houston. Fr. Pat. 357,254, Aug. 26, 1905.

THIS invention includes the discovery and method of manufacture of a new substance (an allotropic form of carbon) for electric incandescence lamps. The filaments are superheated in an electric tube furnace, and after this treatment the electric resistance of the cold filament is diminished, and the coefficient of variation of resistance with temperature becomes positive. These filaments are stated to be more efficient and to last longer than the ordinary ones. (See also Eng. Pat. 6959A of 1904; this J., 1905, 721; also Eng. Pat. 6959 of 1904; this J., 1905, 882; and Fr. Pat. 349,857 of 1904; this J., 1905, 884.)
—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 13.)

[*Petroleum*] *Kerosene; Technical Requirements of Reagents for the Purification of* ——. K. Charitschkow. Westnik shirow. weschtsch., 1905, **6**, 119. Chem. Rev. Fett- u. Harz- Ind., 1906, **13**. 15.

THE colour of kerosene bleached by treatment with sulphuric acid is very injuriously affected by the presence of nitrous acid, of which as little as 0·02 per cent. produces a marked effect. Nitric acid is also objectionable, but 0·05—0·07 per cent. may be present without serious injury. Organic matter in the sulphuric acid is without appreciable effect.—M. J. S.

ENGLISH PATENT.

Ammonia from Distillation Gases; Extraction of ——. R. Brunck, Dortmund, Germany. Eng. Pat. 15,646, July 31, 1905.

SEE Fr. Pat. 356,589 of 1905; this J., 1906, 13.—T. F. B.

FRENCH PATENTS.

Ammonia, from Distillation Gases; Process of Recovering By-Products, especially ——. H. Koppers. Fr. Pat. 356,600, Aug. 2, 1905.

THE gases are first cooled to 40°—45° C., whereby the moisture is condensed carrying with it about one half of the free ammonia, and including all the combined ammonia. The tar having been removed, the purified gases are reheated, preferably by utilising the heat of the crude gases from the retorts, and passed through acid in suitable scrubbers. The condensed water is mixed with lime and distilled with steam, the gases evolved being passed into sulphuric acid at a temperature sufficiently high to ensure that no condensation of water in the acid takes place. The residue in the still contains small quantities of phenols, &c., and it is proposed to project this, in a finely sub-divided condition into the chimney gases, the heat of which, it is stated, is more than sufficient to volatilise the whole of such residue. The gases, freed as above from ammonia, are then passed into a cooling apparatus, where the remainder of the moisture is condensed in the form of water which, it is stated, is pure. The resulting gases can then be treated in the usual way for the recovery of benzene, &c.—T. F. B.

Petroleum and its Homologues; Method of Saponifying ——. F. J. Lothammer and C. Trocquenet. Second Addition, dated Aug. 19, 1905. (Under Int. Conv., Aug. 18, 1905), to Fr. Pat 338,636, Oct. 19, 1903; this J., 655.

EQUAL parts of an aqueous extract of quillaia (density 6° B.) and petroleum are mixed to an emulsion, which is brought to the consistence of gelatin by further additions of petroleum if necessary. The resulting gelatinous mass is next ignited on a sloping table, and the heavy oil, which separates out during the operation, runs down the table and is collected. Then 277 kilos. of solid vegetable oil (cocoanut, palm, arachis, &c.) are gently heated with 117 kilos. of the recovered oil, and treated with 270 litres of caustic soda lye of 12° B., followed by 306 litres of 20° B. strength. The whole is boiled for about three hours until homogeneous, whereupon the mass is treated with 38 litres of potash lye (20° B.), and 10·8 kilos. of pale rosin, heating being continued until a test sample sets on exposure to the air. Finally, the mass is run into moulds and cut into blocks or cakes.—C. S.

Candles; Manufacture of Composite Paraffin ——. Standard Oil Co. Fr. Pat. 357,507, Sept. 5, 1905.

SEE U.S. Pat. 802,100 of 1905; this J., 1905, 1166.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 14.)

Pyridine Dyestuffs from Furfural; Production of ——. W. Konig. J. prakt. Chem., 1905, **72**, 555–562.

WHEN 1 mol. of furfural is heated for a short time in alcoholic solution with 2 mols. of an aromatic amine, and 1 mol. of an acid, diluted with alcohol, is added after cooling, crystalline dyestuffs are precipitated in an almost chemically pure state. They show considerable affinity for unmordanted vegetable fibres. They crystallise with 1 mol. of water, which seems to be constitutional, but can be removed by carefully heating *in vacuo*, and in some cases by recrystallisation from glacial acetic acid. By heating the anhydrous products so obtained from primary amines above their melting-point, or by heating them with acids, they are decomposed forming 1 mol. of a primary amine and 1 mol. of an aryl-β-hydroxypyridonium salt of the formula $C_5H_3(OH).NXR$.

From this fact, together with the empirical formulæ of the various products, the author supposes the hydrated dyestuffs to have the formula :—

$$RR^1N.CH : CH.CH : C(OH).CH(OH).NHXRR^1,$$

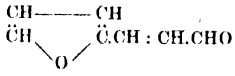
the dehydrated products having the formula :—

$$RR^1N.CH : CH.CH : C(OH).CH : NXRR^1.$$

In these formulæ R represents an aryl radical, R^1 an alphyl radical or hydrogen atom, and X an acid radical. The dyestuffs formed from furfural with aniline and with *p*-phenetidine were closely investigated. For example, 18·6 grms. of aniline were dissolved in 75 c.c. of alcohol and heated for 15 minutes on the water-bath with 9·6 grms. of furfural. 17 grms. (= 14·7 c.c.) of concentrated hydrobromic acid which had been previously diluted with 10 c.c. of alcohol were then added with cooling. The liquid congealed almost instantaneously to a paste of violet-red needles, which were filtered off and washed with ether, 22 grms. of almost pure dyestuff being so obtained. It can be purified by recrystallisation from acetic acid, and has then the m.pt. 164°—165° C. It dyes silk and tannin-mordanted cotton in deep red shades, and unmordanted cotton in pink shades. Its formula is $C_{17}H_{19}O_2N_2Br$. On heating with nitrobenzene it yields phenyl-β-hydroxypyridonium bromide,

$$C_5H_4(OH)N(C_6H_5)Br,$$

The corresponding dyestuff from *p*-phenetidine dyes silk and tannin-mordanted cotton in fine rhodamine shades, which are not fast. Coloured products were also obtained with *m*- and *p*-nitraniline, but differed slightly in properties. The author has also obtained dyestuffs crystallising in bluish-green needles and soluble in alcohol with a pure blue colour by the interaction of furfuracrolem,



with aniline and with monomethylaniline, but the yields were extremely small. The products are very unstable, but the author thinks that further investigation will confirm his view that they possess the constitution

$$C_6H_5.NH.CH : CH.CH : C(OH).CH : CH.CH : NHX.C_6H_5$$

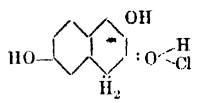
and

$$C_6H_5.N(CH_3).CH : CH.CH : C(OH).CH : CH.CH : N(CH_3)X.C_6H_5$$

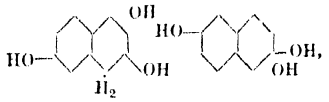
respectively.—E. F.

1.3.6-Trihydroxynaphthalene. R. Meyer and E. Hartmann. Ber., 1905, **38**, 3945–3956.

ON melting 1.6-dihydroxynaphthalene-3-sulphonic acid with alkalis in an open vessel at a temperature not exceeding 270° C., 1.3.6-trihydroxynaphthalene is obtained according to Ger. Pat. 112,176 of 1899. According to the same patent the 1.3.6-trihydroxynaphthalene so obtained exists in two forms. The product obtained directly melts at 95° C., is easily soluble in cold water, and combines readily with diazo compounds to form azo dyestuffs. On recrystallising from hot water this is converted into a compound, of the same percentage composition, which does not melt, but decomposes at about 304° C. The patentees consider that this may represent a diketo-form. The authors, in the course of their investigation confirm the experimental results of the patentees, but bring further experimental data leading to other theoretical conclusions. Both the original trihydroxynaphthalene and its transformation product form triacetyl- and tribenzoyl-derivatives of identical composition, but different properties. The transformation product does not react with either phenylhydrazine or hydroxylamine. These facts show that the original substance is not transformed into a ketonic isomeride. Molecular weight determinations of the transformation product and of its acetyl- and benzoyl-derivatives led to bimolecular formulæ $C_{20}H_{10}(OH)_6$, $C_{20}H_{10}(O.OC_2H_3)_6$ and $C_{20}H_{10}(O.OC_7H_5)_6$, whilst the product directly obtained and its corresponding derivatives agreed with the formula $C_{10}H_5(OH)_3$. The product obtained directly easily forms addition compounds both with water and with hydrochloric acid, which dissociate very easily. The authors come to the conclusion that these are oxonium derivatives of a quinoid keto-form, such as



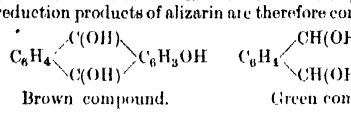
that in aqueous solution both the trihydroxy- and the keto-forms are present, and that the transformation product is formed by a kind of aldol condensation and has some such formula as:—



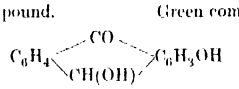
being a hexahydroxydihydrodinaphthyl. In preparing 1.3.6-trihydroxynaphthalene on the laboratory scale it was found necessary to use about twice the amount of alkali hydroxide which is mentioned in the German patent. For instance, 25 grms. of the sodium salt of 1.6-dihydroxynaphthalene-3-sulphonic acid were added gradually to 80 grms. of sodium hydroxide contained in a silver dish, which was heated over wire gauze with an ordinary Bunsen burner. When the water of solution had evaporated, the temperature attained 200° C. The melt then gradually darkened until, at 250° C., the reaction took place with frothing and evolution of steam. It was finished when a sample dissolved in a little water, acidified with hydrochloric acid and shaken up with ether, was almost decolorised, all the yellow product being taken up by the ether. The melt lasted about three hours. The product was dissolved in a little water, strongly acidified with hydrochloric acid, the liquid filtered whilst hot and allowed to cool. Yellow needles of the hydrochloride of trihydroxynaphthalene were so obtained and were purified by recrystallisation from hydrochloric acid with a little animal charcoal. By digestion with a little water it is converted into colourless crystals of 1.3.6-trihydroxynaphthalene, which may be recrystallised from hot water if this is quickly cooled to avoid polymerisation. The polymeric product is obtained by repeatedly heating the trihydroxynaphthalene with water and animal charcoal to the boil, fresh quantities of animal charcoal being added each time. The polymeric compound crystallises out in white lamine. Both 1.3.6-trihydroxynaphthalene and its polymer, yield red dyestuffs by combination with diazobenzene chloride. The compound from trihydroxynaphthalene has the formula $C_6H_5N_2.C_{10}H_4(OH)_3$. Attempts were made to obtain one of the three dinaphthyls by distillation of the polymer $C_{20}H_{16}O_6$ with zinc dust. A crystalline product, yielding fluorescent solutions, was so obtained, but not in sufficient quantity to be identified. —E. F.

Hydroxyanthraquinones; Reduction Products of ——. M. Prudhomme. Rev. Gen. Mat. Col., 1906, **10**, 1–3.

ALIZARIN (0·5 grm.) was dissolved in a solution of sodium hydroxide (1 grm.), and 3 grms. of hydrochloric acid, 100 grms. of water and 5 grms. of zinc were added. Reduction was complete in about 10 minutes and a brown compound resulted, which dissolved in sodium hydroxide to a much redder solution than alizarin. It dyes mordanted fibres similar shades to alizarin from neutral baths, but from acid baths it only gives feeble dyeings on iron and chromium mordants. If, instead of isolating the above brown compound, a further 4 grms. of hydrochloric acid and 50 c.c. of water be added, and the reaction allowed to proceed for about 20 minutes, a green compound is produced; when boiled with water, it is reconverted into the brown compound, with loss of hydrogen: its dyeing properties are similar to those of the brown compound. If either of these compounds is treated with a little dilute acid, it is converted into a yellow substance (with evolution of hydrogen, if prepared from the green compound), which is similar to alizarin in appearance, but its dyeing properties resemble those of the substances from which it is produced. When oxidised in presence of ammonia and treated with acids, all three compounds give a deep violet dyestuff, isomeric with that produced by oxidising the compound which Roemer obtained (Ber., 1881, 1260) by reducing alizarin with zinc dust and ammonia: this latter has been proved to be identical with alizarinimide (produced by heating alizarin, under pressure, with a solution of ammonia in absolute alcohol). The three reduction products of alizarin are therefore considered to be:



Brown compound. Green compound.



Yellow compound.

Anthrapurpurin, when reduced by boiling with zinc dust and ammonia, gives two different colouring matters, very similar in properties to those obtained from alizarin. Flavopurpurin, on the contrary, only gives dyestuffs which dye mordanted fibres similarly to flavopurpurin itself.—T. F. B.

ENGLISH PATENTS.

Anthracene Derivatives and Dyestuffs therefrom; Manufacture of —. A. Meyenberg, C. Weizmann and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 8744, April 25, 1905.

PRODUCTS which it has not hitherto been possible to manufacture on a commercial scale are obtained by the action of dry chlorine on anthracene in the presence of lead peroxide at a high temperature. For example, a mixture of 50 parts by weight of anthracene and 10 parts by weight of dry powdered lead peroxide is treated with dry chlorine at 220° C. until the weight has increased to a total of 120 parts. The temperature may, however, be varied, good results being obtained at from 180° to 260° C. The composition of the melt varies with the temperature employed and amount of chlorine absorbed. The product consists mainly of two portions, namely, β-tetrachloroanthracene, m. pt. 152° C., already described by Liebermann and Lindemann (Ber., **18**, 1589), which is readily soluble in benzene and crystallises out in yellow needles, and another portion, much less soluble in benzene, and more highly chlorinated. This second portion can be separated by fractional crystallisation into two products, one being hexachloroanthracene, melting at 277° C., which crystallises from nitrobenzene, and the other heptachloroanthracene, m. pt. 232° C., which is more soluble in benzene than the former. All these chloroanthracenes are transformed on oxidation into chloroanthraquinones containing two chlorine atoms less, from which it appears that the original products are chlorinated mesodichloroanthracenes. If, for example, a mixture of 10 parts of anthracene and 1 part of lead peroxide is treated with chlorine at 240° C. till it increases in weight by 15 parts, the melt consists almost entirely of the more highly chlorinated products. The above-mentioned tetrachloroanthracene reacts violently with a mixture of concentrated sulphuric and nitric acids, and, on pouring the product of reaction into water, a dichloromononitroanthraquinone is separated, which crystallises in almost white needles, soluble in nitrobenzene, and melting at 300° C. If the sparingly soluble portion of the melt is treated in a similar manner, the hexachloroanthracene yields a tetrachloromononitroanthraquinone, whereas the heptachloroanthracene is merely oxidised to pentachloroanthraquinone, melting at 225° C. On treating the above-mentioned nitro compounds with fuming sulphuric acid, with or without the presence of boric acid, dyestuffs are formed. In the case of mononitrodichloroanthraquinone, this reaction takes place at the ordinary temperature, whilst in the case of the tetrachloro compound, a higher temperature is necessary.—E. F.

Nitro-Derivatives of Certain Aromatic Bases; Manufacture of ——. C. D. Abel, London. From Actienges. für Anilin-Fabrikation, Berlin, Germany. Eng. Pat. 9074, April 29, 1905.

IN Eng. Pats. 6741 and 27,497 of 1904 (this J., 1905, 193

and 1297) there is described a method of manufacturing mononitro derivatives of aromatic bases by heating the arylsulphamino derivative of the base with dilute nitric acid. According to the present invention this process is applied to the nitration of *m*-diamines of the benzene or naphthalene series. The diarylsulphamino derivative of such a *m*-diamine is nitrated by the action of dilute nitric acid in the *p*-position to one of the arylsulphamino-groups. For instance di-*p*-tolylsulpho-*m*-phenylene diamine $C_6H_4(NH.SO_2.C_6H_4.CH_3)_2$ forms 1.3-di-*p*-tolylsulphamino-6-nitrobenzene, $C_6H_3(NO_2)(NH.SO_2.C_6H_4CH_3)_2$, and diphenylsulpho-*m*-toluylenediamine $C_6H_3(CH_3)(NH.SO_2.C_6H_5)_2$ [$CH_3 : (NH.SO_2C_6H_5)_2 = 4 : 1 : 3$] forms 1.3-diphenylsulphamino-4-methyl-6 nitrobenzene. The substance may be treated with the dilute nitric acid, or in suspension dissolved in a suitable solvent such as alcohol or benzene. The nitro derivatives produced as described above are converted into the corresponding nitrodiamines by the action of concentrated sulphuric acid. By the action of reducing agents the corresponding amino derivative of the diarylsulpho-*m*-diamine is produced. The following example illustrates the invention: 41·4 parts by weight of di-*p*-tolylsulpho-*m*-phenylenediamine are dissolved in 120 parts by weight of alcohol; 40 parts by weight of dilute nitric acid of sp. gr. 1·2 are added, and the mixture is boiled under a reflux condenser for 15 hours. The nitro derivative separates on cooling, and is filtered off, washed and dried. It melts at 169° C. To eliminate the two *p*-tolylsulphamino groups from this nitro compound, 1 part by weight of the compound may be introduced into 3 parts by weight of concentrated sulphuric acid with stirring and heating to 30—40° C. When the nitro compound is completely dissolved, the mass is poured into ice, the solution neutralised with sodium hydroxide or carbonate, and the 1.3-diamino-6-nitrobenzene filtered off, washed and dried. Again, for example, 42·8 parts by weight of di-*p*-tolylsulpho-*m*-toluylenediamine [$CH_3 : (NH.SO_2.C_6H_4.CH_3)_2 = 1 : 2 : 4$] are mixed with 160 parts by weight of water and 40 parts by weight of dilute nitric acid of sp. gr. 1.2. This mixture is heated on a steam-bath for about 10 hours, with stirring. The parent material, which is a light powder, and floats on the liquid, gradually changes to the nitro compound and subsides in the form of deep yellow grains. The product is filtered off, washed and dried. After recrystallisation from glacial acetic acid, it melts at 210° C.—E. F.

p-*Amidophenylethersulphonic Acid; Manufacture of a New* —— *and of a Colouring Matter* [*Azo Dyestuff*] *therefrom.* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9325, May 3, 1905.

A NEW sulphonic acid of *p*-aminophenylether is obtained by heating the acid sulphate of the ether; 186 parts of the ether are suspended in a small quantity of water, and 100 parts of sulphuric acid are added. The mass is dried at 100° C., and then heated to 180° C. for twelve hours; the product is dissolved in hot sodium carbonate solution, filtered and precipitated by the addition of acid. When diazotised and combined with β-naphthol, this substance gives a new azo dyestuff, the metallic salts of which form red lakes of technical value.—T. F. B.

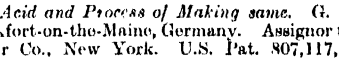
Indigo-White [*Indigo Dyestuffs*]; *Manufacture of Solid Stable Alkali Salts of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 23,122, Nov. 10, 1905.

DRY alkali salts of indigo-white, stable in the air, are obtained by evaporating aqueous solutions of these substances *in vacuo*, preferably in thin layers. Better results are obtained with the monosodium salt, or a mixture of the mono- and di-sodium salts, than with the latter only. The solutions obtained by reducing indigo with finely divided iron in presence of alkali hydroxide are very suitable for the purpose, as they contain no other salts and no excess of alkali. For example, 50 parts of pure Indigo (B.A.S.F.) in powder are reduced with 25 parts or iron-powder, 12 parts of sodium hydroxide and 64 parts of water. The liquid is filtered from iron mud and evaporated *in vacuo* at 80°—90° C. until no more water comes off. On cooling, a brittle product is obtained which, in thin layers, is transparent and has a red colour. It is easily soluble in water.—E. F.

UNITED STATES PATENTS.

Sulpho-Acid and Process of Making same. G. Kalischer, Frankfort-on-the-Maine, Germany. Assignor to Cassella Colour Co., New York. U.S. Pat. 807,117, Dec. 12, 1905.

NEW sulphonic acids of the general formula,



where X represents an aromatic radical, are obtained by condensing in aqueous solution 1 mol. of 1.2-diaminonaphthalene-5-hydroxy-7-sulphonic acid with 2 mols. of an aromatic aldehyde. The products are powders of a slightly yellowish colour, insoluble in water, soluble in alkalis, and precipitated from their alkaline solutions by the addition of acids.—E. F.

Dye [*Azo Dyestuff*]; *Red Azo* —— *and Process of Making same.* F. Klingemann and G. Kalischer, Frankfort-on-the-Maine, Germany, Assignors to Cassella Colour Co., New York. U.S. Pat. 807,119, Dec. 12, 1905.

DISAZO dyestuffs are prepared by condensing in aqueous solution 1 mol. of 1.2-diaminonaphthalene-5-hydroxy-7-sulphonic acid with 2 mols. of a monoazo dyestuff, or with 1 mol. each of two different monoazo dyestuffs, containing an aldehydic group. The monoazo dyestuffs in question are prepared by combining 1 mol. of diazotised *m*-aminobenzaldehyde with 1 mol. of a naphthol sulphonic acid. TRISAZO dyestuffs, which dye unmordanted cotton in red shades, are obtained by combining an aromatic diazo compound with 1 mol. of a disazo dyestuff, prepared as described above from 1.2-diaminonaphthalene-5-hydroxy-7-sulphonic acid, and 2 mols. of a monoazo dyestuff containing an aldehydic group.—E. F.

Dye [*Azo Dyestuff*]; *Zinc Azonaphthol* —— *and Process of making same.* K. Elbel, Assignor to The Firm of Kalle and Co., Akt.-Ges., Biebrich, Germany. U.S. Pat. 807,422, Dec. 12, 1905.

ZINC compounds of 2-hydroxynaphthalenesulphonic-acid-1-azo-β-naphthols are obtained by treating 1-amino-2-naphtholsulphonic acids in concentrated aqueous solution or suspension with alkali nitrite and, at least, an equivalent amount of zinc sulphate, and bringing the product so obtained into reaction with a concentrated alkaline solution of β-naphthol. The products dye wool from an acid bath in bluish-red to violet shades, which are turned into bluish-black by subsequent treatment with a bichromate. The zinc compound of 2-hydroxynaphthalene-4-sulphonic-acid-1-azo-β-naphthol, obtained in the manner described above from 1-amino-2-naphthol-4 sulphonic acid, is specially claimed. (See also Fr. Pat. 353,786 of 1905; this J., 1905, 1062.)—E. F.

Indigo; Process of Brominating ——. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 807,782, Dec. 19, 1905.

SEE Fr. Pat. 322,348 of 1902; this J., 1903, 360.—T. F. B.

FRENCH PATENTS.

Dyestuffs by Oxidation on the Fibre; Process of Making Fast Blue, Violet and Black ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,305, Nov. 11, 1904.

SEE U.S. Pat. 796,715 of 1905, and Eng. Pat. 23,193 of 1904; this J., 1905, 967 and 1225.—T. F. B.

Dyestuffs; Process of Preparing New Azo ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Aug. 21, 1905, to Fr. Pat. 347,655, Nov. 4, 1904.

SEE Eng. Pat. 4359 of 1905; this J., 1905, 1009.—T. F. B.

Anthracene Derivatives [*Anthracene Dyestuffs*]; *Production of New* ——. Soc. Badische Anilin und Soda Fabrik. Fr. Pat. 357,138, Aug. 23, 1905. Under Int. Conv., Jan. 3 and April 3, 1905.

A DIANTHRAQUINONYLAMINE of the formula

$$C_6H_4<\begin{matrix}CO\\CO\end{matrix}>C_6H_3(1).NH.(2)C_6H_3<\begin{matrix}CO\\CO\end{matrix}>C_6H_4$$

is obtained in perfectly pure crystals by the action of 1-aminoanthraquinone on 2-chloroanthraquinone in presence of a condensing agent, such as copper acetate, sodium acetate together with cuprous chloride, &c., and of a diluent such as naphthalene or nitrobenzene. The same substance may be obtained, though less easily, by the action of 2-aminoanthraquinone on 1-chloroanthraquinone. For example, a mixture of 2·4 kilos. of 2-chloroanthraquinone, 2·7 kilos. of 1-aminoanthraquinone, 100 kilos. of naphthalene, 2·5 kilos. of anhydrous sodium acetate and 0·5 kilo. of cuprous chloride is boiled for 15 hours. By extracting the naphthalene with boiling toluene, dianthraquinonylamine is obtained in small crystals with metallic lustre. It may be transformed into dyestuffs in many ways. With fuming sulphuric acid at 100°—130° C. in presence of boric acid, it is converted into a dyestuff which dyes wool in brownish-red shades. In an analogous manner 1-halogenoanthraquinones may be condensed with 1-aminoanthraquinone. Dihalogeno- and diaminoanthraquinones may be employed in the same way and also derivatives of any of these substances. In the case of the condensation of 1-amino-4-halogenoanthraquinones or their derivatives with 1-aminoanthraquinone, it is advisable, in order to avoid secondary reactions, to employ the former in the form of their acetyl derivatives. The acetylaminodianthraquinonylamines thus obtained are readily hydrolysed, forming the corresponding amino compounds. These substances, also, are readily converted into dyestuffs; after sulphonation they give blue shades on wool, which are said to be perfectly fast. For example, a mixture of 1500 kilos. of nitrobenzene, 100 kilos. of 1-acetamino-2-methyl-4-chloroanthraquinone, 140 kilos. of 1-amino-2-methylanthraquinone, 100 kilos. of anhydrous sodium acetate, and 20 kilos. of cuprous chloride are boiled for two hours. After cooling, the product is allowed to stand for some time, the solid filtered off and washed successively with nitrobenzene, alcohol, dilute hydrochloric acid and alcohol. It may then be crystallised from nitrobenzene. It is hydrolysed by dissolving in 10 kilos. of sulphuric acid of 66° B. and precipitating by the gradual addition of water. The mixture becomes hot and deposits the de-acetylated base on cooling. Derivatives of dianthraquinonylamine are also obtained from 4-halogeno-1-aminoanthraquinones, which are substituted in the *o*-position to the amino-group by treating them successively with nitrosulphuric acid and phenols, amines or derivatives of the same.

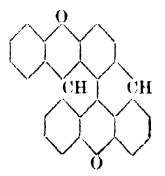
Other compounds of this nature such as 4.2-dihalogeno-1-aminoanthraquinone, also 1.5 diamino-2.4.6.8-tetrahalogenoanthraquinone and other compounds having two halogen atoms, each in *p*-position to an amino group, behave in an analogous manner. The products so obtained are readily sulphonated by fuming sulphuric acid in presence of boric acid. The sulphonic acids dye wool in very fast blue shades from an acid bath. For example, 10 kilos. of 4-chloro-1-amino-2-methylanthraquinone are dissolved in the cold in 100 kilos. of sulphuric acid of 66° B., and 12 kilos. of nitrosulphuric acid, containing 20—21 per cent. of nitric acid, are added without allowing the temperature to rise. The mass acquires an intense brownish-red colour. It is stirred for an hour or two and 10—15 kilos. of phenol are then added. The colour changes to bright blue. After stirring for 2—3 hours the product is poured into water and the precipitate filtered off, washed and dried. It crystallises from naphthalene in bright blue crystals, insoluble in alkalis. The anthraquinone derivatives described above are sulphonated as follows:—10 kilos. of the blue substance are stirred into a mixture of 100—200 kilos. of fuming sulphuric acid (containing, for example, 45 per cent. of sulphur trioxide) and 10 kilos. of dry boric acid. The whole is then heated to 100°—120° C. It is then poured into water, filtered and washed with a dilute salt solution. The dyestuff is preferably used as a paste. The shades obtained on both mordanted and unmordanted wool are blue and very full.—E. F.

Anthracene Derivatives [*Anthracene Dyestuffs*]; *Production of New* ——. Soc. Badische Anilin und Soda Fabrik. Fr. Pat. 357,239, Aug. 25, 1905.

DERIVATIVES of dianthraquinonyls,

$$C_6H_4<\begin{matrix}CO\\CO\end{matrix}>C_6H_3.C_6H_3<\begin{matrix}CO\\CO\end{matrix}>C_6H_4$$

are obtained, either by the action of copper powder or of other dehalogenising metals on halogenated anthraquinones, or by condensing diazo compounds from aminoanthraquinones in such a manner as to eliminate the nitrogen of these compounds. The latter reaction is effected particularly easily by condensing the diazosulphates in presence of acetic anhydride, together with certain metals, such as copper powder. For example, 10 kilos. of 1-chloro-2-methylanthraquinone are mixed with 8 kilos. of copper powder and heated to about 260° C. The temperature of the molten mass soon reaches 280°—290° C., yellowish vapours being evolved. After 20—30 minutes the temperature begins to fall. The mass is then heated to about 280° C. for a quarter of an hour, allowed to cool, powdered, and the copper removed by solution in dilute nitric acid. The remaining mass is washed with water, dried, and the 2.2′-dimethyl-1.1′-dianthraquinonyl extracted in a state of purity by means of boiling xylene. Again, for example, 20 kilos. of 1-amino-2-methylanthraquinone are dissolved in 250 kilos. of sulphuric acid of 66° B., 8 kilos. of sodium nitrite are then gradually added with stirring, and without rise of temperature. When diazotisation is complete, the mass is poured on to ice, allowed to stand for three hours, filtered and the solid diazosulphate washed with a very little cold water, then with alcohol, and, if necessary, with a little ether. 10 kilos. of the air-dried 2-methylanthraquinone-1-diazo-sulphate so obtained are mixed with 60 kilos. of acetic anhydride, and 2 kilos. of copper powder are then added. The temperature of the mass gradually rises, nitrogen is evolved, the solution becomes violet in colour, and deposits a pale yellow precipitate after some hours. It is heated for a short time in a brine-bath, the acetic anhydride decomposed with hot water, and the unattacked copper removed by means of hot dilute nitric acid. The 2.2′-dimethyl-1.1′-dianthraquinonyl is then filtered off and washed with hot water. These new anthracene derivatives can be converted into dyestuffs. If 2.2′-dimethyl-1.1′-dianthraquinonyl or its derivatives are heated by themselves, or treated with dehydrating agents, they lose 2 mols. of water, forming dyestuffs which are converted by alkaline reducing agents, more particularly by hydrosulphites into vats which have the red colour of rhodamine. These dyestuffs have the probable formula



These vats dye cotton in red shades, changing on washing to orange or yellow shades, which are very bright and absolutely fast. The dyestuffs may be printed, with or without a reducing agent, in presence of alkali, and then steamed. They may also be printed without either alkali or a reducing agent, and subsequently passed through an alkaline bath. For example, 1 kilo. of 2.2′-dimethyl-1.1′-dianthraquinonyl, 15 kilos. of potassium hydroxide and 5 kilos. of methyl alcohol are heated to 165°—170° C. under a reflux condenser for one to two hours. The melt is then treated with water, in which it dissolves to a crimson solution. A current of air is passed through the boiling solution until the precipitate acquires a distinctly brown colour. The whole is then acidulated slightly and the precipitate filtered off and washed. Again, for example, 2.2′-dimethyl-1.1′-dianthraquinonyl is

heated to 350°—380° C., whilst stirring well. The melt is greenish-brown in colour and becomes reddish-brown after some time. After half an hour it is allowed to cool and the hardened mass is dissolved in 10—15 times its initial weight of sulphuric acid of 66° B. The product is precipitated by means of ice and water, and is washed with water. It is insoluble in water, and in dilute alkalis and acids.—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from Page* 17.)

Solution and Pseudo-Solution. IV. [*Theory of Dyeing*] E. Linder and H. Picton. Chem. Soc. Trans., 1905, **87**, 1906—1936.

This paper continues the study of solution and pseudo-solution originated by the authors in 1892 (this J., 1892, 64; likewise Chem. Soc. Trans., 1895, **67**, 63; 1897, **71**, 568); (also Dreaper, 1904, 95; and 1905, 223). The present paper is arranged in three sections.

I. *Physical and Chemical Properties of Colloidal Arsenious Sulphide.*—The authors continue their investigation into the nature of the precipitate that separates when colloidal arsenious sulphide is coagulated by metallic salts. They regard such coagula as metallic derivatives of a complex hydrosulphide formed by interchange of hydrogen for metal. Thus,

$$mAs_2S_3.H_2S + BaCl_2 \quad mAs_2S_3.BaS + 2HCl.$$

The coagulation process for salts of uni-, bi-, and tri-valent metals is reviewed in the light of this hypothesis. Tetravalent metals, for example, platinum and zirconium, are found to be non-coagulants of arsenious sulphide in dilute solution. The aggregation and de-aggregation phenomena of arsenious sulphide have been studied microscopically.

II. *Physical and Chemical Properties of Colloidal Ferric Hydroxide.*—The authors discuss the properties of ferric hydroxide. Various grades of the colloidal hydroxide have been prepared by dialysis: The lowest, with aggregates visible under the microscope (1/10th Obj.), the highest diffusible and filterable, but showing a polarised beam in Tyndall's experiment. The physical and chemical properties of the higher grade solutions, and the coagulation phenomena of the colloidal hydroxychloride, have been studied by methods similar to those applied in the investigation on arsenious sulphide.

III. *Dyeing a Phase of Coagulation.*—The authors show that when a solution of "ferric hydroxide" (hydroxy chloride) is just coagulated by a dilute solution of ammonium sulphate, the whole of the iron and sulphuric acid separate as an insoluble hydroxysulphate, whilst an equivalent amount of ammonium chloride remains in solution. If in place of ammonium sulphate a solution of "Soluble Blue," or Nicholson's Blue be taken, the result is precisely similar. At a certain critical point, a red coagulum separates which contains the whole of the iron and the whole of the sulphonic acid added, an equivalent amount of sodium chloride remaining in solution. The coagulative power of "Soluble Blue," calculated from the amount used to exactly coagulate a given volume of hydroxide, is 200, precisely the value obtained for sodium sulphite; Nicholson's Blue gave a much higher figure. If the coagula be extracted exhaustively with strong alcohol to remove every trace of adherent dye, foxy-red precipitates remain. On digesting these extracted coagula with dilute sulphuric acid or concentrated salt solutions, a deep blue solution is obtained*—the hydroxy-dye sulphonate is decomposed, yielding the free sulphonic acid or corresponding sulphonate. If in place of the acidic dye, Aniline Blue, an "equivalent" solution of a basic dye, Methyl Violet, be used, no coagulation results. The latter dye is a *chloride*, and chlorides coagulate ferric hydroxide only in highly concentrated solution. With arsenious sulphide, the behaviour of the dyes is reversed—Methyl Violet readily coagulates arsenious sulphide with formation of a dye-hydrosulphide derivative and liberation of hydrochloric acid, whilst Aniline Blue has no such power. Here the coagulating agent is the chloride of a basic dye, *viz.*, Methyl Violet, which acts like aluminium chloride; whilst the sodium salt of an acidic dye, like other sodium salts, only coagulates arsenious sulphide in highly concentrated solution. Similar results are obtained with Hofmann's Violet and with Magenta.

The authors consider that these facts indicate that the coagulation phenomena of such dyes are precisely analogous to those of metallic salts.

If the addition of ammonium sulphate to a solution of ferric hydroxide be continued beyond the point at which the coagulum separates, the excess remains in solution. With Aniline Blue, this is not the case; the coagulum that separates continues to take up dye with avidity, withdrawing from solution in this way an amount four to five times as great as that required to coagulate the hydroxide before the excess of dye added begins to colour the liquid. Up to this point, the supernatant liquid remains clear and colourless; no trace of alkali can be detected. The dye is therefore taken up as a whole, not as a sulphonic acid. Similar results are obtained if Methyl Violet be added to arsenious sulphide. In both cases the coagula may be said to have been "dyed." Excess of Aniline Blue is also taken up by ferric hydroxide coagula in general, and Methyl Violet by arsenious sulphide coagula.

On the other hand, if ferric hydroxide coagula are treated with Methyl Violet, or arsenious sulphide coagula with Aniline Blue, no appreciable amount of the dyes is taken up. Ferric hydroxide has a selective affinity for the acidic dye, arsenious sulphide for the basic dye. With respect to the cause of this difference, the authors sought for a physical rather than a chemical explanation of the mutual attraction of dye and coagulum, since in the present simple cases of "substantive" dyeing they have shown that in the first, or "coagulation," stage of the process, chemical reactions occur which practically exhaust themselves before the second, or "colour absorption," stage commences, and that there is evidence that the dye taken up during the latter operation is absorbed as a whole. Witt's theory of solid solution, they consider, affords no adequate explanation of the phenomena, as the dyes up to a certain point are completely withdrawn, leaving the solution colourless and neutral. During the present year Dreaper (this J., 1905, **24**, 223) has sought to connect the phenomena of the dyeing process with the de-solution phenomena of colloids. He holds, with Krafft, that the process of dyeing in the great majority of cases consists in the separation of colloidal salts on or in the fibre. The colloid molecules, he argues, are in a state of unstable equilibrium. Under the influence of a "porous fibre substance" aggregation occurs to such an extent that they are thrown out of solution on the fibre and adhere to it by mutual attraction. The authors endeavour to advance beyond the position taken up by Dreaper. They seek to explain why a "porous fibre substance"—ferric hydroxide—should absorb and retain Aniline Blue and reject Methyl Violet, whilst another "porous fibre substance" of a similar physical structure—arsenious sulphide—rejects the first and absorbs the second. They believe an answer is to be found by comparing the physical properties of the four solutions. The more important properties are summarised as follows:—

All four solutions are aggregated and finally coagulated by sodium chloride, forming granular hydrogels. All contain molecular aggregates too small to be visible under high powers of the microscope. All exhibit electrical properties which indicate that a difference of potential exists between the molecular aggregates and the fluid (Quincke), in other words, the aggregates carry an electric charge: the two "basic" compounds, Methyl Violet and ferric hydroxide, a *plus* charge; the two "acidic" compounds, Aniline Blue and arsenious sulphide, a

* The experiment is best performed by placing a small quantity of the extracted coagulum on a piece of dry filter paper. If the coagulum is then moistened with the acid or salt, a deep blue ring is formed. The coagulum must not be boiled in contact with glass, the extracted alkali decolorises it.

minus charge. Any two oppositely-charged hydrosols in dilute aqueous solution combine to form a pseudo-solution the compound aggregates of which possess electric properties which depend on the relative proportions of the constituents present. Thus:

Excess of Methyl Violet (+) with Aniline Blue (—) is electro-positive;

Excess of Aniline Blue (—) with Methyl Violet (+) is electro-negative;

Excess of ferric hydroxide (+) with arsenious sulphide (—) is electro-positive;

Excess of Aniline Blue (—) with ferric hydroxide (+) is electro-negative;

and so on.

Any two oppositely charged hydrosols in strong aqueous solution are mutual coagulants. Thus

Methyl Violet (+) aggregates and finally coagulates Aniline Blue (—).

Ferric hydroxide (+) aggregates and finally coagulates arsenious sulphide (—) *

Further, the hydrogels which separate when ferric hydroxide and arsenious sulphide are coagulated by metallic salts, still retain the same selective affinity for the dyes which will coagulate them—the hydrogel of ferric hydroxide for Aniline Blue, that of arsenious sulphide for Methyl Violet. The authors regard this fact as evidence that the granular aggregates in these hydrogels still retain some charge. In other words, the difference of potential existing between the molecular aggregates and the fluid in the hydrosol state is not destroyed by coagulants, but only reduced to a point at which the forces of cohesion are just able to overpower the forces of repulsion brought into play by such difference of potential.

In conclusion, they regard the simple processes of "substantive" dyeing described above as taking place in two stages:—

Stage 1.—The "coagulation stage," in which simple ionic interchange takes place between the "fibre substance" (colloid) and the dye, resulting in the separation of insoluble dye derivatives retaining a feeble charge

Stage 2.—The "colour absorption stage" in which the coagula produced in Stage 1 attract and retain (as a whole) the oppositely-charged particles of the dye substance.

p-Phenylenediamine and Quinonedi-imine; Injurious Effects of —— on the Health of Workpeople. E. Erdmann and E. Vahlen. Arch. exp. Pathol. u. Pharmak., 53, 401—418. Chem. Centr., 1905, 2, 1809-1810.

p-PHENYLENEDIAMINE is used in the dyeing of furs, and especially for colouring hair brown or black. Workpeople engaged in the manufacture of this compound are said to suffer various injurious effects, and the authors attribute these to the diamine itself and to its oxidation products, especially quinonedi-imine, $NH:C_6H_4:NH$. This latter compound is very unstable and readily polymerises to a dark brown colouring matter $(C_6H_6N_2)_n$. The authors are of the opinion that the use of *p*-phenylenediamine as a dye for human hair should be forbidden. -A. S.

English Patents.

Felt Substance for Industrial Purposes, and Method of Manufacturing the same. R. Haddan. From A. Rupert. Eng. Pat. 2974, Feb. 13, 1905. XIIIC., page 82.

Fibrous Materials; Washing and Rinsing Machine for ——. F. Bernhardt, Leisnig, Saxony. Eng. Pat. 26,287, Dec. 2, 1904.

SEE Fr. Pat. 348,784 of 1904; this J., 1905, 617.—T. F. B.

Yarns; Manufacture of Coloured Polished ——. W. H. Duckworth, Sale, Cheshire. Eng. Pat. 6,230, March 24, 1905.

THE ordinary method of production of polished coloured yarns from cotton or other vegetable fibres consists in first mordanting or preparing the bleached or "boiled off" yarn, then dyeing (or immediately dyeing with direct colours), then sizing and finally polishing on brushing machines. This process is lengthy, and, according to the present patent, the polishing size, mordants, assistants, solvents and dyestuffs or pigments employed are all mixed and directly applied to the bleached or "boiled off" yarns. A polishing size is first made by boiling in water animal, vegetable or mineral fats or waxes, together with one or more of the following substances:—Farina, starches, dextrin, sago flour, tapioca flour, arrowroot, cereals, gums, sugars, soap, shellac or animal and vegetable gelatinous materials. To this prepared size are then added either dyestuffs, coloured pigments or lakes, with or without the addition of china clay, assistants, solvents and mordants. The bleached or "boiled off" yarns are impregnated with this size mixture in the usual way, steamed, allowed to stand for several hours and then polished on brushing machines as usual. Oxidising, reducing, alkaline or acid vapours or gases, such as chlorine, formaldehyde, acetic acid, ammonia, &c., may be introduced in the steaming process. For example, a black polished yarn is produced as follows:—The bleached or "boiled off" yarn is wrung out and worked for a few minutes in the slightly warm or cold size made by boiling together in water 5 parts of white paraffin wax, 5 parts of brown paraffin wax and 12 parts of china clay. This is allowed to cool somewhat and a mixture of 18 parts of farina, 18 parts of sago flour, and 150 parts of water is added and well boiled, with starring, until a stiff paste is produced. To every 135 parts of size, 45 parts of Fast Steam Black (a commercial logwood preparation), 45 parts of chromium acetate solution of 39° T., and about 135 parts of water are added. The shade of black is varied by the addition of such dyestuffs as Auramine, extract of Persian berries, &c., to this size. The yarn is then allowed to stand in a cool place to absorb the dyestuffs and size, the excess being drained off in a few hours, and is then steamed at the atmospheric pressure, or a pressure slightly higher. When the colour is thoroughly developed by the steam, which usually takes about 30 minutes, the yarn is removed from the steamer, allowed to cool and polished as usual. Black polished yarns may also be made in which the Fast Steam Black is replaced by "carbon black powder." Coloured shades of polished yarn are produced by dissolving a direct cotton dyestuff in water and adding it, together with about five times its weight of sodium phosphate or other suitable assistant, to a size made as in the first example, omitting the mordant. In all cases the yarn polishing size contains paraffin wax or similar substances of a fatty or waxy nature, which, being boiled with water and starchy matter form an emulsion. This separates after being applied to the yarn and allows the water to be squeezed out, so that the yarn takes a polish on being brushed, no heat being required for this purpose. —E. F.

Waterproofing of Soft Felt Hats. J. P. L. Maurel, Albi, France. Eng. Pat. 16,726, Aug. 17, 1905. Under Int. Conv., March 8, 1905.

ONE kilo. of alum is dissolved in 2 litres of boiling water and 1·7 kilo. of lead acetate in 3 litres of boiling water. The two solutions are mixed while warm and the liquid decanted from the resulting precipitate. After the hats have been dyed and dried, they are placed in a bath made by mixing 1 litre of the decanted liquid obtained as described above with 12 litres of water. They are then removed and dried in the open air or in a stove. The length of time during which the hats are immersed in the liquid varies with the thickness and nature of the felt. For hair felt about 8—10 hours and for merino felt about 2-3 hours are necessary.—E. F.

United States Patents.

Mordant; Lactic ——. A. A. Claflin, Littleton, Mass. U.S. Pat. 807,019, Dec. 12, 1905.

AN "assistant mordant" of lactic acid and an ammonium

* In this case, some slight chemical action is noticed: the filtrate contains traces of ferrous chloride, due, doubtless, to reduction of the hydroxychloride present.

salt is claimed, the lactic acid being in excess of the acid combined in the form of ammonium salt.—T. F. B.

Dyeing; Apparatus for ——. J. A. Willard, Assignor to The Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 796,381, Aug. 1, 1905.

The apparatus which forms the subject of this invention, comprises an outer receptacle 1 (see Fig.), to the bottom of which is secured an inner, annular casing 4, tapering downwards, leaving a space 4*b* between the receptacle and casing; a removable, perforated bottom-plate 6, adapted to support within the casing the materials to be dyed; a compression-plate 7, capable of being raised or lowered by means of chains attached to a pulley 8, carried by a trolley 9, upon a trolley-line 10; vertical rods, provided with stop-flanges, just above 1, serving to hold the plate 7 in position within the casing 4; pipes 17, 18, 23, 29, 30, 32; a pump 28; couplings, valves, a steam-pipe, &c. The arrangement is such that the central, vertical rod employed in dyeing apparatus (see U.S. Pat. 755,422; this J., 1904, 439) of a nature similar to the apparatus now claimed is dispensed with.

The operation of the apparatus is as follows:—The materials (loose wool, &c.) to be dyed are conveyed upon the plate 6 into the casing 4 and there compressed by the plate 7. The dye-liquor to be employed is run into the receptacle in quantity sufficient to keep the plate 7 submerged during the dyeing operation. Steam is admitted into the pipe 12 to heat the dye-liquor, which is drawn, by the action of the pump, from the space 4*b*, through pipes 23 and 29, and by the same means caused to return through pipes 30, 32, 18 and 17 to the bottom of the receptacle 1. The liquor then passes upwards through the plate 6, the textile materials, and the plate 7, to the space 4*b* whence it is again drawn. After circulating in this manner for a few minutes, the valves are reversed and the dye-liquor is made to flow in the opposite direction. Finally, after being circulated in both directions as often as is necessary, the dye-liquor is withdrawn and the dyed materials are washed with water before being removed from the apparatus.—E. B.

Dyeing-Machine; Duplex ——. J. A. Willard, Assignor to The Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 796,382, Aug. 1, 1905.

Two dye-vessels, with inner casings, material-supporting plates, liquor- and steam-pipes, &c., constructed and arranged as described in U.S. Pat. 796,381 (see preceding abstract), are placed at a convenient distance apart, so that the same pump, material-compression plate, pulley-hoist and trolley rail may serve for both vessels. The object of the invention is to enable the output of dyed textile materials to be doubled without duplicating the whole of the apparatus, the materials in one of the vessels being dyed and afterwards washed, while those in the other vessel are being removed and replaced by undyed materials.—E. B.

Dyeing Machine. J. A. Willard, Assignor to the Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 796,383, Aug. 1, 1905.

A dye-vessel 1 (see Figs., next page), mounted upon a suitable support, is connected, by means of a system of pipes, with a pump 33 (Fig. 1). Two removable, perforated plates, 16 and 11, which, when in use, are placed respectively at the top and bottom of the vessel, serve to compress, during the dyeing operation, the textile materials to be dyed, while allowing dye-liquors to flow through them. These are kept in position by vertical rods, 2, 3, 4, 5 and 6, secured to the bottom of the vessel, a reinforcing plate 16 carrying four or five tapering collars 18, through which the rods pass, being secured above the upper plate. A chamber 22, into or from which the dye-liquor passes from or into the vessel through an opening in its side, contains a filter 23. Rings 13 are fixed in the plates to enable them to be moved into and out of the vessel. The materials are placed upon and removed from the plate 11 while this is outside the dye vessel. The dyeing is accomplished by filling the vessel with the required dye-liquor and circulating this alternately in opposite directions, heating it by means of a steam-pipe, 47, while the materials are compressed, sufficient dye-liquor being employed to

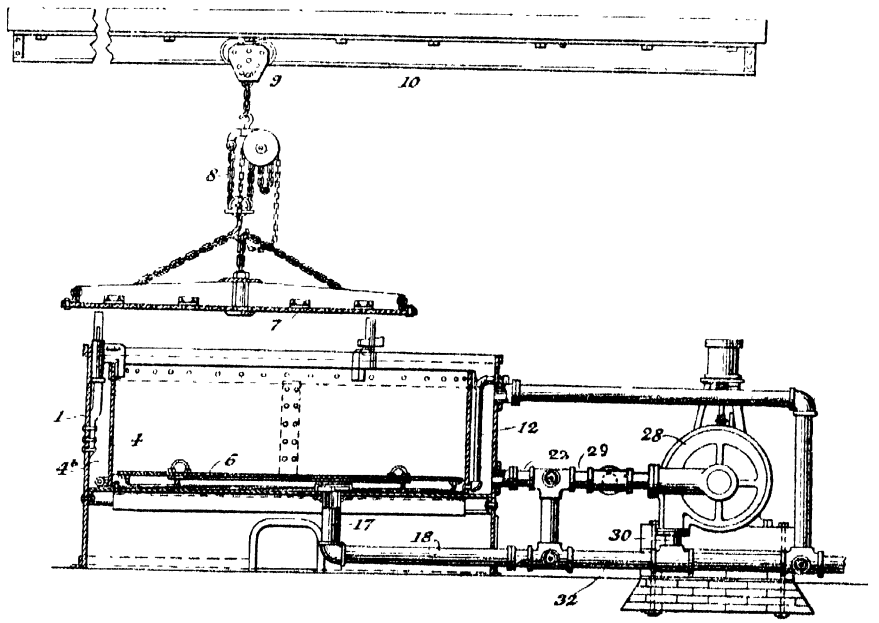


FIG. 1.

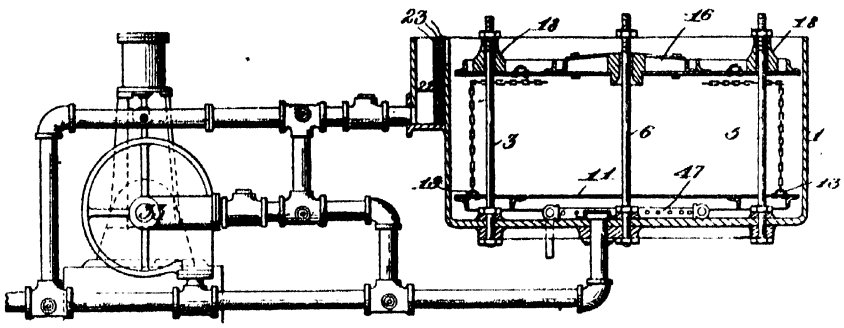
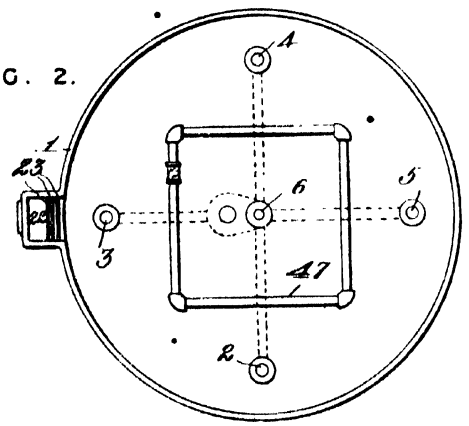
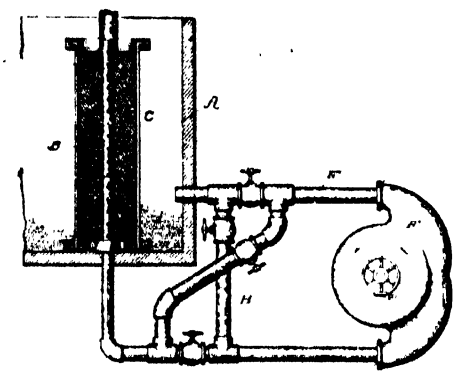


FIG. 2.



submerge the materials during the operation and so prevent them from coming into contact with the air "before the colour has been set."—E. B.

Dyeing Apparatus. G. A. Friedrichs, Assignor to C. A. Proulx, Woonsocket, R.I. U.S. Pat. 806,793, Dec. 12, 1905.



The apparatus comprises a dye vat A containing a basket C with perforated walls for holding the rovings, &c., to be dyed, a perforated spray-pipe B for the introduction of dye-liquor, a pipe F for withdrawing dye-liquor from the bath, a pump E, and the valved pipes as shown in the accompanying figure.—T. F. B.

Indigo Dye [*Liquor*]. J. W. Fries, Winston Salem, N.C. U.S. Pat. 807,453, Dec. 19, 1905.

Claim is made for a padding liquor for use in Indigo dyeing, consisting of Indigo, milk of lime, zinc dust, caustic soda, starch and "Alizarin oil" mixed with water.—T. F. B.

Indigo Dyeing; Process of ——. H. Muller, Paris. U.S. Pat. 808,398, Dec. 26, 1905.

See Eng. Pat. 9532 of 1903; this J., 1903, 993.—T. F. B.

Indigo; Process of Printing ——. M. von Gallois, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on the Maine, Germany. U.S. Pat. 808,443, Dec. 26, 1905.

See Eng. Pat. 13,116 of 1903; this J., 1904, 544.—T. F. B.

French Patents.

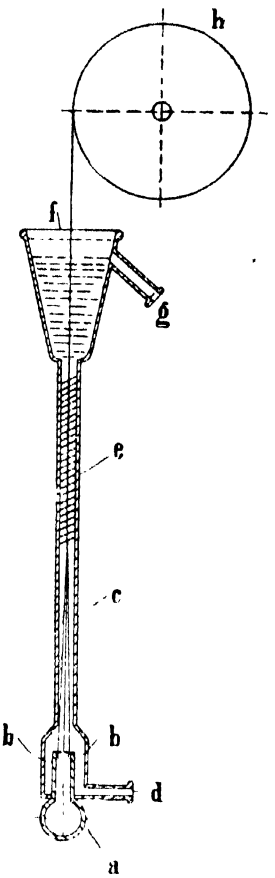
Viscose; Process for Making Threads and Films of ——. S. Pissarev. Fr. Pat. 357,056, Aug. 19, 1905.

Solutions of salts of organic bases, such as aniline, pyridine or naphthylamine are employed to render viscose threads or films insoluble. These bases are stated to be very easily removed by washing. The process is stated to be of value when it is desired to colour the products, *e.g.*, when aniline has been employed, the product may be treated with a solution of a chlorate and hydrochloric acid, and then steamed and dried, thus producing Aniline Black.—T. F. B.

Cellulose Solutions; Process of Making —— by means of Alkylamines. E. W. Friedrich. Fr. Pat. 357,171, Aug. 24, 1905. XIX., page 88.

Threads; Apparatus for Making Artificial ——. E. W. Friedrich. Fr. Pat. 357,172, Aug. 24, 1905. Under Int. Conv., Sept. 7, 1904.

The apparatus consists, as shown in the accompanying figure, of a tube *a*, through which the cellulose or other solution flows, and which communicates with a number of forming orifices *b b*; also a tube *d* by which the coagulating or hardening solution is introduced. The threads thus formed are carried up the tube *c*, in the interior of the upper part of which (*c*) is a helical groove, which causes the liquid to rotate, thus twisting the several threads together into one thread. This passes out of the apparatus, over the pulley *h*, from which it is fed on to an endless band of fabric, around which it makes a complete circuit; during its passage it passes between squeezing rollers, one of which actuates the endless band, and is finally wound on a bobbin. The coagulating or harden-



ing solution passes up into trough *f*, and overflows through pipe *g*.—T. F. B.

Silk Works, &c.; Process for the Recovery of the Alcohol and Ether contained in the Air of Artificial ——. J. M. E. Dervin. Fr. Pat. 350,208, Nov. 8, 1904.

The air is passed in succession through two batteries of absorption towers or columns fed with concentrated sulphuric acid, and cooled by water so that the temperature does not rise above 18°—20° C. In the first series of towers, the ether, alcohol and moisture are all absorbed at first, but as the acid becomes diluted by absorbed moisture, its power of absorbing ether diminishes, and finally only the water and alcohol are retained, the ether passing on to be absorbed in the second series of towers. When the acid in the second series of towers is saturated, it is distilled *in vacuo* for recovery of the ether and then used over again. After being used several times in this way for the absorption of ether, the acid contains a certain quantity of ethylsulphuric acid; it is now transferred to the first series of towers, and used for the absorption of alcohol and moisture, the alcohol being subsequently recovered by known methods.—A. S.

Silk, Artificial; Recovery of Solvents, especially Alcohol and Ether, from Bobbins of ——. J. Douge. Fr. Pat. 356,835, April 21, 1905.

In the manufacture of artificial silk by the Chardonnet process, considerable quantities of alcohol and a small quantity of ether are retained by the filament, and are afterwards lost by evaporation. The recovery of these substances, by evaporation under reduced pressure, is said by the patentee to be unsatisfactory as the apparatus is complicated, the operation delicate and dangerous, and the fibre undergoes deterioration in properties. According to the present invention the alcohol and ether are removed from the fibre by systematic extraction with water by diffusion, in much the same manner as in the extraction of sugar from beets, the filaments, highly charged with solvents being treated with concentrated aqueous solutions of the same, and subsequently with more and more dilute solutions in succession until they are finally extracted by pure water. By using bobbins with longitudinal channels, to admit of free access of the liquid, and by exhausting systematically at 30°—35° C., a liquid containing 15–20 per cent. of alcohol may be obtained. By fractionating this liquid, 40—50 per cent. of the alcohol employed may be recovered. Other solvents of nitrocellulose, soluble in water, such as acetone, may be recovered in the same manner. The extracted fibre is said to be in an especially suitable condition for denitration and other subsequent treatment. A form of apparatus for carrying out the extraction is described. —E. F.

Dyeing, Cleaning and Washing Feathers; Apparatus for ——. J. J. Brossard. First Addition, dated Aug. 21, 1905, to Fr. Pat. 354,530, May 22, 1905.

See Eng. Pat. 18,194 of 1904; this J., 1905, 1011.—T.F.B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 18.)

French Patent.

Wallpapers; Printing ——. A. Fleury. Fr. Pat. 350,249, Oct. 22, 1904.

For printing wallpapers, &c., the inks hitherto employed have been made by mixing powdered pigments with glue, starch paste, gum or some other suitable adhesive. According to the present patent the adhesives hitherto used are replaced by a preparation of casein and borax. For example, technical casein is mixed with three to seven times its volume of water and technical borax is added (from 12 to 18 per cent. of the quantity of casein used); the whole is heated to a sufficiently high temperature to dissolve the borax and casein. A slightly pasty liquid is so obtained and is mixed with the pigments employed. After printing, the casein is rendered insoluble by means of formaldehyde; this is effected either by passing the printed paper through a solution of formaldehyde or by exposing it to formaldehyde vapour.—E. F.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 19.)

Alkali Carbonates; Dissociation of ——. P. Lebeau. Ann. Chim. Phys., 1905, **6** [8], 422—432. Chem. Centr., 1905, **2**, 1657 (See this J., 1903, 739; 1904, 60, 714).

According to Wittorf (Z. anorg. Chem., 1904, **39**, 187; this J., 1904, 488), only the carbonates of lithium, sodium and potassium are dissociated between 800° and 900° C., whilst the carbonates of rubidium and cæsium volatilise at that temperature. The carbon dioxide found by the author on heating the two last-named carbonates must have been, according to Wittorf, derived from the action of the volatilised carbonates on the silicious glaze of the porcelain tube. The author has repeated the experiments, and finds that of the five alkali carbonates above mentioned, cæsium carbonate is the only one that is appreciably volatile, and further that the dissociation of cæsium carbonate is actual dissociation.

In the course of his experiments the author succeeded in crystallising the hydrate $3CsCO_3.10H_2O$, from boiling concentrated alcohol.—A. S.

Phosphoric Acids; Reactions of the Three ——. C. Arnold and G. Werner. XXIII., page 92.

Tellurous and Telluric Acids: Determination of ——. A. Berg. XXIII., page 92.

Copper Sulphate; Electrolytic Preparation of ——. C. Kroupa. XIA., page 79.

ENGLISH PATENTS.

Sodium Ferrocyanide; Manufacture of ——. A. G. Bloxam, London. From Administration der Minen von Buchsweiler, A.-G., Buchsweiler, Germany. Eng. Pat. 29,283, Dec. 31, 1904.

SEE Fr. Pat. 352,246 of 1905; this J., 1905, 891.—T. F. B.

Zinc Sulphide and Alkali or Alkali Hydrates; Apparatus for the Manufacture of ——. H. W. de Stucklé. Eng. Pat. 2174, Feb. 3, 1905. Under Int Conv., May 21, 1904

SEE Fr. Pat. 353,496 of 1905; this J., 1905, 1013.—T. F. B.

UNITED STATES PATENTS.

Nitric Acid; Process of Manufacturing —. H. Pauling, Brandau, Austria. U.S. Pat 807,491, Dec. 19, 1905.

SEE Fr. Pat. 323,491 of 1902; this J., 1903, 495.—T. F. B.

Reagents [e.g., Ferrous Sulphate]; Process of Preparing and Feeding ——. J. F. Wixford, St. Louis, Mo. U.S. Pat. 806,945, Dec. 12, 1905.

A LIQUID is passed upwards through a mass of a solid reagent (water through ferrous sulphate for instance) and in proportion to the amount of solid dissolved, measured charges of the same are added to the mass at measured intervals, each such added charge being small relatively to the mass.—E. S.

Milk of Lime; Process of Preparing and Feeding ——. J. F. Wixford, St. Louis, Mo. U.S. Pat. 806,946, Dec. 12, 1905.

THE lime to be hydrated is contained in a tank provided with a mechanical agitator, into which a continuous stream of hot water is conducted, there being an outflow pipe for the milk of lime produced, at the side near the top of the tank. Measured charges of lime are added at measured intervals of time, proportioned to the quantities of milk of lime carried away.—E. S.

Lime; Process for Hydrating ——. C. Ellis. U.S. Pat. 807,609, Dec. 19, 1905.

A MOVING mass of quicklime is continuously mixed with water in suitable proportions, and the resulting moving body of "lime putty" is kept agitated while being subjected to the action of heat from an adjacent moving mass of lime in a more advanced state of hydration, formed previously. When the absorption of water by the lime is complete, the moving body of slaked lime becomes in turn the heat-imparting agent used to accelerate the hydration of a further quantity of "lime putty."—A. S.

FRENCH PATENTS.

Nitric Acid; Process and Means for the Concentration of ——. E. Collett. Fr. Pat. 357,221, Aug. 10, 1905 Under Int. Conv., Aug. 11, 1904.

THE dilute nitric acid to be concentrated is subjected in a closed vessel to a current of heated air or gas passing over its surface, the vapours passing upwards into a reflux distilling column, set immediately over an opening in the top of the shallow vessel containing the acid. Fresh dilute acid is fed into the upper part of the column. The vapours are led from the column through an immersed cooling worm, draining into a receptacle, whence the uncondensed vapours are conducted successively through a partitioned vessel containing coke or the like, and next through a similar vessel charged with limestone and lime in successive compartments.—E. S.

Electrolysis; Impd. Process and Apparatus for ——. L. A. P. Liénard. Fr. Pat. 356,862, Aug. 5, 1905. XIA., page 79.

Vanadium; Use of Sodium Peroxide and of Hydrogen Peroxide for the Separation of ——, *from Ores and Slags.* M. M. J. Bouffort. Fr. Pat. 357,397, Aug. 2, 1905.

ORES and slags containing vanadium are treated cold with sodium peroxide dissolved in water, or by hydrogen peroxide solution. The vanadium is stated to pass into solution as vanadic acid or as vanadates, the purification of which may be effected by ordinary means.—E. S.

Barium Carbide and Metallic Manganese; Reduction of Barium Manganite in order to Obtain ——. C. M. J. Limb. First Addition, dated Aug 22, 1905, to Fr. Pat. 304,720, Oct. 20, 1900. (Compare Eng. Pat. 7282, of Nov. 27, 1899; this J., 1901, 463).

BARIUM manganite, mixed with carbon (not in excess) and a flux, such as chalk, barium carbonate or sulphate, or fluorspar, is heated, for instance, in an electric furnace, at a temperature too low for the formation of barium carbide. The metallic manganese thus produced is freed from the slag, which latter (containing the barium) is heated in another furnace with excess of carbon and an auxiliary oxide, preferably iron oxide, to the temperature necessary for the formation of barium carbide; the sulphur, phosphorus, silicon, &c., present, pass into the auxiliary metal. The barium carbide formed is treated with water for the production of barium hydroxide and acetylene.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from Page* 21.)

Clay; The Casting of ——. F. Foerster. Chem. Ind., 1905, **28**, 733—740.

BESIDES the usual method of working a kneadable clay mass into the required shapes by hand, the process of casting has been employed, which consists in pouring a sufficiently fluid clay cream into plaster moulds, which, by absorbing a portion of the water from the fluid, allows a layer of clay to form on the walls of the moulds, and after a time the layer becomes sufficiently rigid to allow the still fluid portion of the clay cream to be poured off and the moulded object to be removed from the mould. During subsequent drying, however, such an object frequently cracks. This difficulty can be overcome, however, by making the water employed slightly alkaline, by the use of a 0·5 per cent. sodium carbonate solution, or 0·2 per cent. solution of sodium hydroxide, as the use of these diminishes the amount of water necessary to yield a thin fluid clay "slip." All clays do not yield these fluid "slips" with alkali, but many highly plastic stoneware clays possess this property and retain it when mixed with non-plastic and fluxing materials, such as quartz and felspar The process is particularly applicable to bodies of complicated form, and is also cheap. In forming objects in plaster moulds, parts of the walls of which cannot be covered with clay "slip," the mould is inverted and the opening closed, while the liquid is introduced through a tube in the exit and allowed to rise slowly in the mould, while the air escapes through a separate tube. E. Weber has found that plastic clays mixed with burnt material retain the property of being cast and the process is therefore applicable, for instance, to the making of glass-house pots.

By long storage of ready mixed ceramic bodies the plasticity is improved, and, during this time, the water present in the body acquires an alkaline reaction, possibly due to its action upon the felspar. Consequently there appears to be a resemblance between this maturing process and the influence of small amounts of alkali upon certain clays. The author considers that the effect of alkalis upon clays is closely connected with the question of the nature of plasticity, and that clays do not differ essentially from colloidal substances. When a considerable amount of water is mixed with a highly plastic clay, the liquid

layers show no sign of clearing for perhaps two months, and a similar observation may be made with many colloidal solutions of gold, the particles being so fine that, to the human eye, they do not appear as separate bodies. Colloidal bodies are classed either as negative or positive, according as they tend to collect either at the anode or cathode under the influence of an electric current. The author has found that clays of very various kinds behave as negative colloids. Only a difference in the size of grain constitutes the distinction between colloids and fine particles in suspension, recognisable as such by the human eye. A turbid clayey fluid, containing negatively charged particles, follows the analogy of negative colloids, and is precipitated by acids, and maintained in a fluid condition by alkalis. On this theory, therefore, if the effect of the negative hydroxyl groups is to push the particles of clay apart, so that the water can glide more easily between them, then a smaller amount of water will produce the effect of rendering a given mass of clay "fluid" than would be required if the repellent effect of the hydroxyl groups were not present.

The fact that all clays do not admit of being cast is due to the want of the formation of colloidal conditions, owing to the presence of larger particles settling out from the liquid. The effect of small quantities of alkali is always greater on clays that contain a larger proportion of those fine particles that impress a colloidal character on the mixture. The fineness of the particles and their amount are shown by the time required for the clayey fluid to clear, and by the difficulty or ease with which the fluid can be filtered through paper. Those clays which remain turbid for a long time and cannot be filtered by the best papers, require the smallest amounts of alkali to enable them to be cast, while clays that clear easily on standing and are easily filtered, and do not stop the pores of the paper, do not become fluid for casting even with considerably larger additions of alkali. The alkali is said to have no effect upon the behaviour of the clay on burning, being present only in a relatively small proportion.

In the case of the alkali taken, the electrical effect of the negatively charged hydroxyl ions overcomes the attractive effect of the positive sodium ions, and the question arises as to the effect of other positive ions, *e.g.*, calcium or barium. The author found that while 25 c.c. of N/20 caustic soda rendered 50 grms. of a certain clay quite "fluid," the similar quantity of N/20 calcium hydroxide or N/20 barium hydroxide left the clay quite stiff; and the fluid condition arose only when the lime water reached the same amount as required of distilled water. Partial replacement of the N/20 sodium hydroxide by the equivalent of lime water causes a diminution of the fluidity produced by 25 c.c. of solution on 50 grms. of the clay considered, when the lime constitutes more than one-fifth of the sodium hydroxide content. Nearly all clays, especially secondary clays, give up more or less calcium sulphate to water, and these amounts even when small have a prejudicial effect upon the fluidity. Hence the study of the aqueous extract of clays assumes increased importance, not only as regards the calcium salts, but other soluble components of the clay. A solution of ordinary sodium phosphate, to which a trace of sodium hydroxide has been added, acts in the same way on a clay in rendering it capable of being cast. It is noted with regard to calcium salts that objects formed in a plaster mould have so dense a structure that they will not take up a glaze when dipped. This may be due to the quite appreciable quantities of plaster absorbed from the mould, which produce a stiffening of those parts of the object in contact with the mould and on further drying and contraction of the object, the porosity necessary for absorbing the glaze is lost at these points.—W. C. H.

Metallic Glazes on Enamels; Methods used by the Arabs to Produce ——. L. Franchet. Comptes rend., 1905, **141**, 1237—1240.

THE formulæ used by the Arabs and their Italian successors are partly disclosed in MSS. in the British and South Kensington Museums; two are given below:—

	Arab.	Italian.
Copper sulphide	26·87	24·74
Silver sulphide	1·15	1·03
Mercury sulphide	—	24·74
Red ochre	71·98	49·49

These were ground with vinegar, and applied with the brush to the already baked enamel. The author finds that a great variety of iridescent and metallic tones can be obtained by one or the other or a mixture of the following formulæ:—

	1.	2.	3.	4.	5.	6.
Copper carbonate	30	—	—	28	—	95
Copper oxalate	—	—	—	—	5	—
Copper sulphide	—	—	20	—	—	—
Silver carbonate	—	3	—	2	1	5
Bismuth subnitrate	—	12	—	—	10	—
Stannous oxide	—	—	25	—	—	—
Red ochre	70	85	55	70	84	—

Silver chloride and yellow ochre may be respectively substituted for silver carbonate and red ochre. The ingredients, ground with a little gum tragacanth and water, are applied with a brush to enamels melting about 990° C., and are furnaced at 650° C. in the reducing atmosphere already described (this J., 1906, 29). After cooling, the ferruginous deposit is rubbed off, and the colours thus brought out

The author has thus imitated the old Arab wares, and has shown that sulphur, free or combined, is not necessary, that cinnabar has no action, that ochre may be dispensed with, that any organic gummy matter may be used instead of vinegar, and that broom (*loc. cit.*) is not needed in the furnace. The intensity and tone of the iridescence depend on the duration of the reduction, and the nature of the enamel. Enamels containing a colouring base—copper, iron, antimony, nickel—especially in presence of tin, give the best results.—J. T. D.

Manganese Dioxide; Determination of Traces of Iron in —— [*for Glass Manufacture*]. H. Cormimbœuf. XXIII., page 92.

FRENCH PATENT.

Glass in Tank Furnaces. Arrangement of Burner to allow of the Manufacture of White ——. Société H. Bemlan and Cie. Fr. Pat. 357,270, Aug. 26, 1905.

THIS invention relates to a burner that will always yield an oxidising atmosphere in tank furnaces. In order to obtain a thorough intermixture of the gas and air, a series of pillars is arranged at the point where the gas enters the burner, and another series at the mouth of the burner, where it enters the tank.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 21.)

UNITED STATES PATENTS.

Wood; Apparatus for Forcing Fluids into ——. S. Willner, Memphis, Tenn. U.S. Pat. 807,411, Dec. 12, 1905.

THE log of wood is supported in a frame, one end of which consists of a number of grooves and ridges, and the other end of a screw device for forcing the log on to the ridges. The latter are sharpened so that they will enter the wood and the grooves are each connected with valve-controlled pipes for supplying liquid under pressure to the said grooves.—W. P. S.

Portland Cement; Method of Ageing ——. W. O. Emery, Crawfordsville, Ind. U.S. Pat. 806,788, Dec. 12, 1905.

THE method described for ageing Portland Cement consists in spraying the heated clinker with a dilute solution of a

carbonate or bicarbonate, such as ammonium bicarbonate, and afterwards exposing it to the action of gases containing a large percentage of carbon dioxide, for example, by introducing stack or kiln gases into the conveyor which carries the freshly-ground cement away from the grinding apparatus.—W. C. H.

FRENCH PATENT.

Wood: Process of Drying —— by Preliminary Treatment of the Sap. Société Guignard et Lestandie. Fr. Pat. 357,224, Aug. 16, 1905.

BY this process freshly-sawn wood is placed in a stove, and subjected to the action of live steam, with the object of dissolving out the gummy and resinous substances, and removing them in the current of steam. The wood is afterwards dried in a drying chamber provided with a powerful fan, and heated with steam, which may be made to pass on to the stove above mentioned.—W. C. H.

X.—METALLURGY.

(*Continued from page* 27.)

Ore Flotation; Physics of —— J. Swinburne and G. Rudorf. Proc. Faraday Soc., Dec., 1905 [Advance Proof].

THE flotation of ores (especially the Broken Hill sulphides), by which they are separated from gangue, is carried out by immersing them in dilute sulphuric acid or a strong solution of acid sodium sulphate at a temperature between 65° and 100° C. Bubbles of gas attach themselves to the sulphide particles and float them as a coherent scum to the surface, whilst the quartz and other gangue remains at the bottom. The gas is undoubtedly not hydrogen sulphide, but carbon dioxide, and the authors suppose it to be generated, not from calcite, but from carbonates produced by slight weathering of the ores. They assume that the attachment of the gas-bubbles to the particles is the result of equilibrium between two opposing forces—the adhesion between the particle and the liquid, which tends to wet the particle completely, to reduce the area of contact between bubble and particle, and ultimately to detach the bubble; and the surface tension of the liquid, which tends to include bubble and particle in one enclosing surface, to make that surface as small as possible, and hence to prevent separation of bubble from particle. While both forces are weakened by rise of temperature, adhesion falls off at much the more rapid rate, so that a high temperature is favourable to flotation. Adhesion is relatively much stronger in the case of the gangue than of the sulphides. The adhesion of liquids to solids, and hence the readiness or otherwise of solids to be wetted, is closely connected with the presence of an air-film surrounding them.

—J. T. D.

Metalliferous Sulphides; Concentration of —— by Flotation. A. K. Huntington. Proc. Faraday Soc., Dec., 1905 [Advance Proof].

THE carbon dioxide which floats the sulphides in Broken Hill tailings (see previous abstract) is not due to calcite nor to carbonates produced by weathering of the ore, but to ferrous and manganous carbonates which exist in the ore, and are not decomposed by cold, but only by hot dilute acid. Ores which have been exhausted of these can be readily floated by adding these carbonates in their natural condition (siderite and rhodochrosite) to them and submitting the mixture to the hot acid treatment. The flotation is not due to electrostatic action, though, when carbon dioxide is generated in this way the escaping gas and the remaining liquid are oppositely charged. A certain ratio between ore and gangue seems requisite, for certain blendes very free from gangue, which cannot be floated if treated alone, are easily floated if previously mixed with sand, while the flotation of other ores which are easily separated in this way is injured by farther dilution with gangue. The air-film is not concerned; for ores which have been thoroughly and completely wetted and denuded of any air-film can yet be floated perfectly. The author considers that the area of contact between a gas bubble and a solid depends on, and is inversely as the degree of wetting of the solid by the liquid concerned, the latter factor being measured by the angle between the solid and the liquid when the former is partially immersed. For a variety of sulphides this angle, in the case of water or weak acid, lies between 47° and 63°, while quartz and magnetite are completely wetted. The less the wetting the greater force is required to detach the bubble.—J. T. D.

Siemens-Martin Furnace; Treatment of Fluid Pig-Iron in the Basic ——. C. Dichmann. Stahl u. Eisen, 1905, **25**, 1337—1346, and 1429—1437.

1. *Oxidising Action of the Furnace Gases.*—The ordinary Siemens-Martin process is an oxidising one. It would be reasonable to assume that the high temperature needed for its operation could only be attained by complete combustion and an oxidising flame, and calculations from the results of ordinary practice show this to be the case. The following example shows the way in which the author makes his calculations and gives data for similar ones:—Charge of 6560 kilos. of pig-iron and 13,120 kilos. of scrap; tests taken when melted, and four hours afterwards:—

	C	Si.	P.	Mn.
Test at 6 a.m.	1·20	0·89	0·04	0·59
Test at 10 a.m.	0·09	0·00	0·01	0·25
Removed	1·11	0·89	0·03	0·34
Oxygen required, kilos.	291	196·6	7·6	19·4

Iron was also oxidised. The oxygen needed for this can be found if the quantity and composition of the slag are known, and the quantity of slag can be calculated from the silica in it. There went into the slag, silica from:—(1.) The metal, $196{\cdot}8 \times 0{\cdot}89 = 175{\cdot}1$ kilos. of silicon, or 374 kilos. of silica. (2.) The limestone, $11{\cdot}48 \times 1{\cdot}65 = 19$ kilos. (3.) The basic lining and the structure of the furnace—the former, calculated from the dolomite required (3·5 per cent. of the output of steel), and assumed to be regular over the time of the operation, amounted to 0·136 kilo. per minute, and the latter, taken similarly from the consumption of material for furnace repairs, to 0·123 kilo. per minute (the corresponding figures for the process with pig-iron and ore were 0·2 and 1·0 kilo. per minute respectively). The total silica from all these sources amounted in the four hours in question to 455 kilos.; and the percentages of silica and of iron in the slag being 28 and 9·23, the amount of oxygen combined with the iron as ferrous oxide was $455 \times \frac{9{\cdot}23}{28} \times \frac{16}{56} = 43{\cdot}5$ kilos. The total amount of oxygen provided by the furnace was therefore 558·1 kilos., or 2·33 kilos. per minute. Similar calculation for the 37 minutes to the end of the operation gave for that period 1·6 kilos. per minute. The calculated amount of slag was 1995 kilos., and that actually weighed was 1983 kilos. Similar calculations gave for the melting of a charge of 19,756 kilos. of pig-iron and 1638 of limestone, an oxygen supply of 0·65 kilo. per minute, and for the first 105 minutes of the working off of a charge of 19,705 kilos. of fluid pig-iron by exposure to the flame alone, an oxygen supply of 2·43 kilos. per minute.

2. *Oxidation by Iron Ore.*—It is usually assumed that in the working of the ordinary furnace, only a small proportion of the metal in the added ore is reduced and found in the metallic product, while with the Talbot process from 60 to 90 per cent. of it is thus recovered. The author gives details of the working of a charge of 1000 kilos. of limestone and 3276 kilos. of Krivoi-Roger ore, containing 66·61 per cent., or 2182 kilos. of iron, on which were poured 20,300 kilos. of fluid pig-iron. After 190 minutes the reaction was over, and the slag (calculated as above) contained 318 kilos. of iron, so that 1864 kilos., or 85 per cent. of that contained in the ore, had gone into the bath. Further additions of 819 kilos. and 81 kilos. of ore were made, and the operation was finished in 110 minutes more,

after adding 100 kilos. of spiegel and 245 kilos. of ferro-manganese. The slag now only contained 294 kilos. of iron, so that the whole of the iron in the later additions of ore had gone into the bath; or 89 per cent. of the whole amount in the ore was reduced and recovered. The oxygen-consumption during the first 190 minutes was 1154 kilos. for the oxidation of the impurities removed from the metal (C 3·14, Si 0·79, P 0·12, Mn 1·57 per cent.), and 100 kilos. to oxidise the iron in the slag—total, 1254 kilos. The amount contained in the added ore was 933 kilos.; so that 321 kilos., or 1·69 kilos per minute, were contributed by the furnace gases. The corresponding figure during the rest of the operation was 1·83 kilos. per minute. It appears, then, that no reduction of the ore can be effected by the furnace-gases themselves, the effect of which is to oxidise chiefly the iron, as the preponderating and most accessible constituent: and this in turn is reduced from the slag by the impurities in the pig-iron. The latter can only act, however, when the bath is completely fused; and the whole operation from beginning to end consists, in the author's view, of oxidation of the impurities by iron oxides in the slag, whether these iron oxides result from the solution in the slag of added ore or of oxide formed from the iron by the action of the furnace gases. This view is borne out by figures given by Harbord in 1886, in which the iron oxide in the slag rose to over 63 per cent during the fusion of the pig-iron, and, after complete fusion, fell till the carbon was reduced to 0·07 per cent., when the slag contained 5·45 per cent. of iron, then rose slowly to the end of the operation when the normal figure of 0·88 per cent. of iron was reached.

3. *Reactions of Ferric Oxide with the Impurities of Pig-Iron.*—Ledebur first gave figures showing the amounts of iron reduced from ferrous oxide by 1 kilo. of each of the impurities of pig-iron, and the heat-evolution accompanying the reaction, but he should have proceeded from ferric oxide or magnetic oxide, and he did not take account of the formation from silica and phosphoric anhydride of silicates and phosphates respectively. The author has recalculated these figures, and also the amount of heat needed to heat up the ferric oxide required in each case, on the assumptions that the fluid pig-iron is at 1250° C., and the ore at 0° C., and that the specific heat and latent heat of fusion of the ore are 0·19 and 50 respectively. The results are as follows:—

Substance, 1 kilo of.	Heat evolved	Product.	Ferric Oxide needed.	Heat absorbed by Ferric Oxide	Nett heat result.
	Calories		Kilos	Calories	Calories.
Silicon	+3630	Fe_2SiO_4	7·62	2191	+1439
	+3330	$FeSiO_3$	5·72	-	—
Manganese	+5026	Mn_2SiO_4	—	-	—
	+ 508	MnO	0·97	297	+229
Phosphorus	+ 878	$Fe_3(PO_4)_2$	6·88	-	—
	+1023	$Fe_3P_2O_9$	7·74	2225	—1202
Carbon	- 3150	CO	4·44	1276	—4406

The figures are, of course, only rough approximations, but they show that the reactions of silicon and manganese are strongly exothermic, and that of carbon strongly endothermic, while that of phosphorus, exothermic in itself, yet lowers the temperature of the bath if the oxide required for it has to be heated up. In an experiment in which 16,400 kilos. of pig iron were melted with 2,328 kilos. of limestone, and 2032 kilos. of ore were then suddenly added, the reaction was very rapid; after 30 minutes the bath foamed and the slag rose to the level of the doors, and in ten minutes more the ore had completely disappeared, whilst samples showed that the carbon, silicon, manganese, and phosphorus had been reduced from 3·66, 1·33, 2·71, and 0·12 to 3·14, 0·02, 0·33, and 0·01 per cent. The reaction had, without doubt, raised the temperature of the bath, for the furnace gases themselves would not so rapidly have melted and completed the reaction of such a large quantity of ore. Experiments with fluid pig-iron showed that the removal of silicon manganese and phosphorus is extremely rapid—4590 kilos. of ore were spread on the furnace bottom, then two ladles of ten tons each of fluid pig-iron were poured in as follows:—

	Si.	Mn.	P.	C.
4h 36m. to 4h 38m., 10 tons containing	1·61	2·73	0·27	4·06
4h. 45m., sample contained	0·04	0·24	0·08	3·42
4h. 58m to 5h. 0m., 10 tons containing	1·63	2·86	0·27	4·06
5h 8m., sample contained	0·04	0·41	0·08	3·47

It appears, then, that the exothermic reactions occur first, and that the speed of reaction is similar to that found in ordinary aqueous solutions, *i.e.*, the reaction occurs practically as rapidly as mixture of the reacting solutions can be effected. Here, the mixture is not nearly so perfect as that between two liquids, one reacting substance being to start with solid, but the retardation due to this is compensated by the high temperature.

4. *Experiments without the aid of Furnace Heat.*—From the above it would seem that the removal of silicon, manganese, and phosphorus might be effected without the aid of the furnace, and experiments showed that when ore was placed in the transport ladle used to carry the iron from the blast-furnace to the Siemens-Martin furnace, and fluid pig-iron poured upon it, a small amount of slag soon formed, and then reaction set in and became continuously more rapid, being controllable by slackening or quickening the iron- supply. In one such experiment the silicon, manganese, phosphorus and carbon were reduced from 3·50, 0·88, 0·46, 3·93 to 0·42, 0·33, 0·36, 3·74 per cent.; and of the iron of the ore, 37·2 per cent. went into the metal, 60 per cent. went as ferrous oxide into the slag, and 2·8 per cent. remained as ferric oxide. Calculation of the heat result showed that (if the estimates for specific heats of iron and slag be correct) the temperature rose during the operation by 125° C. This experiment was carried out in an acid-lined ladle, yet a notable oxidation and removal of phosphorus occurred. A similar experiment in a basic-lined Siemens-Martin furnace with the gas shut off, showed a reduction of phosphorus from 0·36 in the original metal to 0·14 immediately after pouring in the charge, and to 0·09 after ten minutes more.

5. *The Function of the Furnace.*—This would appear, then, to be to furnish the high-temperature heat needed for the separation of the carbon. But it is probably not desirable to remove the other impurities separately outside the furnace, for not only does their removal impose no burden on the furnace, but the heat evolution thereby caused favours and renders more rapid the removal of the carbon. Moreover, silica is needed to bring the ferric oxide into solution, and hence an iron with 1—1·25 per cent. of silicon is most suitable in the furnace. The added lime serves in due course to substitute the ferrous oxide in the slag, and render it available for the oxidation of the carbon, and the rate at which a lime-ferrous oxide-silica slag will dissolve ferric oxide and that at which carbon will reduce the dissolved oxide balance one another in the furnace, so that while the carbon is being steadily removed the iron-content of the slag remains constant.

6. *Influence of the Impurities on the Heat needed in the Process.*—The highest temperature in the furnace is estimated by different authorities at from 1718° to 1788° C., that of the finished steel at discharge from 1486° to 1586° C. Assuming 1200° C. as the temperature of the entering fluid pig-iron, and the specific heats of iron and of slag as 0·21 and 1¼ times that figure, we find that to raise the temperature of iron and slag from that of the entering pig-iron to that of the finished steel we need 100 calories per kilo. of iron and 150 per kilo. of slag. The limestone for the slag requires per kilo., for heating to 1200° C., dissociation, and fusion, 715 calories per kilo.; 1 kilo. of silica in the slag requiring (for Ca_2SiO_4) 3·46 kilos. of limestone. Calculations on similar lines to those above, but taking account in the case of each constituent of the heat required for the equivalent amount of limestone, show as follows the effects in the furnace:—

Substance, 1 kilo.	Requires.		Yields.		
	Ferric Oxide	Lime-stone	Slag.	Metal.*	Heat Result.
	Kilos	Kilos	Kilos.	Kilos	Calories.
Silicon	3·81	7·40	10·70	1·56	—4964
Phosphorus	4·30	6·70	2·68	2·01	- 5932
			accounted		
Manganese .	0·97	–	for under Si	—0·32	+ 228
Carbon	4·04	0·78	1·35	1·31	—3751
Silica in ore	—	3·46	5·00	–	—4500

* Difference between amount of reduced iron added to metal and amount of constituent removed

From these figures the results of using any given pig-iron in the furnace can be calculated. Thus, 100 kilos. of metal containing 1·03, 0·14, 1·82, and 4·21 per cent of silicon, phosphorus, manganese and carbon respectively, require 23·30 kilos. of ferric oxide, or 23·56 kilos. of ore containing 98·9 per cent. of ferric oxide and 1 per cent. of silica. The slag formed will weigh 18·23 kilos., and the addition to the metal will be 6·82 kilos., while the heat required will be 22,378 calories (not including that for raising the temperature of the metal). This works out to 209 cal. per kilo. of finished steel, or, adding the heat needed to raise 6·82 kilos. of iron from 0° and 100 kilos. from 1200° C. to the final temperature, 325 cal. per kilo. of steel.

7. *Examples from Practice.*—The difficulty in practice with the fluid pig-iron process is in ascertaining the composition of the iron. There is no time for analysis, and the only plan is to keep the ore well under the necessary quantity at first, and add more as required. Using the metal and ore mentioned immediately above, 2330 kilos. of limestone and 5720 of ore were used, 330 kilos. and 180 kilos. of ore being added later. The metal used was 26,200 kilos. of the fluid pig-iron and 200 kilos. of 80 per cent. ferromanganese. The steel contained 0·00, 0·02, 0·71, 0·09 per cent. of silicon, phosphorus, manganese and carbon respectively. The ore used was 23·60 per cent. of the metal charged, while 23·56 per cent. was calculated. The slag (calculated as before from the silica charged) weighed 18·33 per cent. of the metal, against 18·23 in the former calculation. The iron reduced and recovered was 88·7 per cent. of that in the ore, or 3830 kilos.; and 1900 kilos. of impurities were removed from the pig-iron, so that the metal gained 1930 kilos., or 7·3 per cent., against 6·82 per cent. calculated. The calculated results, therefore, are well borne out by practice.

8. *Heat comparison of Scrap and Ore processes.*—The charge just referred to and the scrap charge described early in the paper were compared as to the quantities of heat actually in the products, those yielded by the reactions in the process, and hence by difference those supplied by the furnace. In the scrap process, 19,284 kilos. of steel were produced with a heat-supply from the furnace of 318 cals. per kilo.; in the ore process, 28,330 kilos., with a heat supply of 326 cals. per kilo.—almost identical with the other. But the actual yield of the furnace was much higher in the second case, for, the pig-iron being fluid to start with, the time was relatively shorter. The scrap process lasted 277 minutes, or yielded 70 kilos. per minute; the other lasted 300 minutes, or yielded 94 kilos. per minute. Even though it be assumed that the heat-content of the fluid pig-iron to start with was 285 cal., instead of 250 as assumed in the calculations, the utilisation of the furnace heat would still appear to be better in that process than in the scrap process in the proportion of 27·7 to 22·2; and the author believes the reasons to be (1) that the furnaces are less cooled in the ore process, and the perfect combustion of the gases less interrupted; (2) that throughout the ore process the bath is in constant agitation, ensuring a more thorough absorption of heat; (3) that this heat does not simply produce rise of temperature, but is absorbed in quickening the carbon removal, and the temperature gradually rises as the carbon disappears; there is no fear of overheating as long as both carbon and ore exist.

The same Siemens-Martin furnace, which gave a monthly production of 1600 tons with the scrap process, is now giving 3000 tons with the fluid pig-iron and ore process, and the yield is still improving. The author considers, therefore, that the ordinary basic Siemens-Martin furnace is capable of giving quite as good results as are claimed for the Talbot or the Bertrand Thiel process.—J. T. D.

Blast-Furnace; Gases of ——, during occurrence of Scaffolds in the Furnace Throat. E. Kraynik. Stahl u. Eisen, 1905, **25**, 1437—1439.

THE author finds that scaffolds are indicated in gas-samples taken at the furnace-throat, by (1) an increase in oxygen; (2) great variations in carbon monoxide and dioxide; (3) the appearance of heavy hydrocarbons. The high oxygen-content probably arises from portions of the blast finding their way through the sintered mass without action. The variations in the oxides of carbon arise from irregularities in the reduction process; and the carbon monoxide is probably produced by the reaction of the dioxide on the carbon-dust formed at such times. The same carbon-dust, together with hydrogen from the moisture in the blast, the ore, and the coke, may produce the hydrocarbons. Regular analysis of the furnace-gases will at once indicate irregularities in the working of the furnace, and probably allow of forecasting the possible occurrence of explosions.—J. T. D.

Platinum; Sublimation of —— below its Melting Point. A. Guntz and H. Bassett, Jun. Bull. Soc. Chim., 1905, **33**, 1306 - 1308.

A GREY crystalline deposit, which had formed on the carbon in an electric furnace which was heated by platinum wire, was found to consist of pure platinum: since the temperature of the furnace varied between 1000° and 1300° C., sublimation had occurred. The rate of loss for a 0·3 mm. diameter platinum wire was about one-tenthousandth of its weight per hour.—T. F. B.

Platinum Ware; Repairing ——. E. J. Sweetland. Eng. and Mining J., 1905, **80**, 1163.

FOR repairing platinum ware by welding, the author uses a block or anvil prepared by mixing plaster of Paris and powdered pumice stone into a stiff paste with water and moulding it into the desired form. The article to be repaired is placed over the block and the cleaned surfaces of the pieces of metal to be welded are heated to incandescence and gently hammered together.—A. S.

Aluminium and its Alloys; Analysis of ——. C. Formenti. XXIII., page 92.

Mineral Industry of New Zealand. Bd. of Trade J., Jan. 4, 1906.

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The return of gold exported for 1904 shows a falling-off in value (as compared with that of the previous year) of £50,330, the figures being £1,987,501 for 1904, as against £2,037,831 for 1903.

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Small quantities of *platinum* are obtained at the Round Hill Gold Mining Company's works at Round Hill, South Land. A little is also reported as being present in the wash at the Takaka Hydraulic Claim, but up to the present no attempt has been made to save it commercially.

Hematite paint is made from the iron ores of Parapara, and also at Thames. The crude mineral is also supplied from a deposit at one of the South Land lignite mines for use as a pigment for colouring paper at the Mataura Paper Mills.

The *rock-phosphate* deposits near Milton, Otago, are being worked, and the stone, after calcination, is treated

at the Burnside Chemical Works and put on the market as a fertiliser.

Copper.—The Mineral Belt Copper Mining Co., Ltd., commenced operations upon the Anisced Valley section of their property in Jan., 1904. So far as can be judged at present they should have no trouble in maintaining a fair grade of output, as assays range from 5 to 26 per cent. of copper, and the ore bodies are from 2 ft. to 10 ft. wide.

Deposits of copper ore are known to exist at several places in both Islands, but their extent and value are, generally speaking, as yet unproved. A syndicate has been formed for the purpose of exploiting the deposits at Moke Creek, near Queenstown, Otago.

Petroleum.—A borehole has been put down at Moturoa, near New Plymouth Breakwater, to a depth of 2100 ft. Before reaching this depth a blower of natural gas and water was met with, and later on the strata drilled through gave evidence of the ground carrying crude petroleum to some extent. [T.R.]

Mineral Exports from Brazil. Bd. of Trade J., Jan. 11, 1906.

The following table showing the exports of minerals from Brazil during the years 1902—4 is taken from the "Brazilian Review" of Dec. 5 last:—

		1902	1903	1904
Monazite	Tons	1,205	3,299	4,860
Manganese	,,	157,295	161,926	208,280
Mica and talc	,,	11	7	14
Copper ore	,,	234	316	610
Gold bar	Grammes	3,989,982	4,322,043	3,871,426
Diamonds	Value £	65,708	51,467	29,001
Carbonates	,,	41,227	55,302	26,587
Other precious stones	,,	3,600	6,815	10,369
Platinum	Grammes	—	1,315	2,122
Rock crystal	Tons	35	23	37
Agate	,,	84	74	54

[T.R.]

Mineral Production of Tasmania. Bd. of Trade J., Jan. 4, 1906.

The following table, compiled by the Government geologist, shows, as far as can be ascertained, the quantities and values of metals and minerals produced in Tasmania in the quarters ending March 31 and June 30, 1905:—

	March Quarter, 1905		June Quarter, 1905.	
	Quantity	Value	Quantity.	Value.
		£		£
Gold,* fine, won Ozs	16,170	68,657	17,696	75,170
Silver and lead ore,† raised Tons	17,701	54,896	14,940	53,034
Blister copper,† produced ,,	1,907	152,778	1,981	157,732
Copper ore and native copper produced ,,	215	11,903	319	13,805
Tin ore ,,	928	82,602	741	61,862
Iron ore ,,	1,600	700	1,700	700
Coal ,,	13,283	11,291	12,372	10,616
Wolfram ore ,,	9	747	7	480
Bismuth ore Cwts	15	200	—	—
Total value	—	383,804	—	373,379

* Including gold contained in blister copper and silver lead bullion.
† Value of gold contents deducted.

[T.R.]

Iron Drillings; Standardised Cast ——. Amer. Foundrymen's Assoc., Dec. 26, 1905.

The Standardising Bureau of the American Foundrymen's Association has been taken over by the Government, and the standardised drillings of cast iron are now to be obtained from the Bureau of Standards of the Department of Commerce and Labour, Washington, where all orders must be sent. The charge is 2 dols. per sample of 150 grms., or 5 dols. for three samples of the same weight. [T.R.]

Mineral Production of Italy. Eng. and Mining J., Dec. 23, 1905.

Rassegna Mineraria publishes the following statistics of mineral and metal production of Italy for 1903 and 1904. The quantities are in metric tons unless otherwise specified.—

	1903.	1904.
Ores of		
Antimony	6,927	5,712
Silver	405	143
Arsenic	50	80
Iron	374,790	409,460
Manganese	1,930	2,836
Mercury	55,528	60,403
Gold	5,734	6,746
Lead	42,143	42,846
Copper	118,823	157,503
Sulphur	3,690,532	3,539,444
Zinc	157,521	148,365
Metals		
Pig and cast iron	90,744	12,598
Wrought iron	177,392	381,355
Rolled steel	154,134	177,080
Tinned plates	11,275	16,845
Antimony	905	836
Silver, kilos	24,988	24,949
Mercury	312	352
Gold, kilos	63	10
Lead	22,126	23,475
Copper and its alloys	11,217	11,873
Tin	15	15
Zinc	126	180
Non-metallic		
Boric acid	2,583	2,624
Coal, lignite, &c.	346,887	392,151
Graphite	7,920	9,765
Crude petroleum	2,486	3,544
Pyrites	101,455	112,004
Asphaltic rock	89,078	111,390
Asphaltum, mastic and bitumen	35,757	30,817
Coal briquettes	724,993	903,610
Crude sulphur	553,751	527,564
Refined sulphur	139,404	163,695
Ground sulphur	139,376	189,266
Pulverized talc	6,300	6,740

The total value of the 1904 output was 294,472,153 lire (£11,778,886), an increase of 20,799,959 lire over that of the previous year. [T.R.]

English Patents.

Iron Oxide; Preparing —— for Treatment in Furnaces. U. Wedge, Ardmore, Pa., U.S.A. Eng. Pats. 16,232 and 16,233, Aug. 9, 1905.

See U.S. Pats. 804,692 and 804,693 of 1905; this J., 1905, 1310.—T. F. B.

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Substance, 1 kilo.	Requires.		Yields.		
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rounded by a cotton fabric. The electrolyte must be constantly circulated and always kept acid with carbonic acid, as otherwise the anode becomes coated with a sticky yellow substance which increases the resistance. A current of 1 ampère per sq. dcm. is used, the voltage being 1·5 to 2 volts. As anode melted scrap copper or cement copper is used, the vats being made of tarred or paraffined wood. The carbonate formed is dissolved in sulphuric acid at 26° B. According to the author, the actual cost of the process for 100 kilos. of copper sulphate produced is 8·70 marks.—A. G. L.

ERRATUM.

Nitrogen; Utilisation of Atmospheric ——. *O. N Witt.*

This J., 1906, 27, *col.* 1 Paragraph beginning l. 12, and ending l. 9 from bottom include in the preceding parenthesis, but word as follows. "In accordance with a suggestion by R. Messel to use basic calcium nitrate, the normal calcium nitrate is," &c.

Plumbism due to Electrolysis. B. Latham. XVIII*B*, page 86.

ENGLISH PATENT.

Fish-oil, [*Electrical*] *Process for Eliminating the Odour of* ——. A. de Hemptanne. Eng. Pat. 12,525, June 16, 1905. XII, page 80

UNITED STATES PATENTS

Liquids; [Electrical] Apparatus for Sterilising, Purifying, and Ageing ——. R. C. Turner Assignor to C. E Turner. U.S. Pat. Re issue, 12,421, Dec. 12, 1905 XVIII*A*, page 86.

Ozone; Apparatus for Producing ——. W P. Rice, Assignor to The National Ozono Co., both of Chicago, Ill U.S. Pat. 807,964, Dec. 19, 1905.

AIR is forced under pressure through a closed box formed by two thin parallel flat metal plates, acting as the electrodes, and joined at their margins by insulating strips forming air-tight joints. The plates are separated by a narrow air-gap, and a flat dielectric is interposed between them and extends beyond the parallel parts of the plates The outer surfaces of the electrodes are exposed freely to the atmosphere.—B. N.

FRENCH PATENTS.

Carbon Filaments for Incandescence Lamps; Manufacture of ——. Cie. Franç. pour l'Exploit. des Procédés Thomson-Houston. Fr. Pat. 357,254, Aug. 26, 1905 II., page 62.

Voltaic Arcs; Production of Stable —— *of Great Size.* Soc. Badische Anilin und Soda Fabrik. Fr. Pat 357,358, Aug. 30, 1905. Under Int. Conv., June 23, 1905.

THE object of the invention is the production of voltaic arcs of great size by the aid of currents of small tensions An insulated electrode is fixed within a tube near to one extremity, and gas, in the form of eddies, is passed between the tube and the electrode. The tube itself is bound to the other pole of the source of current, or an electrode of special form may be used.—B. N.

Electrolysis; Improved Process and Apparatus for ——. L. A. P. Liénard. Fr. Pat. 356,862, Aug. 5, 1905.

THIS invention relates to the electrolysis of salts, more particularly of sodium chloride, for the production of sodium hydroxide and chlorine. Each electrode is enclosed in an envelope, preferably of asbestos, the anode envelopes being open at the base, whilst the cathode envelopes are thicker and consequently less porous than those used for the anodes. The electrodes, and consequently the apparatus, are short in height, and the anodes are so mounted that thin sheets of platinum may be employed. Notches are cut near to each other in the vertical sides of the sheet-iron box forming the cathode, the bottoms of the notches being as nearly as possible on a straight horizontal line. The sodium hydroxide produced is thus rapidly removed from the upper surface of the cathode liquid to the interior of the cathode box, and the stay of the hydroxide in the apparatus is thus reduced to a minimum.—B. N.

Ozonisers with Electric Discharges; Impts. in ——. H J. Wessels de Frise. Fr. Pat 357,136, Aug. 23, 1905.

THE ozoniser is composed of an envelope, with cooled walls, constructed of a substance impermeable to ultra-violet rays, and is provided with one or more forms of apparatus for producing rays of short wave length by means of electricity.—B N.

(*B.*)—ELECTRO-METALLURGY.

Zinc Fuses. A Schwartz and W. H N James. Electrician, 1905, **56**, 184.

THE authors have studied the behaviour of zinc fuses in the form of strips when used as thermal cut-outs in electric circuits. Zinc shows very little deterioration; when run continuously at 90 or even 95 per cent. of the normal fusing current; the oxidation is very slight and the final resistance of the strip is practically the same as its initial resistance. This is a marked advantage in comparison with copper, which becomes red hot with about 75 per cent. of its normal fusing current and above this point oxidises rapidly. Zinc has, however, certain disadvantages. The mass of the fuse is about 3·5 times, the volume 4·4 times, that of a copper fuse of the same length and for the same fusing current Moreover, on disruption, the metal is distributed in the form of globules, which are not only red hot, but which continue to burn in air, being accompanied by dense white fumes which deposit heavily on contiguous surfaces.—R. S H.

Aluminium Fuses. A Schwartz and W. H. N. James. Electrician, 1906, **56**, 408—409.

FUSES of aluminium wire, particularly of small diameter, are unreliable owing to the molten metal being held up by the skin of oxide which forms on the surface. The present study was therefore limited to the metal in the form of strip The metal attains a dull red heat just before fusion, and on disruption will throw off burning globules of metal a distance of several feet even on a low-tension circuit. Aluminium, zinc and cadmium, being highly electro-positive to copper and brass, are liable to considerable corrosion of the contacts when used in damp situations. Consequently their application is somewhat limited.
—R. S. H.

Tantalum, Production and Properties of ——. I. Nordenskjöld. Tekn. Tidskrift, Stockholm, 1905, Chem. and Mining Sect., 26—28 Proc. Inst. Civ. Eng., 1905, **162**, 39—40 (see this *J.*, 1904, 140).

METALLIC tantalum can be prepared by Goldschmidt's alumino-thermal method, but it is then largely alloyed with aluminium, and is brittle. Pure tantalum, which is rather hard and very malleable, is obtained by passing an electric current through the oxide in a vacuum, or by smelting the oxide *in vacuo* by the aid of the electric arc. Pure tantalum has a specific heat of 0·0365. The cast metal has the sp. gr. 16·64. Specific electrical resistance of a wire 1 m. long and 1 sq. mm. cross-section, 0·165 ohm, with an average rise of 0·3 per cent. per degree of temperature between 0° and 100° C., and of 0·26 per cent. between 0° and 350° C., tensile strength of a wire of 1 mm. diameter, 93 kilos per sq. mm.; elongation, 1—2 per cent.; modulus of elasticity of a wire of 0·08 mm. diameter, 19,000 kilos. per sq. mm.

Tantalum takes up hydrogen readily, but its properties do not appear to be appreciably affected thereby; the hydrogen can be expelled only partially and with difficulty even by melting the metal. Oxygen has little action on tantalum; at 400° C. it is tarnished slightly yellow, the colour changing to blue at a low red heat, whilst the wire ultimately becomes coated with a white layer of tantalum pentoxide. If an electric current

be sent through a tantalum wire placed under the bell of an air-pump into which oxygen is gradually admitted, no action takes place until the pressure reaches 20 mm. of mercury, and even at higher pressures oxidation only proceeds very slowly. Tantalum is not acted upon by acids and alkalis. On heating it in nitrogen, the gas is absorbed, and the tantalum becomes brittle. It can be alloyed with iron, and hardens the latter just as vanadium does. Carbon renders tantalum hard and brittle.—A. S.

Barium; Preparation of Pure ——. Guntz. Comptes rend., 1905, **141**, 1240—1241.

THE author's method (this J., 1902, 54) will not yield a metal purer than 98·5 per cent. But by dissociation of the hydride he has obtained a practically pure metal. Preparing the metal as described (*loc. cit.*) and using a flat-bottomed boat and a quantity of amalgam to yield not more than 20 grms. of metal, he allows hydrogen to enter and to be absorbed for several hours at 900° C., and then gradually heating to the melting-point of the hydride formed (1200° C.), obtains a hydride free from mercury. This, after cooling, is heated to 1200° C. *in vacuo*, in an iron tube open at one end and enclosed in a porcelain tube connected with a mercury-pump. When dissociation is complete, the barium begins to distil, and is collected in a water-cooled polished steel tube placed near the mouth of the iron tube. The metal is silver-white, and has a density of 3·78; the density of the hydride is higher than that of the metal, *viz.*, 4·21. Pure metallic strontium has been similarly prepared. J. T. D.

UNITED STATES PATENTS.

Electrolytic Deposits; Process of Obtaining Marketable ——. P. Steenlet, Assignor to M. P. Lloyd, Brussels. U.S. Pat. 807,973, Dec. 19, 1905.

SEE Eng. Pat. 16,988 of 1903; this J., 1903, 1356.—T. F. B.

Metals [*Electrolytically*]; *Galvanising* ——. G. L. Meaker, Evanston, Ill., Assignor to The American Steel and Wire Co., New Jersey. U.S. Pat. 808,103, Dec. 26, 1905.

THE metal is subjected to the action of an electric current in an electroplating apparatus, the electrolyte consisting of a solution of zinc chloride, zinc sulphate and a small proportion of a vegetable acid.—B. N.

Galvanoplastic Deposits; Method of Separating —— from Metal Matrices. E. Albert, Munich, Germany. Assignor to F. Wesel, New York. U.S. Pat. 808,331, Dec. 26, 1905.

A METALLIC bath is heated to a temperature lower than the melting point of the matrix, and the latter and the deposit are suddenly heated by floating them on the molten metal.—B. N.

Decarburising [*Ferrochrome*]; *Process of* ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to The Willson Aluminium Co., New York. U.S. Pat. 807,034, Dec. 12, 1905.

A METAL or alloy, *e.g.*, ferrochrome, low in carbon, is produced by first reducing the ore in presence of carbonaceous material to obtain a product high in carbon, and then decarburising the same by using it as an electrode and fusing it in absence of carbonaceous material and in presence of a substance having a high affinity for carbon. —A. S.

Calcium [*Electrolytically*]; *Production of Metallic* ——. W. Borchers and L. Stockem, Aachen, Germany. U.S. Pat. 808,066, Dec. 26, 1905.

THIS invention relates to a process for the production of metallic calcium by the fusion and electrolysis of anhydrous calcium salts. The small cathode is kept sufficiently cool to prevent the calcium, as it deposits, from melting, and the metal is thus obtained in a spongy state. The spongy calcium is pressed whilst under the molten calcium salt, and thus withdrawn from the bath.—B. N.

FRENCH PATENTS.

Ore Treatment; Magnetic Separator for ——. Soc. Maschinenbau Anstalt Humboldt. Fr. Pat. 357,216, Aug. 5, 1905.

A NON-MAGNETIC drum revolves around a fixed permanent magnet, a "magnetic star," having radial projections, influencing about three-fourths of the circumference of the drum, the projections being alternately positive and negative. Between the magnetic arms is a series of trapezoidal projections which become magnetised; outside the drum is a skeleton or framework of iron having many rectangular openings. The whole arrangement is placed above three collectors or bins which receive the various products of the operation. The material to be treated is fed on to the rising shoulder of the revolving drum just above the first of the magnetic radii by means of a shoot which, aided by the magnetised projections, holds the variously magnetic particles as they are carried around by the drum, whilst the non-magnetic particles fall away at once into the first of the collectors. In their passage over the remaining alternately magnetised radii, the more magnetic particles are separated from those which are less magnetic and each product finally falls into its own collector.—J. H. C.

Metals; [Electrolytic] Method of Purifying ——. H. M. Chance. Fr. Pat. 357,466, Sept. 4, 1905.

SEE U.S. Pat. 800,984 of 1905; this J., 1905, 1116.—T. F. B.

Etching [Designs on] Metals, and especially Printing Cylinders [Electrolytically]. J. A. Dejey. First Addition dated Aug. 16, 1905, to Fr. Pat. 335,941, Sept. 18, 1903 (this J., 1904, 327).

THE addition relates to the use of insoluble anodes of platinum, carbon, &c., for the electrolytic deposition of tin, iron, copper, lead, &c., and to the application of this process to photo-engraving and all work of engraving on metals.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 32.)

ENGLISH PATENTS.

Sewage Sludge; Method and Apparatus for Recovering Fatty and Oily Matter from —— —. The Mayor, Aldermen and Citizens of Bradford, J. Garfield and J. Grossmann, Manchester. Eng. Pat. 29,558, Dec. 31, 1904. XVIII*B.*, page 86.

Fish-oil; [Electrical] Process for Eliminating the Odour of ——. A. de Hemptinne, Gand, Belgium. Eng. Pat. 12,525, June 16, 1905.

THE oil to be treated is placed in a rotating cylinder in which is arranged a series of parallel plates consisting alternately of metal and glass. The metal plates are connected with a supply of electricity and the drum is filled with an atmosphere of hydrogen. As the drum rotates, the oil is caught up by a number of gutters fixed to the internal wall of the drum and is sprinkled over the plates. The action of the silent electric discharge in the atmosphere of hydrogen is stated to remove all odour from the fish-oil. (See also Eng. Pat. 1572, 1905; this J., 1905, 448.)—W. P. S.

UNITED STATES PATENTS.

Oil, Grease and the like from Oil-Bearing Material; Process of Extracting ——. F. J. Maywald, Assignor to E. H. Fallows, both of New York. U.S. Pat. 807,567, Dec. 19, 1905.

THE invention relates to a process of extracting oil, grease, or the like from water or similar liquid, or from material floating or in suspension in the liquid. Carbon tetrachloride is added and allowed to descend through the mass;

the heavy layer is run off and the carbon tetrachloride separated from the dissolved grease or oil by distillation. —B. N.

Cooling and Drying Oil-Cake; Apparatus for ——. A. W. French, Piqua, Ohio. U.S. Pat. 808,081, Dec. 26, 1905.

The material to be cooled and dried is fed into an upright cylinder, having a conical bottom, provided with an internal conduit for the treating agent, and suspended from one arm of a weighted lever. A positively acting rotary discharge drum is fixed to the bottom of the cone and receives motion from a pulley and belt. A belt-tightening device, actuated by a rod attached to the weighted lever, presses on the belt, and when the cylinder is full, and consequently heavy, the lever is moved, the belt tightened and the discharge drum commences to work. As soon as the cylinder is lightened, the lever moves again, the belt becomes slack and the discharge is stopped until the cylinder is filled up again. In this way the weight of material in the cylinder is kept nearly constant.—W. H. C.

Soap Machine. N. G. Knight, Crestline, Ohio. U.S. Pat. 806,816, Dec. 12, 1905.

The apparatus claimed consists of a jacketed vessel, in which revolves a shaft carrying mixing blades. There are also buckets carrying an internal gear, which rotate about the shaft, a gear wheel on one end of the shaft, and a pinion on the inner face of the head of the vessel meshing with the gear-wheel and the internal gear of the buckets. —C. A. M.

FRENCH PATENT.

Oils; Process and Apparatus for Extracting — —. W. H. Gesner and A. R. Brandly. Fr. Pat. 357,329, Aug. 29, 1905.

The vegetable seeds, &c., are treated with a solution of a silicate of sodium or other alkali metal to liberate the oil, the process being facilitated by a preliminary crushing and drying of the material. The mass, after being boiled with the silicate, is plunged into hot water or a suitable aqueous solution, with the result that the oil separates out on the surface, whilst the residue falls to the bottom. The apparatus claimed for carrying out this process comprises a kettle, a drying apparatus and a separator, the latter being provided with internal partitions to facilitate the separation of the oil.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 33.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENT.

p-Amidophenylethersulphonic Acid; Manufacture of a New —— *and of a Colouring Matter* [*Azo Dyestuff*] *therefrom.* C. D. Abel. From Act.-Ges. f. Anilinfabr. Eng. Pat. 9325, May 3, 1905. IV., page 65.

UNITED STATES PATENT.

Lampblack; Apparatus for Making ——. G. Wegelin, Kalscheuren, Germany. U.S. Pat. 807,646, Dec. 19, 1905.

See Eng. Pat. 13,837 of 1903; this J., 1903, 1190.—T. F. B.

FRENCH PATENT.

Paints, Varnishes, &c., Rendered Non-inflammable by the Addition of Carbon Tetrachloride. E. D. P. Fournier. Fr. Pat. 350,314, Nov, 16, 1904.

The composition of a non-inflammable paint is claimed. It consists of potassium or sodium silicate, 400 parts; 5 per cent. borax solution, 100 parts; glycerin containing 5 per cent. of carbon tetrachloride, 150 parts. This liquid is then mixed with suitable proportions of pigments, &c. The addition of carbon tetrachloride to varnish and the constituents of paints is also claimed.—W. P. S.

GERMAN PATENT.

Drying Process, in which the Material to be Dried is Subjected to the Action of Light Rays. A. Junghans. Ger. Pat. 162,696, Sept. 23, 1904. I., page 59.

(*B.*)—RESINS, VARNISHES.

Copals; Physical and Chemical Properties of ——. Bottler. Chem. Rev. Fett-u. Harz-Ind., 1906, **13**, 1—5.

Tables are given showing the external appearance, colour, translucency, lustre, fracture, specific gravity, hardness, fusibility, and solubility of fourteen of the principal varieties of commercial copal. The specific gravity of the most valuable varieties lies between 1·03 and 1·07 (estimated without removal of entangled air). If the air be removed, higher numbers are obtained, but the less these differ from the former the greater is the value of the copal. Thus Lindi and Zanzibar copals give numbers differing by only 0·001—0·0015, whilst the (South American) Hymenæa copal and Kauri copal show differences of 0·06—0·064. Relative hardness is an important characteristic for distinguishing copals. A scale of hardness is furnished, beginning with Zanzibar copal (the hardest) and ending with the soft Brazilian varieties. With regard to melting point, the author adopts the temperature at which a fragment in a capillary tube becomes transparent, rather than that of complete liquefaction, since at the latter point decomposition has already commenced. Different varieties exhibit melting points ranging from 90° to 360° C. Besides the older solvents for copal, chlorhydrin, terpineol, and carbon tetrachloride are employed. Oil of turpentine only dissolves copal when ozonised. An excellent method of dissolving copal consists in drying at 100° C., mixing with sand, treating for 24 hours with dry ether, and then adding an equal volume of warm alcohol. Ether containing ⅓ of its weight of camphor is another good solvent. A table of solubilities, originally published in Dingler's Polyt. J. (see this J., 1893, 773) is here reproduced with modifications and extensions. Some varieties of copal possess an odour; others are inodorous. Other physical characters, such as refractive index, "streak," &c., are useless as distinctive features.—M. J. S.

Japan Lac [*Ki-urushi*]. A. Tschirch and A. B. Stevens. Arch. Pharm., 1905, **243**, 504—553.

Two authentic specimens of the milky juice of the Japan lac tree, *Rhus vernicifera*, were examined. This lac has the following percentage composition. Soluble in alcohol, 72·4 per cent.; soluble in water, 4·05 per cent.; moisture, 21·20 per cent.; insoluble residue, 2·35 per cent. The portion soluble in alcohol, the urushinic or laccic acid of Yoshida, or the laccol of Bertrand, is shown to be a mixture, being separable by light petroleum spirit into two substances, one soluble, the other insoluble. The former is further separable into a non-volatile toxic body, a gum and an enzyme. Lac also contains free acetic acid. The hardening and blackening on exposure to air of the lac, which normally is light yellowish-grey, and of the consistence of a balsam, is due to the action of the oxydase, laccase, on the resins. The lac, spread on wood and covered with a damp paper, soon becomes nearly black and hardens in 24 hours. If it be first sterilised by heat, it does not alter when thus exposed. If sterilised, and then treated with alkali, it blackens at once, but does not harden.

The authors have named the unoxidised resin *urushin*, the oxidation product *oxyurushin*. On treating the lac with alcohol *in vacuo*, the soluble portion, on removal of the solvent, gave to ether a body, which, when shaken

out and treated with various alkalis, removed a resin which ultimately changed, in all cases, to oxyurushin. Fractional precipitation with lead acetate gave no definite results.

Both urushin and oxyurushin contain nitrogen, the latter giving analytical figures corresponding to the formula $C_{102}H_{138}N_2O_{10}$. This is the first recorded instance of the occurrence of a nitrogenous substance among the resins. Neither urushin nor oxyurushin have a true acid function. It is remarkable that although lac is so readily oxidised, oxyurushin, the oxidation product, is extremely stable and resistant to reagents.

The poison of lac is a non-volatile body, and neither a poisonous gas or a volatile substance as stated by some investigators. It has not been isolated in a pure state, but as an oily liquid. Its action is intense; a very minute particle coming into contact with the skin causes great irritation and inflammation. It resembles toxicodendrol, the toxic substance isolated by Pfaff from *Rhus toxicodendron* and is closely allied to cardol, from *Anacardium* seeds; it has been named "*vernicifero*l." It appears to be strictly local in its action on the epidermis. It is intimately combined with the resin, which adheres with remarkable persistence to any article with which it comes in contact, so that in handling lac, the hands should be well protected, and any lac coming in contact with the skin should be at once removed by means of benzene or petroleum. The portion of the lac insoluble in alcohol was found to be chiefly oxyurushin.

It was not found possible to separate the gum and enzyme of the lac quantitatively. The gum contains nitrogen, and gives pyrrol on heating with alkali. When hydrolysed it yields sorbose.

The enzyme, resembling the oxidising ferments accompanying other gums, is a gummase, and has been designated *lac-gummase*.—J. O. B.

Euphorbium Resin. A. Tschirch and Paul. Arch. Pharm., 1905, **243**, 249—291.

Euphorbium resin contains 0·7 per cent. of a free amorphous resin acid, euphorbinic acid, $C_{21}H_{30}O_6$; an aldehyde present in traces only; two resenes, both insoluble in caustic potash, one crystalline, viz., euphorbone, $C_{30}H_{48}O$, to the extent of 40 per cent., the other amorphous, 21 per cent.; also 20 per cent. of water-soluble carbohydrate which differs in character from gum, and 2·5 per cent. of soluble malates, together with an acrid principle. The last has not been isolated in a state of purity, it is removed by most solvents, and is very soluble in alcohol. It reduces alkaline cupric tartrate solution, is precipitated by tannin, also by lead salts, and is coloured, and precipitated by ferric chloride.

Euphorbium resin may be identified by the following reaction: 10 grms. are extracted with 10 c.c. of light petroleum spirit. After filtration, the solution is floated on to strong sulphuric acid containing one drop of nitric acid in 20 c.c. A blood-red colour zone is formed at the zone of contact; on shaking, the colour passes into the lower acid layer, and persists for a couple of days, before turning brown.—J. O. B.

Resin Acids of the Coniferæ. A. Vesterberg. Ber., 1905, **38**, 4125—4132.

What was formerly known as pimaric acid is really a mixture of large quantities of abietic acid with small quantities of true pimaric acid, possibly also with other resin acids. Both *d*- and *l*-pimaric acids give sparingly soluble ammonium salts which crystallise from dilute ammonia in fine needles, whereas the ammonium salt of abietic acid sets to a gelatinous soap. If the pimaric acid be present in considerable proportions, the needles of the ammonium salt separate out soon after cooling, but if the abietic acid be present in predominating quantities, the crystallisation of the ammonium pimarate may not appear for days or even weeks. The author has isolated *d*-pimaric acid from Bordeaux rosin (*Pinus Pinaster*). By digesting the rosin with 70—80 per cent. alcohol, a crystalline powder was obtained, consisting mainly of abietic acid; this product when converted into the ammonium salt, yielded practically no crystallisation of the pimarate. But when the pimaric acid had been concentrated by a few recrystallisations from 85 per cent. alcohol (by volume), a good crystallisation of ammonium pimarate was obtained. This was converted first into the sodium salt and then into *d*-pimaric acid, m. pt. 210°—211°C.—J. F. B.

United States Patent.

Turpentine from Wood; Apparatus for Extracting ——. J. G. Gardner, Assignor to Pure White Turpentine Co. Jacksonville, Fla. U.S. Pat. 808,035, Dec. 19, 1905.

The apparatus consists of a vertical vessel "having a drop-down door provided with a perforated plate, the door and plate being separated to provide a steam chamber." The plate supports the mass of sawdust or ground wood composing the charge, and keeps the same from falling into the outlet provided in the door for the escape of vapours. Means are provided for directing steam downward through the charge and plate, into the outlet, with means for opening up paths for the passage of the steam. —C. S.

French Patent.

Resin and Resin Oils; Method of Treating ——. K. Bosch. Fr. Pat. 357,391, June 21, 1905. Under Int. Conv., June 21, 1904.

Resin is distilled in the usual manner until the resin "acids" and pinoline have been driven over. The rate of distillation is then increased so that a clear yellow fraction is obtained amounting to about 60 per cent. of the bulk of the resin taken. This fraction is then heated to boiling, and treated with from 10 to 18 per cent. of sodium hydroxide solution (40° B.). The heating is continued until the resin soap separates from the remaining resin oil. The latter is suitable for use as an insecticide, in paints, &c.—W. P. S.

(*C.*)—INDIA-RUBBER, Etc.

English Patents.

Caoutchouc, Gutta-Percha, Balata and the like; Treatment of the Milks or Laticiferous Juices of ——. L. P. T. Morisse, Paris. Eng. Pat. 7094, April 11, 1905.

The object of the invention is to render possible the transport of the latices, from the trees to a distance, without coagulation setting in. This is effected by coating all the surfaces of the trees, with which the latex comes in contact, with an aqueous solution made alkaline with ammonia, and by adding to the vessels in which it is collected, a 10 per cent. alkaline, or "decalcifying" solution (*e.g.*, of potassium oxalate or sodium fluoride). For transport, india-rubber latices are mixed with a solution of an alkali or an alkaline or "decalcifying" salt (*e.g.*, 3 grms. of ammonia per 100 grms. of latex), a solution of phenol or of formaldehyde being also added in the case of *Hevea* latices; gutta-percha or balata latices are mixed with formaldehyde solution, care being taken that the liquid is distinctly alkaline.—E. W. L.

Felt Substance for Industrial Purposes and Method of Manufacturing the same. R. Haddan, London. From A. Ripert, Asnière, France. Eng. Pat. 2974, Feb. 13, 1905.

The "felt" claimed as a new article of manufacture consists of a mixture of pure india-rubber and entire asbestos fibres, the latter being present in quantities not exceeding 60 per cent. of the weight of the mixture. Pure india-rubber is heated to 266° F., and well mixed with a small quantity of asbestos. The mass is then heated to its melting point (293° F). and the remainder

of the asbestos added, and the whole well mixed in order to ensure the thorough felting of the mixture. Cotton or silk-waste fibres may also be incorporated with the mixture.—E. W. L.

FRENCH PATENTS.

Hydrocarbons; Transformation of —— [*into Rubber, &c., Substitutes*]. E. A. L. Rouxeville. Fr. Pat. 356,716, Aug. 7, 1905.

LIQUID or solid hydrocarbons of all kinds, or their derivatives, are oxidised, and the oxidation products separated, purified, coagulated and vulcanised. The resulting compounds are stated to be viscous or solid bodies (according to the original hydrocarbon used). They are employed as substitutes for rubber, insulating materials, in the preparation of varnishes, &c. For example, a rubber substitute is prepared by dissolving 1 part of rosin in 5 parts of turpentine oil, filtering, and treating the solution with 2 parts of sulphuric acid. The portion of the product which is liquid after standing, is boiled with excess of water, and the mixture neutralised with alkali. The product is filtered off, washed, again boiled with water, collected and treated with sulphur chloride. The resulting body is stated to closely resemble ordinary gutta-percha.—T. F. B.

Rubber Waste of all kinds; Process for the Regeneration of ——. J. Neilson. Fr. Pat. 357,336, Aug. 29, 1905.

THE waste vulcanised rubber is dissolved in rosin oil (b. pt. 300°—360° C.), and the caoutchouc is precipitated from the solution by a ketone, for example, acetone.

—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 33.)

Kamatchil Bark. J. Paessler. Deutsche Gerb.-Zeit., 1905, 139—140.

THIS newly imported tanning material from Saypan (Ladron or Marianne Islands) was submitted to the author for valuation. An analysis gave the following results:—Tannins absorbed by hide, 29·3; Non-tannins, 5·6; Insoluble in water at 15° C., 52·1; and Water, 13·0 per cent. The material contained 0·2 per cent. of dextrose and 0·4 per cent. of sucrose. 23·0 per cent. of the tannins are easily soluble and the bark therefore compares favourably with oak- and pine-bark, but as it contains much less non-tannins than these, it should be used for tanning in combination with one of them. The new tanning material imparts to the leather a very pale colour which darkens somewhat on exposure to light and air. Judging from the results obtained by practical experiments in tanning calf-skins for russet-calf and hides for light sole-leather (Vache-leder), the author thinks that Kamatchil-bark should become as popular as mallet-bark has, and he draws special attention to its remarkable weight-giving properties.—F. K. K.

UNITED STATES PATENTS.

Tanning Vat. R. Koenitzer, St. Louis, Mo. U.S. Pat. 806,899, Dec. 12, 1905.

THE hides or skins are suspended from shafts mounted in a frame on the top of the vat containing the tanning solution. these shafts being so operated that when they are rotated, the hides are successively "rolled and unrolled out of the tanning solution."—A. S.

Hides; Apparatus for [*Electrically*] *Treating* ——. F. B. Hinkson, Newcastle, Pa., Assignor to J. M. and J. J. Flannery, Pittsburg, Pa. U.S. Pat. 807,930, Dec. 19, 1905.

THE apparatus consists of a tank furnished with bars, from which the hides are supported within the tank. A number of pairs of electrodes are also arranged in the tank, parallel to the bars, the electrodes of the same polarity being connected in multiple. Means are provided for reversing the direction of the electric current passing through the electrodes.—A. S.

FRENCH PATENTS.

Tanning; Method of ——. E. E. Guignan and L. E. E. Defaix. Fr. Pat. 350,242, Oct. 20, 1904.

ACCORDING to this patent, hides are soaked in a solution of sodium carbonate of 10° B. for three to six hours. After washing with water they are allowed to remain for five hours in a bath of caustic soda the strength of which may vary from 2° to 30° B. From this they are transferred to a bath of hydrochloric acid (1° to 5° B.) in which they remain for two hours. Finally the hides are washed and the "beam-work" finished in the usual way. The tannage consists of a special bath of sodium or ammonium sulphoricinoleate (2 to 30 per cent.) and sumach extract, or similar tanning material (2 to 50 per cent.). The strength of this bath is gradually raised from 4° B. to 30° or 40° B.

—W. B. H.

Leather; Process for Making —— Tough and Impervious. F. W. Stoffer. Fr. Pat. 357,037, July 25, 1905.

LEATHER is impregnated with a solution of 1 part of caoutchouc or gutta-percha in 16 parts of benzene or other solvent, to which is added 10 parts of linseed oil. Wax and resin may be added to thicken the solution.—W. B. H.

Leather; Oil for the Preservation of ——. L. Vulted, née Maier. Fr. Pat. 356,936, August 16, 1905.

CLAIM is made for an oil which will penetrate either dry or wet leather, and will make it thoroughly impervious to water. The oil is applied cold and consists of poppy-seed (*Papaver somniferum*) oil, 45 grms.; sesame (*Sesamum orientale indicum*) oil, 45 grms.; oil from the fruit of *Eriobotrya japonica* (a kind of Japanese medlar), 10 grms.—W. B. H.

Glue; Method of Purifying ——. W. S. Sadikoff. Fr. Pat. 356,849, July 17, 1905.

GLUE is soaked in cold water and dissolved in a hot 25 per cent. solution of magnesium sulphate. The hot solution is filtered, and to the filtrate is added a 25 per cent. solution of magnesium sulphate containing 0·5 per cent. of hydrochloric acid (or, if necessary, sulphuric acid). A white flocculent precipitate is obtained which is difficult to filter. The remainder of the glue in the saline solution is extracted by treatment with magnesium sulphate.

The viscous matter is washed, then dissolved in hot water, and allowed to cool, a quantity of weak alcohol acidulated by 1 per cent. of hydrochloric acid being added just before the mass solidifies. From 2 to 3 parts by volume of strong alcohol (methyl or ethyl) are then added and the solution filtered, charcoal being used if necessary. The glue is finally precipitated from this solution by neutralising with ammonia and washing with alcohol or water.—W. B. H.

XV.—MANURES, Etc.

(*Continued from page* 34.)

Manganese as a Fertiliser. G. Bertrand. Comptes rend., 1905, 141, 1255—1257.

THE discovery of the presence of manganese in leaves led to experiments on the employment of salts of this metal in fertilisers. It was found on the small scale that very appreciable results were obtainable with the use of an extremely minute proportion of manganese. This observation was satisfactory from the point of view of expense, but, seeing that most arable soils already contain notable quantities of manganese, it raised a doubt whether the addition of further small proportions could give any beneficial effect. The author has conducted field experiments with oats on a soil which contained 0·057 per cent. of manganese, including 0·024 per cent. soluble in boiling 1 per cent. acetic acid. Two plots of ground received the usual fertilisers in the same proportions, and to one of them manganese sulphate, at the rate of 50 kilos. of dry

salt per hectare = 1·6 grm. of metal per sq. metre, was added. The results were extremely satisfactory and showed an increase in the total crop of 22·5 per cent. in favour of the plot to which manganese was added. This increase was made up of 17·4 per cent. increased yield of grain and 26·0 per cent. increase of straw. The analysis showed that the grain from the plot, which received the manganese, had a higher bushel-weight and contained less moisture and slightly less nitrogen than the grain from the control plot.—J. F. B.

Fertilisers in Japan. Bd. of Trade J., Jan. 4, 1906.

In 1904, the imports of fertilisers, which had been growing steadily for some years, showed a slight diminution, owing to disorganisation caused by the war. During the first six months of 1905, however, the value of the fertilisers imported amounted to 12,976,352 yen, as compared with 5,757,075 yen in 1904. The increase was shown chiefly in oilcakes (7,265,109 yen, as compared with 2,035,279 yen); this remarkable increase was due to the resumption of commercial relations with Newchwang, the chief centre for the export of oilcakes. A large increase is also shown in the imports of ammonium sulphate (638,217 yen), calcium phosphate (1,179,304 yen), and sodium nitrate (636,997 yen); these, with oilcakes, being the fertilisers most in demand. A very large proportion of this trade goes to Kobe, which takes six-sevenths of the oilcakes, two-thirds of the phosphate and sulphate, and one-half of the nitrates. China furnishes all the oilcakes imported; one-third of the nitrates are imported from the United States, and the remainder from Chile and various other countries; nearly the whole of the import of calcium phosphate and ammonium sulphate comes from the United Kingdom. There are a certain number of chemical factories at Osaka which produce fertilisers, more especially ammonium sulphate. [T.R.]

English Patents.

Sewage Sludge; Method and Apparatus for Recovering Fatty and Oily Matter from ——. The Mayor, Aldermen and Citizens of Bradford, J. Garfield and J. Grossmann. Eng. Pat. 29,558, Dec. 31, 1904. XVIII*B*., page 86.

Chlorine and Citrate-Soluble Phosphate; Treatment of Phosphates and Production of ——. A. Clemm, Mannheim, Germany. Eng. Pat. 9443, May 4, 1905.

See Fr. Pat. 354,109 of 1905; this J., 1905, 1067.—T.F.B.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 34.)

Sugar Production of Argentina. Bd. of Trade J., Dec. 28, 1905.

The production of cane sugar in the Argentine Republic in the year ending Oct. 31, 1905, amounted to 129,043 metric tons; in the same period of 1903—1904, it amounted to 124,763 tons, an increase of 4280 tons in 1905. There are 37 sugar factories in operation, and one refinery in Rosario. The industry is very prosperous at present, and prices have not varied much in spite of the larger production, owing, presumably, to larger consumption in the country. The better-managed factories with modern machinery are paying good dividends, assisted by the very high import duty on sugar. [T.R.]

Trehalose; Detection and Determination of —— in Plants, by means of the Enzyme Trehalase. P. Harang. XXIII., page 93.

Digitoxose. H. Kiliani. XXIV., page 93.

Starch Paste; Certain Liquefying and Saccharifying Actions on ——. P. Petit. XVII., see below.

Gum Tragacanth; Detection of Gum Acacia in Powdered ——. E. Payet. XXIII., page 92.

English Patents.

Drying Vegetables, Fruits, Starch and the like; Apparatus for ——. N. Yagn. Eng. Pat. 5225, March 13, 1905. XVIII*A*., page 86.

Adhesive or Binding Agent Applicable for use in the Manufacture of Beltings, Doubling Cloths and other Manufactures. P. C. D. Castle, Bebington, Cheshire. Eng. Pat. 6936, April 1, 1905.

The adhesive consists of a mixture of gum tragasol, or "carbolised" gum tragasol, and castor oil.—E. W. L.

German Patent.

Drying Process, in which the Material to be Dried is Subjected to the Action of Light Rays. A. Junghans. Ger. Pat. 162,696, Sept. 23, 1904. I., page 59.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 36.)

Barley and Green Malt; Influence of Light on Germinating ——. G. Bode. Woch. f. Brau., 1905, **22**, 768—770.

Many maltsters have observed that blue light has a favourable influence on the germination process, and they therefore cover the windows of their maltings with a blue wash. At the same time it must be admitted that the influence of light in the malting process must be very small compared with that of other conditions such as temperature and moisture, since pneumatic malting is conducted perfectly well in the dark. The rays of the blue half of the spectrum do, however, appear to stimulate the mobility of the protoplasm and to increase the vital activities of the corn. The rays of the red half of the spectrum are favourable to chlorophyllic assimilation, but, since the grain in the malting stage develops quite independently of such assimilation, these rays may be excluded without harm. It is important, however, that the germinating grain should be protected from direct sunlight. The blue and ultra-violet rays are known to have a destructive action upon diastase. This action, however, is mitigated on the one hand by the natural protection afforded by the yellow colouring matter of the husk and by the fact that the total amount of light admitted to the malting floor is never very great, and on the other hand by the circumstance that the brewer always works with an excess of diastase over his actual requirements. For the preparation of highly diastatic malt for distilling purposes, however, it might be advantageous to work entirely in the dark or behind windows of yellow glass.—J. F. B.

Starch Paste; Certain Liquefying and Saccharifying Actions on ——. P. Petit. Comptes rend., 1905, **141**, 1247—1249.

Malt infusions react towards guaiacum tincture like solutions of ferrous and ferric or manganous and manganic compounds. The presence of iron can easily be detected in the coagulum from the boiled infusion; manganese is also present in minute traces. The ferric compounds can be reduced by treating the infusion with caustic soda and aluminium; after neutralisation of the alkali by acetic acid, the liquid does not give a blue reaction with guaiacum and is devoid of liquefying and saccharifying properties. Conversely, if a malt infusion gives, in the natural state, only a very faint guaiacum reaction, it may be made to give a full reaction by adding a trace of alkali, passing a current of air through the liquid and re-acidifying with lactic acid. The liquid, after such treatment, is still capable of liquefying starch, but has lost its saccharifying property. Citric acid destroys the property of liquefying starch and of reacting with guaiacum. Solutions possessing some of the properties of malt infusions can be made artificially by treating a solution of commercial albumin with ferrous and ferric oxides. The filtered solution gives a blue reaction with guaiacum and has a pronounced liquefying action on starch paste at 20° C. The addition

of lactic acid and asparagine to the albumin solution containing the oxides of iron intensifies the starch-liquefying action very considerably, and even imparts a distinct saccharifying power to the liquids.—J. F. B.

Fermentative Enzymes from Plants; Isolation of ——. J. Stoklasa. Centralb. Bakt. [Abth. 2], 1904, 13, 86; through Z. ges. Brauw., 1905, 28, 860.

THE author sums up the conclusions drawn from his various researches on anaërobic respiration in plants (see this J., 1905, 907 and 204). It is definitely established that the process of anaërobic respiration in the plant cell is an alcoholic fermentation accompanied by the production of lactic acid, the mechanism of the process being governed by the nature of the available carbohydrates. The anaërobic metabolism of plants is identical with fermentation by yeast, and its quantitative relationships are the same. Aërobic respiration is probably a secondary phenomenon; the primary process is the intra-molecular movement of the atoms in the molecule of living matter involving the migration of oxygen in the molecule. In absence of air, the reduced atomic grouping—*i.e.*, alcohol—has no opportunity of becoming fixed with the absorption of oxygen in molecular syntheses; it is therefore eliminated together with carbon dioxide. But in presence of air such fixation occurs under the influence of aëro-oxydases and the alcohol takes part in the building up of new portions of living protoplasm, in which process carbon dioxide and hydrogen are not formed.

The migration of atoms in the molecule of dextrose is termed "glycolysis," a process which is induced by glycolytic enzymes; first by an enzyme "alcoholase," and secondly by one called "lactolase," which produces lactic acid.—J. F. B.

Yeast; Action of Stimulants on ——. Delbrück. Tageszeit. f. Brau, 1905, No. 242.

CERTAIN substances, especially the salts of phosphoric acid, asparagine, peptone, magnesium sulphate, &c., stimulate the fermentative power of yeast in a most marked degree. The stimulating influence of the addition of cereal grist is to be ascribed to the presence of such bodies in the corn. Oat grist shows the strongest zymase-producing power, owing probably to the phosphates contained therein. Certain industrial effluents, such as the water used for washing the yeast, also increase the zymatic power and fermentative activity. The metabolic products of yeast isolated by Kutscher also belong to the category of yeast stimulants. (See this J., 1905, 555 and 1120.)—J. F. B.

Beer; Fixation of Carbon Dioxide and Permanence of "Head" in ——. Mohr. Tageszeit. f. Brau., 1905, No. 242.

THE fact that beer is capable of retaining a larger proportion of carbon dioxide than an equivalent mixture of water and alcohol is attributed to physical causes rather than to chemical. The main factor is the viscosity of the liquid, which increases the stability of the supersaturated solution. The viscosity is due to the colloids which hold the carbon dioxide in solution by a kind of surface action termed "adsorption." The "head" of foam also offers a resistance to the escape of the carbon dioxide remaining in the beer. The existence of the "head" is again mainly due to the colloids, but the hop resins also play a part. The carbohydrates have no appreciable influence.—J. F. B.

Tannin in Wine; Determination of ——. L. Krâmszky. XXIII., page 93.

ENGLISH PATENTS.

Yeast; Desiccating and Preserving ——. H. Livingstone, London. Eng. Pat. 27,026, Dec. 17, 1904.

CLAIM is made for the method of desiccating and preserving yeast consisting in removing the bulk of the liquid therefrom, dividing or crumbling the moist yeast, spreading the latter out thinly, subjecting it to a current of pure air, naturally dry or artificially dried, of a temperature not exceeding about 70° F., and packing the dried yeast in tins or other receptacles in a vacuum.—T. H. P.

Caramel; Preparation of ——, *and its Application as a Colouring Matter in the Production of Fermented Liquors and for other Industrial Purposes.* T. D. Lichtenstein, London. Eng. Pat. 28,547A., Dec. 28, 1904.

CLAIMS are made for (1) the process of purifying caramel by subjecting its solution to dialysis, with or without subsequent concentration; (2) the products thus obtained and beverages coloured by them; (3) the colouring of beer by adding dialysed caramel to the unfermented wort.—T. H. P.

Beer and Similar Beverages; Cooling and Aerating ——. M. F. Chambers and D. S. L. Archibald, Romford. Eng. Pat. 2317, Feb. 6, 1905.

THE apparatus described, in which the cooling and aeration of beer and the like beverages are carried out simultaneously, consists of a suitable aerating vessel provided with a cooling coil the ends of which pass through stuffing-boxes in the aerator into inlet and outlet pipes from the brine or other cooling medium. The cooling coil is fitted with beaters or wings to act as rousers, and is rotated by means of a pulley fitted to one of its prolonged ends outside the aerator, or by other means. The two ends of the coil may be connected together inside the aerator by a central hollow or solid shaft, so as to provide for the symmetrical rotation of the coil within the aerator.—T. H. P.

Beer and other like Liquids; Process for Conditioning, Cooling and Freeing from Fermentable Matter ——. E. H. West and R. W. Webster, London. Eng. Pat. 5360, March 14, 1905.

CLAIM is made for an improved process for conditioning beer and other like liquids, which consists in running the beer or other liquid into a vessel provided with devices for warming, cooling, and, when necessary, agitating the same, adding thereto dry hops, and, when necessary, "priming" or unfermented wort. The mixture is then heated by means of a warm liquid applied to the surface of the said vessel in order to facilitate fermentation, with or without rousing by devices operating in the vessel. When the desired point of conditioning is reached, the fermentation is checked by cooling the mixture to a temperature approximating to its freezing point, by means of a cold liquid applied to the surface of the vessel.—T. H. P.

Whisky and the like; Method and Means of Blending ——. J. Dunbar, Glasgow. Eng. Pat. 1355, Jan. 24, 1905.

CLAIMS are made for: (1) the blending and complete mixing of various kinds of manufactured whisky or other liquid substances by the use of a circlet of inwardly directed pipes associated with an air pipe so as to form a fine spray which is collected in a confined space; (2) the continuous circulation, aeration and cooling of the drinking water in the tanks on board sea-going vessels by this spraying process, and the cooling of manufactured beer in heated atmospheres.—T. H. P.

GERMAN PATENT.

Beverages free from Alcohol or Poor in Alcohol; Process for the Preparation of —— from Sterile Fermented or Non-fermented Fruit Juices and the like. C. Brünneke. Ger. Pat. 162,486, Dec. 9, 1903.

THE claim is for a process of preparing beverages free from alcohol or poor in alcohol from fermented or non-fermented fruit juices, by the action of *Saccharomyces membranæfaciens* or *Mycoderma cerevisiæ* with free access of sterilised air. The fruit juice is sterilised in a vessel, the outlet of which is closed by an air-filter, and a pure culture of *Sacch. membranæfaciens* or *Mycoderma cerevisiæ* is introduced. After a few days, the decomposition of the alcohol or sugar becomes perceptible. The fermentation can be stopped at any time desired by heating to at least 60° C.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from Page* 37.)

(*A.*)—FOODS.

Malic Acid; Detection of —— *in Fruit Juices.* R. Kunz. XXIII., page 92.

English Patents.

Milk and Milk Compounds; Method of Preserving ——. C. Jung, Vienna. Eng. Pat. 27,516, Dec. 16, 1904.

See Fr. Pat. 347,877 of 1904; this J., 1905, 452.—T. F. B.

Milk Products; Process and Apparatus for Producing——. J. M. Simpson, Liverpool, and F. Jackson, Garstang. Eng. Pat. 2020, Feb. 1, 1905.

Skimmed or separated milk and oil or melted fat are blown through an injector jet in order to thoroughly emulsify them. The product may be dried on the hot roller system and powdered. A cream may be obtained by using a larger proportion of fat to begin with or by subjecting the thin emulsion to centrifugal action. (Attention is drawn under the Pat. Act, 1902, to the following Eng. Pats.:—3348 and 3359 of 1882; 2869 of 1883; 8475 of 1891; 22,115 of 1892; 17,630 of 1893; 2081 of 1896; 11,524 of 1900; 3489 of 1901; 22,875 of 1903; and 13,715 of 1904, this J., 1905, 632.)—W. P. S.

Whisky and the like; Method and Means of Blending ——. J. Dunbar. Eng. Pat. 1355, Jan. 24, 1905. XVII., page 85.

Butter; Process of Making——. S. C. Boykin, Gadsden, and R. B. Mitchum, Milan, U.S.A. Eng. Pat. 13,479, June 29, 1905.

See Fr. Pat. 355,837 of 1905; this J., 1905, 1249.—T.F.B.

Drying Vegetables, Fruits, Starch and the like; Apparatus for ——. N. Yagn, St. Petersburg. Eng. Pat. 5225, March 13, 1905.

A tall chamber is divided into a series of horizontal compartments by V-shaped metal partitions. The lowest compartment is heated by steam and is in communication with the atmosphere, whilst the second and succeeding chambers are heated by conduction through the metal divisions to a successively decreasing degree and are isolated from the external air by flaps or doors which cover the openings through which the material to be dried is introduced or withdrawn. The latter is spread on trays which are introduced at short intervals into one end of the second compartment and pushed forward to the other end, when they are lifted to the next higher compartment and so on till the top compartment, which is open to the air, is reached. The air in each compartment is agitated by fans, and being heated by contact with the metal partition forming the bottom of the compartment, rises through the material in the trays and takes up moisture; it is next cooled by contact with the underside of the bottom of the compartment above, deposits the moisture on the surface and sinks, to perform the cycle over again. The deposited moisture flows down the under surface of the V-shaped partitions and is carried away by a gutter.—W. H. C.

United States Patents.

Liquids; [Electrical] Apparatus for Sterilising, Purifying and Ageing ——. R. C. Turner, Assignor to C. E. Turner, Columbus, Ohio. U.S. Pat. Re-issue 12,421, Dec. 12, 1905.

The liquid is allowed to flow from a tank into a funnel supported above a receiving vessel. In the latter is placed an electrode connected with one pole of a battery or electric supply, whilst the funnel is connected with the other pole. The current passes from the vessel to the funnel through the stream of liquid falling from the stem of the funnel. The receiving vessel is provided with a spout so that the liquid may flow into a second funnel and receiving vessel placed below the first pair and similarly connected with an electric supply.—W. P. S.

Milk Separator; Centrifugal ——. B. A. O. Prollius, Assignor to Aktieselskabet Burmeister & Wains Maskin-og Skibsbyggeri, Copenhagen. U.S. Pat. 807,639, Dec. 19, 1905.

See Eng. Pat. 14,960 of 1904; this J., 1905, 509.—T. F. B.

French Patent.

Alimentary Product from Grains; Preparation of an ——. Blattmann and Co. Fr. Pat. 357,451, Sept. 2, 1905.

The substance extracted from cereals, &c., by alcohol, mixtures of alcohol and ether, benzene, carbon tetrachloride or chloroform is separated from the solvent by evaporation, and the residue obtained treated with acetone or methyl acetate. The product is then dried at a temperature below 40° C.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Plumbism due to Electrolysis. B. Latham. Electrician, 1905, **56** [10], 398—399.

A case of lead poisoning having occurred in a cottage supplied with water by the South Hants Waterworks Co., investigations were carried out for the purpose of ascertaining the cause of the presence of notable quantities of lead in the water. The corrosion of the service pipe was found to be entirely due to electrolysis, set up by leakage from electric lighting mains and installation, in the near vicinity. When a current of 30 ampères was passing through the mains an E.M.F. of 1·8 volts was detected between the earth-return and the water pipe running to the house, which, in the engineer's opinion, accounted for the whole trouble which had occurred. Laboratory experiments confirmed this view.—W. P. S.

English Patent.

Sewage Sludge; Method and Apparatus for Recovering Fatty and Oily Matter from ——. The Mayor, Aldermen and Citizens of Bradford, J. Garfield, Bradford, and J. Grossmann, Manchester. Eng. Pat. 29,558, Dec. 31, 1904.

The sewage sludge is treated with sulphuric acid, or with alkali, or heated under pressure so as to liberate the fatty acids. The mass is then filter-pressed and the cake, now containing about 30 per cent. of water, distilled. For this purpose it is fed by means of a double hopper into long D-shaped retorts which are surrounded with tiles and saddles. A travelling arrangement conveys the cake through the retorts at such a rate that when it reaches the other end of the retorts, the fatty acids, ammonia and other organic compounds are removed, the heat being kept sufficiently low to enable the residue to retain such an amount of nitrogenous matter as will render it available for manurial purposes. The gases leaving the retorts are condensed, scrubbed and separated, whilst the residue is drawn off through a closed discharging box. Superheated steam may be blown through the retorts during the distillation. The temperature to which the retorts are heated depends on the nature of the sludge.—W. P. S.

United States Patents.

Fuel; Artificial —— *[from Garbage].* E. C. May, Assignor to National Garbage Fuel Co., U.S. Pat. 807,629, Dec. 19, 1905. II., page 61.

Water; Process for Purifying ——. J. F. Wixford, St. Louis, Mo. U.S. Pat. 807,008, Dec. 12, 1905.

From 4 to 8 grains of ferrous sulphate are added to each gallon of water and afterwards sufficient calcium hydroxide to neutralise the free carbon dioxide and sulphates in the water. The reagents are added in solution to a running stream of the water, the lime solution being introduced at a point below that at which the ferrous sulphate is

added. After the addition of the reagents the water is kept in a state of agitation for a few minutes and then allowed to settle. The quantity of calcium hydroxide added should be such that the water shows a distinct alkalinity when tested with silver nitrate after the lapse of a considerable time.—W. P. S.

Water; Process for Purifying ——. J. F. Wixford, St. Louis, Mo. U.S. Pat. 807,412, Dec. 12, 1905.

The process consists in adding from 0·25 to 2 grains of ferrous fluoride to each gallon of the water and afterwards sufficient calcium hydroxide solution to render the water distinctly alkaline. After mixing, the water is allowed to settle.—W. P. S.

Purification of Liquids; Method of Biological ——. W. P. Dunbar, Hamburg, Germany. U.S. Pat. 807,667, Dec. 19, 1905.

See Fr. Pat. 337,301 of 1903; this J., 1904, 500.—T. F. B.

German Patent.

Argillaceous Matter from Waters; Process for the Separation of ——. C. Borchardt. Ger. Pat. 162,698, May 5, 1903.

The process is intended for the separation of argillaceous matter from water which is to be subsequently treated in contact-beds or filters. A long piece of textile material is laid over the perforated bottom of the supply channel of the filter-chamber and is held in place by weights on the two long sides, and also by the water. The sides of the bottom of the supply channel are preferably constructed in the form of steps on which the weights holding the cloth in position are placed; the width of cloth used may then be varied according to the quantity of argillaceous matter contained in the water. It is stated that by the use of this auxiliary filter for argillaceous matter, the working life of a filter-chamber or bed is lengthened by from one to three months.—A. S.

(C.)—DISINFECTANTS.

English Patent.

Insecticide; Improved —— as a Destructive Agent for Farm and Garden Invertebrate Pests. E. M. Holmes, Sevenoaks, Kent. Eng. Pat. 8081, April 15, 1905.

Claim is made for an insecticide consisting of saponin mixed either as a solution, emulsifier or powder with staveseacre oil, tar oils, fatty oils, preparations of tobacco, sulphur, lime, hellebore, quassia and flowers of chrysanthemum, or any of them, whereby certain of the said substances are rendered more suitable for practicable application as insecticides and their efficiency increased.—T. H. P.

French Patents.

Resin and Resin Oils; Method of Treating ——. K. Bosch Fr. Pat. 357,391, June 21, 1905. XIIIB., page 82.

Insecticide; Manufacture of an ——. K. Bosch. Fr. Pat. 357,392, June 21, 1905. Under Int. Conv., June 21, 1904.

The preparation is particularly applicable for the destruction of phylloxera, caterpillars, &c., and consists of nitrophenol or a solution of the same. Resin soap may be added to bring the solution in close contact with the leaves, and for transport the preparation may be mixed in the form of a powder with infusorial earth, gypsum, barytes, &c. Sulphur and copper sulphate may also be added.—W. P. S.

Copper and Calcium; Manufacture of a Double Acetate of —— [*Insecticide*]. I. C. Ponthus. Fr. Pat. 357,414, Aug. 31, 1905.

A boiling concentrated solution of copper sulphate is added to a hot concentrated solution of calcium acetate, until the colour of the solution becomes blue without a green tinge. The acetic acid vapour expelled during the process is conducted away for condensation. The solution, filtered from the precipitated calcium sulphate, is set to crystallise. The composition assigned to the crystals formed, is $6(C_2H_3O_2)_2Ca$, $6(C_2H_3O_2)_2Cu$, H_4CuO_2, $2H_2O$, and the salt is said to be very efficacious in the treatment of infected vines.—E. S.

XIX.—PAPER, PASTEBOARD, Etc.

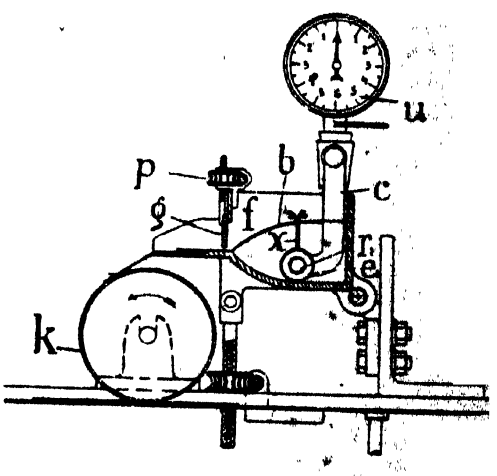
(*Continued from page* 38.)

English Patents.

Paper; Manufacture of Irregularly Coloured ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/ Main, Germany. Eng. Pat. 27,870, Dec. 30, 1904.

A suitable solution of dyestuff is allowed to drop from a series of vessels on to the pulp in a paper machine at a suitable point, where the pulp is sufficiently dilute, *e.g.*, between the admission box, above the breast roller, and the sluices. The vessels containing the colour solution may be given a transversal movement in relation to that of the paper pulp, or an undulating movement may be given to the pulp by placing weirs before the last sluice, or by suitably adjusting the flow of water to the pulp.—T. F. B.

Paper-Making Machines; Apparatus for Supplying Colouring Matter, Mixed Colour Solutions, or Colour-Producing Chemicals in —— for the Manufacture of One-Side Coloured, Clouded Coloured and Marbled Papers. C. Tittel, Josefsthal, Austria. Eng. Pat. 17,163, Aug. 24, 1905.



The apparatus shown in side elevation in the accompanying figure is suited for the production of "marbled" or "clouded" coloured papers. The colour solution is introduced through pipe *c*, and enters pipe *e*, regulated by aid of the dial *u*; inside pipe *e* is a perforated steam pipe r_1, both these pipes extending the width of the web of paper. On the top of *e* are provided a number of nozzles (see *x*), through which the colour solution is forced by the steam. These nozzles terminate above the top *g* of trough *f*, and cause the colour to flow over it in irregular streams, whence it passes over the squeezing roller *k* on to the web of paper. For preparing evenly-coloured paper, pipes *e* and *r* are replaced by stirring blades, revolving at about 300 revolutions per minute. These also serve to drive the colour through a number of holes in the cover *b*, whence it flows through sluices *x* (controlled by wheel *p*) on to the squeezing roller as before. The device is an improvement on Eng. Pat. 10,795 of 1904 (this J., 1904, 834).—T. F. B.

United States Patents.

Card or Pulp Board; Method and Apparatus for the Manufacture of ——. H. D. Loria, Orchamps, France. U.S. Pat. 807,753, Dec. 19, 1905.

See Eng. Pat. 23,245 of 1904; this J., 1905, 149.—T. F. B.

Wood-Fibre Digester. A. W. Handford, Evanston, Ill., Assignor to Wood Distillates and Fibre Co., Chicago. U.S. Pat. 807,925, Dec. 19, 1905.

The apparaus consists of a rotary shell containing a rotary axial shaft fitted with arms for the purpose of moving forward the contents of the shell while the latter is at rest. The shaft and shell can be rotated separately, and either of them can be disconnected from the source of power. Steam is supplied to the shell through a pipe telescoping with the axial bore of the shaft, which bore opens into the shell, whilst an exhaust pipe is connected with the opposite end of the shaft bore. A number of pipes, connected with the shaft bore, extend longitudinally in the shell, and open at different points to distribute steam. A valve connection for a drain pipe is provided at one part of the shell, and a drain pipe, fitted with a pump, is provided to connect with this valve when the shell is in a certain position. The exhauster is connected with the exhaust-pipe to draw off vapours from the shell. The shell is also fitted with a manhole.—C. S.

Pulp and Paper Machinery. H. Parker, Assignor to Improved Paper Machinery Co., both of Nashua, N.H. U.S. Pat. 808,614, Dec. 26, 1905.

In a paper machine of the cylindrical type, each independent "cylinder mold" is provided with its own couch roll and endless felt. The webs made on each cylinder are superposed to form one composite web of paper which passes over a suction apparatus above which a press-roll is adjusted so as to subject the web simultaneously to pressure and suction.—J. F. B.

French Patents.

Photographic Papers for Producing Images Sensitive to Daylight; Phosphorescent ——. R. Bau. Fr. Pat. 356,735, Aug. 7, 1905. XXI., page 90.

Straw, Jute, &c. Treatment of——[*for Paper Manufacture*]. D. Giaj-Tenua. Fr. Pat. 357,374, Aug. 31, 1905. Under Int. Conv., March 27, 1905.

In order to obtain a tough cellulose from straw, jute, esparto, &c., suitable for use in paper manufacture in place of wood pulp, the following process is carried out: 100 kilos. of the straw, &c., are boiled with a mixture of sodium carbonate, 8 to 10 kilos.; lime, 6 to 7·5 kilos.; borax, 0·5 to 1 kilo.; kaolin or clay, 2 to 2·5 kilos.; and casein or starch, 1 to 1·5 kilos. The product is washed, bleached, and made up into paper in the usual way. It is stated that the yield of bleached cellulose is from 53 to 58 per cent. of the weight of straw used.—T. F. B.

Silk; Recovery of Solvents, especially Alcohol and Ether, from Bobbins of Artificial ——. J. Douge. Fr. Pat. 356,835, April 21, 1905. V., page 71.

Viscose; Process of Making Threads and Films of ——. S. Pissarev. Fr. Pat. 357,056, Aug. 19, 1905. V., page 70.

Cellulose Solutions; Process of Making —— *by means of Alkylamines.* E. W. Friedrich. Fr. Pat. 357,171, Aug. 24, 1905. Under Int. Conv., Aug. 25, 1904.

It is proposed to employ solutions of copper oxide in alkylamines instead of in ammonia for dissolving cellulose for various purposes, *e.g.*, making artificial silk. 320 grms. of cellulose are moistened with hot water, and added to 3·4 litres of caustic soda solution (30° B.); 250 grms. of copper sulphate are then gradually added, the solution of sodium sulphate is filtered off, and the cellulose is dissolved in a 33 per cent. aqueous solution of methylamine, the temperature being kept low. These solutions are stated to coagulate very rapidly, the resulting threads being very elastic.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

(*Continued from page* 39).

Strychnine; Action of Bromine on ——. H. Beckurts. Arch. Pharm., 1905, **243**, 493—496.

It has been previously shown that when two atoms of bromine are allowed to act on strychnine hydrobromide in aqueous solution, bromo-strychnine hydrobromide $C_{21}H_{21}Br_2N_2O_2.HBr$ is formed. With four atoms of bromine, another bromo-compound, bromostrychnine dibromide, $C_{21}N_{21}Br_2N_2O_2Br_2$ is obtained as well, in the form of a bulky yellow precipitate. On employing an excess of bromine, this dibromide is not obtained, but the tribromide $C_{21}H_{21}Br_2N_2O_2Br_3$ results.

This tribromide is obtained by the addition of an excess of bromine solution to a strong hot solution of strychnine hydrobromide until precipitation ceases, and the supernatant liquid is coloured yellowish-red. The microcrystalline tribromide, dried over sulphuric acid, has no definite m. pt.; it is insoluble in water, and sparingly soluble in alcohol; the latter solution is at first alkaline in reaction but becomes acid on keeping. When strychnine nitrate is used, the precipitate obtained is not pure; bromostrychnine tribromide is not obtained, but a precipitate containing less bromine and much nitric acid.

On treating bromostrychnine tribromide with boiling absolute alcohol, the yellow alkaline solution at first obtained became colourless and acid on continued heating for 10 minutes. On evaporation, no crystalline compound was formed; the syrupy residue obtained was dissolved in hot water, and treated with excess of ammonia. The precipitated body was dissolved in alcohol; on adding water to this solution, crumbling crystals were obtained, which, when recrystallised, separated as well formed rhombic tablets of monobromostrychnine $C_{21}H_{21}BrN_2O_2$; m. pt. 222° C. The same body was obtained by the action of alcoholic potash. With hydrogen sulphide, monobromostrychnine hydrobromide was formed, and nascent hydrogen reduced the tribromide to the monobromide.

When heated at 105° C., to constant weight, the lighter coloured powder had the constitution of bromostrychnine dibromide $C_{21}H_{21}BrN_2O_2Br_2$. This dibromide behaves like the tribromide when treated with alcoholic potash, hydrogen sulphide and nascent hydrogen. It may also be obtained by extracting the tribromide with cold alcohol which removes one atom of bromine.

The behaviour of bromostrychnine tribromide indicates that the bromine atoms are readily split off, so that it must be regarded as a mere bromo additive compound of bromostrychnine and bromine.—J. O. B.

Otto of Rose; Alcohol in ——. W. H. Simmons. Chem. and Druggist, 1906, **68**, 20.

The presence of dilute alcohol, has, in two cases, recently been detected in deliveries of otto of rose; the preliminary samples did not contain alcohol, the presence of which was probably due to insufficient drainage after the vases had been cleaned and rinsed with alcohol. The quantity of foreign matter (alcohol *plus* water) found was 0·65 and 1·0 per cent. The refractive indices of the oils were low, otherwise their properties were those of the pure oil. —T. F. B.

Oil of False Savin (*Juniperus Phœnicia*). J. C. Umney and C. T. Bennett. Pharm. J., 1905, **75**, 827—829.

The authors recently examined a sample of savin oil from the South of France, the characters of which differed considerably from those of pure savin oil and German savin oil, but agreed closely with those of some of the oils which, hitherto, have been looked upon as adulterated with oil of turpentine. Examination of the plant from which the oil was derived showed this to be not *Juniperus sabina* but *Juniperus Phœnicia* (the common Mediterranean species). A comparison of the oil of *Juniperus Phœnicia* with German savin oil and with oil distilled in England from *Juniperus sabina* is given in the following table:—

	English. From *J. Sabina.*	German. From *J. Sabina.*	French. From *J. Phœnicia.*
Specific gravity	0·909	0·920	0·892
Optical rotation	+68°	+42°	+4°30′
Esters	47·6%	36·5%	9·1%
Total sabinol	52·1%	48·2%	17·1%
Solubility in 90% alcohol	1 in 1	1 in 1	1 in 5
Portion distilling—			
Below 155°C.	nil	nil	18%
Below 165° C.	nil	nil	61%
Below 175° C.	14%	nil	68%
Below 180° C.	23%	4%	80%
Below 200° C.	48%	20%	82%
Below 220° C.	62%	49%	84%
Below 230° C.	80%	60%	86%

The oil from *J. Phœnicia* contains over 75 per cent. of pinene.

The authors point out that as the medicinal properties of savin oil are most probably due to the sabinol and its acetate present therein, the oil from *J. Phœnicia* (false savin) should not be substituted for the oil from *J. sabina* (true savin).—A. S.

Parsley Fruits; Essential Oil of ——. [*Proportions of "Light" and "Heavy" Oil*]. Haensel's Report. Oct., 1905, 26.

THURINGIAN parsley seeds have been found to yield 1·1 per cent. of "light" oil and 3·5 per cent. of "heavy" oil. The "light" oil had the sp. gr. 0·887 at 18° C.; $\alpha_D = -45°$. The "heavy" oil the sp. gr. 1·106 at 18° C; $\alpha_D = -1°25'$. No crystallisation of apiol was observed either during distillation, or on standing.—J. O. B.

Cinnamon Chips; Essential Oil of ——. [*Proportions of "Light" and "Heavy" Oil of Cinnamon*]. Haensel's Report. Oct., 1905, 11.

IN a recent distillation of cinnamon chips, the heavy and light oils were collected separately. The light oil had the sp. gr. 0·996 and contained 47 per cent. of aldehydes. The heavy oil, sp. gr. 1·025, contained 67 per cent. of aldehydes. About 66·6 per cent. of the total oil obtained was "light" oil, and 33·3 per cent. "heavy" oil.—J. O. B.

Acetaldehyde; Action of Sodium Sulphite on ——. Seyewetz and Bardin. Bull. Soc. Chim., 1905, **33**, 1312—1314.

FIFTY c.c. of a 15 per cent. solution of anhydrous sodium sulphite are slowly added to 200 grms. of 95 per cent. acetaldehyde, the temperature being kept at 0° C., and the mixture is extracted with ether. The extracts are evaporated, and the residue is distilled, the products consisting chiefly of crotonic aldehyde and crotonic acid. The above conditions are stated to give the best yield of crotonic aldehyde (about 40 per cent. of the theoretical yield).—T. F. B.

Mercuric Chloride; Solubility of —— *in Ethyl Acetate and Acetone.* A. H. W. Aten. Z. physik. Chem., 1905, **54**, 121—123.

THE results of the author's determinations are shown in the following table:—

Temperature.	Composition of Solution in Mols. per cent. of Mercuric Chloride		
	Ethyl acetate solution	Acetone solution.	
°C.			
— 15	9·10	14·5	
0	9·25	14·3	
+ 10	—	18·7	23·5
+ 17	—		23·2
+ 25	9·15		22·8

In the column relating to the acetone solution, the first three numbers refer to the case of the solution containing a compound of mercuric chloride and acetone, $HgCl_2.(CH_3)_2CO$, as solid constituent, whilst the last three refer to mercuric chloride as the solid substance. On adding mercuric chloride to acetone at temperatures below 10° C., it dissolves rapidly and abundantly at first, but after a short time, a compound of the composition given above, separates from the clear solution. The solubility curve for mercuric chloride in acetone consists of two distinct branches, corresponding to mercuric chloride and the compound of the same with acetone respectively, and intersecting at the transition point which is 13° C. for a solution containing 27 mols. per cent. of mercuric chloride. —A. S.

Urotropine [Hexamethylenetetramine]; Examination of ——. A. Wöhlk. XXIII., page. 93.

Cinchona Exports from Java. Chem. and Druggist, Jan. 5, 1906.

THE N.V. Nederlandsche Veem at Amsterdam reports the shipments from Java to Europe as follows:—

	Amst. lb.		Amst lb.
1905 ..	15,399,000	1898 ..	11,150,000
1904 ..	14,450,000	1897 ..	8,437,000
1903 ..	13,725,000	1896 ..	10,079,000
1902 ..	13,346,000	1895 ..	8,827,700
1901 ..	12,799,000	1894 ..	8,917,700
1900 ..	10,780,000	1893 ..	7,342,000
1899 ..	11,409,800		

(Amst. pound = 1·1 English pound.)

With regard to the possibility of an export-tax on Java cinchona, which has been mooted in several quarters, it now appears from the report of the Java Budget, which has just been issued, that cinchona has not been selected for an export duty. [T.R.]

ENGLISH PATENTS.

Camphor; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 9008, April 28, 1905.

A MIXTURE of borneol vapour and oxygen or air, at about 190° C., is passed over some catalytic agent, *e.g.*, spirals of copper wire or platinised asbestos, or broken earthenware contained in a tube; after about eight hours, the product is stated to contain about 25 per cent. of camphor. (Compare Eng. Pat. 9550 of 1905; this J., 1905, 902.) —T. F. B.

Protocatechuic Aldehyde; Process for Manufacturing ——. E., H., and K. Fritzsche (Schimmel und Co.), Miltitz-Leipzig, Germany. Eng. Pat. 18,092, Sept. 20, 1905. Under Int. Conv., Oct. 17, 1904.

PIPERONAL or piperonal chloride is heated with a halogen compound of sulphur or of sulphuric acid; the dichloropiperonal chloride thus produced (which is chlorinated in the methylene group only) is converted into protocatechuic aldehyde by boiling with water. 15·4 kilos. of piperonal may be heated with 26·8 kilos. of sulphuryl chloride to about 80° C.; the product of the reaction is boiled with water, and the aldehyde extracted with ether. —T. F. B.

UNITED STATES PATENTS.

Organic Compounds; Manufacture of —— *by Oxidation.* W. Lang, Salbke-on-the-Elbe, Germany. U.S. Pat. 808,095, Dec. 26, 1905.

SEE Fr. Pat. 323,916 of 1902; this J., 1903, 571.—T. F. B.

Guanyldialkylbarbituric Acids; Process of Making ——. B. R. Seifert, Assignor to Chem. Fabr. von Heyden, Act.-Ges., Radebeul, Germany. U.S. Pat. 808,407, Dec. 26, 1905.

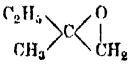
SEE Eng. Pat. 10,201 of 1905; this J., 1905, 939.—T. F. B.

FRENCH PATENTS.

Ethylene Oxides; Production of ——. Etabl. Poulenc Frères, and E. Fourneau. Fr. Pat. 350,248, Oct. 22, 1904.

SUBSTITUTED ethylene oxides are obtained by treating with concentrated solutions of alkalis, the chlorhydrins of the general formula $R.R'C(OH)CH_2Cl$ (see Fr. Pat. 339,131 of 1903; this J., 1905, 43). The following com-

pounds are described and claimed :—Metho-ethenylethane oxide,



metho-ethenylisopentane oxide, and methophenylethenyl oxide. When treated with amines, these oxides yield amino-alcohols, stated to be of therapeutic value ; when reduced, they produce alcohols. They can also be converted, *e.g.*, by mineral acids, into odoritic aldehydes.
—T. F. B.

Dialkylmalonylureas ; Process for Making Derivatives of Dialkylmalonic Acid and ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,255, Oct. 24, 1904.

When dimethyl- or methylethylmalonic esters are condensed with dicyanodiamide by means of a solution of sodium in methyl or ethyl alcohol, or when diethylmalonic esters are similarly condensed by aid of a solution of sodium in methyl alcohol, intermediate products are obtained which, when heated with acids, are converted into the corresponding dialkylmalonylureas. (Compare Fr. Pat. 346,188 of 1904 ; this J., 1905, 131.)—T. F. B.

Dialkylbarbituric Acids ; Process of Preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,316, Nov. 16, 1904.

See U.S. Pat. 795,495 of 1905 ; this J., 1905, 903.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 39.)

Sensitive Preparations [and Photographic Papers] Darkening Directly in Light, and Containing no Soluble Silver Salts ; Production of ——. A. and L. Lumière. Phot. J., 1905, **45**, 408.

All "printing out" papers at present in use contain an excess of soluble silver salts, which cause deterioration of the emulsion, as well as favouring the formation of silver stains on the negative and print. It has been found that, when reducing agents are added to a silver halide emulsion (especially a chloride emulsion), containing no excess of soluble silver salts, the emulsion is darkened by light. Among organic substances, amino compounds are less active in this respect than hydroxy compounds, and with the latter the reducing properties depend on the number of hydroxy groups present : resorcinol is very suitable for use in making such papers. Of inorganic substances, manganous salts, nitrites and arsenites are of interest in this connection. The reducing agent is incorporated with the silver emulsion, which may be prepared with gelatin, casein, albumin, collodion, &c. Papers prepared as indicated above are stated to possess excellent keeping properties, and to have no tendency when damp to stain negatives. They are toned and fixed in the same manner as ordinary "printing out" papers.—T. F. B.

English Patents.

Photographic Plates, Films or the like ; Developing and Finishing —— and Photographic Developers for use therein. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9116, May 1, 1905.

See Fr. Pat. 354,005 of 1905 ; this J., 1905, 1084.—T. F. B.

Reproduction of Pictures or the like with Aid of Catalysis. Neue Photographische Ges., A.-G., Steglitz, Germany. Eng. Pat. 20,372, Oct. 9, 1905. Under Int. Conv., Oct. 13, 1904.

See Fr. Pat. 347,732 of 1904 ; this J., 1905, 347.—T. F. B.

French Patents.

Reproduction ; Process of Polychrome —— by Chemical Selection of the Colours, the Original being Regenerated. T. M. J. Truchelut. Fr. Pat. 350,289, Nov. 3, 1904.

This specification relates to a process of reproducing objects coloured only by the three fundamental colours, the red consisting of a mixture of an Eosin lake and nickel phosphate : the blue, a Methylene Blue lake and mercurous chloride, and the yellow, a Martius' Yellow lake and lead sulphate. The original is first treated with a 1 per cent. solution of potassium ferricyanide, washed, treated with a 10 per cent. oxalic acid solution and washed again : this is said to convert the red portions of the image into orange, and to decolorise the yellow. The resulting image is photographed, and printing plates made from this and the subsequent negatives. The image is now treated with an ammoniacal solution of potassium ferrocyanide, washed, treated with 2 per cent. sulphuric acid, and photographed. The image is further treated with a 5 per cent. ferric chloride solution, washed, and treated with an 8 per cent. potassium bichromate solution, washed, and immersed in 2 per cent. sulphuric acid and again photographed. The printing plates obtained from these negatives correspond to the red, blue and yellow portions respectively of the original. By now washing the treated image in water, it is stated to be restored to its original colours, the only difference being that the Martius' Yellow portions are replaced by lead chromate. The printing plates are inked with suitable colours and utilised for three-colour printing in the usual manner.
—T. F. B.

Flashlight Powders. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 350,308, Nov. 15, 1904.

See Eng. Pat. 24,987 of 1904 ; this J., 1905, 1031.—T. F. B.

Photographic Papers for Producing Images Sensitive to Daylight ; Phosphorescent ——. R. Bau. Fr. Pat. 356,735, Aug. 7, 1905.

One cubic decimetre of the paper pulp is mixed with 150 grms. of calcium sulphide, 30 grms. of zinc sulphide and 20 grms. of strontium sulphide. The paste is made into paper in the usual manner, and this, when dry, is rendered impervious with a lac varnish. The paper is now coated with a sensitive silver emulsion. It gives phosphorescent prints when exposed beneath a negative and finished as usual.—T. F. B.

Photographic Papers ; Process of Making ——. I. Hoffsummer Fr. Pat. 357,453, Sept. 2, 1905.

See Eng. Pat. 17,303 of 1905 ; this J., 1905, 1189.—T. F. B.

Viscose, Process for Making Threads or Films of ——. S. Pissarev. Fr. Pat. 357,956, Aug. 19, 1905. V., page 70

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 40.)

Match Industry of Italy. Bd. of Trade J., Jan. 4, 1906.

The manufacture of phosphorus matches in Italy dates back to 1831, the first match factory being established at Empoli. This factory is still in existence, employing about 50 workmen. The most important centres of the industry are in Piedmont and Tuscany.

In 1880 the exports of wax matches amounted to 9357 quintals valued at 2,198,825 lire, and 6079 quintals of wooden matches valued at 243,160 lire. The industry showed a notable development between the years 1881 and 1890 ; it received, however, a set-back in 1895 when a law was passed imposing a tax on the manufacture of matches. Before the promulgation of this law there were 480 manufactories of wooden matches and 40 manufactories of wax matches, but this number has since shown a great decrease, and at the present day there are only 220 factories of both kinds. The formation of a company combining over a dozen large firms has brought about the closure of a large number of small factories. In 1903—04 the total output of the combine amounted to 8987 million wooden matches and 25,684 million wax matches, the total output of the country being 43,178 million wooden matches and 29,523 million wax matches.

The importation of wooden matches into Italy is very small, but there is a fairly large import of wax matches.

White and red phosphorus used in the manufacture of wax matches comes from Germany, France, and Great Britain. During the years 1902 and 1903 the average import of phosphorus for match making amounted to about 790 quintals. The 216 factories employed, during 1903—04, 6699 persons. The industry is mainly carried on by hand, very few factories possessing machinery. Amongst the latter, two factories have gas power, one hydraulic, ten steam, and one electric. [T.R.]

ENGLISH PATENT.

Match Compositions. W. Bokmayer, Mödling, and A. Swoboda, Vienna. Eng. Pat. 20,350, Oct. 9, 1905.

SEE Fr. Pat. 355,846 of 1905; this J., 1905, 1256.—T. F. B.

UNITED STATES PATENT.

Smokeless Powder; Apparatus for Making ——. G. W. Gentien and R. S. Waddell, Peoria, Ill. U.S. Pat. 808,036, Dec. 19, 1905.

THE claims include the combination of a receptacle or tank, traversed by a hollow revolving shaft carrying a number of hollow arms communicating with the interior of the shafts; a stationary pipe, for compressed air, fitting in the hollow shaft, and provided on the lower side with ports that coincide with the hollow arms; a liquid-supply pipe, extending into and discharging within the air-pipe; a valve controlling the liquid-supply pipe; nozzles discharging into the tank, near the bottom; a pipe supplying compressed air to the hollow arms and nozzles, and surrounded with a steam jacket; and means for introducing material into and discharging the same from the receptacle.—C. S.

FRENCH PATENT.

Explosive [Non-Hygroscopic]. Soc. Anon. de la Poudrerie de Ben-Ahin. Fr. Pat. 357,233, Aug. 25, 1905.

CLAIM is made for a process of coating dry, finely powdered sodium nitrate with a natural or a nitrated hydrocarbon of the fatty acid series, by melting the hyhrocarbon or its nitrated derivative, if solid or semi-solid, and mixing it with the salt, or if already liquid, by simply mixing the two in the cold. The combustible base thus obtained is non-hygroscopic, and may qe mixed with other ingredients to form explosive powders for mines, &c. Suitable mixtures claimed are as follows:—(*a*) sodium nitrate, 55 to 70; solid hydrocarbon, 10 to 20; sulphur, 6 to 12; and carbon, 10 to 16 per cent. (*b*) sodium nitrate, 20 to 40; highly nitrated hydrocarbon 20 to 30 per cent.; and potassium chlorate, 40 to 60 per cent. (*c*) sodium nitrate, 35; liquid hydrocarbon, 28; and ammonium perchlorate, 37 per cent. Explosives prepared on these lines are stated to resist moisture, to be free from danger, and to be equal to the best nitro-glycerin products.

—C. A. M.

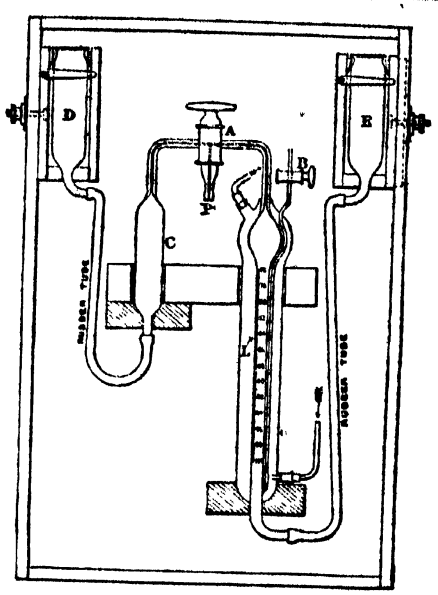
XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 43.)

APPARATUS, ETC.

Gases; Portable Apparatus for the Analysis of Flue ——. C. J. Wilson. Proc. Inst. Civil Eng., 1905, **162**, Paper No. 3580.

THE portable apparatus shown in the figure (scale 1½ in. = 1 ft.) is proposed for the analysis of flue gases. It consists of a water-jacketed eudiometer L connected with an absorption bulb C; between these is a three-way cock A, so that C and L can be connected together, or either of them with the exit tube P in the stopcock. D and E contain mercury, and are adjustable vertically. The apparatus is first completely filled with mercury, when P is connected with the eudiometer, and the gas is passed into it, and brought to the desired volume. Stop-cock A is then turned so as to connect P with C; this latter is now filled with the necessary absorbing solution by placing a small beaker containing the latter under P and lowering D. Tap B is then closed, E is raised, and L is



connected with C, thus sending the gas into C. When absorption is complete, E is lowered until the gas has flowed back into L, when tap A is turned, so that the absorbing solution passes out at P and is collected. The bulb C is then washed out with water, and a second absorbing solution run in, the absorption being repeated as before.—T. F. B.

ENGLISH PATENTS.

Loss or Gain in Weight; Apparatus for use in Ascertaining the Extent to which Materials Lose or Gain in Weight in being subjected to Drying or Exposure to Moisture or other Treatment tending to Cause —— and for use in Weighing of other kinds. T. Oxley, Manchester. Eng. Pat. 20,653, Oct. 12, 1905.

THE improvement consists in supporting the beam and the scale-pan by arms projecting from the beam, so as to allow a rider, which slides along the beam, to be set in any position from one in the vertical plane of the beam support, to one in the vertical plane of the scale-pan support. By making the rider a definite fraction of the fixed weight, and by placing it in the vertical plane of the latter and balancing the two by the material to be examined, it is possible, when any alteration in the weight of the material has taken place, and the balance is again restored by moving the rider, to read off the loss or gain in weight as a percentage or fraction of the whole weight. This can be done at once from the marking of the scale and without calculation.—W. H. C.

Photometers or Apparatus for Testing the Intensity of Light, comprising the use of a Selenium Cell. T. Torda and V. Bornand, Birmingham. Eng. Pat. 4020, Feb. 27, 1905.

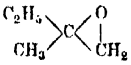
CLAIM is made for improvements in photometers comprising a device in combination with the use of a selenium cell and current meter, whereby the selenium cell is exposed to the light rays for a certain period, "which, together with the time of rest in darkness, is automatically effected in the required proportions."—T. H. P.

INORGANIC—QUANTITATIVE.

Acetylene; Reaction of ——, on Iodic Anhydride. G. F. Jaubert. Comptes rend., 1905, **141**, 1233—1234.

WHEN air containing acetylene is passed over iodic

pounds are described and claimed :—Metho-ethenylethane oxide,



metho-ethenylisopentane oxide, and methophenylethenyl oxide. When treated with amines, these oxides yield amino-alcohols, stated to be of therapeutic value ; when reduced, they produce alcohols. They can also be converted, *e.g.*, by mineral acids, into odoritic aldehydes.
—T. F. B.

Dialkylmalonylureas ; Process for Making Derivatives of Dialkylmalonic Acid and ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,255, Oct. 24, 1904.

When dimethyl- or methylethylmalonic esters are condensed with dicyanodiamide by means of a solution of sodium in methyl or ethyl alcohol, or when diethylmalonic esters are similarly condensed by aid of a solution of sodium in methyl alcohol, intermediate products are obtained which, when heated with acids, are converted into the corresponding dialkylmalonylureas. (Compare Fr. Pat. 346,188 of 1904 ; this J., 1905, 131.)—T. F. B.

Dialkylbarbituric Acids ; Process of Preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,316, Nov. 16, 1904.

See U.S. Pat. 795,495 of 1905 ; this J., 1905, 903.—T. F. B.

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(*Continued from page* 39.)

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English Patents.

Photographic Plates, Films or the like ; Developing and Finishing —— and Photographic Developers for use therein. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9116, May 1, 1905.

See Fr. Pat. 354,005 of 1905 ; this J., 1905, 1084.—T. F. B.

Reproduction of Pictures or the like with Aid of Catalysis. Neue Photographische Ges., A.-G., Steglitz, Germany. Eng. Pat. 20,372, Oct. 9, 1905. Under Int. Conv., Oct. 13, 1904.

See Fr. Pat. 347,732 of 1904 ; this J., 1905, 347.—T. F. B.

French Patents.

Reproduction ; Process of Polychrome —— by Chemical Selection of the Colours, the Original being Regenerated. T. M. J. Truchelut. Fr. Pat. 350,289, Nov. 3, 1904.

This specification relates to a process of reproducing objects coloured only by the three fundamental colours, the red consisting of a mixture of an Eosin lake and nickel phosphate : the blue, a Methylene Blue lake and mercurous chloride, and the yellow, a Martius' Yellow lake and lead sulphate. The original is first treated with a 1 per cent. solution of potassium ferricyanide, washed, treated with a 10 per cent. oxalic acid solution and washed again : this is said to convert the red portions of the image into orange, and to decolorise the yellow. The resulting image is photographed, and printing plates made from this and the subsequent negatives. The image is now treated with an ammoniacal solution of potassium ferrocyanide, washed, treated with 2 per cent. sulphuric acid, and photographed. The image is further treated with a 5 per cent. ferric chloride solution, washed, and treated with an 8 per cent. potassium bichromate solution, washed, and immersed in 2 per cent. sulphuric acid and again photographed. The printing plates obtained from these negatives correspond to the red, blue and yellow portions respectively of the original. By now washing the treated image in water, it is stated to be restored to its original colours, the only difference being that the Martius' Yellow portions are replaced by lead chromate. The printing plates are inked with suitable colours and utilised for three-colour printing in the usual manner.
—T. F. B.

Flashlight Powders. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 350,308, Nov. 15, 1904.

See Eng. Pat. 24,987 of 1904 ; this J., 1905, 1031.—T. F. B.

Photographic Papers for Producing Images Sensitive to Daylight ; Phosphorescent ——. R. Bau. Fr. Pat. 356,735, Aug. 7, 1905.

One cubic decimetre of the paper pulp is mixed with 150 grms. of calcium sulphide, 30 grms. of zinc sulphide and 20 grms. of strontium sulphide. The paste is made into paper in the usual manner, and this, when dry, is rendered impervious with a lac varnish. The paper is now coated with a sensitive silver emulsion. It gives phosphorescent prints when exposed beneath a negative and finished as usual.—T. F. B.

Photographic Papers ; Process of Making ——. I. Hoffsummer Fr. Pat. 357,453, Sept. 2, 1905.

See Eng. Pat. 17,303 of 1905 ; this J., 1905, 1189.—T. F. B.

Viscose, Process for Making Threads or Films of ——. S. Pissarev. Fr. Pat. 357,956, Aug. 19, 1905. V., page 70

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 40.)

Match Industry of Italy. Bd. of Trade J., Jan. 4, 1906.

The manufacture of phosphorus matches in Italy dates back to 1831, the first match factory being established at Empoli. This factory is still in existence, employing about 50 workmen. The most important centres of the industry are in Piedmont and Tuscany.

In 1880 the exports of wax matches amounted to 9357 quintals valued at 2,198,825 lire, and 6079 quintals of wooden matches valued at 243,160 lire. The industry showed a notable development between the years 1881 and 1890 ; it received, however, a set-back in 1895 when a law was passed imposing a tax on the manufacture of matches. Before the promulgation of this law there were 480 manufactories of wooden matches and 40 manufactories of wax matches, but this number has since shown a great decrease, and at the present day there are only 220 factories of both kinds. The formation of a company combining over a dozen large firms has brought about the closure of a large number of small factories. In 1903—04 the total output of the combine amounted to 8987 million wooden matches and 25,684 million wax matches, the total output of the country being 43,178 million wooden matches and 29,523 million wax matches.

The importation of wooden matches into Italy is very small, but there is a fairly large import of wax matches.

citrate and removed, while the barium malate remains in solution. The liquid is evaporated on the water-bath and when cool, treated with four times its volume of alcohol. The precipitate is collected with the aid of the filter pump, washed with alcohol and transferred to a platinum capsule. Ten c.c. of 10 per cent. sodium hydroxide solution are added, and the whole evaporated to dryness on the water-bath. The residue is then heated for about two hours at 120°—130° C. The product is dissolved in dilute hydrochloric acid, decolorised with animal charcoal, filtered, and shaken out with ether, leaving the ether in contact with the aqueous liquid for half an hour, if the amount of acid be but small. On separating and evaporating the ethereal layer, fumaric acid, derived from malic acid, is left.

By this test, the author finds that malic acid is not present as a natural constituent in raspberry juice, which is, however, rich in citric acid, and contains very little tartaric acid.—J. O. B.

Urotropine (Hexamethylenetetramine); Examination of ——. A. Wahlk. Z. anal. Chem., 1905, **44**, 765—766.

The author has found that Nessler's solution (an alkaline solution of mercuric and potassium iodide) forms a very satisfactory reagent for testing the purity of hexamethylenetetramine, since it is capable of indicating the presence of ammonium salts, amines and paraformaldehyde, which are the most common impurities of this compound. Pure hexamethylenetetramine, when dissolved in water and boiled with Nessler's solution, will not give either a yellowish-brown or brown colour (ammonia or amines) or a precipitate of mercury (formaldehyde).—A. S.

Euphorbium Resin [and Reaction for same]. A. Tschirch and Paul. XIII*B.*, page 82.

ORGANIC—QUANTITATIVE.

Trehalose; Detection and Determination of —— in Plants by means of the Enzyme Trehalase. P. Harang. J. Pharm. Chim., 1906, **23**, 16—20.

The presence of trehalose in mushrooms and fungi may be detected, and its proportion determined by converting it into dextrose by the action of the enzyme trehalase. An active preparation of this enzyme is obtained by cultivating *Aspergillus niger* in Raulin's solution. After about 30 hours at 33° C. the nutrient liquid is decanted off and replaced by water, the operation being performed five or six times. The mould is then grown, the culture is separated, pressed and treated with 95 per cent. alcohol for three hours, drained, and then dried and powdered. This powder will invert twice its weight of trehalose in 48 hours at 33° C. To extract the trehalose, the freshly-cut plants are chopped up and extracted twice in succession with an equal weight of boiling 80 per cent. alcohol, the extracts being mixed, filtered and concentrated *in vacuo* to a small volume. The liquid is mixed with four times its volume of 80 per cent. alcohol and the precipitate allowed to settle. The solution is poured off and the precipitate again treated with water and alcohol in a similar manner. The alcoholic liquids, containing the trehalose are evaporated to dryness *in vacuo*; the sugar is dissolved in thymolised water and treated with the *Aspergillus* preparation at 33° C. After 10 days the inversion is complete, and the quantity of trehalose, $[\alpha]_D = 197{\cdot}3°$, is calculated from the decrease in optical rotation. In *Clitocybe nebularis*, the author found 0·94 per cent. of trehalose calculated on the fresh plant substance.—J. F. B.

Tannin in Wine; Determination of ——. L. Kramszky. Z. anal. Chem., 1905, **44**, 756—766.

For the determination of tannin in wines, the author uses as a precipitant an ammoniacal solution of zinc sulphate. The normal constituents of wine, including the colouring matter, have no influence on the precipitation of tannin by this reagent. The zinc solution is prepared by dissolving about 25 grms. of pure zinc sulphate in water, adding ammonia until the precipitate formed at first, just re-dissolves, then adding a further 300 c.c. of ammonia and making up to 1 litre. Fifty c.c. of a red wine or 100 c.c. of a white wine are made alkaline with ammonia and treated with 20 c.c. of the zinc solution, the mixture is stirred, and made up to 300 c.c. with warm water. After standing, the precipitate is washed several times by decantation with hot, faintly ammoniacal water, and collected in a Gooch crucible containing a little asbestos. The precipitate is dried at 100°—130° C., weighed, ignited in a tared crucible, with the addition, finally, of a few drops of nitric acid, and again weighed. The difference between the weights of the dried and ignited precipitates gives the quantity of tannin.—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 44.)

Phosphorus Tribromide and Tri-iodide; Action of Ammonia on ——. [Production of Phosphamide and Phosphimide.] C. Hugot. Comptes rend., 1905, **141**, 1235-1237.

Ammonia reacts at 65° C. on phosphorus tribromide, at slightly higher temperatures on the tri-iodide, forming yellow phosphamide

$$15NH_3 + PBr_3 = 3(NH_4Br.3NH_3) + P(NH_2)_3.$$

This can be separated from the ammoniacal ammonium bromide formed, but dissolves in the corresponding iodine compound. Whether isolated or in solution, it slowly decomposes (more rapidly at higher temperatures) yielding phosphimide: $2P(NH_2)_3 = P_2(NH)_3 + 3NH_3$. Phosphimide is a brown substance which decomposes on heating.—J. T. D.

Selenious Acid; Action of Dextrose on ——. [Amorphous Selenium.] O. de Coninck and Chauvenet. Comptes rend., 1905, **141**, 1254—1255.

When solutions of dextrose and selenious (or selenic) acid are gently heated together, the selenium separated is in a semi-colloidal condition red, amorphous, insoluble in carbon bisulphide, extremely finely divided and difficult to separate from the liquid by settlement or filtration. At 100° C. it is partially transformed into ordinary black selenium. J. T. D.

Digitoxose. H. Kiliani. Ber., 1905, **38**, 4040—4043.

Digitoxose, $C_6H_{12}O_4$ (see this J., 1898, 1174) is now shown to be an aldose sugar having the constitution $CH_3(CHOH)_3CH_2COH$. It does not yield an osazone, and it is readily oxidised in aqueous solution by bromine to digitoxonic acid, which exists in the form of a lactone and yields an uncrystallisable calcium salt. Digitoxose is energetically oxidised by concentrated nitric acid, but if the calcium salt of digitoxonic acid be treated with nitric acid, a dihydroxyglutaric acid is the main product, thus confirming the above constitutional formula for the sugar.—J. F. B.

Prizes.

Portland Cement; Research on ——.

The Prussian Government and the German Society of Portland Cement Manufacturers offer premiums to the amount collectively of 3000 marks (about £150) for essays on the processes which take place in the hardening of hydraulic cements. The essays which take as general subject matter the demonstration of the properties and of the induration process of calcareous hydraulic coments, synthetically, analytically, microscopically and mineralogically as applied to hardening in air, fresh and sea water, may deal with all or any of the following questions:—(*a*) To prove whether silicic acid, alumina and oxide of iron combine with lime as crystalloids in stable proportions, or as colloids in varying proportions. (*b*) To prove whether double combinations result between silicic acid, alumina, and oxide of iron with lime, and in what manner these substances take part in the hardening process. (*c*) Consideration of the swelling phenomenon which accompanies the hydraulic hardening. (*d*) Consideration of the influence of the temperature and the duration of the burning process on the different kinds of hydraulic cements. (*e*) Properties of puzzuolana and its hardening with lime; beginning with silicic acid, as the most active and prominent puzzuolana, alumina, oxide of iron, and manganese,

independently and in combination with silicic acid, either as natural or artificial puzzuolana. The papers must be written in German and must be submitted under a *nom de plume* to the Ministry of Public Works, 80, Wilhelmstrasse, Berlin, on or before Dec. 31, 1906.

Trade Report.

UNITED KINGDOM; TRADE OF ——— IN 1905.

Bd. of Trade J., Jan. 11, 1906.

The following table shows the value of certain imports from foreign countries and British possessions during the twelve months ended December 31st last, as compared with the corresponding periods of the two previous years:—

	Year ended 31st December.		
	1903.	1904.	1905
RAW MATERIALS AND ARTICLES MAINLY UNMANUFACTURED—	£	£	£
Coal, coke and patent fuel	3,987	2,689	42,582
Iron ore, scrap iron and steel	4,887,793	£ 4,599,200	£ 5,530,784
Other metallic ores	5,915,491	6,597,702	7,611,185
Wood and timber	27,122,956	23,637,985	23,279,358
Cotton	45,026,578	55,024,825	52,370,878
Wool	23,808,809	23,316,455	26,648,261
Other textile materials	11,829,806	13,030,669	14,517,288
Oil-seeds, nuts, oils, fats and gums	24,461,171	25,290,505	23,594,010
Hides and undressed skins	7,381,872	6,876,310	8,084,824
Materials for paper making	3,431,467	3,554,133	3,804,692
ARTICLES WHOLLY OR MAINLY MANUFACTURED			
Iron and steel and manufactures thereof	8,662,481	8,216,772	8,588,571
Other metals and manufactures thereof	18,511,270	20,053,877	21,840,599
Chemicals, drugs, dyes and colours	8,848,292	9,211,770	9,624,607
Leather and manufactures thereof	11,313,951	10,893,182	11,037,762
Earthenware and glass	4,780,739	4,337,273	4,310,016
Paper	4,850,183	4,940,619	5,156,145

The value of the exports of home produce, also of foreign and colonial produce, during the 12 months of 1905, as compared with 1904 and 1903, is shown in the following table:—

	Year ended 31st December		
	1903	1904	1905.
RAW MATERIALS AND ARTICLES MAINLY UNMANUFACTURED	£	£	£
Coal, coke and patent fuel	27,262,786	26,862,386	26,061,117
Iron ore, scrap iron, and steel	453,946	500,621	474,866
Other metallic ores	134,843	120,630	116,011
Wood and timber	51,104	67,593	79,046
Cotton	—	—	—
Wool	1,092,997	1,618,737	1,744,772
Other textile materials	128,385	179,672	155,578
Oil-seeds, nuts, oils, fats and gums	2,976,551	2,759,019	2,507,319
Hides and undressed skins	1,276,836	1,428,041	1,854,526
Materials for paper making	409,624	428,481	538,023
ARTICLES WHOLLY AND MAINLY MANUFACTURED			
Iron and steel and manufactures thereof	30,389,261	28,066,671	31,827,142
Other metals and manufactures thereof	6,958,305	6,991,421	8,934,590
Chemicals, drugs, dyes and colours	13,544,551	13,647,449	14,525,195
Leather and manufactures thereof	4,946,609	4,758,999	5,658,574
Earthenware and glass	3,278,482	3,116,223	3,209,281
Paper	1,795,850	1,876,797	1,938,379

Subjoined are particulars in respect to imports and exports of articles of interest to chemical industry:—

Imports.

Articles.	Quantities.	Value in £.
Chemicals—		
Bleaching materials	236,396 cwt.	61,302
Borax ,,	254,608 ,,	103,565
Brimstone	400,313 ,,	99,783
Coal products (not dyes)	93,303 ,,	66,477
Cream of tartar	*66,840 ,,	247,881
Glycerin	*79,924 ,,	141,630
Muriate of ammonia	4,569 ,,	6,393
Potassium nitrate	†182,052 ,,	173,689
Soda compounds	*365,704 ,,	115,606
Sulphuric acid	*92,691 ,,	7,224
Tartaric acid	36,443 ,,	177,196
Unenumerated	—	*1,943,008
Condensed milk	33,044 ,,	62,642
,, (sweetened)	760,888 ,,	1,522,261
Drugs and medicines—		
Cinchona	*31,251 ,,	74,724
Quinine	†708,866 oz.	32,708
Gum arabic	73,312 cwt.	*105,697
Lac-dye, shellac, &c.	†99,772 ,,	755,730
Mineral water	*1,409,922 doz bots.	308,535
Oils, (coco, cotton, olive and palm)	—	600,449
Petroleum	300,110,335 gals.	5,423,115
Quicksilver	*2,552,586 lb	†256,768
Rosin	1,610,629 cwt	687,842
Saccharin	*850,896 oz.	38,368
Scientific apparatus	—	846,920
Soap	*473,066 cwt	500,430
Sugar (refined and unrefined)	†27,706,467cwt	19,484,785
Turpentine	526,699 ,,	1 104,000
Yeast	*175,386 ,,	365,860

* Notable increases. † Notable decreases.

Exports.

Articles.	Quantities	Value in £
Aerated waters	*1,103,201 doz.bots	180,751
Chemicals, drugs, &c—		
Bleaching materials	*937,267 cwt.	192,043
Coal products (not dyes)	10,324,789 ,,	1,347,674
Copper sulphate	†55,893 tons	1,125,827
Cream of tartar	†1,104 cwt.	4,612
Dye-stuffs	246,099 ,,	378,314
Glycerin	147,169 ,,	301,141
Manure (chemical)	561,204 tons	3 466,768
Muriate of ammonia	99,269 cwt.	128,292
Soda compounds	4,721,235 ,,	1,436,524
Sulphuric acid	85,752 ,,	34,706
Tartaric acid	1,572 ,,	7,687
Unenumerated	—	2,484,719
Medicines—		
Quinine	891,578 oz.	48,657
Oils (coco, olive and palm)	—	70,638
Scientific instruments	—	598,466
Soap	1,230,310 cwt.	1,284,158
Vinegar	434,071 gals.	44,431

* Notable increases. † Notable decreases.

SAMPLES OF BRITISH GOODS; EXHIBITION OF ——— AT CAPE TOWN AND CHICAGO.

Bd. of Trade J., Jan. 4, 1906.

The Board of Trade desire to draw attention to the fact that Mr. E. J. Cattell (the Secretary of the Cape Town Chamber of Commerce), and Mr. A. Finn, H.M. Consul at Chicago, are prepared to receive samples from British manufacturers, at the manufacturers' risk, and to exhibit such samples, respectively, at the Chamber of Commerce and at the Consulate. Prices should be attached in sterling f.o.b., or c.i.f., or if possible in currency, landed, duty paid. No charge is proposed at Cape Town, but at Chicago a fee of 5*s.* per square foot occupied by the exhibitors has to be made for any period not longer than a year. Messrs. Hickie, Borman, Grant and Co., of 14, Waterloo Place, London, S.W., have consented to act as forwarding agents for any packages intended for the sample room at Chicago.

Drug and Chemical Trade in 1905.

J. C. Umney. Chamber of Com. J., Jan., 1906.

The shrinkage in value of drugs and chemicals reached an acute stage at the end of 1904. In the aggregate the volume of business in 1905 has shown improvement, but it has been apparently in export rather than in home trade, and it may be that the ratio of profits has not been maintained, and it is on this account that the increased exports as shown in the Board of Trade returns, may be an indication rather of weak trade at home, and a desire to keep factories running and men employed by a forcing of export trade. Heavy chemicals have shown an upward tendency during the past year. Potash salts, principally due to the shortage of the beet crop in the previous autumn, have been on a higher scale. Tartaric acid has about maintained its level, but higher rates have ruled for citric acid, and although at the close of the year, prices are hardly at their best, yet they finish at least 25 per cent. higher than the corresponding time of 1904. Metals generally have shown a strong upward tendency. The appreciation in the value of antimony at the close of 1904 has been practically maintained. Tin has advanced to almost prohibitive prices, whilst zinc, and latterly copper, have also shown considerable advances. Bismuth, which at the close of 1904, was advanced by about 20 per cent., has, after a small advance at the beginning of the year, suffered a large drop at the hands of the syndicate controlling its sale during the last few weeks. Mercury has varied a trifle in price, but competition in mercurials has presumably reduced the level of profit to practically nothing, so that the sooner a reasonable agreement of prices is made the better, at any rate, for the manufacturers. Silver also shows considerable appreciation in value, and this has naturally had a corresponding effect in those products coming to this country from China, &c. The very considerable advance that was made in iodine during the month of February resulted apparently in attracting considerable competition to this country both from Japan and also Germany. Chloroform, which as a result of the breaking of the bleaching powder Convention, dropped to the lowest point on record during 1904, has been raised, by agreement of manufacturers, by at least 33 per cent., and there is every indication that prices will be maintained. French lavender flowers and their products have shown considerable increase in price, partly due to the drought, which has also affected prices of saffron, which are very high, and it is stated has practically ruined the Spanish olive oil crop, although fortunately, the Italian is unaffected. In camphor, prices have reached a very high level, and are higher and firmer than they have been during the past 12 months. Whether the development of the Japanese celluloid industry has resulted in a considerably increased home demand or not, is not clear. American turpentine has shown violent fluctuations, closing firm, but the prices that have ruled during the year appear to indicate fairly plainly that most of the so-called turpentine substitutes have not been efficient ones. Norwegian cod liver oil, which had shown firmness during the early autumn, closed flat, but prices can hardly be lower in view of the comparatively small stocks held, and in the event of the cod fishing being either delayed, or the yield of oil poor, prices should show considerable advances. In alkaloids there has been but little speculation. Quinine appears to have ceased to attract, whilst the decreased consumption of cocaine, owing to the restrictions placed upon it in India and elsewhere, has had the general effect of depressing prices, with a slight spurt only just at the end of the year.

New Books.

Adolf von Baeyer's Gesammelte Werke. Herausgegeben zur Feier des siebzigsten Geburtstages des Autors, von seinen Schülern und Freunden. In Zwei Bänden. Mit dem Porträt des Verfassers in Photogravure, &c. Friedrich Vieweg und Sohn, in Braunschweig, 1905. Price M.16. Bound in cloth, M.20.

Two large 8vo volumes; Vol. I. containing Baeyer's portrait as frontispiece; preface by the Committee; a chapter by Baeyer entitled "Erinnerungen aus meinem Leben, 1835–1905," including "Erinnerungen aus der Strassburger Studienzeit, 1872–1875," by Emil Fischer. Then a chapter entitled "Meine wissenschaftliche Arbeiten in den Jahren 1865–1905," and finally one entitled "Zur Geschichte der Indigo-Synthese." Following these is a compendium, filling 63 pages, of the titles of Researches emanating from Baeyer's Laboratories in Berlin, Strassburg and Munich, with the names of those who co-operated with him. Vol. I, contains 990 pages and Vol. II. 1169, with a final alphabetical index of subjects. These researches are classified in a special Table of Contents (CXIX. to CXXXII.), according to order of date, whilst in the text itself they are collected into Monographs, according to the General Themes or Subjects treated of. Thus, nineteen groups are dealt with, and are as follows:—I. Organic Arsenic Compounds. II. The Uric Acid Group. III. Indigo. IV. Investigations which have relationship to the Indigo researches. V. Pyrrol and the Pyridine Bases. VI. Dehydration and Condensation. VII. Phthaleins. VIII. The Chemistry of the Hydroaromatic Compounds. Building up of Mellitic Acid, and Constitution of Benzene. IX. Investigations on the Terpenes. X. The Nitroso Compounds. XI. Furfural. XII. On the Acetylene Compounds and the Theory of Tension. XIII. The Peroxides. XIV. The Basic Properties of Oxygen. XV. Dibenzalacetone and Triphenylmethane. XVI. Treatises on Certain Substances in the Aromatic Series. XVII. Similar Treatises on Certain Bodies of the Aliphatic Group. XVIII. Nomenclature. XIX. Miscellaneous.

Kurzes Lehrbuch der Organischen Chemie. von Prof. Dr. A. Bernthsen. 9te Auflage, Bearbeitet in Gemeinschaft mit Dr. Ernst Mohr. Friedrich Vieweg und Sohn. Braunschweig, 1906. Price M.11. Bound in cloth, M.11.80.

8vo volume, containing 601 pages of subject matter, and an alphabetical index. After an introduction of 34 pages dealing with general methods and theories, the main subject is treated of under the following divisions:—Group I. Methane Derivatives. II. Chemistry of the Isocyclic Compounds. III. The Heterocyclic Compounds, including those of which each contains in the molecular ring or cycle, three, four, five or six atomic members or groups.

Die Elektrolyse Geschmolzener Salze. Monographie n über angewandte Elektrochemie. Zweiter Theil: Das Gesetz von Faraday; die Ueberführung und Wanderung der Ionen; das Leitvermögen. Von Richard Lorenz, Ph.D., Professor für Elektrochemie und Physikalische Chemie am eidgen. Polytechnikum in Zürich. Wilhelm Knapp's Verlag. Halle a. S., 1905. Price M.8.

8vo volume, containing 243 pages of subject matter, with 59 illustrations, and including from two to three pages of a bibliographic index. There are alphabetical indexes of the names of authors and of subjects. The subject is divided as follows:—A. Faraday's Law; B. The Movements of the Ions; and C. Conductivity. Appendix I. Conductivity of Glass, Porcelain and Quartz. Appendix II. Various Statements in Literature as to the Conductivity of Oxides, Sulphides and Selenides.

independently and in combination with silicic acid, either as natural or artificial puzzuolana. The papers must be written in German and must be submitted under a *nom de plume* to the Ministry of Public Works, 80, Wilhelmstrasse, Berlin, on or before Dec. 31, 1906.

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Unenumerated	—	*1,943,008
Condensed milk	33,044 ,,	62,642
,, (sweetened)	760,888 ,,	1,522,261
Drugs and medicines—		
Cinchona	*31,251 ,,	74,724
Quinine	†708,866 oz.	32,708
Gum arabic	73,312 cwt.	*105,697
Lac-dye, shellac, &c.	†99,772 ,,	755,730
Mineral water	*1,409,922 doz bots.	308,535
Oils, (coco, cotton, olive and palm)	—	600,449
Petroleum	300,110,335 gals.	5,423,115
Quicksilver	*2,552,586 lb	†256,768
Rosin	1,610,629 cwt	687,842
Saccharin	*850,896 oz.	38,368
Scientific apparatus	—	846,920
Soap	*473,066 cwt	500,430
Sugar (refined and unrefined)	†27,706,467cwt	19,484,785
Turpentine	526,699 ,,	1 104,000
Yeast	*175,386 ,,	365,860

* Notable increases. † Notable decreases.

Exports.

Articles.	Quantities	Value in £
Aerated waters	*1,103,201 doz.bots	180,751
Chemicals, drugs, &c—		
Bleaching materials	*937,267 cwt.	192,043
Coal products (not dyes)	10,324,789 ,,	1,347,674
Copper sulphate	†55,893 tons	1,125,827
Cream of tartar	†1,104 cwt.	4,612
Dye-stuffs	246,099 ,,	378,314
Glycerin	147,169 ,,	301,141
Manure (chemical)	561,204 tons	3 466,768
Muriate of ammonia	99,269 cwt.	128,292
Soda compounds	4,721,235 ,,	1,436,524
Sulphuric acid	85,752 ,,	34,706
Tartaric acid	1,572 ,,	7,687
Unenumerated	—	2,484,719
Medicines—		
Quinine	891,578 oz.	48,657
Oils (coco, olive and palm)	—	70,638
Scientific instruments	—	598,466
Soap	1,230,310 cwt.	1,284,158
Vinegar	434,071 gals.	44,431

* Notable increases. † Notable decreases.

SAMPLES OF BRITISH GOODS; EXHIBITION OF ——— AT CAPE TOWN AND CHICAGO.

Bd. of Trade J., Jan. 4, 1906.

The Board of Trade desire to draw attention to the fact that Mr. E. J. Cattell (the Secretary of the Cape Town Chamber of Commerce), and Mr. A. Finn, H.M. Consul at Chicago, are prepared to receive samples from British manufacturers, at the manufacturers' risk, and to exhibit such samples, respectively, at the Chamber of Commerce and at the Consulate. Prices should be attached in sterling f.o.b., or c.i.f., or if possible in currency, landed, duty paid. No charge is proposed at Cape Town, but at Chicago a fee of 5*s.* per square foot occupied by the exhibitors has to be made for any period not longer than a year. Messrs. Hickie, Borman, Grant and Co., of 14, Waterloo Place, London, S.W., have consented to act as forwarding agents for any packages intended for the sample room at Chicago.

JOURNAL OF THE

Society of Chemical Industry.

No. 3.—Vol. XXV. SUPPLEMENT. February 15, 1906.

HON. TREASURER:—
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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Members are reminded that the subscription of 25*s.* for 1906, payable on January 1st, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

THE BINDING OF THE JOURNAL.

The two unpaged official pages, containing the lists of Council and Committees, issued with this number of the Journal, should, in binding, be placed in front of page 1 of the January 15th number, whether the supplements be bound up or not.

LONDON SECTION.

The next meeting of the London Section will be held at the Chemical Society's Rooms, Burlington House, Piccadilly, on Monday, March 5th, 1906, at 8 p.m., when Dr. W. H. Perkin will read a paper on "The Synthesis of Nitrogenous Compounds in Plant and Animal Organisms."

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Morson, Thos. D.; Journals to 14, Elm Street, Gray's Inn Road, London, W.C.
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Wigglesworth, E., l/o New York City; c/o Pulaski Mining Co., Pulaski, Va., U.S.A.
Young, James, l/o Runcorn; 38, Dunster Gardens, Brondesbury, N.W.

Change of Address Required.

Weston, D. B., l/o Harvard Street, Cambridge, Mass., U.S.A.

Deaths.

Hermsdorf, Dr. W., Salzstrasse, Chemnitz, Saxony. Jan. 22.
Meyer, A R., Dwight Building, Kansas City, Mo., U.S.A.
Redpath, L. W., International Smokeless Powder Co., Parlin, N.J., U.S.A. Nov. 21, 1905.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (1) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 1158. Schmidt. *See under* XVIIIB.
„ 1204. Lake (Nordyke and Marmon Co.). *See under* VII.
„ 1245. Kobusch. Heating drums. Jan. 17.
„ 1280. Barnes. Extraction of liquids from solid materials.* Jan. 17.
„ 1479. Mecredy and Hawes. Apparatus for obtaining dry products from liquids or semi-liquids. Jan. 19.
„ 1490. Graham. Furnaces. Jan. 19.
„ 1770. Cotton. Reverberatory furnaces.* Jan. 23.
„ 1814. Watson. Method and apparatus for obtaining selected constituents from complex material. Jan. 24.
„ 2040. Derval. Retort furnaces and retorts.* Jan. 26.
„ 2045. Smith, *See under* XIIIA.
„ 2087. Connell, Haldane and Thomson. Treatment of smoke and fumes for preventing pollution of the atmosphere. Jan. 27.
[C.S.] 1177 (1905). Hatmaker. Cylinder drying machines. Jan. 24.
„ 8476 (1905). Pampe. Separation of the head and tail products in continuous and periodic distillation and rectification. Jan. 31.
„ 8895 (1905). Berberich and Schröder. Method and apparatus of mechanically mixing or combining liquids. Jan. 24.
„ 11,140 (1905). Windhausen. Compressing air or gases. Jan. 24.
„ 17,884 (1905). Heylandt. Portable storage vessels for liquefied gases. Jan. 31.
„ 21,190 (1905). Aktiebolaget Separator, and Forsberg. Centrifugal separators for liquids. Jan. 31.
„ 21,830 (1905). Horst. Drying apparatus. Jan. 31.

II.—FUEL, GAS, AND LIGHT.

[A.] 1100. Lake (Trump). Gas producers.* Jan. 15.
„ 1185. Smith. Producer gas plants. Jan. 16.
„ 1257. Blakeley. Tar fog extractor for compound gases. Jan. 17.
„ 1295. Maschinenfabrik und Mühlenbauanstalt G. Luther. Gas producers. [Ger. Appl., Dec. 13, 1904.]* Jan. 17.
„ 1315. Gallmann. Gas producers. Jan. 17.

[A.] 1331. Goehtz. Gas generators. [Ger. Appl., Nov 30, 1905.]* Jan. 17.
„ 1417. Dowson. Gas generators. Jan. 18.
„ 1510. Crawford. Treatment of peat. Jan. 19.
„ 1642. Armstrong. Manufacture of coke and gas. [U.S. Appl., June 20, 1905.]* Jan. 22.
„ 1684. Ringsdorff. Production of artificial carbon. Jan. 23.
„ 1766. Konitzer. Electrode for arc lamps. [Ger. Appl., May 27, 1905.]* Jan. 23.
„ 1841. Schatz. *See under* XXIII.
„ 1980. Morton. Producer gas plants. Jan. 26.
„ 2154. Grayson. Manufacture of artificial fuel. Jan. 27.
[C.S.] 1288 (1905). Drees. Gas purifying apparatus. Jan. 24.
„ 1329 (1905). Beck. Apparatus for generating combustible products under pressure for power purposes. Jan. 24.
„ 1434 (1905). Bueb. Water-gas generators. Jan. 31.
„ 5825 (1905.) Ellis. Manufacture of producer gas. Jan. 31.
„ 8162 (1905). Woods. Incandescent mantles for gas burners. Jan. 31.
„ 8730 (1905). Stapf. Gas generators. Jan. 31.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 8590A (1905). Noerdlinger. Distillation of wood tars, resin oils and the like.* Jan. 26.
„ 1257. Blakeley. *See under* II.
„ 1397. Stauber. Ovens for coking or carbonising peat, wood, and the like. Jan. 18.
[C.S.] 1202 (1905). Birkbeck (Barboni). Manufacture of non-inflammable products from benzene. Jan. 24.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 1373. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of nitro- or amidosulphonic acids of *o*-dichlorobenzene. Jan. 18.
„ 1475. Abel (Act.-Ges. f. Anilinfabr.). *See under* XIIIA.
„ 1596. Rahtjen and Stephan. Process of making indigo. Jan. 22.
„ 1954. Johnson (Badische Anilin und Soda Fabrik). Manufacture of indigo paste.* Jan. 25.
[C.S.] 644 (1905). Junius and Vidal. Manufacture of black sulphur dyes. Jan. 24.
„ 4646 (1905). Imray (Meister, Lucius und Brüning). *See under* XIIIA.
„ 7390 (1905). Imray (Meister, Lucius und Brüning). Manufacture of indigo preparations. Jan. 31.
„ 14,543 (1905). Imray (Meister, Lucius und Brüning). Manufacture of red to violet sulphurised dyestuffs). Jan. 31.
„ 82 (1906). Johnson (Badische Anilin und Soda Fabrik). *See under* XIIIA.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 1235. Brandt. Method of preserving engraved, embossed, or calendered figures impressed on fabrics. Jan. 17.
„ 1296. Bottomley. Manufacture of boracic acid wool.* Jan. 17.
„ 1300. Cassella und Co. Printing sulphide colours on textiles fabrics. [Ger. Appl., July 15, 1905].* Jan. 17.
„ 1731. Helleken. Washing machines. Jan. 23.
„ 1804. Haigh, Wheeler and Appleyard. Rendering certain substances waterproof, non-inflammable and non-conducting of electricity.* Jan. 24.
„ 1939. Abel (Act. Ges. f. Anilinfabr.). Process for dyeing acetylated cellulose or artificial silk made therefrom. Jan. 25.
„ 2083. Hey. Method and apparatus for treating textiles and fibrous materials with the products of electrolysis of water solutions of acids, oxides and salts. Jan. 27.
[C.S.] 1547 (1905). Wood. Continuous open fabric steaming apparatus. Jan. 31.
„ 11,410 (1905). Mackey. Apparatus for purifying dye-water or similar effluent. Jan. 24.
[C.S.] 81 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of zinc formaldehyde hydrosulphite. Jan. 31.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 1050. Wetter (Wülfing). Manufacture of black oxide of iron. Jan. 15.
„ 1204. Lake (Nordyke and Marmon Co.). Art of catalysis and apparatus therefor. Jan. 15.
„ 1299. Conedera. Depuration of copper sulphate contaminated with iron salts, and direct extraction of copper sulphate from ores. [Ital. Appl., Feb. 19, 1905.]* Jan. 17.
„ 1498. Latham. Utilisation of old plaster casts and other hydrated sulphate of lime and apparatus therefor. Jan. 19.
„ 1529. Cole. Production of compounds of silicon. Jan. 20.
„ 1764. Noerdlinger and Noerdlinger. *See under* XVIIIB.
„ 1771. Poulenc. Preparation and purification of peroxides.* Jan. 23.
„ 1960. Dewar. Production of hydrochloric acid. Jan. 25.
„ 2008. Ryan and Cantrell-Hubbersty. Lime kilns and the like.* Jan. 26.
„ 2047. Cooper. Production of hydrocyanic acid and of cyanides therefrom. Jan. 26.
„ 2073. Dewar. *See under* X.
[C.S.] 7915 (1905). Best, Hollingsworth, and The United Alkali Co., Ltd. Burning pyrites of an explosive character and apparatus therefor. Jan. 24.
„ 8448 (1905). Reiss. Manufacture of insoluble aluminium acetate. Jan. 24.
„ 26,803 (1905). Kaiser. Process for producing ammonia. Jan. 31.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 1407. Bates. Fire resisting glazing. Jan. 18.
„ 1408. Richards and Sutcliffe. Roofing tiles and apparatus for manufacturing the same. Jan. 18.
[C.S.] 17,890 (1905). Seaboldt. Process of treating siloxicon. Jan. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 1105. Bohm. Method of cleaning and separating clays and apparatus therefor.* Jan. 15.
„ 1129. Smith. Composition for making red bricks, tiles, &c. Jan. 16.
„ 1325. Poulsen. Preservation of wood.* Jan. 17.
„ 1611. Aeberli. Manufacture of a dust-proof macadam.* Jan. 22.
„ 1635. Nay and Revello. Cement composition. Jan. 22.
[C.S.] 5513 (1905). Zellenka. Cementing material. Jan. 31.
„ 6362 (1905). Coudere. Treatment of wood to render it hard and impermeable and to impart a polish to it. Jan. 24.
„ 9108 (1905). Newell and Fennell. Rotary cement kilns. Jan. 31.
„ 9350 (1905). Butterfield. Road making. Jan. 24.

X.—METALLURGY.

[A.] 1102. Benjamin. Process for obtaining a slag. Jan. 15.
„ 1166. Power. Production of fine silver from silver chloride in fusion with other chlorides. Jan. 16.
„ 1356. André. Method and apparatus for manufacturing steel.* Jan. 18.
„ 1926. Edison. Process of making metallic films or flakes. [U.S. Appl., March 30, 1905.]* Jan. 25.
„ 2052. Richardson. Processes for smelting and refining metals and apparatus therefor. Jan. 26.
„ 2073. Dewar. Desulphurisation of galena and other sulphide ores, and recovery of sulphuric acid. Jan. 26.
„ 2074. Dewar. Treatment of lead, zinc, sulphide ores or blende concentrates containing galena. Jan. 26.
[C.S.] 28,019 (1904). Schumacher. Process for agglomerating pulverulent iron ores. Jan. 31.

[C.S.] 1821 (1905). Sulman, Picard and Ballot. Wet separation of minerals. Jan. 31.
„ 2861 (1905). Boult (Soc. Anon. des Mines de Bormettes et Lotti). Treatment of lead and like ores. Jan. 31.
„ 7813 (1905). Sulman, Picard and Ballot. Ore concentration. Jan. 24.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 1019. Gin. Electric furnaces.* Jan. 15.
„ 1065. Wilderman. Electric batteries. Jan. 15.
„ 1569. Wilderman. Accumulators.* Jan. 20.
„ 1576. Fellows, Pickup and Tice. Electric secondary batteries. Jan. 20.
„ 1578. Cowper-Coles. Electrolytic manufacture of copper wire, strip, or the like. Jan. 20.
„ 1716. Finlay and Finlay. Electrolytic cells. Jan. 23.
„ 1924. Edison. Electrode for storage batteries. [U.S. Appl., Nov. 2, 1905.]* Jan. 25.
„ 1925. Edison. Storage battery electrode. [U.S. Appl., March 30, 1905.]* Jan. 25.
„ 1927. Edison. Electrode mass for storage batteries and process for forming same. [U.S. Appl., March, 30, 1905.]* Jan. 25.
„ 1928. Edison. Storage battery electrodes. [U.S. Appl., April 28, 1905.]* Jan. 25.
„ 1968. Cowper-Coles. Electrodeposition of alloys.* Jan. 26.
[C.S.] 13,690 (1905). Girod. Electric furnaces. Jan. 24.
„ 23,402 (1905). Girod. Electric furnaces. Jan. 24.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 1719. Wörner. Manufacture of emulsifiable matter. Jan. 23.
„ 1869. Lifschütz. Process for manufacturing fats and oils capable of absorbing water.* Jan. 24.
„ 2076. Raschen and Raschen. Method of treating cocoanut and similar oils. Jan. 26.
[C.S.] 17,777 (1905). Heys. Detergent and the manufacture thereof. Jan. 24.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 1279. Potter. Paint. [U.S. Appl., Jan. 25, 1905.]* Jan. 17.
„ 1475. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of colour lakes. Jan. 19.
„ 2045. Smith. Drying pulp white lead. Jan. 26.
[C.S.] 4646 (1905). Imray (Meister, Lucius und Brüning). Manufacture of red colour lakes. Jan. 31.
„ 82 (1906). Johnson (Badische Anilin und Soda Fabrik). Production of red colour lakes. Jan. 31.

(*B.*)—RESINS, VARNISHES.

[A.] 1508. Kruse. Manufacture of a turpentine substitute or siccative. Jan. 19.

(*C.*)—INDIA-RUBBER.

[C.S.] 12,859 (1905). Von Stechow. Extraction of pure raw rubber from rubber plants. Jan. 24.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 1733. Finn. Preparation for renovating leather. Jan. 23.
„ 1787. Bryan. Process for hardening leather. Jan. 24.
„ 1850. Johnson (Badische Anilin und Soda Fabrik). Decolorisation of extracts containing tannin. Jan. 24.
„ 2088. Lambert. Glue and process for making same. Jan. 27.
[C.S.] 8875 (1905). Story. *See under* XIX.
„ 17,551 (1905). Baron and Aubert. Process of tanning leather and skins. Jan. 24.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 1046. Hopmann. Production of trypsin-zymolyse, a substance causing fermentation, which lends trypsin a digestible effect.* Jan. 15.
„ 1326. Chew, and H. J. West and Co., Ltd. Apparatus for cooling and carbonating beer and the like. Jan. 17.
1639. Effront. Preparation of malt by means of hypochlorite salts.* Jan. 22.
[A.] 1962. Faulkner. *See under* XVIIIA.
„ 2113. Hilliard. Method of ageing or maturing whisky.* Jan. 27.
[C.S.] 4174 (1905). Spencer, Spencer and Spencer. Maturing and mixing alcoholic liquors. Jan. 31.
„ 11,474 (1905). Dewar. Malting apparatus. Jan. 31.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

[A.] 1046. Hopmann. *See under* XVII.
„ 1084. Ehrmann. Manufacture of butter.* Jan. 15.
„ 1429. Paisley. Purifying machines for semolina, &c. Jan. 19.
„ 1621. Alsop. Treatment of flour. Jan. 22.
„ 1871. Bond. Alimentary product. Jan. 24.
„ 1962. Faulkner. Treatment of brewers' grains or draff for the production of material suitable for use as yeast food. Jan. 25.
„ 1964. Woosnam. Process of obtaining dry milk. Jan. 25
„ 2098. Macfarlane. Purification of cocoa. Jan. 27.
[C.S.] 12,526 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of preparations of pepsin containing hydrochloric acid. Jan. 24.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 1158. Schmidt. Purifying apparatus for liquids.* Jan. 16.
„ 1764. Noerdlinger and Noerdlinger. Process for rendering innocuous waste waters, &c., containing cyanogen and sulphocyanogen compounds. [Ger. Appl., Jan. 24, 1905.]* Jan. 23.
„ 1894. Guy and Wormald. Treatment of the settlings from sewage tanks. Jan. 25.
[C.S.] 11,410 (1905). Mackey. *See under* V.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 1178. Sachsenröder. Manufacture of parchment paper.* Jan. 16.
„ 1182. Soc. Franç. de la Viscose. Cellulose product and process of manufacturing same. [Fr. Appl., Jan. 28, 1905.]* Jan. 16.
„ 1377. Armengaud. Manufacture of paper by the web machine. [Fr. Appl., Jan. 21, 1905.]* Jan 18.
[C.S.] 8325 (1905). Morris. Manufacture of paper. Jan. 24.
„ 8875 (1905). Story. Production of substitutes for horn, celluloid, ebonite, &c. Jan. 24.
„ 21,415 (1905). Kruse. Stuff purifier and screen for the manufacture of cellulose or paper. Jan. 31.
„ 22,718 (1905). Parker. Machines for forming and combining webs of paper pulp. Jan. 31.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 1850. Johnson (Badische Anilin und Soda Fabrik). *See under* XIV.
[C.S.] 8445 (1905). Reiss. *See under* VII.
„ 11,759 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new amino-hydroxylated derivative of phenylnaphthimidazole. Jan. 24.
„ 21,172 (1905). Jansen. Manufacture of a solution of oxyhemoglobin. Jan. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 2057. Hoffsümmer. Process for making photographic papers.* Jan. 26.
[C.S.] 7319 (1905). Rawlins. Developing photographic plates, &c., without the use of a dark room. Jan. 24.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 1573. Grobet. Manufacture of safety explosives. [Ger. Appl., Jan. 28, 1905.]* Jan. 20.
„ 1950. Maguire and Maguire. Match making apparatus. Jan. 25.
„ 2048. Cocking, and Kynoch, Ltd. Powders for propulsive purposes. Jan. 26.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 1841. Schatz. Automatic apparatus for analysing gas. [Ger. Appl., April 12, 1905.]* Jan. 24.

JOURNAL OF THE

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Vol. XXV. January, 1906.

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SOCIETY OF CHEMICAL INDUSTRY.

NOTICE OF EXTRAORDINARY GENERAL MEETING OF THE SOCIETY.

(Summoned pursuant to Bye Law 40.)

Notice is hereby given that an Extraordinary General Meeting of the Society will be held at 3.30 o'clock, precisely, in the afternoon of Tuesday, the twenty-seventh day of March, 1906, at the House of the Society of Arts, John Street, Adelphi, W.C., by kind permission of the Council of that Society, with the object of considering and adopting the resolution mentioned in the Requisition hereinafter set forth:—

"TO THE PRESIDENT AND COUNCIL OF THE SOCIETY OF CHEMICAL INDUSTRY."

We, the undersigned Members of the Society of Chemical Industry, hereby request that, in accordance with Bye-Law 40, you will convene an Extraordinary General Meeting of the Society with the object of considering, and if approved by the said Extraordinary Meeting, of adopting the following resolution (that is to say):—

RESOLUTION.

"That it is desirable that the Society of Chemical Industry as now existing should be incorporated under and subject to the grant of a Royal Charter and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation."

Dated this twenty-second day of December, 1905.

Here follow signatures of the following:—

George Beilby.	Henry de Mosenthal.
V. G. Bloede.	Prof. Chas. E. Munroe.
Jas. H. Bowman.	Jas. P. Murray.
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SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

The attention of Members is drawn to the Notice which accompanies this issue of the Journal.

Deaths.

Hermsdorf, Dr. Walter, Salzstrasse 69, Chemnitz, Saxony. Jan. 22.

Meyer, August R., Dwight Building, Kansas City, Mo., U.S.A.

Redpath, L. W., International Smokeless Powder Co., Parlin, N.J., U.S.A. Nov. 21 1905.

London Section.

Meeting held at Burlington House, on Monday, January 8th, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

CINCHONA BARKS AND THEIR CULTIVATION.

BY DAVID HOWARD.

I propose this evening to give a brief sketch of some of the results of the cultivation of Cinchona bark, and before doing so, will only venture on a mere reference to the previous history of the Cinchona barks and to the chemistry of their alkaloids; for the former I would refer anyone interested in the subject to the admirable work by Sir Clements Markham, entitled "Peruvian Bark," and for the latter to Leger's admirable monograph, "Les alcaloides des Quinquinas."

Quinine and its cognate alkaloids have hitherto only been found in the barks of the genus Cinchona and the allied genus Remgia. These are only found in a limited zone of the eastern slopes of the Andes, and nothing was known to Europeans of their medicinal properties till some time after the Spanish conquest. It is not certain whether the Indians were aware of them, but if they were, they concealed their knowledge from their conquerors. In 1638, the wife of the governor, the Count of Chinchon, being very ill with malarial fever was cured by the administration of a hitherto unknown remedy, and she took great pains to introduce its use in Europe, and hence the name of the genus which purists spell Chinchona.

The chemistry of these barks was investigated by Dr. Gomes, a Portuguese, who isolated cinchonine in 1816, and in 1820 Pelletier and Caventou isolated quinine, and the alkaloid has since then taken the place of the bulky powdered bark that was formerly employed in medicine. The later investigations into the properties and relations of the various cinchona alkaloids opens up so wide a subject that I will not attempt to go into it, especially as I have very little that is unpublished to add to the stock of knowledge.

From that time the use of Cinchona bark and quinine in medicine steadily increased, and as the collection of the bark was in the hands of ignorant Indians who never thought of planting trees to replace those cut down, district after district was denuded of the trees, and there was every prospect of most inefficient supplies if not of extinction of the genus.

In British India there was not only a great demand for quinine, but climatic conditions very similar to those on the Andes, and the Government wisely determined to set about the introduction of the Cinchona into the country. It was no easy matter, the bark collectors arguing rightly enough that if the bark was cultivated elsewhere their occupation would be gone, and any one who was even suspected of an attempt to carry off plants or seeds went in peril of his life. Undeterred by these difficulties, Sir Clements Markham and his coadjutors arranged expeditions into the districts from which the most valuable species were procured, and after adventures, far more interesting than those of a novel, succeeded in bringing home plants in Wardean cans and seeds of various species, specially of the Succirubra and Officinalis.

It all sounds very easy, but to get the plants alive to the coast, to keep them alive on the voyage to England, and again through the Red Sea was a triumph of skill and patience. When they reached India, they were cultivated

with infinite care and skill at Darjiling, and on the Himalayas. At the former place, the Government were fortunate in securing the services of a Scotchman named MacIvor, who nursed them as only a Scotch gardener can. The cultivation prospered and spread to other districts of India and Ceylon, and for 10 or 15 years the greater part of the quinine supply of the world was obtained from India and Ceylon.

The cultivation of these barks under such skilful management has thrown light on many questions as to the formation of alkaloids in these barks. Samples of the wood and leaves of the trees were carefully examined for the alkaloid, but none was found in either; it seems therefore, that the elaboration of the alkaloids takes place solely in the downward course of the sap. Further, that the percentage of alkaloid constantly increases in the bark from the twigs to the ground, and certainly in the less flourishing trees the root bark is richer still. Another curious point is shown by such analyses, namely, that the root alkaloid invariably contains more of the dextrogyrate alkaloids, quinidin and cinchonine, than the bark of the same tree above the ground.

Another point of great interest that has been made very clear is, that the more flourishing a tree is the more alkaloid it will produce, and the result of cultivation has been to produce bark yielding 10 per cent. or even more of alkaloid; this is three or four times as much as was found in the average wild barks of commerce. "I remember that the first 5 per cent. bark I tested, astonished me so much that I at once repeated the analysis, thinking that my weighings must have been wrong. To obtain such results as these, however, it is necessary to have the best varieties as well as healthy trees. The yield from trees growing side by side, all from the same cultivation, of the same seed, in the same soil differs very widely, and a great number of analyses of individual trees showed by the irregular incidence of good and bad tests that the variation must be in the trees and not in the conditions of growth.

. . . By the application of various manures to these trees, it was shown that such manures as increased the apparent vigour of the trees increased their alkaloidal yield, and that for this purpose nitrogenous manures were the best.

I may mention that for the purpose of these analyses, the trees were not cut down, but strips taken from them at the same height above the ground.

As the wood of the trees is of little or no use, a system of bark collection was adopted in India and Ceylon, similar to that by which cork is obtained. In this country, if a portion of the bark is taken from a tree, nature makes an attempt to heal over the wound, but the process is capricious and often fails, but in hot climates, it takes place much more freely, provided always that the cambium is not damaged. Of course, the partial removal of the bark must be longitudinal, ringing a tree will kill it even in the tropics.

The plan successfully introduced by MacIvor was as follows: Incisions were made down the trees about an inch apart and of any convenient length, the enclosed strip being carefully cut across at the top and bottom, the strip was pulled off and dried, a strip of bark was then left untouched, and then another strip taken and so on all round the tree, which was then wrapped round with moss to keep off the sun and air, and in an amazingly short space of time the cambium poured out sap which formed bark all over the wound, not only at the side as we so often see in this country. The next year the strips left on the tree, or a portion of them, could be similarly treated, and the second or third year the renewed bark could be taken off and the same process of healing would take place. A similar process has also been treated by cutting shavings off the trees with a spokeshave, but though involving much less labour, it is less effectual, as it is most difficult to cut deeply enough into the bark to ensure the process of renewal without damaging the cambium.

The renewed bark gives very interesting results, it is in the first place richer in alkaloid; this is not surprising, as it has always been found that the alkaloids were chiefly contained in the cellular tissue of the bark, not in the fibrous portion. In some barks, these two structures are very distinct, and there is no difficulty in cutting them apart. The renewed bark shows little or no sign of fibrous growth, and is almost entirely cellular.

But not only is the quantity of alkaloid greater, but the quality is very different. The species which lend themselves best to this treatment are the Succirubra and Officinalis; both these and especially the Succirubra yield, from the natural bark, large percentages of cinchonidine. In the renewed bark the proportion of cinchonidine is very much diminished as compared with the quinine, sometimes almost disappearing. This result is curiously different from the changes in the relative proportion of alkaloid found in the root; there the dextrogyrate alkaloids increase as against the lævogyrate, here the less oxydised lævogyrate alkaloid increases as against the more oxydised. It is difficult to imagine that one changes into the other, if Pasteur's formula were correct, and the difference were only in the oxygen, that might be, but it is evident that the difference is much more fundamental.

Another point of interest was the study of hybrids. The inflorescence of the cinchonas lends itself greatly to hybridisation owing to the fact that the flowers, though having both stamina and petals are of two forms, sometimes the one, sometimes the other of the organs being prominent, and thus fertilisation must take place from another flower by the help of insects.

Many hybrids were produced, but it is unfortunate that no accurate records are available of the exact circumstances of the crossing. It was difficult if not impossible to learn which species was the seed bearer. One hybrid, known as "Robusta," was specially interesting, its growth was even more luxuriant than that of the parent Succirubra, while the yield and purity of the quinine approximated to fine Calisaya.

A great deal more would doubtless have been learned but for the fact, disastrous for British India and Ceylon, that the cultivation of cinchona in those regions ceased to be profitable. In old days the unit of price, i.e., the cost of each percentage of quinine in a pound of bark varied from 8d. to 2s. At 6d. the cultivation in the British plantations was splendidly profitable, but the Indian Government was not the only one that perceived this importance of cinchona cultivation.

The Dutch had, early on, rightly guessed that Java afforded an ideal home for the cultivation of cinchona, and great efforts were made to obtain plants or seed. At first, though the plants were obtained they were, by accident or on purpose, a collection of species very interesting no doubt to the quinologist, but utterly valueless as a source of valuable alkaloid.

At last, an English merchant named Ledger, living on the West Coast of America, obtained, by the help of an Indian named Manuel, a packet of seeds, largely from one magnificent tree; when Manuel went home again the cascarilleros found out what he had done and murdered him.

These seeds were sold by Ledger, half to British India and half to the Dutch Government; he received, I think, £50 from each, all of which he gave to the widow of poor Manuel. The British half was somehow or other mismanaged, and at any rate no success was obtained in the cultivation. The Java portion gave very different results.

In the skilful hands of the managers of the Government gardens the plants throve wonderfully, and were managed with most admirable skill. The barks of individual trees were analysed, and only those which gave high tests were allowed to flower; the seed from these was cultivated in spots far away from other plantations, and the same weeding out of the inferior plants repeated. The result has been wonderful. The richest bark from South America, such as, no doubt, Ledger's seed came from, yielded up to 4 per cent. of quinine alkaloid; we now find in the Amsterdam sales, whole parcels of bark giving 10 per cent. of quinine alkaloid. Where the plant finds room for it, it is hard to guess. It is a curious question—what use, if any, the alkaloid is to the life of the tree. The alkaloid is only produced in favourable soil and environments, and at high elevations. The trees may apparently flourish at low elevations or in hot houses, but in those circumstances the yield of alkaloid is very

small. It is clear that the fault is in the circumstances not in the trees, for some of the richest officinalis bark in the Nilgiries was obtained from trees which were the offspring of trees grown from cuttings sent out by my uncle, J. E. Howard, F.R.S., from plants grown in England. These mother plants out-grew his hot houses, and had to be cut down; their bark contained but little quinine.

The wonderful strain of Calisaya, called after Ledger Ledgeriana, was eagerly cultivated with all the Dutch skill in gardening, and now the yield of Ledgeriana bark from Java is about 12,000,000 lb. per annum. I hear of dividends of 60 per cent. from plantations in Java, and Ledger got nothing.

"Sic vos non vobis festis aratra boves."

In the rich deep soil of Java, the trees flourish marvellously, and sprout so freely from the root that coppicing, instead of the laborious process of renewing, is universally adopted. In six years the plantation begins to yield, and may go on for many years.

Now, as it is cheaper to grow 6 to 10 per cent. bark in Java than 2 to 5 per cent. bark in British India, it is not wonderful that the English planters were beaten out of the field, and the Dutch planters, by growing more than the market could possibly stand, and recklessly competing in their efforts to sell, got the price down to 0·4 of a penny per unit. They were profoundly convinced of the wickedness of the quinine manufacturers of the world, but learned their lesson, and by allowing the demand to overtake the supplies, got the unit up to 2d. Over production again followed, and the price is down to 1d. and falling still.

A good deal of "hybrid" bark is sent from Java without very clear intimation of its origin, it gives a sporting interest to the analysis, as one never knows if it will turn out as calisaya or succirubra, and bark is also sent as succirubra which from its test must be robusta. Another very interesting study is given us by the grafted bark of which a good deal has been grown, Ledgeriana, being grafted on a succirubra stock; this "enten baast" generally gives excellent tests, but lately some of the plantations seem to have worn out, and the root bark has been sent over; it is most interesting to find that this gives exactly the test of succirubra root, and "enten wortel" and "enten baast" are as different as the bark of the stock and the bark of the graft originally were. This shows that there is no transference of the alkaloid from above downwards; that the descending sap cannot carry the alkaloid as such, but that the stem and the root each elaborate after their own kind.

The success of the Dutch in knocking out all their rivals, and it must have required the doggedness of a Hollander to hold on, even in Java at 2¼ cents, has prevented other plantations of cultivated bark having the success they deserve.

We receive, however, cultivated calisaya from the Andes, and some wonderful cultivated "soft Columbian bark" has lately been brought to London. The cultivation in Jamaica is only a question of price, and we get the very richest Succirubra bark from West Africa, but as people do not take quinine for enjoyment because it is cheap, but only when they want it, the supply now seems to have but little to do with the demand. . . It is true that the reduction in price from 10s. to 10d. has increased the consumption to about ten times what it was 40 years ago, but now it is difficult to imagine that anyone now goes without quinine on account of its price.

The synthesis of quinine has always been hitherto an unattainable aim. It has been frequently attempted, and I believe that to one such attempt we owe the invention of aniline dyes; even the change from one alkaloid to another has only been effected in one case. It used to have a pecuniary as well as a scientific attraction, but, from the commercial standpoint, can we hope to beat nature with her synthesis of 10 per cent. Ledgeriana?

Discussion.

Dr. Divers said he had much pleasure in congratulating Mr. Howard on the discourse he had given on a subject in which he was such an expert. He could confirm from personal knowledge the statement that Dr. Perkin was indeed seeking the synthetical formation of quinine when he discovered the coal-tar colours.

Mr. R. A. Robinson said he had noticed that the Medical Council recognised Succirubra as the only bark now used in pharmacy, but he hoped the culture of the other barks in India was not ruined. If it was bought by the unit, and could be grown cheaply, he hoped it could still be cultivated and used by manufacturers, although it could not compete with the richer bark which came from Java. He entirely agreed with Mr. Howard that there was a point at which it was no good producing a thing more and more cheaply. A thing might be too cheap, and hence not valued. If it were the fact that quinine could be bought in India, where it was urgently needed, at such a low price that the poorest natives could have the benefit of it, its cultivation should not be pressed beyond a certain point, because there was no benefit in producing larger quantities.

Mr. Hanbury said he was much interested in what the author had said about the readiness with which various species of cinchona hybridised. He should like to ask whether it was not usual to find much greater strength in the trees which were hybridised than in the original species when they were transplanted in a different country. The plants he was interested in himself, when hybrids, were far more vigorous than the imported species. It was difficult to keep the imported species as good as they were when they first came over; whereas the hybrids grew larger and larger, and became far finer plants than either of the parents. He should like to know whether it was the hybrids formed in these new countries, such as Java, or the transplanted species that gave the best results?

Mr. E. M. Holmes said he understood that the renewed bark was richer in quinine than the ordinary bark. And he believed that was even more so in the case of barks which were mossed, but it was found that mossed barks were liable to the attacks of insects, and that process had to be given up, and the bark renewed without moss. He might suggest the possibility that the action of oxygen in the renewed bark might be greater than in the original bark, because it had been stated that when cinchonas were grown at higher elevations, where the air probably contained more oxygen, the proportion of quinine was greater. They had not heard anything about the soil in which cinchonas were grown, and he should like to ask whether it was ferruginous—whether it contained hydrated oxide of iron rather than oxide which was not soluble. The increase in quinine in the root seemed to suggest the greater possibility of oxidation either by ferrous oxide in the soil or an oxidase in the bark. With regard to hybrids, he imagined it was almost impossible, in the case of trees which were mixed up together, to ascertain which was the male plant and which was the female from which any special hybrid was derived. But what seemed to him of far more importance was this, if they got a good hybrid, it would be possible, he should imagine, to reproduce that by cutting or by grafts near the root instead of depending upon the seeds. He did not know whether that had been attempted by the Dutch, but such a process might lead to the selection of much richer plants. Every horticulturist knew what systematic botanists do not often realise, that among ordinary species you might have "strains"—i.e., some particular individual might present specially advantageous characters. This was probably the same with cinchonas, and those particular individuals of the so-called species or hybrids should be selected for cultivation. He did not hear Mr. Howard say whether the low price of quinine was due in large measure, as he had heard, to the introduction of immense quantites of the cuprea bark into this country, which, being cheaper than cinchona bark, lowered the price of the alkaloid very considerably. Cinchona is now cultivated very largely in Bolivia, so that, even if they had an extra supply from Java, there would still be the Bolivian supply to supplement it. One could not but regret that the Indian Government had not succeeded with Mr. Ledger's seeds as the Dutch had.

Dr. Passmore said Mr. Howard would forgive him if he claimed for an English chemist, Dr. Paul, the honour of having separated the two constituents of homo quinine,

namely, quinine and cuprine. That was done in his laboratory some few weeks before Dr. Hesse, who received the Hanbury gold medal from the Pharmaceutical Society for his alkaloidal work, did the same; but Dr. Hesse went further, and showed that cupreine, the second alkaloid of the homoquinine,stood in the same relation to quinine as a phenol did to its simple ether; so that by methylation of cuprine quinine could be obtained. Although chemists had so far failed to produce quinine synthetically, nevertheless the study of organic chemistry relating to the constitution of the alkaloids had produced a wonderful number of other substances of importance in the medical world. Antipyrin, for example, was an enormous success. It was supposed at one time that it would eclipse quinine entirely, but it had lived alongside it. There was only one cinchona alkaloid which was worth mentioning now, and that was cinchonamine, which had an interest to chemists because at the time it was discovered it was pointed out that it was an excellent reagent for nitric acid.

Dr. POWER said the history of the cinchonas was a remarkable one, and, although it included some traditions, there was much of substantial fact, for it presented a marvellous record of travel and exploration, in which occurred the names of many distinguished persons, such as those of Humboldt, at the beginning of the past century, and Sir Clements Markham, at a later period. The subject was also one which had afforded a most fruitful field for botanical and chemical investigation. In the long roll of illustrious names connected with the cinchonas, that of Howard occupied a prominent and worthy place. He recalled the fact that Mr. John Eliot Howard had not only published a valuable work, entitled, "Quinology of the East Indian Plantations," but that he had rendered a further most important service to quinological science. It was recorded, for example, that the work of the Peruvian botanists, Ruiz and Pavon, designated as "Nueva Quinologia," which was written between 1821 and 1826, but not then published, was entirely lost sight of for a period of over thirty years. Through a fortunate circumstance however, it came into the hands of Mr. John Eliot Howard, who not only published it, but embellished it with 27 plates, most of them made from the original drawings of Pavon, lying in the herbarium at Madrid.

Dr. H. A. D. JOWETT said the exact constitution of quinine was not yet determined, and it appeared to him that this ought to be known before anything could be said about its synthesis. But, with the remarkable instance of the synthesis of Indigo before them, it was not too much to hope that, at some time, even with the low price of quinine, they would be independent of the natural product, and be able to produce the alkaloid in the laboratory synthetically.

Sir GEORGE WATT and Mr. P. MACEWAN also contributed to the discussion.

Mr. DAVID HOWARD, in reply, said an enormous quantity of quinine was used for sub-cutaneous injection, the acid hydrochloride being the usual salt now used. He fancied it was much less irritating than the acid sulphate. With regard to the supply of Succirubra bark for pharmacy, he did not think there was much fear; many druggists, Italian druggists especially, would give enormous prices for really inferior bark if it only had the right appearance of lichen on it. The only difficulty they found was that the Pharmacopœa provided a maximum in alkaloid which was much below the average of the rich cultivated Succirubra bark. The Pharmacopœa prescribed 6 per cent. of alkaloids, and if you gave 10 per cent. it would be rather a heavy dose for the patient. For pharmacy it was no doubt one of the finest, if not the finest, bark there was, and the Dutch were growing it very freely. Owing to the great production of bark, the wholesale price of German quinine was now 8½d. an ounce. He wished he knew more about hybrids; there were a great many produced, and they seemed to thrive. What was commonly known as a hybrid in Java was a hybrid of the Calisaya. They called them all hybrids, and when a bark was marked "hybrid" one could not foretell whether it was going to turn out a Succirubra or Ledgeriana. But the grafted bark interested him, because of the very great purity of the alkaloids of graft, and the unmistakable original condition of the root. As to the soil, he only knew it was said to be very rich and black. Probably it was ferruginous, and that might have something to do with the production of alkaloids. The question of mossed bark and renewed bark was exceedingly interesting. The mossed bark was chiefly the intermediate strip which was left when the bark was taken off, and it was then covered with moss to keep the moisture from evaporating so that the renewed growth might take place. The mossed bark was quite as rich as the renewed bark. Apparently the stimulating process had done it good. It was rarely richer, but the mossed portion continued to contain the same proportion of alkaloids as before. The Cuprœa bark undoubtedly brought down the price a good deal, as low as 6d. a unit. Then came in the flood of Ceylon bark, and then Java, and it ceased to pay.

A NEW METHOD FOR THE QUANTITATIVE DETERMINATION OF ACETONE.*

BY S. J. M. AULD, PH.D., A.I.C.

The content of acetone in wood-spirit and crude acetone is frequently required for technical purposes by varnish makers, wood distillers and others.

The methods at present employed for the quantitative determination of acetone are on the whole unsatisfactory, the conversion of acetone into iodoform being generally employed for its estimation†. Either the iodoform is directly weighed after extraction with ether as in the method generally attributed to Kramer, or the excess of iodine is titrated with sodium thiosulphate in presence of starch. A third method devised by Squibb, and improved by Kebler, gives satisfactory results, but is exceedingly cumbersome, no less than five special solutions being required. (See this J., 1897, 168, 569.)

The use of iodoform for quantitative work is open to several objections, especially in the older and more general method of procedure in which it is itself weighed. Iodoform is very volatile, some loss by evaporation being caused even at ordinary temperatures. It is also decomposed to a certain extent by the oxygen of the atmosphere when exposed to sunlight, with the formation of iodine, carbon dioxide and water. This action can frequently be observed when estimating acetone by the gravimetric method, the residue left after complete evaporation of the ethereal solution very often having a distinctly brown shade.

A volumetric method for the estimation of acetone has been worked out depending on the formation of bromoform and its subsequent hydrolysis with alcoholic potash. The hydrolysis is generally expressed as follows:—

$$CHBr_3 + 3KOH + C_2H_5OH = CO + C_2H_4 + 3KBr + 3H_2O,$$

but it is more probably

$$3CHBr_3 + 9KOH + C_2H_5OH = 3CO + C_2H_4 + 9KBr + 7H_2O,$$

it having been shown by Hermann and Long that exactly three volumes of carbon monoxide to one of ethylene are evolved.

The residual potassium bromide is estimated by means of standard silver nitrate solution.

Bromoform is specially suitable for this purpose for several reasons. It is very readily formed by the action of bromine and potash on acetone, and, although very volatile in steam, it is not liable to loss due to its own evaporation. Further, its high molecular weight and large percentage of bromine conduce to accurate results, 58 grs. of acetone being responsible for the formation of 357 grs. of potassium bromide.

The method of carrying out the analysis is as follows:—

* Taken as read.

† M. Klar "Die Holzverkohlung," 1904.

A known quantity of the solution to be tested, containing acetone to the extent of 0·1 to 0·2 grm., is pipetted into a 500 c.c. round bottom flask, diluted with a little water, and mixed with 20—30 c.c. of a 10 per cent. solution of caustic potash. The flask is connected with a long reflux condenser, and is also fitted with a dropping funnel containing a solution of bromine in potassium bromide (200 grms. of bromine and 250 grms. of potassium bromide to 1 litre of water). The bromine solution is allowed to flow into the mixture until it has acquired a faint yellow tinge, the flask and its contents being then heated on the water-bath at about 70° C. for half an hour. Bromine solution is added drop by drop until the slight coloration is permanent, excess of bromine being got rid of by boiling for a minute or two with a little more caustic potash. The mixture is then distilled until the distillate is free from bromoform, halogen being tested for in the usual manner. Water is added to the contents of the flask if necessary. It may be here observed that no acetone can be detected in the distillate by means of the mercuric oxide test, and free bromine is also absent. The condenser having been washed out with a little alcohol in order to remove any traces of bromoform which may have collected, the distillate and washings are mixed with 50 c.c. of alcohol and sufficient solid caustic potash to make an approximately 10 per cent. solution. The mixture is then heated on the water-bath under a reflux condenser until the bromoform is completely decomposed. This generally occupies about three-quarters of an hour. The liquid is allowed to cool, evaporated to smaller bulk if necessary, and exactly neutralised with dilute nitric acid. It is then diluted with water to 500 c.c., and aliquot parts titrated with N/10 silver nitrate solution, using potassium chromate as an indicator. 240 parts of bromine correspond to 58 parts of acetone.

The complete analysis can be performed in 1½—2 hours. Some of the results obtained by this method are quoted below:—

1. Three c.c. of a solution containing 9·61 per cent. acetone gave 1·7850 gr. KBr. Acetone found = 9·66 per cent.

2. Ten c.c. of a solution containing 0·96 per cent. acetone gave 0·5847 gr. KBr. Acetone found = 0·95 per cent.

3.‡ 0·5 c.c. of a solution containing 34·2 per cent. acetone gave 1·0460 gr. KBr. Acetone found = 33·8 per cent.

The method is suitable for the estimation of acetone in wood spirit, the spirit being diluted to 10 times its volume and 5 c.c. of this solution employed for the determination. Results of the same standard of exactness as those quoted above can be obtained.

The formation of carbon tetrabromide from the bromoform cannot be urged against the process, as by the above procedure any appreciable excess of free bromine is avoided. It is imperative that the bromine employed should be pure, as crude bromine frequently contains bromoform.

‡ This stronger solution was diluted to ten times its volume and 5 c.c. of this taken for the estimation.

Manchester Section.

Meeting held at Manchester on Friday, January 5th, 1906.

DR. J. H. BAILEY IN THE CHAIR.

CHEMICAL AND PHYSICAL VALUATIONS OF SOME CLAYS AND SHALES, FOR BRICK-MAKING, CHIEFLY FROM EAST CHESHIRE.

BY DR. E. A. WAGSTAFFE, M.SC., F.I.C.

In England the scientific study of the uses and characteristics of clays, except the materials used in the manufacture of china and ordinary table and toilet ware, is just beginning to be appreciated by the practical man. A few of the results of an extensive series of experiments made by the writer, on clays and shales from the districts near Manchester, may therefore be of interest to clay workers.

The writer has made a special study of the shales from the middle and lower coal measures of East Cheshire, a district which, though hitherto neglected by the high class brick, tile, and terra cotta maker, abounds in a great variety of most excellent raw material.

For convenience of reference the clays and shales are numbered. The one numbered 3 is a hard West Bromwich marl, and is given as a standard of comparison for engineering bricks.

No. 1 is a surface clay from Marple. In appearance it is of a sandy clay colour, containing small lumps of lime.

No. 2 is a clay supplied by Messrs. Peter Bailey and Sons, Heaton Mersey, used for making common bricks.

No. 3 is the West Bromwich marl. In appearance it is of a reddish clay colour, and was obtained in a plastic condition ready for use.

No. 4 is a shale from the top of Kerridge. It is of a dark grey colour, and very hard. It occurs in seams among the rough rock overlying a bed of fine ashlar sandstone in the upper strata of the lower coal measures.

No. 5 is a shale from Pingot Colliery, between Birch Vale and New Mills. It is almost black in colour and occurs in solid masses in the lower coal measure series. It is very hard.

No. 6 is a surface shale from Wigan. In colour it is inclined to yellow, and is hard.

No. 7 is the shale found below the preceding one at Wigan. It is the colour of light grey stone, and is very hard.

No. 8 is a shale from Endon Quarry. In appearance it is of a reddish clay colour, and is fairly hard.

No. 9—this shale is found in a ravine at Middlewood in the middle coal measure.

No. 10 is a shale found in East Cheshire, and occurs in black hard masses.

The clays and shales were first submitted to analysis. To this end they were ground very fine, and dried at 100° C. Nos. 1, 2 and 3 being received in a plastic condition, were first dried, and then carefully ground to a fine impalpable powder, and dried at 100° C. The analyses were made upon the clays and shales dried at 100° C. The total constituents of the clays and shales were determined in the usual way. The composition of the clays and shales, or the rational analysis, was determined by the method depending upon the fact that kaolin is more or less dissolved by long digestion with hot concentrated sulphuric acid. The sand and felspar are determined in the insoluble residue.

Silica and Bases.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Silica, combined	33·97	43·76	52·81	52·78	33·50	24·49	49·45	39·79	37·06	36·91
Silica, uncombined	40·95	17·36	4·76	4·41	19·82	4·60	17·05	17 78	30·69	25·53
Alumina	13·78	17·09	22·36	23·48	23·85	16·59	19·44	22·01	18·07	23·38
Oxide of iron	3·66	5·77	9·09	6·23	6·25	34·75	6·25	7·31	5·82	3·01
Lime	1·81	2·72	0·71	1·21	0·80	0·36	0·45	0·52	0·39	0·36
Magnesia	1·61	2·64	1·12	1·33	1·41	1·88	1·55	1·23	0·44	1·11
Alkalis	0·40	3·32	2·22	2·83	2·71	1·43	0·17	1·58	1·94	2·21
Water, &c.	3·82	7·34	6·93	8·23	11·65	15·90	5·64	9·78	5·59	7·49
Specific gravity	2·41	2·36	2·34	—	2·24	2·65	2·40	2·62	2·44	2·36

Proximate Components.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Kaolin	23·78	41·55	53·28	41·14	45·63	78·53	39·26	67·69	35·63	52·17
Felspar	35·27	41·09	41·96	54·45	34·55	16·87	43·69	14·53	33·68	22·30
Sand	40·95	17·36	4·76	4·41	19·82	4·60	17·05	17·78	30·69	25·53

For the purpose of studying the effect of various temperatures (1000°—1250° C.) upon the clays and shales, they are made into small briquettes, measuring 1½ in. by 1 in. by ½ in. The shales are ground to a fine powder, mixed with water until fairly plastic, and then moulded with a moderately strong pressure, so that, on turning out, the briquettes have perfectly sharp edges. The briquettes are carefully dried at 100° C., removed to a desiccator and allowed to cool, when they are weighed and accurately measured. They are re-heated at 100° C. until the weight is constant. The briquettes are next burnt at the following temperatures in succession, *viz.*, 1000° C., 1050° C., 1100° C., 1150° C., 1200° C., and 1250° C. Weighings, measurements and observations are taken at each of these temperatures. The measurements of the briquettes are also checked by ascertaining their volume, by displacement of water.

The burning of the briquettes is effected in muffle furnaces. A temperature of 1000° C. can easily be reached in an ordinary muffle furnace, provided the gas supply is more than sufficient to work the furnace at its full power. For temperatures above this, the writer has found that Fletcher, Russell and Co.'s gas muffle furnace provided with air blast gives excellent results. It is simple to work and easy to regulate to any desired temperature from 1000°—1400° C. For ascertaining and controlling the temperature, the writer uses Seger cones, so that all temperatures mentioned in this paper are those which correspond with the cones used.

The briquettes, dried at 100° C., are placed in the furnace, and heated gradually at first. The heat is then increased until a temperature of 1000° C. is attained. They are burnt for a considerable time at this temperature. The briquettes are allowed to cool in the furnace, weighed, measured, and observations taken of colour, density, &c. The briquettes are then burnt at the higher temperatures in succession, noting weighings, measurements, &c., at each temperature.

The results of the loss in weight sustained by the clays and shales, dried at 100° C., at the different temperatures, and their shrinkage, i.e., the percentage loss in volume, are collated in the two following tables:—

Percentage Loss in Weight on Heating from 100° C.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Loss at 1000° C.	4·34	7·71	7·46	8·87	12·17	16·98	6·48	8·10	5·47	6·94
„ 1050° C.	4·44	8·12	7·47	9·12	12·34	23·43	6·66	8·15	5·66	7·08
„ 1100° C.	4·53	—	7·83	9·22	12·57	—	6·92	8·50	5·73	7·19
„ 1150° C.	4·63	—	7·84	9·24	12·88	—	6·93	8·50	5·73	7·19
„ 1200° C.	4·86	—	7·84	9·24	12·88	—	6·93	8·50	5·73	—
„ 1250° C.	—	—	—	—	—	—	—	—	5·73	—

Shrinkage.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Loss at 1000° C.	0·00	7·24	3·62	8·33	5·24	14·63	5·00	7·48	2·88	1·63
„ 1050° C.	0·00	12·61	8·78	8·43	5·33	22·57	5·62	15·63	2·88	8·60
„ 1100° C	0·00	—	21·26	14·26	6·59	—	8·63	20·29	2·88	13·21
„ 1150° C	4·82	—	21·26	25·29	—	—	15·03	20·29	5·87	13·21
„ 1200° C.	—	—	21·26	25·29	—	—	—	20·29	5·87	—
„ 1250° C	—	—	—	—	—	—	—	20·29	5·87	—

The specific gravity and porosity of bricks are of some importance. These determinations were made of briquettes, obtained from the clays and shales by burning at the three following temperatures, *viz.*, 1000° C., 1100° C., and 1200° C.

As bricks are porous bodies, it is necessary to take into account this pore space in determining the specific gravity. If this pore space is not taken into account in calculating the specific gravity, we obtain that quantity defined by Seger as volume weight, *viz.*, the ratio between the weight and the total volume of the body inclusive of the pores.

The determinations were made as follows:—

The weight of the briquette having been ascertained, the briquette was soaked in water for 24 hours, taken out, and the surface water removed with a dry cloth. The increase in weight gives the amount of water absorbed by the briquette, i.e., the amount that fills the pore spaces. The volume of the briquette is determined by displacement of water. The volume may also be determined by measurement, provided the briquette has not suffered any unequal contraction, whereby its shape has become distorted.

Then if the weight of the briquette in grms. is w, and the increase in weight due to absorption of water is t, and the volume in c.c. displaced when water saturated is v,

$$\text{The Specific Gravity} = \frac{w}{(v-t)}$$

$$\text{The Volume Weight} = \frac{w}{v}$$

$$\text{Porosity} \quad .. \quad .. = \frac{100 \times t}{w}$$

The results of these determinations are collated in the following tables:—

Specific Gravity of Briquettes.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
At 1000° C.	2·42	2·38	2·56	—	2·38	3·51	2·56	2·38	2·47	2·51
„ 1100° C.	2·36	2·22	2·47	—	2·46	—	2·49	2·38	2·39	2·27
„ 1200° C.	—	—	2·39	—	—	—	2·39	2·37	2·28	2·19

Volume Weight of Briquettes.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
At 1000° C.	1·97	1·78	2·05	—	1·88	2·10	2·02	1·74	1·80	1·97
„ 1100° C.	2·14	2·11	2·37	—	1·96	—	2·17	2·23	2·03	2·08
„ 1200° C.	—	—	2·37	—	—	—	2·31	2·31	2·03	2·18

Porosity of Briquettes.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
At 1000° C.	9·38	13·88	14·60	—	12·79	19·73	11·34	15·24	14·74	11·71
„ 1100° C.	4·29	2·22	1·77	—	10·38	—	6·03	3·32	7·49	8·95
„ 1200° C.	—	—	0·56	—	—	—	1·48	1·04	6·34	1·44

With respect to the suitability of these clays and shales for brickmaking, No. 2 is undoubtedly a good clay for common bricks, as is also No. 1, although the bricks are somewhat friable. Most of the clays and shales do not withstand the temperature at which a good engineering brick is obtained, the exception, besides No. 3, being No. 8, from which an excellent engineering brick can be obtained. No. 10, might, with some manipulation, be employed in the manufacture of fire bricks, as the colour is good and the shale withstands the highest temperature reached in these experiments.

The temperature at which the clays and shales melt, was determined by comparison with the melting points of Seger cones. For this purpose, each clay is made into a plastic mass with water, and moulded into the form of a small cone or pyramid. The cones are then carefully dried at 100° C. before being burnt with the Seger cones.

The following temperatures were obtained:—

Melting Points of the Clays and Shales.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1250° C.	1160° C.	1410° C.	1430° C.	1370° C.	1120° C.	1270° C.	—	1430° C.	—

The refractoriness of clays for brick and terra-cotta is an important point. It may be determined directly, as above, by ascertaining the temperature at which the clay begins to fuse. Refractoriness may also be judged from a survey of the chemical data. Thus, the silicates of lime, magnesia, and alumina are practically infusible; on the other hand, those of soda, potash, and iron are readily fusible. If lime, iron, or alkalis be added to the infusible silicates in calculated quantity, double silicates are formed, which also are readily fusible. Hence, refractoriness of clays depends chiefly on the percentage of silica and alumina, and is influenced by the presence of alkalis, iron, lime, and magnesia in the order mentioned. It must be noted, however, that if any of these bodies be in excess, the fusibility of the clay is not necessarily lowered, as, for instance, excess of soda would set free lime and magnesia, which themselves are infusible. A comparison of the chemical composition of the clays and shales from this point of view with the actual melting points as determined is not without interest, as showing relationship of composition and refractory character. The melting point of No. 6 is 1120° C. This clay contains over 30 per cent. oxide of iron. No. 2 fuses at 1160° C., the easy fusibility of this clay is evidently due to the low percentage of alumina, and high percentage of alkalis, lime, and magnesia. Nos. 1 and 7 fuse at 1250 °C. and 1270° C. respectively. The high percentage of lime, magnesia and iron, and the low percentage of alumina account for the fusibility. The higher refractoriness of No. 9 is no doubt due to low percentage of lime and magnesia. The remaining clays all contain over 22 per cent. of alumina, and all are highly refractory.

Dr. WAGSTAFFE, in reply to several questions, said the experiments referred to in the paper had been carried out on a small scale in the laboratory, and he could not say that the same results would be obtained on a large working scale. He did not consider the length of time taken in obtaining the melting point of the clays and shales was a material point, and he had not estimated the carbon and sulphur. The change in specific gravity, was undoubtedly due to shrinkage in volume and increase in weight. Porosity was tested for by immersing the bricks for 24 hours in water, leaving one-eighth of an inch above the surface.

New York Section.

Meeting held at Chemists' Club, on Friday, November 24, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

NEW PROCESS OF PUERING OR BATING HIDES AND SKINS.

BY DR. ALLEN ROGERS.

The process to be described is covered by U.S. Pat., No. 798,293, by Francis J. Oakes, of New York City (this J. 1905, 1023).

In working with the Oakes' process the skins or hides are washed, limed, unhaired, and washed again. A bath is now prepared at a temperature of from 95°—100° F., consisting of 5 per cent. of glucose syrup, and 1 per cent. of sulphur, computed on the weight of the skins or hides, and about 1 lb. of yeast for every 1000 lb. treated. Having prepared the bath in this manner it is allowed to stand about 24 hours to secure a definite fermentation. At the end of this time the temperature is raised to 100°—105° F., and the hides or skins introduced. In order to have a continuous bath, however, one half the original amount of sulphur, glucose, and yeast are added at the

same time. In working this process it is not necessary to keep the skins or hides in constant motion, but only to move them from time to time in order to secure uniformity of action, once an hour being sufficient. By this method of treatment heavy bull or cow hides will be free from lime, and in a soft and open condition at the end of eight hours; while lighter skins will require a proportionately shorter period. On removing the pack the temperature of the bath may be raised, and after introducing one half the original quantity of sulphur, glucose and yeast, another pack may be treated, so making it possible to work two packs each day in the same vat if desired. It will be understood that a continuous bath would, in time, become too concentrated from solutions of calcium compounds, and thus prevent or retard fermentation. This difficulty, however, is obviated by drawing off half of the solution each and every time after treatment of the second pack.

The hides or skins as they are removed from the bath show no trace of lime with phenolphthalein. They are soft and open, and have a smooth silky grain. As there is nothing in this treatment to cause putrefaction, there is, consequently, no loss of hide substance, and, furthermore, as all of the lime has been neutralised they do not require a drench or pickle, but after washing are ready for the tan, regardless whether it be vegetable or mineral in character.

From a chemical point of view it is somewhat difficult to express all of the reactions taking place in the bath, although by careful observation and thought certain conclusions are apparent. Thus when the bath is first prepared it is neutral in reaction, and after standing gradually assumes a slight acid condition. On introducing the hides or skins it becomes alkaline, due to diffusion of the lime. After standing a short time, however, it becomes neutral again, and remains thus until the skins are in a perfect condition, when a slight acid reaction is observed. These changes taking place are caused by the fermentation of the glucose, which generates carbon dioxide and alcohol; and owing to the presence of sulphur a quantity of hydrogen sulphide is produced, which in its nascent condition combines with the alcohol to form mercaptans, which in their turn are slowly oxidised to thio-acids. These mercaptans and thio-acids, being of a weak acid character, act in conjunction with any excess of hydrogen sulphide, upon the calcium hydroxide, or other compounds of calcium, converting them into a soluble condition, in which they are readily removed by diffusion. Thus, when the lime is all neutralised the bath becomes acid in reaction, and in this way serves as an indicator of the completion of the operation. It is not necessary, however, to remove the hides or skins as soon as the acid condition is secured, as the products formed and the excess of acid do not dissolve the gelatin; and as there is no putrefaction there can be no loss of hide substance, or depletion, which assertion has been proven by practical demonstrations, and the value of the process established beyond a doubt.

Nottingham Section.

Meeting held at Leicester on Wednesday, November 29th, 1905.

MR. J. M. C. PATON IN THE CHAIR.

CONDITIONS AFFECTING THE FOAMING AND CONSISTENCY OF GLUES.

BY S. R. TROTMAN, M.A., F.I.C., AND J. E. HACKFORD.

In a recent paper (this J., 1904, 1072—1074) we have shown that good and bad glues may be chemically differentiated by means of the ratio between total nitrogen and nitrogen precipitated by zinc sulphate, and that any carelessness in manufacture or selection of materials which increases the quantity of nitrogen incapable of such precipitation decreases to a corresponding extent the value of the finished glue.

The present paper attempts, *inter alia*, to prove this synthetically. It will be shown that consistency is very largely influenced by the presence of peptones. Further experiments have been undertaken with the object of (1) Throwing light upon the cause and remedy of foaming in glue; (2) obtaining some idea of the effect of some of the impurities commonly present in glue on both the foaming capacity and the consistency of the jelly.

In making these experiments, foaming power and consistency were chosen as special tests, since they are two very important properties to which a manufacturer must attend. A good glue should give a minimum foam with a maximum strength, two qualities which by no means go hand in hand. Many strong glues have high foam figures, although most bad ones have, also. Thus it will be shown that over boiling, which, as we have before proved, causes peptonisation and corresponding loss of consistency, invariably increases the foaming power of a glue. The results obtained prove that certain classes of bodies considerably affect both the foaming capacity and the strength of a glue, and that care in manufacture directed to the elimination of these deleterious impurities would result in much improvement in commercial glues. While considerable attention has been called to the evolution of methods of testing glue, little has been done to elucidate which of the constituents of the glue affect these properties prejudicially or otherwise, although it is obvious that such an investigation must be of great value. Users of glue and size are continually complaining of the foaming nuisance. A glue which foams badly is of little use for making joints, especially if applied by means of a rotatory brush, since the air bubbles which it contains render the joint valueless. In the dressing of fabrics, a foaming glue causes an uneven deposit and tends to produce films, which block the holes in the case of a net, and are difficult to remove. The value of a high consistency is too well known to need emphasis.

Consistency.—This was measured in a special form of apparatus, which it is hoped will be made the subject of a further communication, since the method appears capable of considerable development. In brief, it consists in measuring the time taken by perfectly symmetrical spheres to fall through a column of the substance under examination.

Foaming.—The literature on this subject may be summed up in the statement that a 10 per cent. solution is employed in testing foaming capacity, and that glues give from half to eight inches of foam. The method used in testing is, of course, immaterial when comparative results only are desired, but those at present employed are so varied that there is little chance of close agreement.

The method described below is free from this objection, and the necessity for some standard form of test is shown by the fact that the amount of foam given by a solution of glue is dependent upon—(1) the height of liquid in the tube; (2) the diameter of the tube; (3) the temperature of the solution, and, to a less extent, the time and method of testing.

The following experiments illustrate these points:—

(1) Varying quantites of the same solution were shaken in identical tubes, the results being shown in Table A, indicating that height of foam is approximately in proportion to the height of liquid in the tube.

TABLE A.

Influence of Height of Liquid upon the Foam.
Temperature, 60° C.

Height of liquid in cms.	Foam Figure.	Ratio.
5	3·0	1 : 0·6
10	7·5	1 : 0·75
15	11·0	1 : 0·73
20	18·0	1 : 0·90
25	22·0	1 : 0·88

The effect of varying the diameter of the tube is shown in Table B.

TABLE B.

Influence of the Diameter of the Foam Tube upon the Foam Figure.

Volume of Liquid.	Diameter of Tube.	Foam Figure.
25 c.c.	1 cm.	17·5
25 c.c.	2 cms.	7·5

The effect of temperature on the foam figure is considerable, as will be seen in Table C.

TABLE C.

Influence of Temperature on the Foam Figure.

25 c.c. of Gelatin Solution containing 10 per cent. of Peptones was used in each case.

Temperature °C.	Foam Figure.
30	30·0
40	25·5
50	20·0
60	15·0
70	13·0
80	11·0
90	5·5
100	3·5

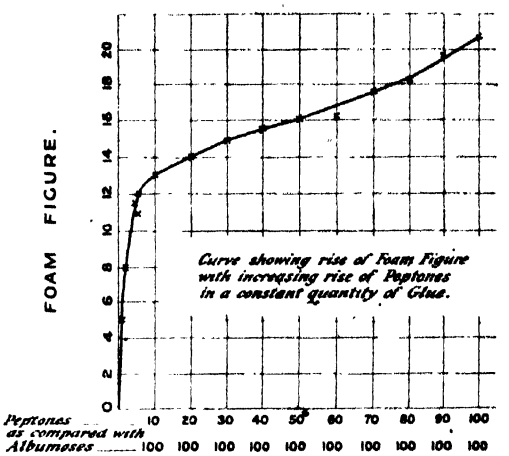
The decrease in foam caused by rising temperature is no doubt due to the fact that, as the temperature rises, both viscosity and surface tension become less.

Apparatus Employed in Testing Foam.—A graduated tube, about 70 cm. in length and of such diameter that each division is 1 cm. in length and has a capacity of 1 c.c., is half filled with a solution of the glue to be tested and placed in the water-jacket, the temperature of which may be raised by passing steam into it. The even distribution of the steam is effected by means of a ring at the end of the delivery tube and an overflow is provided. The temperature of the bath is maintained at 60° C., which is a convenient one for glue solutions. After allowing sufficient time for the temperature of the glue solution to reach 60° C., the tube is withdrawn from the bath and its level adjusted by means of the tap till it stands at zero, there being then exactly 25 c.c. of the solution in the tube. The tube is now corked and shaken vigorously for about a minute, replaced in the bath, and the height of the foam read off. The top of the foam is read off, since this is found to be constant with a constant temperature. The line of demarcation between the foam and the liquid is too indistinct to allow of the lower reading being accurately taken. The higher reading is so constant that different operators can always obtain the same figures. Since the foam produced always varies with the temperature, the importance of carrying out the test at a constant temperature is apparent. Prolonged delay often causes hydrolysis and an increased figure.

Foam Figure of Pure Gelatin.—A sample of the purest gelatin containing less than 1 per cent. of peptone and neutral in reaction was precipitated with zinc sulphate as described in a previous paper.* The precipitate was pressed thoroughly to remove zinc sulphate, and then redissolved in water and thrown down by means of alcohol, the latter operation being repeated till the product was almost ash free. It was then dried in a vacuum at a low temperature, after which 1 grm. was dissolved in water and tested as above. The foam figure was found to be 10·5, which may be regarded as the minimum for a generally pure gelatin. Since, however, some glues have a foam figure less than this, it is obvious that certain of the accidental constituents of glue have the power of decreasing the foaming capacity, just as peptones have the power of increasing it. The following experiments were carried out with the object of throwing light upon this point, together with the effect of these impurities on the strength of the jelly formed as measured by the consistency.

(1) *Effect of Peptones.*—100 c.c. of the solution employed contained 1 grm. of albumose and increasing quantities of peptones. The figures show that there is a

* This J., 1904, 1072.



continual rise in the foam figure and that this rise is very marked with small quantities of peptones, the result being well shown in the curve (Fig. 2). This is a point of much importance to the manufacturer and confirms the result of a recent paper by us. So far as consistency is concerned, the figures show that small quantities of peptones do not exercise an adverse effect so long as they do not actually replace albumose nitrogen. When, however, the total nitrogen is kept constant and the gelatin gradually replaced by peptone the consistency very rapidly falls to zero.

TABLE 1 (A).

Effect of the Peptones on the Foam Figure of a Glue.

No.	Amount of Gelatin.	Amount of Peptones.	Relative consistency.	Foam Figure.	Increase of foam figure due to Peptones.
1	100	0	400	10·0	0·0
2	,,	½	420	15·0	5·0
3	,,	1	420	17·0	7·0
4	,,	2	430	20·0	10·0
5	,,	3	453	21·0	11·0
6	,,	4	570	21·5	11·5
7	,,	5	475	22·0	12·0
8	,,	10	415	23·0	13·0
9	,,	20	267	24·0	14·0
10	,,	30	348	25·0	15·0
11	,,	40	290	25·5	15·5
12	,,	50	240	26·0	16·0
13	,,	60	166	26·5	16·5
14	,,	70	154	27·5	17·5
15	,,	80	132	28·0	18·0
16	,,	90	125	29·5	19·5
17	,,	100	96	30·0	20·0
18	,,	100	0	20·5	20·5

Effect of Over Boiling.—A glue with an original foam figure of 16 was boiled for a varying time and retested. The results show that over boiling must be a large factor in the production of foaming glues.

The following table shows the influence of peptones by hydrolysis on foam figure of a 1 per cent. gelatin solution:

TABLE 1 (B).

Time of boiling.	Foam Figure.
0 hours	16
1 ,,	18
2 ,,	19
4 ,,	20
12 ,,	24
18 ,,	24
24 ,,	24

Action of Alkalis in the Cold.—The results are shown in Table 2, and it will be doted that soda is the most deleterious. Table 2A shows the influence of alkalis on an already existing foam.

TABLE 2.

Influence of Alkalis and Soap in the Glue.

	Percentage of Alkali present.	Relative consistency Figure.	Foam Figure.	Increase or Decrease in Foam Figure.
Gelatin solution	0	1000	10	—
Sodium hydroxide	½	0	16·0	6·0
	1	0	19·5	9·5
	5	0	20·0	10·0
	25	0	21·0	11·0
	50	0	23·0	13·0
	100	0	23·0	13·0
Lime	5	0	11	1·0
	25	0	11	1·0
	50	0	15	5·0
	100	0	15	5·0
Ammonia	5	0	8	— 2·0
	25	0	8	— 2·0
	50	0	9	— 1·0
	100	0	10	0·0
Sodium carbonate	5	0	9	— 1·0
	25	0	8	— 2·0
	50	0	10	0·0
	100	0	12	+ 2·0
Soda soap	5	1000	7	— 3·0
	25	1000	7	— 3·0
	50	800	8	— 2·0
	100	500	—	—
Potash soap ...	5	1000	5	— 5·0
	25	1000	16	+ 6·0
	50	700	30	+ 20·0
	100	400	—	—

TABLE 2 (A).

Influence of Alkalis on the Foam.

Alkali used (added to 1 per cent. solution Gelatin).	Percentage of Alkali added calculated on 100 c.c. Gelatine solution	Time taken by foam in sinking through 15 cms.
	Per cent.	Secs.
1% solution gelatin	0	163
Sodium hydroxide..	½	160
	1	163
	5	168
Ammonia	½	174
	1	68
	5	45
Sodium carbonate	½	60
	1	53
	5	32
Sodium soap	½	5
	1	53
	5	32
Potash soap	½	2
	1	23
	5	173

Effect of Prolonged Boiling with Alkalis.—These results are of importance in skin glues, which are sometimes distinctly alkaline, and the action of ammonia is of particular interest since it is frequently present as a decomposition product.

TABLE 2 (B).

Influence of Prolonged Action of Alkalis on the Glue.

Alkali used.	Percentage of Alkali compared Glue present in solution.	Foam Figure.
Sodium hydroxide ...	1	9·0
	5	11·0
	25	16·0
	50	16·5
	100	13·0
Sodium carbonate ...	1	9·0
	5	12·0
	25	16·0
	50	16·5
	100	21·0
Ammonia	1	10·0
	5	15·0
	25	19·0
	50	19·0
	100	17·5
Ammonium carbonate	1	16·0
	5	18·0
	25	18·0
	50	17·5
	100	—

The Effect of Soaps and Fats.—Small quantities of fats decrease the foam, as might be expected, but their addition for this purpose would be inadmissible, since grease is a fatal objection for many of the uses to which glue is put. A small percentage of soap largely decreases the foam figure, but a maximum is soon reached, after which the foam rapidly increases. It is commonly supposed that soaps are the chief cause of foaming, but it is extremely rarely that a glue contains a sufficiently large quantity to show this effect, leaving out of account the fact that the majority of glues are sufficiently acid to decompose a considerable amount of soap. It will be seen from Table 3 that the decomposition products of soaps, such as oleic acid also reduce the foam figure, although they form a dry scum which would render the glue useless for many purposes.

Effect of Acids.—Upon the assumption that foam is chiefly caused by soaps, the remedy usually recommended is an acid. Table 4 gives the results of an experiment made upon this point. In all cases the required quantity of acid was mixed with the glue solution and allowed to stand over-night. The fall of consistency is only what could be expected, but it is interesting to note that carbolic and salicylic acids, both preservatives, largely reduce the value, while boric acid only does so to a much smaller extent, indicating the superiority of boric acid over the other two as preservatives.

On the other hand, if these acids be added to an already existing foam, carbolic is much more efficient than boric acid, as will be seen from Table 4A. The immediate fall in consistency caused by the acids is, of course, due to hydrolysis with the formation of peptones. Practically all acids are able to peptonise glue, and their presence in more than traces is highly deleterious.

Effect of Suspended Matter.—Finely-divided suspended matter, whether organic or inorganic, considerably affects the foaming power and consistency of a glue. The following experiments were made with solid impurities sometimes found in commercial glues. To a 1 per cent. solution of the glue under examination varying quantities of certain insoluble bodies were added and the mixture well shaken. The foam figure having been noted, the jelly was allowed to set and its consistency measured. The results are given in Table 5.

It may be noted that while plaster of Paris considerably increases the consistency, the hydrated body, $CaSO_4, 2H_2O$

has no effect on it. The experiment also indicates that loaded glues, such as Russian, may be expected to give considerable foam.

Effect of Salts likely to be present in Water.—Table 6 indicates that the quantity of these salts likely to be present in water used in glue making would not be sufficient to affect the quality of the resulting glue, although in large quantities they are able to cause hydrolysis.

TABLE 3.

Influence of Oils and Fats upon the Foam.

Kind of oil added.	No. of c.c. of oil added per 100 c.c. gelatine solution.	Action of Oil upon Foam.		Foam figure on re-shaking.
		Foam figure after standing 1 min. after addition of oil.	Increase or decrease in foam figure.	
1% gelatin solution	—	—	—	12
Lubricating	0·05	6	— 6	3
	0·1	7	— 5	3
	0·25	7	— 5	3
	1·0	8	— 4	3
Paraffin ...	0·05	12	0	12
	0·1	12	0	12 no
	0·25	12	0	12 change
	1·0	12	0	12
Bone	0·05	6	— 6	0
	0·1	0	— 72	0 scum
	0·25	0	— 12	0 produced
	1·0	0	— 12	0
Oleic acid	0·05	0	— 12	0
	0·1	0	— 12	0 scum
	0·25	0	— 12	0 produced
	1·0	0	— 12	0
Fatty acids from soap	0·05	12	0	12
	0·1	12	0	12 no
	0·25	12	0	12 change
	1·0	12	0	12
Olive	0·05	12	0	12
	0·1	12	0	12 no
	0·25	12	0	12 change
	1·0	12	0	12
Cod	0·05	3	— 9	2
	0·1	2	— 10	3 heavy
	0·25	0	— 12	4 scum
	1·0	0	— 12	4
Castor	0·05	12	0	5
	0·1	12	0	6
	0·25	12	0	6
	1·0	12	0	7
Neatsfoot ..	0·05	12	0	6
	0·1	12	0	6
	0·25	12	0	6
	1·0	12	0	6
Rape	0·05	12	0	6
	0·1	12	0	7
	0·25	12	0	7
	1·0	12	0	5
Cedar	0·05	12	0	12
	0·1	12	0	12 no
	0·25	12	0	12 change
	1·0	12	0	12

TABLE 4.

Influence of Acids in the Glue.

Acid added to Gelatin solution.	Percentage of acid added calculated on the glue.	Relative consistency.	Foam figure.	Increase or decrease in foam figure.	
				Actual.	Per cent.
1% gelatin solution	0	1000	15	0	0
Hydrochloric	5	0	9	— 6	— 40
	25	0	8	— 7	— 47
	50	0	7	— 8	— 53
	100	0	7	— 8	— 53
Sulphuric	5	0	9	— 6	— 40
	25	0	10	— 5	— 33
	50	0	9	— 6	— 40
	100	0	9*	— 6	— 40
Acetic	5	0	9	— 6	— 40
	25	0	14	— 1	— 70
	50	0	11	— 4	— 27
	100	0	10	— 5	—
Carbolic	5	100	23	+ 8	+ 53
	25	2	21	+ 6	+ 40
	50	0	21	+ 6	+ 40
	100	0	14	— 1	— 7
Salicylic	5	0	9	— 6	— 40
	25	0	11	— 4	— 27
	50	0	11	— 4	— 27
	100	0	10	— 5	— 33
Boric	5	340	18	+ 3	+ 20
	25	300	—	—	—
	50	285	19	+ 4	+ 27
	100	75	14	— 1	— 7

TABLE 4 (A).

Influence of Acids on the Foam.

Acid added.	Percentage of Acid added calculated by volume on the Glue solution.	Time taken by foam in sinking through 15 cms.
1% gelatin solution	Per cent. 0	Secs. 63
Hydrochloric	½	35
	1	37
	5	42
Sulphuric	½	27
	1	27
	5	30
Acetic	½	20
	1	24
	5	5
Carbolic	½	2
	1	0
	5	0
Salicylic	½	30
	1	38
	5	42
Boric	½	63
	1	63
	5	64

TABLE 5.

Influence of Insoluble Substances on Foam Figure.

ubstance added.	Percentage of Salt added calculated on the Glue.	Relative consistency.	Foam figure.	Increase in figure.
% gelatin solution	--	1000	10	—
Inc oxide	5	1000	22	12
	25	925	23	13
	50	870	24	14
	100	1380	25	15
White lead	5	1000	10	0
	25	975	21	11
	50	1000	21	11
	100	864	21	11
alcium carbonate ..	5	255	21	11
	25	250	21	11
	50	300	23	13
	100	40	25	15
Plaster of Paris	5	1500	17	7
	25	1520	18	8
	50	2500	19	9
	100	2428	20	10
uspended organic matter	approx. 5	—	15	5
	25	—	19	9
	50	—	25	15
	100	—	39	29
Coarse gypsum	5	—	14	4
	25	—	17	7
	50	—	18	8
	100	—	18	8

TABLE 6.

Influence of Soluble Substances Dissolved in the Glue Solution.

Substance added.	Percentage of substance added calculated on the Glue	Relative consistency.	Foam Figure.	Increase or decrease in Fometer Figure.
1% gelatin solution ...	—	1000	15	—
Sodium chloride	5	998	12	— 3
	25	872	12	— 3
	50	760	13	— 2
	100	230	13	— 2
Sodium sulphate	5	1068	8	— 7
	25	1220	15	0
	50	980	15	0
	100	675	15	0
Magnesium sulphate	5	700	14	— 1
	25	703	19	+ 4
	50	—	18	+ 3
	100	700	18	+ 3
Magnesium chloride	5	1308	13	— 2
	25	1154	16	+ 1
	50	900	13	— 2
	100	630	9	— 6
Calcium chloride	5	830	23	+ 8
	25	420	25	+ 10
	50	350	21	+ 6
	100	233	21	+ 6

DISCUSSION.

Mr. H. S. GARRY said that in dealing with liquids in bulk of, say, 500 to 1000 galls. under vacuum, the foam was always greater in proportion to the quantity of liquor in operation. With regard to Table B, the same remarks applied to liquors foaming *in vacuo*. With regard to Table C, there was a considerable difference in the foaming characteristics of glue in proportion to the temperature at which the glue was originally extracted. In liquors obtained at a low temperature, and which had not been subjected to some peptonisation in extraction, foaming took place very strongly. He thought the paper certainly carried the technical testing of glues a stage further, and was a valuable addition to the literature on the subject. He would like to have seen some attempt, however, to separate the peptones into different classes of glues, as, for instance, bone glues and skin glues. Bone glues invariably foamed to a greater extent than skin glues, and skin glues, subjected to a two hours' extraction, foamed more than skin glues subjected to a six hours' extraction. There was also a distinct increase in consistency in the two-hour extraction glues over the six hours, and a corresponding loss in weight in the six-hour glues. This appeared to be contradictory to some of the statements in the paper. The effect of alkalis on glues was of necessity to reduce the consistency and foaming power. The addition of oils and fats to glue liquors (especially skin glues) did in bulk operations reduce the foaming, but in actual working *in vacuo* appeared to increase the tendency in the initial stages. In evaporating foaming liquors *in vacuo*, where the chief trouble to the manufacturer arose, the principal remedy applied was to increase the temperature at the foaming point, and to decrease it in the liquor; this, in all cases, proved efficacious. For instance, in a vacuum pan having four coils, the top coil would be served with full steam and the lower coils shut off, in which case the foam fell into liquor. In the case of a liquor into which air was admitted, the result was a setting up of a foam, while the admission of liquor at a lower temperature than the vacuum pan would also produce a heavy foam, and once foam has set up in a liquor it remained there. He would be inclined in all cases to regard foams as evidence of decomposition of animal matter in the glue, and thought further researches by the authors would show that the foaming capacity of glue rested almost entirely upon the efficiency of the cleaning and preparing methods employed on the material before extraction.

Mr. L. ARCHBUTT thought that the method of measuring foam employed by the authors would be improved by agitation by means of a current of air. The application of the principle of allowing symmetrical spheres to drop through a vertical column had been mentioned as applicable to the measurement of viscosities; but he felt bound to protest against the multiplication of instruments for the measurement of viscosities, none of which in his opinion offered many advantages over a burette form of viscosimeter, and many of which lacked simplicity of construction and manipulation.

Mr. H. J. WATSON wrote:—"Foaming glue is a subject very imperfectly understood; it is one upon which I have worked, and have already published a foam test which only differs from that of the authors in some minor details. The following are the particulars of my test, published four months ago in a technical trade journal:—'The glue to be examined is broken up in an iron mortar, over which a cover is placed to prevent glue from flying about; 5 grms. are weighed out, and put into a beaker of 100 to 150 c.c. capacity; 40 c.c. of water are then poured over the glue, and allowed to soak several hours, preferably overnight. The beaker is then placed in a water-bath heated to about 130° F. When completely melted the solution is poured into a stoppered measuring jar graduated to 100 c.c., and about 2½ cm. diameter. The volume in the jar will be about 45 c.c.; this is made up to 50 c.c. by washing out the beaker with hot water. The temperature of the solution of glue will now be about 120° F. The stopper is inserted, and the jar shaken vigorously for a few seconds or until no more foam is produced. The jar is then allowed to stand for a

few minutes. It will be noticed that the foam gradually collects upon the top of solution. As soon as the height of the solution has reached 45 c.c. the height to the top of foam is read, and the difference between 45 and the height to top of foam is taken as c.c. of foam.

"It has been found better to read the height of foam this way than to read the height immediately after shaking, and subtract 50 c.c In the first place it gives one an idea whether the foam will quickly die away or be permanent, and, secondly, it has been found that the foam-reading is practically the same, because taking the reading from the top of the solution at 45 c.c. makes up for any shrinkage in volume of foam. With some glues the height to top of solution reaches the 45 c.c. mark quicker than others; this is an indication that the foam will die away quicker, which is also an important point to know.

"This test has been used on a considerable number of samples, and the following table is a comparison of glues from different sources:—

Source.	Quality.	Colour	Grms. taken.	Made up to c.c	Top of foam c.c.	Top of Soln c.c	c.c Foam
British	Bone	Palish	5	50	70	45	25
,,	,,	Pale	5	50	68	45	23
,,	,,	Medium	5	50	73	45	28
,,	,,	Dark	5	50	95	45	50
,,	,,	Medium	5	50	100	45	55
,,	,,	Dark	5	50	65	45	20
,,	Skin	,,	5	50	83	45	38
,,	,,	Pale	5	50	70	45	25
,,	,,	Medium	5	50	90	45	45
,,	,,	,,	5	50	75	45	30
,,	,,	Pale	5	50	84	45	39
Foreign	Bone	Medium	5	50	74	45	29
,,	,,	Pale	5	50	82	45	37
,,	,,	Darkish	5	50	78	45	33
,,	,,	Medium	5	50	100	45	55
,,	Skin and Bone	...	5	50	95	45	50
,,	Skin	Pale	5	50	65	45	20
,,	,,	,,	5	50	95	45	50
,,	,,	,,	5	50	90	45	45
,,	,,	,,	5	50	80	45	35
,,	,,	,,	5	50	73	45	28

"I can confirm the authors' conclusions with regard to over-boiling. Acid and alkali, in my own experiments, do not appear to influence the amount of foam produced. There is one important factor, not touched upon by the authors, *viz.*, the source of the glue. The cleansing of the raw material from foreign matter is a very important factor, and if neglected it matters little how much care be taken with the boiling operations."

Mr. S. R. TROTMAN, in replying, said that the chief difference between the test for foaming which they proposed and that described by Mr. Watson was that their measurements were exactly given and greater care was taken to maintain a constant temperature, and, in fact, to standardise the process; this being essentially a test which required standardisation. It was true that they had not specifically referred in this paper to the cleansing of raw material, but the results, which they had obtained from the introduction of peptones and other degradation products, would point to the importance of so doing, since it did not matter whether the peptone was introduced with the raw material or produced during the manufacture; the effect on the glue was in both cases identical. In their previous paper the authors had already shown that the chief chemical difference between a good and bad glue was the quantity of nitrogen that could not be precipitated by zinc sulphate, and had at the same time drawn attention to the different ways in which the presence of this nitrogen could be accounted for. In his opinion too little attention was paid to the cleansing of raw materials. The removal of loose fragments, and the washing away of the readily soluble constituents from the surface of materials used for glue making, would always reduce the percentage of peptone subsequently found in the manufactured glue, and hence decrease its foaming power, increase its consistency. Of course, it must be understood that all washings thus obtained should be as far as possible recovered. He agreed with Mr. Archbutt that it would be preferable to agitate by means of air With reference to the multiplication of viscosimeters, he felt that a method which would do away with the variable head of the liquid and the friction of the orifice would have some distinct advantage.

Meeting held at Derby on Wednesday, January 24th, 1906.

MR. J. M. C. PATON IN THE CHAIR.

RECENT ADVANCES IN THE BACTERIOLOGY OF PUTREFACTION.

BY J. T. WOOD.

To those who have to do with the manufacture of leather the changes which take place in the skin from the time it leaves the animal are of the utmost interest. The most important of these changes is the natural process of decomposition known as putrefaction.

Nineteen hundred years ago Ovid* wrote:—

> Caetera diversis tellus animalia formis
> Sponte sua peperit; postquam vetus humor ab igne
> Percaluit Solis, coenumque, udaeque paludes
> Intumuere aestu; fecundaque semina rerum
> Vivaci nutrita solo, seu matris in alvo,
> Creverunt, faciemque aliquam cepere morando.
>
> * * * * *
>
> Quippe ubi temperiem sumsere humorque callorque;
> Concipiunt; et ab his oriuntur cuncta duobus.

Francis Bacon carried this idea a step further, a very natural one for a believer in spontaneous generation, for, if life arose of itself, then by scientific means it should be possible to find out the conditions of this generation and to produce various kinds of life. In his wonderful dream of a college of research ("The New Atlantis," p. 38), Bacon says:—"We make a Number of Kindes, of Serpents, Wormes, Flies, Fishes, of Putrefaction; Wherof some are advanced (in effect) to be Perfect Creatures, like Beastes or Birds; And have Sexes and do Propagate. Neither doe we this by Chance, but wee know before hand, of what Matter and Commixture, what Kinde of those Creatures will arise."

I need not say that these ideas of the origin of life on the earth are not in accord with modern ones, the theory of spontaneous generation having been completely disproved by the researches of Pasteur, Tyndall and others, though I remark in passing that quite recently certain writers have speculated whether, in the earlier stages of the earth's history, the conditions may have been suitable for the combination of the elements to form living organisms.

You may inquire what this has to do with putrefaction which is the end and destruction of the organism, but the end is also the beginning like the mystical Chrysmon of St. Ambrose, no sooner does the work of the higher organism cease than myriads of lower organisms commence their work of splitting it up into its simpler elements, so that it may serve for the making of other bodies of other animals or plants. It has always seemed to me a wonderful thought that the matter of which our body is constructed has served for the building up of the bodies of many other living creatures during an infinity of past time, and will again serve for the making of others "When we have shuffled off this mortal coil."

Putrefaction may be defined as the decomposition of nitrogenous organic matter by living organisms, accompanied by the evolution of malodorous gases. The study

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* (Metam. Lib. 1, VIII.) "The earth brought forth of herself the other animals in different shapes, for after her natural moisture had been heated by the fire of the sun and the slime and the wet fens swollen by the heat, the fruitful seeds of things nourished by an enlivening soil as in the womb of a mother, grew, and in continuance of time took some regular shape upon them. . . For when wet and heat have had a due mixture, they conceive, and all things arise from these two."

of it may be divided into two parts—(1) the biological, (2) the chemical. The first concerns the organisms which break down the proteid molecule either directly or by means of enzymes; the second that of the different products of the action of these organisms. It is extremely difficult to separate these two studies.

Dr. Sims Woodhead (2) gives a concise account of the earliest researches on the organisms causing putrefaction by Leeuwenhoek (1692), Plenciz of Vienna, Müller of Copenhagen (1786), Needham (1749), Spallanzani (1769), Schwann (1837), Schroeder and Van Dusch (1854), Tyndall (1870), Lister (1878). These names show that the history of putrefaction proceeds parallel with the evolution of the microscope and the development of the comparatively recent science of bacteriology. I propose to-night briefly to carry it up to the present day.

I need scarcely say that putrefaction is not a specific fermentation like alcoholic or acetic fermentation, but that it is extremely complex. In any putrefying matter, such as gelatin or albumin, a large number of different species of bacteria may be observed as well as monads and infusoria, and in some cases moulds, all of which take part in the process. The first stage is a process of oxidation in the presence of air, in which aerobic bacteria use up the oxygen present and only simple inorganic compounds are formed, carbon dioxide, nitrates and sulphates; this part of the process is generally without odour. The second stage, or true putrefaction, takes place in the absence of oxygen by anærobic bacteria, and is a process of reduction. It has been shown that there are no bacteria in healthy tissues, and if a muscle or any organ is taken from an animal under antiseptic conditions it may be preserved indefinitely in a sterile vessel to which filtered air has free access. Solid matter is usually liquefied by organisms like B. liquefaciens magnus, which are invariably present in the air, and which prepare the way for more specifically putrefactive bacteria, such as Proteus vulgaris and B. putrificus, but it one observes a number of putrefactions of the same kind of matter under natural conditions, scarcely any two follow the same course. The modern study of putrefaction dates from Hauser, who, in 1885, isolated from putrefying flesh the three organisms—Proteus vulgaris, P. mirabilis and P. zenkeri. He studied the action of these in pure cultures, and came to the following conclusions:—

That Bacterium termo (Ehr.) is not a single definite species; various forms and stages of other organisms have been described under this name. The various species of Proteus go through a wide range of forms during their development in which cocci, short and long rods, thread forms, vibrios, spirilli, and spirochætæ occur. Under special nutritive conditions Proteus goes through a swarm stage, in which condition it is capable of moving over the surface and in the solid gelatin. The Proteus bacteria are facultatively anærobic, they all cause putrefaction; P. vulgaris and P. mirabilis are the commonest and most active of all putrefactive bacteria. They do not secrete an unorganised ferment, but decompose albuminous bodies by direct action. They also produce a powerful poison, of which small quantities injected into animals produce septicæmia.

Tito Carbone (3) found amongst the products of P. vulgaris, choline, ethylenediamine, gadinine, and trimethylamine. Macé, criticising Hauser's work, considers the cocci form of Proteus to be spores. Bienstock (5) believes the rôle of the Proteus group somewhat doubtful. He discovered (1884) another widely distributed putrefactive organism, which he called Bacillus putrificus; it is a spore bearing, drumstick shaped bacillus found in fæces; it is anærobic and specially attacks fibrin. Now fibrin is extremely resistent to the action of most putrefactive bacteria, and it is very probable that specific organisms ferment the different albuminous compounds in the same way that the different carbohydrates are each decomposed by specific ferments. A certain number of species of bacteria are able to decompose both carbohydrates and proteids. Tissier and Martelly (13) call these mixed ferments, and divide them further into two groups (1), mixed proteolytic ferments, including B. perfringens, B. bifermentans sporogenes, Staphylococcus albus, Micrococcus flavus liquefaciens, Proteus vulgaris, this group decompose albumin by means of tryptic enzymes. (2) Mixed peptolytic ferments are only able to attack the albumin when it has undergone a preliminary decomposition. This group comprises B. coli, B. filiformis, Streptococcus pyogenes, Diplococcus griseus non liquefaciens.

The second class of bacteria are those which are without action on carbohydrates, and only attack proteids; these consist of the true proteolytic bacteria B. putrificus, and B. putidus gracilis, and the peptolytic bacteria, Diplococcus magnus anærobius and Proteus zenkeri, which can only decompose peptones.

These authors state that B. putrificus is always present in putrefying albumin, but always accompanied by facultative aerobes which favour the growth and development of the special putrefactive bacteria.

In the putrefaction of meat the reaction is first acid owing to the action of the mixed ferments on the sugars present. In the next stage ammonia is formed by the tryptic enzymes secreted by the aerobic bacteria, and so the anærobic organisms are enabled to develop. We can thus understand how it is that putrefaction proceeds more rapidly the more mixed ferments there are present, although these were formerly supposed to hinder putrefaction from taking place.

When meat is exposed to air it is first attacked by the mixed ferments. Micrococcus flavus liquefaciens, Staphylococcus, Bacillus coli, Bacillus filiformis, Streptococcus and Diplococcus, and becomes acid, at the same time the presence of decomposition products of albumin may be detected, proteoses, amidoacids, amines and ammonia; the latter quickly neutralise the acids, and in three to four days the meat is alkaline, and has a faint putrid smell. Bacillus perfringens and Bacillus bifermentans sporogenes now make their appearance; the latter of these organisms produces amines, amido-acids and ammonia. In this stage the simple anærobic ferments are able to begin their work, and real putrefaction sets in; as this proceeds, the mixed ferments gradually disappear and finally the only organisms remaining are Bacillus putrificus, Bacillus gracilis puddus, and Diplococcus griseus nonliquefacions.

Another organism, which appears to play an important part in the decomposition of animal bodies, is described by Klein (6); he found that in bodies, which had been buried from three to six weeks, bacteria such as B. coli and B. proteus had almost disappeared, and an anærobic bacterium, which he calls B. cadaveris sporogenes, was very active. It is a motile bacillus 2—4 μ long, with flagellæ all over its surface. Spores are formed at the rounded ends, giving it a drumstick form. It coagulates milk, the clot gradually dissolving. It grows on all the usual nutritive media, but only under strictly anærobic conditions.

In a paper, entitled "Fermentation in the Leather Industry" (this J., 1894, 218), I gave a short account of the progress of putrefaction as it takes place in the animal skin, and also described some of the organisms I had observed in putrefying skin. A small piece of skin was placed in water and allowed to stand at room temperature. During the first two days there was little change, but on the third day a number of swiftly moving darting monads made their appearance. Some of these were propelled by flagellæ, but a few had assumed amœboid forms. A slowly moving bacillus consisting of a long straight rod, apparently broken up into cells exactly like the Vibrio subtilis, illustrated in the "Micrographic Dictionary," was observed, accompanied by some species of spirillum. Higher organisms present were a Paramœcium and a colourless transparent piece of protoplasm, shaped like a dumb-bell, with a slow rotating motion. On the fifth day the number of vibrios and spirilli had greatly increased, some with a swifter motion than others. There were also many large infusoria present; one of a peculiar double form which appeared to be a development of the dumb-bell shaped piece of protoplasm seen on the third day. On the seventh day the most striking feature was the great increase in the number of vibrios; the field of the microscope was crowded; masses of the bacilli could be seen clustered round small particles of the disintegrating skin as if feeding upon it; there were more infusoria, many of them short, boat-shaped monads, with a trembling motion, refracting light strongly; these evidently accom-

pany the putrefaction bacteria, and assist in the final disintegration. On the ninth day the piece of skin was entirely dissolved.

Proctor calls attention to the relative putrescibility of the different constituents of skin, and especially to the rapid putrescence of the lymph and serum. So far as I know, this part of the subject has not been studied at all thoroughly, and there is a considerable field open to workers in our research laboratories.

Pure fat is not decomposed by bacteria, but if albuminous matter is present, the fat is split up by several species of bacteria and moulds. Schreiber (16) has shown that the presence of oxygen is necessary. As this subject scarcely comes within the category of putrefaction, I refer you to Schreiber's paper, and also to an important paper by Otto Rahn (17) recently published.

In the putrefaction of vegetable matter the cellulose is attacked by specific organisms, which have been thoroughly investigated by Omelianshy (18). He has shown that the fermentation of cellulose is an anærobic process, caused by two species of bacteria belonging to the class of butyric ferments. Morphologically the organisms closely resemble one another, but one of them decomposes the cellulose with evolution of hydrogen, the other with evolution of methane; in both cases considerable amounts of acetic acid and normal butyric acid are produced.

The rottenness of fruit is caused mainly by different species of moulds, and has recently received considerable attention on the Continent and in America. One of the principal organisms concerned is a species of Fusarium, isolated and described by Osterwalder (15) under the name of Fusarium putrefaciens. I give a list of the principal moulds known to take part in putrefaction.

I have previously stated that monads and infusoria take part in the process of putrefaction, but I do not know that their action has been studied in the same way as that of bacteria. The life history and morphology of some of these monads was studied in 1871 to 1875 by Dallinger and Drysdale.(19) These authors in their researches into the life history of the monads found in a putrefying infusion of cod's head, came to the conclusion that "bacteria are not the only or even (in the end) the chief organic agents of putrefaction, for most certainly in the later stages of a disintegration of dead organic matter the most active agents are a large variety of flagellate monads."

Dallinger cultivated some of the monads in Cohn's fluid and found that they lived and multiplied in it. Their spores were killed at a temperature of 250° F. There is a big field of research open in this direction.

The consideration of the chemical aspect of putrefaction is a vast subject and would demand a special treatise. I shall only call your attention to one or two points of interest.

Taking the simpler bodies first, sulphuretted hydrogen is formed in putrefying liquids in two ways—1. By reduction of the sulphates in the liquid by an anærobic organism Spirillum desulfuricans; 2. By bacteria capable of growing in the presence of oxygen such as B. coli commune and B. lactis ærogenes, which ferment glucoses with formation of lævorotatory lactic acid and evolution of CO_2 and hydrogen, and if at the same time the material contains albumen or sulphur, H_2S is given off; these organisms are incapable of reducing sulphates. Boyerinck (7) has investigated this process, and found a variety of different forms intermediate between the two above-mentioned, but all possessing the same characteristics so far as their chemical action is concerned, so that they may be classed as one order which he calls Aerobacter.

Stich (8) found phosphorus pentoxide in the residue from the putrefaction of casein, nuclein, lecithin and protagon, and in the putrefaction of certain organs of animals and plants gases contaning phosphorus are evolved. The nucleic acid of yeast yielded phosphoric acid along with hypoxanthin and xanthin.

Vitali (9) found in the putrefaction of muscle, which had been freed from sugars and fat, that some alcohol was duced. He considers that a hexose is split off from the albumin in a similar manner to the splitting off of a fermentable sugar from the glucoproteids (compounds of simple proteins with carbohydrates). The formation of alcohol in the putrefaction of muscle occurs in the alkaline stage. Thus alcoholic fermentation is caused not alone by saccharomyces, but also by certain putrefactive bacetria.

Lermer (20) finds that the putrefaction of barley resembles butyric fermentation. An analysis of the gases given off during the later stages of the process gave the following result:—Nitrogen, 58·88; Hydrogen, 37·43; Methane, 3·15.

In the residue from the putrefaction he found acetic, butyric and valerianic acids, but not caproic or caprilic acid. In the normal steeping process employed for barley the gases given off consisted almost entirely of carbon dioxide and nitrogen. This observation is interesting to compare with the evolution of nitrogen in the fermentation of bran shown by Wood and Willcox (this J., 1893, 422).

The action of putrefactive bacteria has been found capable of transforming hexoses into pentoses. Salkowski and Neuberg (21) inoculated a solution of *d*-glukuronic acid with putrefying meat, and showed that it was changed into *l*-xylose with evolution of CO_2 according to the following formula:

$$COH(CHOH)_4COOH = CO_2 + COH[CHOH]_3CH_2OH.$$

This is an interesting fact, especially as, according to Neuberg, the pentose contained in animal nucleoproteids is *l*-xylose.

In conclusion, I hope that this short review of the subject will be of use in bringing together a good many references to work scattered in various periodicals. I also wish to express my indebtedness to Dr Alfred Koch's "Jahresbericht über Gärungs-organismen" for some of the abstracts.

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(21) Salkowski and Neuberg. Die Verwandlung von d Glukuronsaure in l-Xylose Zeitschr. f. physiol. Chemie Bd. 36, p. 261.

List of putrefactive bacteria which have been studied in pure cultures:—

1. Proteus Vulgaris (Hauser). 2. Proteus mirabilis. 3. Proteus Zenckeri. 4. Bacillus Oedematis maligni (Kerry, Nencki, Bovet). 5. Bacillus Chauvæi = B. sarcophyematos bovis. 6. B. Liquefaciens magnus. 7. B. spinosus. 8. B. putrificus (Bienstock). 9. B. pseudo œdematicus (Liborius). 10. B. enteridis sporogenes (Klein). 11. B. tetani. 12. Clostridium fœtidum. 13. B. cadaveris sporogenes (Klein.) 14. Spirillum desulfuricans

of it may be divided into two parts—(1) the biological, (2) the chemical. The first concerns the organisms which break down the proteid molecule either directly or by means of enzymes; the second that of the different products of the action of these organisms. It is extremely difficult to separate these two studies.

Dr. Sims Woodhead (2) gives a concise account of the earliest researches on the organisms causing putrefaction by Leeuwenhoek (1692), Plenciz of Vienna, Müller of Copenhagen (1786), Needham (1749), Spallanzani (1769), Schwann (1837), Schroeder and Van Dusch (1854), Tyndall (1870), Lister (1878). These names show that the history of putrefaction proceeds parallel with the evolution of the microscope and the development of the comparatively recent science of bacteriology. I propose to-night briefly to carry it up to the present day.

I need scarcely say that putrefaction is not a specific fermentation like alcoholic or acetic fermentation, but that it is extremely complex. In any putrefying matter, such as gelatin or albumin, a large number of different species of bacteria may be observed as well as monads and infusoria, and in some cases moulds, all of which take part in the process. The first stage is a process of oxidation in the presence of air, in which aerobic bacteria use up the oxygen present and only simple inorganic compounds are formed, carbon dioxide, nitrates and sulphates; this part of the process is generally without odour. The second stage, or true putrefaction, takes place in the absence of oxygen by anærobic bacteria, and is a process of reduction. It has been shown that there are no bacteria in healthy tissues, and if a muscle or any organ is taken from an animal under antiseptic conditions it may be preserved indefinitely in a sterile vessel to which filtered air has free access. Solid matter is usually liquefied by organisms like B. liquefaciens magnus, which are invariably present in the air, and which prepare the way for more specifically putrefactive bacteria, such as Proteus vulgaris and B. putrificus, but it one observes a number of putrefactions of the same kind of matter under natural conditions, scarcely any two follow the same course. The modern study of putrefaction dates from Hauser, who, in 1885, isolated from putrefying flesh the three organisms—Proteus vulgaris, P. mirabilis and P. zenkeri. He studied the action of these in pure cultures, and came to the following conclusions:—

That Bacterium termo (Ehr.) is not a single definite species; various forms and stages of other organisms have been described under this name. The various species of Proteus go through a wide range of forms during their development in which cocci, short and long rods, thread forms, vibrios, spirilli, and spirochætæ occur. Under special nutritive conditions Proteus goes through a swarm stage, in which condition it is capable of moving over the surface and in the solid gelatin. The Proteus bacteria are facultatively anærobic, they all cause putrefaction; P. vulgaris and P. mirabilis are the commonest and most active of all putrefactive bacteria. They do not secrete an unorganised ferment, but decompose albuminous bodies by direct action. They also produce a powerful poison, of which small quantities injected into animals produce septicæmia.

Tito Carbone (3) found amongst the products of P. vulgaris, choline, ethylenediamine, gadinine, and trimethylamine. Macé, criticising Hauser's work, considers the cocci form of Proteus to be spores. Bienstock (5) believes the rôle of the Proteus group somewhat doubtful. He discovered (1884) another widely distributed putrefactive organism, which he called Bacillus putrificus; it is a spore bearing, drumstick shaped bacillus found in fæces; it is anærobic and specially attacks fibrin. Now fibrin is extremely resistent to the action of most putrefactive bacteria, and it is very probable that specific organisms ferment the different albuminous compounds in the same way that the different carbohydrates are each decomposed by specific ferments. A certain number of species of bacteria are able to decompose both carbohydrates and proteids. Tissier and Martelly (13) call these mixed ferments, and divide them further into two groups (1), mixed proteolytic ferments, including B. perfringens, B. bifermentans sporogenes, Staphylococcus albus, Micrococcus flavus liquefaciens, Proteus vulgaris, this group decompose albumin by means of tryptic enzymes. (2) Mixed peptolytic ferments are only able to attack the albumin when it has undergone a preliminary decomposition. This group comprises B. coli, B. filiformis, Streptococcus pyogenes, Diplococcus griseus non liquefaciens.

The second class of bacteria are those which are without action on carbohydrates, and only attack proteids; these consist of the true proteolytic bacteria B. putrificus, and B. putidus gracilis, and the peptolytic bacteria, Diplococcus magnus anærobius and Proteus zenkeri, which can only decompose peptones.

These authors state that B. putrificus is always present in putrefying albumin, but always accompanied by facultative aerobes which favour the growth and development of the special putrefactive bacteria.

In the putrefaction of meat the reaction is first acid owing to the action of the mixed ferments on the sugars present. In the next stage ammonia is formed by the tryptic enzymes secreted by the aerobic bacteria, and so the anærobic organisms are enabled to develop. We can thus understand how it is that putrefaction proceeds more rapidly the more mixed ferments there are present, although these were formerly supposed to hinder putrefaction from taking place.

When meat is exposed to air it is first attacked by the mixed ferments. Micrococcus flavus liquefaciens, Staphylococcus, Bacillus coli, Bacillus filiformis, Streptococcus and Diplococcus, and becomes acid, at the same time the presence of decomposition products of albumin may be detected, proteoses, amidoacids, amines and ammonia; the latter quickly neutralise the acids, and in three to four days the meat is alkaline, and has a faint putrid smell. Bacillus perfringens and Bacillus bifermentans sporogenes now make their appearance; the latter of these organisms produces amines, amido-acids and ammonia. In this stage the simple anærobic ferments are able to begin their work, and real putrefaction sets in; as this proceeds, the mixed ferments gradually disappear and finally the only organisms remaining are Bacillus putrificus, Bacillus gracilis puddus, and Diplococcus griseus nonliquefacions.

Another organism, which appears to play an important part in the decomposition of animal bodies, is described by Klein (6); he found that in bodies, which had been buried from three to six weeks, bacteria such as B. coli and B. proteus had almost disappeared, and an anærobic bacterium, which he calls B. cadaveris sporogenes, was very active. It is a motile bacillus 2—4 μ long, with flagellæ all over its surface. Spores are formed at the rounded ends, giving it a drumstick form. It coagulates milk, the clot gradually dissolving. It grows on all the usual nutritive media, but only under strictly anærobic conditions.

In a paper, entitled "Fermentation in the Leather Industry" (this J., 1894, 218), I gave a short account of the progress of putrefaction as it takes place in the animal skin, and also described some of the organisms I had observed in putrefying skin. A small piece of skin was placed in water and allowed to stand at room temperature. During the first two days there was little change, but on the third day a number of swiftly moving darting monads made their appearance. Some of these were propelled by flagellæ, but a few had assumed amœboid forms. A slowly moving bacillus consisting of a long straight rod, apparently broken up into cells exactly like the Vibrio subtilis, illustrated in the "Micrographic Dictionary," was observed, accompanied by some species of spirillum. Higher organisms present were a Paramœcium and a colourless transparent piece of protoplasm, shaped like a dumb-bell, with a slow rotating motion. On the fifth day the number of vibrios and spirilli had greatly increased, some with a swifter motion than others. There were also many large infusoria present; one of a peculiar double form which appeared to be a development of the dumb-bell shaped piece of protoplasm seen on the third day. On the seventh day the most striking feature was the great increase in the number of vibrios; the field of the microscope was crowded; masses of the bacilli could be seen clustered round small particles of the disintegrating skin as if feeding upon it; there were more infusoria, many of them short, boat-shaped monads, with a trembling motion, refracting light strongly; these evidently accom-

Filtering, Purifying, and Decanting Apparatus. H. Desrumaux, Paris. U.S. Pat. 809,099, Jan. 2, 1906.

A NUMBER of superposed filtering chambers communicate with one another by central overflow pipes, which extend from above the level of the filtering medium in one chamber through the partition which divides it from the one below. The filtering medium is supported on perforated plates, and each chamber is provided with revolving stirring bars, having "fingers" or projections depending from them and adapted to stir up the filtering medium. Valved outlet pipes are connected to each chamber above and below the level of the filtering medium.—W. H. C.

FRENCH PATENTS.

Drying-Stove. A. Schroder. Fr. Pat. 357,768, Aug. 28, 1905. Under Int. Conv., Aug. 30, 1904.

A DRYING chamber enclosed on three sides by hollow walls, and on the fourth by a double-walled door, is heated by hot air circulating through the hollow walls which are provided with regulating dampers. The air itself is heated by being passed through a chamber, fitted with baffles and filled with metal turnings or shavings to assist in the absorption of heat by the air. The chamber is placed beneath the drier and heated by external gas jets which are arranged in double rows beneath the corrugated bottom of the air-heating chamber. The corrugations serve the double purpose of providing a large heating surface and forming channels for the escape of the products of combustion. The materials to be dried are placed on trays which are supported on ledges or grooves on the two side walls of the drying chamber, a space being left between the ends of the trays and the back wall for the escape of the vapours given off.—W. H. C.

Drying by Exposure to Light; Method of ——. Ges. für Trockenverfahren, m.b.H. Fr. Pat. 357,895, Sept. 23, 1905. Under Int. Conv., Sept. 22, 1904.

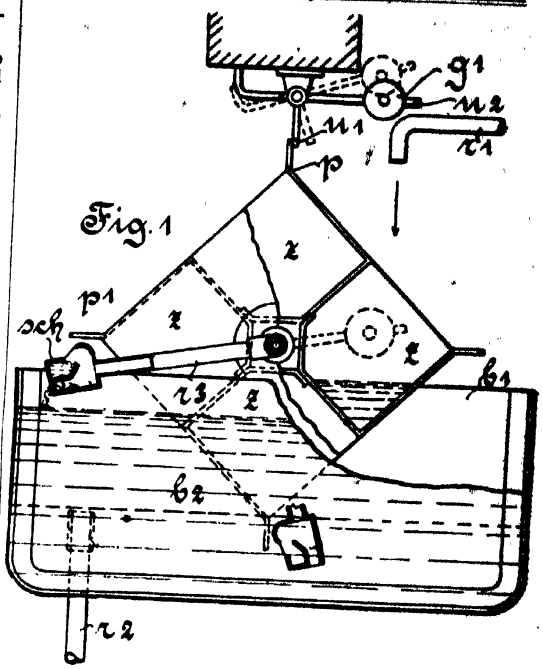
SEE Ger. Pat. 162,696 of 1904; this J., 1906, 59.—W. H. C.

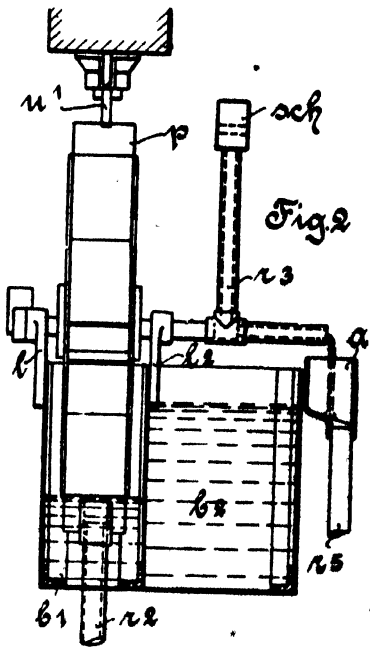
Concentration of Solutions by the method of freezing and the removal of the Ice Crystals from the soluble Matter; Process and Apparatus for ——. E. Mouti. Fr. Pat. 357,770, Sept. 7, 1905.

THE present patent relates to improvements in Fr. Pat. 324,472 of 1902 (this J., 1903, 567), and claims are made for the progressive freezing of the solutions from above downwards; the utilisation of the heat rendered latent during the fusion of the ice crystals to cool the refrigerating gas; the use of a gas to saturate and agitate the solutions being frozen, which gas may or may not act chemically on the solution; and the application of the process to the concentration of solutions of alcohol, sugar, salts, acids, &c.—W. H. C.

Mixing two or more Liquids in a determined proportion; Apparatus for ——. W. J. Schumacher. Fr. Pat. 357,863, Sept. 19, 1905.

THE bucket-wheel z z (Fig. 1) is mounted on a shaft carried by supports l l^2 (Fig. 2) and is fed with liquid through the pipe r^1 (Fig. 1). The wheel is prevented from rotating, while it is being filled, by the weighted lever stop u^1,u^2,g^1, the balance of which is so adjusted that the projection p cannot clear the bent end until the liquid in z is sufficient to overcome the resistance of the weighted lever. Consequently, by varying the weight on the lever, the rate at which the wheel buckets fill can be varied. The projections p p^1 serve the further purpose of retarding the movements of the wheel when it is turning, owing to the resistance offered to their movement by the air or liquid. As the wheel turns round, the contents of each bucket in succession are emptied into the tank b_1 and flow from thence to the mixing tank proper by the pipe r_2; at the same time the dipper *sch* carried on the hollow arm r_3 is made to take up a quantity of liquid from the tank b_2, and as the wheel rotates, to empty it into the mixing tank through the shoot a and r_5 (Fig. 2). As many arms r_3 and scoops *sch* may be used as there are liquids to be





mixed; the liquids are stored in separate tanks, each of which has its own scoop. The apparatus described is claimed for the mixing of two or more liquids together in determined proportion.—W. H. C.

Reagents; Process and Apparatus for Preparing and Feeding ——. J. F. Wixford. Fr. Pat. 357,941, Sept. 22, 1905. Under Int. Conv., Sept. 23, 1904.

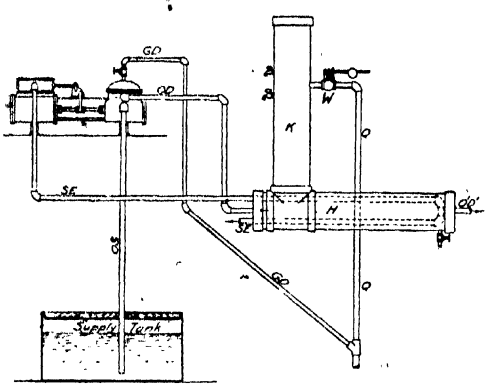
SEE U.S. Pat. 806,945 of 1905; this J., 1906, 72.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 62.)

Oil-Burning equipment; A simple ——. C. De Kalb. Eng. and Mining J., 1906, **81**, 74.

One of the most important points in connection with



the use of liquid fuel, is the delivery of the oil to the burner under constant pressure. The author points out that uniform pressure can be most easily maintained when the oil rises in the suction-pipe of the pump with a low velocity, and this can only be attained by using a pump of large capacity. The plant shown in the accompanying figure has proved satisfactory in practice. The oil is drawn from the supply-tank through the suction pipe OS (2 in. diam.) and delivered through pipe OD (1½ in. diam.) to the reservoir H (6 in. diam.), where it is preheated to a certain extent by the exhaust steam from the pump passing through the pipe SE (1½ in. diam.). From the reservoir H, rises a stand-pipe K (6 in. diam.) provided with a weighted valve W, which opens when the pressure exceeds a determined limit; any oil which overflows is returned to the supply-tank through the pipe Q. Any gas accumulating in the pump is blown off through the pipe G D. From the reservoir H, the oil is supplied through pipe O^1 D^1 to the burner, which consists of an oil-tube of ⅜ in. diam. disposed concentrically within a 1 in. steam-pipe, terminating a few inches beyond the oil tube. The end of the steam-pipe is in the form of a flattened lip with a slit in the shape of an arc of a circle so disposed that it would be bisected by the (prolonged) longitudinal axis of the oil-tube.—A. S.

Calcium Hydride; Occurrence of a Gaseous —— in commercial Acetylene. C. Hoffmeister. Z. anorg. Chem., 1906, **48**, 137—139.

The author has frequently observed, on the cooler parts of an acetylene gas plant, white deposits consisting of lime or, when the deposit had been exposed to the air for some time, calcium carbonate. This deposit has been traced to the presence in the acetylene of a gaseous compound of calcium and hydrogen. The compound was separated by passing some of the acetylene containing it successively through a filter of cotton-wool, a number of flasks containing acetone, and finally through ammoniacal copper solution. From 100—150 c.c. were obtained from 100 litres of acetylene, but the gas still contained admixed air. It is colourless, has an odour resembling that of commercial acetylene and hydrogen phosphide, and is very slightly soluble in water. It burns with an intense calcium flame, and, when mixed with oxygen, gives an extremely explosive mixture; the only products of combustion detected were lime and water.—A. S.

Calcium Carbide and Acetylene. J. H. Vogel, Z. angew. Chem., 1906, **19**, 49—57.

The German production of carbide in 1905 was about 3000 tons, and the import about 16,000 tons. From 1 kilo. of carbide are obtained, in practice, about 290 litres of acetylene (97 per cent. of the theoretical yield), so that 24,000 tons of carbide replace for lighting purposes about 13 million galls. of petroleum. While five years ago the price of carbide was 50—60 marks per 100 kilos., at present it is produced at 22 marks per 100 kilos.—J. T. D.

English Patents.

Burners; Liquid Fuel ——. C. Leistner, London. Eng. Pat. 24,372, Nov. 10, 1904.

The burner consists of an outer conical casing, an inner concentric casing divided by a partition into oil and compressed-air chambers, nozzles secured to these chambers to form annular outlet passages for the oil and air respectively, and a central spindle acting as an oil regulating valve. Compressed air is admitted to both the outer and inner casings, the arrangement being such that the mixture of atomised fuel and air, issuing from the nozzle of the inner casing, is completely surrounded by an annular jacket of air. For the automatic regulation of the oil supply, according to variations in the air pressure, a branch tube from the air pipe is connected to a cylinder containing a spring-controlled piston, which is linked to the cock of the oil supply pipe.—H. B.

Burners; Gaseous Fuel ——. F. A. Wegner, Brockville, Ontario, Canada. Eng. Pat. 137, Jan. 3, 1905.

The end of the gas-supply pipe is screwed into a concentric mixing pipe, which leads to the burners and is provided with a lateral branch pipe through which air is introduced from a blower or other air-forcing device. The gas supply pipe projects into the mixing pipe for a short distance beyond the point at which the air enters.—H. B.

[*Suction*] *Gas Producers.* L. W. Crosta and G. L. Morton, Nottingham. Eng. Pat. 6434, March 27, 1905.

The gas outlet pipe, between the producer and the scrubber, is provided with corrugations, ribs, or the like, to present an extended heating surface, and is surrounded by the air inlet pipe, so that the air becomes heated in flowing through the annular space between the two pipes. The air then enters an annular mixing chamber for air and steam, which surrounds the upper part of the producer, and is there mixed with steam which is generated continuously in an annular boiler surrounding the incandescent zone of the fuel. The annular steam-pipe, which admits the steam to the mixing chamber, also communicates with a bell, immersed in water, outside the producer, this device serving to condense the steam when the gas production ceases, thus preventing the accumulation of steam in the mixing chamber. The tuyères, through which the air and steam from the mixing chamber are admitted into the lower part of the furnace, are fitted with wire gauze, small tubes, or other devices, which deliver the mixture to the furnace in fine streams.—H. B.

Gas; Apparatus for the manufacture of ——. H. P. Bell. London. Eng. Pat. 6794, March 31, 1905.

The apparatus consists of three vessels provided with jackets, the vessels and the jackets being connected by pipes, controlled by valves, so that each vessel in turn becomes the first, second, and third of the series. The apparatus is worked in a cycle of three stages, the gases, or part of them from the first vessel at each stage being discharged into the air after passing through the jackets surrounding the other two vessels, and the gases generated in the second vessel at each stage passing through the third vessel before leaving the apparatus. The apparatus is for the production of water-gas or producer gas from suitable fuel, air being admitted to the first vessel and steam to the second vessel, with or without air or part of the gases from the first vessel, and fuel being introduced into the second vessel at each stage.—W. C. H.

Generator- or Water-Gas; Production of Carburetted ——. J. A. Hutmacher, Berlin. Eng. Pat. 19,995, Oct. 3, 1905.

The generator, which is fitted with feed-hopper, gas outlet

pipe, air-blast pipe, and steam supply pipe as usual, is also provided at one side of the combustion space, with a chamber, open at the lower end, which depends into the fuel as far as the incandescent zone. This chamber serves for vaporising and superheating the hydrocarbon used as the carburetting material, which is admitted at the top through a siphon tube. The open end of the chamber is arranged at such a level that the hydrocarbon vapours are discharged into the incandescent fuel at a point above the oxidising zone. Combustion of the vapours is thus prevented, but the temperature is nevertheless sufficiently high to convert the vapours into permanent gases.—H. B.

Gases; purification of, and recovery of Tar and other Substances from Blast Furnace, Producer, and like ——. G. Neilson, Coatbridge, N.B. Eng. Pat. 28,508, Dec. 28, 1904.

The gas is led, on its way from the by-product plant to the gas-engine or the like, through a purifier consisting of a casing in which are fixed horizontal platforms or diaphrams, each carrying a number of tar-trapping vessels, whilst at the bottom of the casing the gas is admitted through an oil washer. Each tar-trap consists of a short vertical cylindrical tube, open at both ends, but provided at the top with a cover which is fixed so as to leave a narrow space—from one-fiftieth to one-sixteenth of an inch—between the cover and the upper edge of the cylinder. A conical rim or flange extends downwards from the cover a short distance round the cylinder, forming an annular space round the latter. The crude gas, passing up through the platform and the cylinder, issues in a thin sheet at high velocity through the narrow opening between the cylinder and cover, the tar, which is deposited on the conical flange, running down and being led off by a collecting pipe.—H. B.

Incandescent Lamps; Manufacture of light emitting Bodies for Electric ——. H. Kuzel, Baden, Austria. Eng. Pat. 28,154, Dec. 22, 1904.

In manufacturing glow bodies from elements of high melting-point, such as chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, platinum, osmium, iridium, boron, and silicon, a plastic mass composed of one or more of these in a colloidal state, without the addition of any binding material, is brought into the desired shape, dried slowly, and finally raised to a white heat in a neutral atmosphere. To obtain the plastic masses, the metals are obtained as colloidal suspensions, for example by Bredig's method, which consists in setting up a voltaic arc between two electrodes made of the metal, having a very rough surface and immersed in water. The colloidal suspension formed is then dried by slow evaporation to reduce it to a pasty condition.—H. B.

Incandescence Bodies for Electric Light; Manufacture of [Tantalum] ——. Siemens and Halske A. G., Berlin. Eng. Pat. 23,097, Nov. 10, 1905. Under Int. Conv., Nov. 15, 1904.

Tantalum, which though of very high melting point can easily be drawn into fine wire, is used as a core upon which another difficultly fusible metal (such as osmium, tungsten or molybdenum) which cannot be fashioned easily into wires, is deposited. On raising the coated wire to a very high temperature, the tantalum and other metal form an alloy.—H. B.

Incandescence Bodies of Tungsten, Molybdenum or similar metals; Manufacture of [Electrical] Glow Lamps with ——. Siemens and Halske A. G., Berlin. Eng. Pat. 23,098, Nov. 10, 1905. Under Int. Conv., Nov. 15, 1904.

In manufacturing glow-lamps with filaments of difficultly-worked metals, such as tungsten and molybdenum, a fine metal wire or carbon filament, serving as core in the first instance, is stretched between a series of supporting devices upon a frame adapted to be introduced into the lamp globe (see Eng. Pat. 27,712 of 1903). The incandescence metal is then deposited upon the stretched wire, for example by heating it in an atmosphere of hydrogen and tungsten oxychloride. Tantalum wire is particularly suitable for use as the core of the filament. (See Eng. Pat. 28,508 in preceding Eng. Pats.)—H. B.

United States Patents.

Gas-Producers; Process of preventing the formation of Clinker in ——. J. E. Sheaffer, Assignor to O. C. Skinner, Burnham, Pa. U.S. Pat. 809,021, Jan. 2, 1906.

The claim is for the process of preventing the formation of clinker in gas-producers, by agitating the fuel and injecting water through the hollow arms of the agitator into the mass of incandescent fuel at points near the walls of the generator, where the clinker most commonly forms.—W. H. C.

Gas-Producer. O. C. Skinner and J. E. Sheaffer, Burnham, Pa. U.S. Pat. 809,023, Jan. 2, 1906.

A hollow, water-cooled shaft with hollow, water-cooled agitating arms is arranged to be rotated within a producer. The arms are rotated within the mass of fuel, and have nozzles through which a current of water is discharged towards the sides of the producer.—W. H. C.

Gases; Apparatus for the separation of —— from their Mixtures. R. P. Pictet, Berlin. U.S. Pat. 809,218, Jan. 2, 1906.

See Eng. Pat. 19,254, of 1900; this J., 1901, 1194.—T. F.B.

Illuminant. J. Lewy, Frankfort-on-Maine, Germany. U.S. Pat. 809,121, Jan. 2, 1906.

See Fr. Pat. 318,129 of 1902; this J., 1902, 1448.—T. F. B.

French Patents.

Anthracite Dust; Process for the Agglomeration of ——. A. Exbrayat. First Addition, dated March 11, 1905 to Fr. Pat. 350,258, Oct. 25, 1904. (This J., 1906, 10.)

Instead of resin, quicklime or calcium salts may be added to the gelatinous mass prepared from seaweed (fucus) in order to dehydrate it. The briquettes are hardened by the addition of formaldehyde or alkali peroxides, previously mixed with alkali silicates.—W. H. C.

Combustible [Briquette]; Manufacture of Agglomerated ——. A. Bienaimé and A. Requier. Fr. Pat. 357,631, Sept. 9, 1905.

A mixture of anthracite, coke, or non-coking coal dust, with tar, pitch, coking-coal or other agglomerant, is first briquetted and then heated in a retort or oven to such a temperature that the volatile products are distilled off. The briquettes may be further hardened by immersing them, while still hot, in a solution of an alkali silicate, or the silicate may be added before the heating takes place. The use of briquettes, so prepared, which are said to produce neither smoke nor smell on burning, for domestic fires, especially in slow-combustion stoves, and for industrial furnaces is claimed. Further, if the briquettes are intended for use in metallurgical operations in which the evolution of sulphur dioxide from the contained sulphur is objectionable, the latter is fixed by the previous addition of a suitable proportion of lime, magnesia or other metallic oxide.—W. H. C.

Briquettes of any Materials; Process for the manufacture of hard and compact ——. L. Weiss. Fr. Pat. 357,801, Sept. 16, 1905.

Combustible substances, ores or other materials are formed into compact briquettes by mixing them with milk of lime, compressing in moulds, and subjecting the mass either during or after compression to the action of carbon dioxide at a pressure of from 8 to 25 atmospheres. The carbon dioxide may be introduced into the closed moulds or into reservoirs preferably constructed of "Mannesmann" tubes, containing the compressed briquettes.—A. S.

Furnace; Retort ——. Soc. P. de Lachomette, Villiers and Cie. Fr. Pat. 357,804, Sept. 16, 1905.

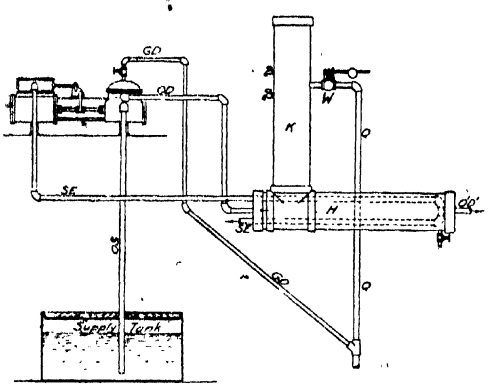
To prevent, in the distillation of coal, the upper portions

II.—FUEL, GAS, AND LIGHT.

(*Continued from page 62.*)

Oil-Burning equipment; A simple ——. C. De Kalb. Eng. and Mining J., 1906, **81**, 74.

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the use of liquid fuel, is the delivery of the oil to the burner under constant pressure. The author points out tha uniform pressure can be most easily maintained when the oil rises in the suction-pipe of the pump with a low velocity, and this can only be attained by using a pump of large capacity. The plant shown in the accompanying figure has proved satisfactory in practice. The oil is drawn from the supply-tank through the suction pipe OS (2 in. diam.) and delivered through pipe OD (1½ in. diam.) to the reservoir H (6 in. diam.), where it is preheated to a certain extent by the exhaust steam from the pump passing through the pipe SE (1¼ in. diam.). From the reservoir H, rises a stand-pipe K (6 in. diam.) provided with a weighted valve W, which opens when the pressure exceeds a determined limit; any oil which overflows is returned to the supply-tank through the pipe Q. Any gas accumulating in the pump is blown off through the pipe G D. From the reservoir H, the oil is supplied through pipe O^1 D^1 to the burner, which consists of an oil-tube of ⅜ in. diam. disposed concentrically within a 1 in. steam-pipe, terminating a few inches beyond the oil tube. The end of the steam-pipe is in the form of a flattened lip with a slit in the shape of an arc of a circle so disposed that it would be bisected by the (prolonged) longitudinal axis of the oil-tube.—A. S.

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The author has frequently observed, on the cooler parts of an acetylene gas plant, white deposits consisting of lime or, when the deposit had been exposed to the air for some time, calcium carbonate. This deposit has been traced to the presence in the acetylene of a gaseous compound of calcium and hydrogen. The compound was separated by passing some of the acetylene containing it successively through a filter of cotton-wool, a number of flasks containing acetone, and finally through ammoniacal copper solution. From 100—150 c.c. were obtained from 100 litres of acetylene, but the gas still contained admixed air. It is colourless, has an odour resembling that of commercial acetylene and hydrogen phosphide, and is very slightly soluble in water. It burns with an intense calcium flame, and, when mixed with oxygen, gives an extremely explosive mixture; the only products of combustion detected were lime and water.—A. S.

Calcium Carbide and Acetylene. J. H. Vogel, Z. angew. Chem., 1906, **19**, 49—57.

The German production of carbide in 1905 was about 3000 tons, and the import about 16,000 tons. From 1 kilo. of carbide are obtained, in practice, about 290 litres of acetylene (97 per cent. of the theoretical yield), so that 24,000 tons of carbide replace for lighting purposes about 13 million galls. of petroleum. While five years ago the price of carbide was 50—60 marks per 100 kilos., at present it is produced at 22 marks per 100 kilos.—J. T. D.

English Patents.

Burners; Liquid Fuel ——. C. Leistner, London. Eng. Pat. 24,372, Nov. 10, 1904.

The burner consists of an outer conical casing, an inner concentric casing divided by a partition into oil and compressed-air chambers, nozzles secured to these chambers to form annular outlet passages for the oil and air respectively, and a central spindle acting as an oil regulating valve. Compressed air is admitted to both the outer and inner casings, the arrangement being such that the mixture of atomised fuel and air, issuing from the nozzle of the inner casing, is completely surrounded by an annular jacket of air. For the automatic regulation of the oil supply, according to variations in the air pressure, a branch tube from the air pipe is connected to a cylinder containing a spring-controlled piston, which is linked to the cock of the oil supply pipe.—H. B.

Burners; Gaseous Fuel ——. F. A. Wegner, Brockville, Ontario, Canada. Eng. Pat. 137, Jan. 3, 1905.

The end of the gas-supply pipe is screwed into a concentric mixing pipe, which leads to the burners and is provided with a lateral branch pipe through which air is introduced from a blower or other air-forcing device. The gas supply pipe projects into the mixing pipe for a short distance beyond the point at which the air enters.—H. B.

[*Suction*] *Gas Producers.* L. W. Crosta and G. L. Morton, Nottingham. Eng. Pat. 6434, March 27, 1905.

The gas outlet pipe, between the producer and the scrubber, is provided with corrugations, ribs, or the like, to present an extended heating surface, and is surrounded by the air inlet pipe, so that the air becomes heated in flowing through the annular space between the two pipes. The air then enters an annular mixing chamber for air and steam, which surrounds the upper part of the producer, and is there mixed with steam which is generated continuously in an annular boiler surrounding the incandescent zone of the fuel. The annular steam-pipe, which admits the steam to the mixing chamber, also communicates with a bell, immersed in water, outside the producer, this device serving to condense the steam when the gas production ceases, thus preventing the accumulation of steam in the mixing chamber. The tuyères, through which the air and steam from the mixing chamber are admitted into the lower part of the furnace, are fitted with wire gauze, small tubes, or other devices, which deliver the mixture to the furnace in fine streams.—H. B.

Gas; Apparatus for the manufacture of ——. H. P. Bell. London. Eng. Pat. 6794, March 31, 1905.

The apparatus consists of three vessels provided with jackets, the vessels and the jackets being connected by pipes, controlled by valves, so that each vessel in turn becomes the first, second, and third of the series. The apparatus is worked in a cycle of three stages, the gases, or part of them from the first vessel at each stage being discharged into the air after passing through the jackets surrounding the other two vessels, and the gases generated in the second vessel at each stage passing through the third vessel before leaving the apparatus. The apparatus is for the production of water-gas or producer gas from suitable fuel, air being admitted to the first vessel and steam to the second vessel, with or without air or part of the gases from the first vessel, and fuel being introduced into the second vessel at each stage.—W. C. H.

Generator- or Water-Gas; Production of Carburetted ——. J. A. Hutmacher, Berlin. Eng. Pat. 19,995, Oct. 3, 1905.

The generator, which is fitted with feed-hopper, gas outlet

must have, at a state of incandescence corresponding to 1·5 watts per candle, an electric resistance nine or more times greater than at ordinary temperature (20°C.). To obtain filaments answering these requirements, tungstic acid is heated in a hydrogen atmosphere at incipient red heat until its weight is constant, and is then made into a paste with a viscous solution of gum and caramel. The paste is formed into threads, and these are moderately heated first without access of air, then in an atmosphere of hydrogen, together with sufficient oxygen to eliminate the carbon. For the process of hardening, the temperature must be raised very high. To avoid deformation of the filaments, this must be done in an atmosphere of non-conducting gases or *in vacuo*.—R. L.

GERMAN PATENT.

Furnace for Drying and Carbonising Briquettes, working continuously and with exclusion of Air. Sächsische Bankges. Quellmalz und Co. Ger. Pat. 163,033, June 29, 1904.

THE furnace comprises a number of chambers, open alternately above and below, through which the material (briquettes) is conveyed by means of an endless chain. The furnace casing is closed against the outer air, and only a few of the chambers or shafts in the middle of the furnace are directly heated, so that in passing through the apparatus, the material is heated very gradually until it reaches the middle, and is afterwards gradually cooled; by using a large number of chambers or shafts, the material may be sufficiently cooled when it reaches the exit, to be available directly for storage or transport.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 63.)

Carbon Bisulphide in Benzene; Determination of ——. J. Stavorinus. XXIII., page 139.

Paraffin Scale; Determination of the Oil in ——. L. Neustadtl. XXIII., page 139.

Pitch. U.S. Customs Decision, Nov. 29, 1905.

AN asphaltic bituminous compound, partly sulphonated and largely soluble in alkali, was held to be dutiable as "pitch," under the provision of paragraph 93 of the tariff, as claimed by the importer.—R. W. M.

UNITED STATES PATENTS.

Petroleum; Extracting Sulphur from the sulphur-containing constituents of ——. H. S. Blackmore, Mount Vernon, N.Y. Assignor to Black-Ford Utility Oil Co., D.C. U.S. Pat. 809,086, Jan. 2, 1906.

THE sulphur-containing petroleum oils or petroleum constituents are exposed to the action of a metal- (*e.g.*, zinc-) hydrogen carbide, and the heat evolved during the reaction is absorbed by refrigeration, so that the sulphur is removed from the oil, and "hydrogen carbide" is formed. —C. S.

Petroleum; Eliminating Sulphur from the sulphur-containing constituents of ——. H. S. Blackmore, Mount Vernon, N.Y. Assignor to Black-Ford Utility Oil Co., D.C. U.S. Pat. 809,087, Jan. 2, 1906.

THE petroleum oils, or petroleum constituents, containing sulphur are exposed to the action of a metal- (*e.g.*, nickel-) carbonyl. The process may be rendered continuous by converting the resulting metallic sulphide into oxide, deoxidising this oxide, and exposing it to the action of carbon monoxide "liberated during the precipitation of a previous increment of metal carbonyl," thus forming a fresh "increment" of metal carbonyl, which is employed for treating a fresh batch of oil.—C. S.

FRENCH PATENTS.

Benzene; Non-inflammable —— and process of making same [by Chlorination]. E. B. Barboni. Fr. Pat. 350,313, Nov. 16, 1904.

THIRTY grms. of iodine are dissolved in a mixture of 100 kilos. of benzene and 12 litres of carbon bisulphide. A current of dry chlorine is then passed into the solution, which is kept well agitated in a vessel provided with a reflux condenser. The chlorination is said to be finished when iodine chloride is formed. At that stage, 1 kilo. of sulphur is added to the cooled solution, which is thoroughly agitated, and then distilled. The distillate is agitated with half its weight of water to decompose the sulphur chloride, and then with a 0·5 per cent. solution of sodium hydroxide, and is dried over calcium chloride and filtered. The resulting solution of chlorobenzenes in benzene is stated to be non-inflammable.—T. F. B.

Wood and Sawdust, Process for Treating —— by distillation, to produce Wood Spirit, Acetic Acid, Acetone, and a substitute for Animal Charcoal. Orljavacer Chem. Fabrik, J., H., and A. Müller. Fr. Pat., 357,432, Sept. 2, 1905.

WOOD or sawdust is treated with a mineral acid, preferably sulphuric acid, and is then distilled, the vapours being passed through a red-hot iron tube. The following products are stated to be produced by treating 100 kilos. of wood (containing 35 per cent. of moisture) with 20 kilos. of sulphuric acid, and then distilling up to 160° C., and rectifying the distillate:—3 kilos. of wood alcohol, 7 kilos. of acetic acid, 2 kilos. of oil of turpentine, and 40 kilos. of a wood charcoal of high specific gravity, which may be used in place of animal charcoal.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 67.)

ENGLISH PATENTS.

Sulphonic Acids; Manufacture of —— and of [Azo] Dyestuffs therefrom. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 8908, April 27, 1905.

SEE U.S. Pats. 807,117 and 807,119 of 1905; this J., 1906, 65.—T. F. B.

Dyestuffs; Manufacture of Azo ——. O. Imray, London. From Society of Chemical Industry in Basle, Basle, Switzerland. Eng. Pat. 10,022, May 12, 1905.

SEE Addition of May 10, 1905, to Fr. Pat. 351,125 of 1905; this J., 1905, 1168.—T. F. B.

Dyes [Sulphide Dyestuffs]. Manufacture of brown sulphur ——. H. H. Lake, London. From K. Oehler, Offenbach on Maine, Germany. Eng. Pat. 13,950, July 6, 1905.

SEE U.S. Pat. 801,598 of 1905; this J., 1905, 1167.—T. F. B.

UNITED STATES PATENT.

Dyestuff; Red Azo —— and process of making same. J. Hagenbach, Assignor to Aniline Colour and Extract Works, formerly J. R. Geigy, Basel, Switzerland. U.S. Pat. 808,919, Jan. 2, 1906.

SEE Eng. Pat. 17,274 of 1904; this J., 1905, 724.—T. F. B.

FRENCH PATENTS.

p-Nitroso-p-acetaminodiphenylamine and its Sulphonic Acids; Process of producing ——, and Blue Dyestuffs derived therefrom. L. Cassella et Cie. Fr. Pat. 350,234, Nov. 22, 1904.

SEE Eng. Pat. 25,998 of 1904; this J., 1906, 1207.—T. F. B.

Dyestuff; Process of producing a yellow Sulphine [Sulphide] ——. L. Cassella et Cie. Fr. Pat. 350,352, Nov. 26, 1904.

See Eng. Pat. 26,361 of 1904; this J., 1905, 1167.—T. F. B.

Dyestuffs: Production of Brown Monoazo ——, *susceptible to chroming on the fibre.* Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 350,361, Nov. 29, 1904.

See Eng. Pat. 25,901 of 1904; this J., 1905, 919.—T. F. B.

Dyestuffs of the Anthracene Series [Indanthrene]; Production of ——. Badische Anilin und Soda Fabrik. Second Addition, dated Aug. 30, 1905, to Fr. Pat. 319,018, Feb. 24, 1902. Under Int. Conv., April 25, 1905.

See Eng. Pat. 17,242 of 1905; this J., 1905, 1298.—T. F. B.

Oxazine Series; Production of leuco-derivatives of the ——. Manuf. des Mat. Col., cess. de la Soc. L. Durand, Huguenin et Cie. First Addition, dated Sept. 4, 1905, to Fr. Pat. 280,176, July 30, 1898. Under Int. Conv., April 3, 1905.

See Eng. Pat. 7835 of 1905; this J., 1905, 885.—T. F. B.

Lakes [from Azo Dyestuffs]; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 357,858, Sept. 19, 1905. XIIIA., page 129.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 71.)

Cotton and Worsted; Comparative data on Moisture in ——. W. D. Hartshorne. Paper read before New England Cotton Manufacturers' Assoc., Sept. 21, 1905.

The paper relates to the average natural condition of worsted yarn and cotton, as determined by the percentage absorption of moisture by the dry yarn, in the neighbourhood of Lawrence, Mass., U.S.A. Results of experiments, extending over a period of a year, on a skein of worsted yarn, the absolutely dry weight of which was known, are given. Variations of from 7 to 35 per cent. on the dry weight were observed, and even 19 per cent. during 24 hours, the weight being generally greater in the morning than in the afternoon. The average for the year was 17·45 per cent. of moisture absorbed. Experiments, to trace the relationship between atmospheric humidity and temperature and the absorbing capacity of fibres, have been made, and, for the determination of the former in factories, the author recommends a new form of wet and dry bulb apparatus called the sling hygrometer or psychrometer. The operator slings or whirls the apparatus as he walks through a room, and rapid observations of differences in conditions may be obtained. For a given humidity and temperature, a higher result is obtained with a falling percentage of moisture in the yarn and the opposite effect with a rising, but by experiments made with two similar skeins, exposed previously to a damp and to a dry atmosphere, it has been shown that after 20 minutes the mean between the two weights gives the true relationship. A new method of charting the results is shown, using the percentages of absorption and the grains of aqueous vapour per cubic foot as co-ordinates. From the results the isothermal curves, 5° F. of temperature apart, from 35° to 100° F., and the curves of relative humidity from 15 per cent. to saturation for worsted and cotton, have been plotted. Similarly, by using temperature and grains of aqueous vapour per cubic foot as co-ordinates, curves have been plotted, showing that, at ordinary mill temperatures, the 7½ per cent. cotton curve agrees closely with the 15 per cent. absorption worsted curve, and these cross a 60 per cent. humidity curve at 77° F., a room condition which has been stated to be compatible with good work and comfort in cotton spinning. In an appendix, tables and an analysis of the year's observations are given, together with some mathematical deductions establishing the general physical law of absorption of moisture by textile fibres, especially worsted.—B. N.

Textile Fibres; Behaviour of Animal and Vegetable —— towards solutions of Metallic Salts. W. Schellens. Arch. Pharm., 1905, **243**, 617—631.

When animal or vegetable textile fibres are macerated in aqueous solutions of metallic salts, at the normal temperature, a portion of the base is fixed in such a manner that it cannot be removed except by chemical reagents. In order to determine the fixing power of various fibres, 1 grm. of each was macerated in 50 c.c. of solutions of various salts, in a closed vessel, for several days. The fibre was then washed and boiled with water until no reaction for either the acid or the base was obtained with the washings.

Fixing of Iron.—With an aqueous solution of ferric chloride containing 1 per cent. of iron, filter-paper fixed 0·229 per cent. of iron; pure cotton-wool, 0·112 per cent.; kapok fibre, 1·008 per cent.; Indian jute, 0·56 and 0·44 per cent.; raw silk and Japanese silk, 0·672 per cent.; wool, previously freed from fat with light petroleum spirit, 0·84 per cent. Similar experiments with 0·1 per cent. solutions gave corresponding, but lower, results. With alcoholic solution of ferric chloride, cotton-wool fixed 0·22 per cent. of iron both from 1·0 and 0·1 per cent. solutions; paper, 0·56 per cent.; kapok, 1·56 per cent.; jute, 0·78 per cent.; silk, 1·23 per cent.; wool, 2·27 per cent., and practically half as much from 0·1 per cent. solutions. With an aqueous solution of ferric acetate containing 1 per cent. of iron, cotton-wool fixed 0·39 per cent. of iron; paper, 0·41 per cent.; kapok, 0·78; jute, 0·78 per cent.; silk, 1·26 per cent.; wool, 0·448 per cent. Pure cellulose was found to behave similarly to cotton-wool.

Fixing and Absorption of Mercury.—With solutions of mercuric chloride containing 1 per cent. of mercury, both cotton-wool and filter-paper were found to fix 0·2 per cent. of the metal. From the determination of the amount of mercury fixed in fibres and that left in the maceration liquid, it would appear that a double action, one of fixing, the other of mere absorption, takes place. Thus jute absorbs 4·77 and fixes 1·09 per cent. of mercury; silk absorbs 6·04 and fixes 1·90 per cent.; wool absorbs 18·25 and fixes 5·89 per cent. With mercuric cyanide solution, containing 1 per cent. of mercury, cotton-wool and paper absorb 1·25 per cent.; kapok, 3·14 per cent.; jute, 3 per cent.; silk, 3·5 per cent.; and wool, 5·05 per cent. of mercury. With mercuric acetate solution, containing 1 per cent. of mercury, cotton-wool absorbs 9 per cent. and fixes 1·5 per cent. of mercury; paper absorbs 7 per cent. and fixes 1·5 per cent.; kapok absorbs 14·5 per cent. and fixes 6·5 per cent.; jute absorbs 12 per cent. and fixes 5·2 per cent.; silk absorbs 17·5 per cent. and fixes 9·8 per cent.; wool absorbs 20·5 per cent. and fixes 12·3 per cent.

Fixing and Absorption of Lead Salts.—Similar results are recorded with lead nitrate solution.

Fixing of Chromic Acid.—From potassium bichromate solution, containing 1 per cent. of chromium trioxide, kapok fixed 0·43 per cent.; jute, 0·53 per cent.; silk, 0·20 per cent.; and wool, 0·69 per cent. of the trioxide.

Absorption of Iodine.—The amount of iodine fixed on the fibres could not be accurately determined. The quantity absorbed was, for kopak, 1·52 per cent.; jute, 2·16 per cent.; silk, 4·19 per cent.; wool, 7·62 per cent.

Behaviour towards Dilute Potassium Nitrate Solutions.—All fibres experimented with were found to have a marked reducing action on potassium nitrate solutions containing 0·001, 0·01 and 0·1 per cent. of NO_3 respectively. Filter-paper had the weakest action, followed by kapok and jute; the animal fibres, silk and wool, were much more active.—J. O. B.

Dyeing; Contributions to the theory of ——. *Colour Lakes.* W. Biltz and K. Utescher, Ber., 1905, **38**, 4143—4149.

It has hitherto been uncertain whether the lakes of organic dyestuffs and metallic oxides are chemical compounds in the ordinary sense, or solid solutions, or "adsorption compounds," and in no case has such a lake hitherto been shown to possess a composition to which an ordinary

stochiometric formula could be given. The authors have investigated the question by agitation of metallic oxides (hydroxides) with solutions of mordant dyestuffs, both in the cold and at the boiling point of the solvent, and noting the effect of varying concentration of the dyestuff solution when the amount of metallic oxide was kept constant. The amount of dyestuff left in solution was determined colorimetrically, after removal of all suspended matter by filtration, and curves were then constructed showing the concentrations of dyestuff in the lake as ordinates, and concentrations of dyestuff in the final solution as abscisse. In the case of the reaction of iron oxide on a solution of Alizarin in 1 per cent. sodium hydroxide solution in the cold, the results obtained showed that a chemical compound of the formula $Fe_2O_3.3C_{14}H_8O_4$ is formed. On the other hand the action of boiling aqueous solutions of Alizarin Red S W, on chromium hydroxide led to the production of adsorption compounds. This is borne out by the fact that the results obtained in this latter case agree fairly well with the formula :—

$$\frac{C^n_{(\text{oxide})}}{C_{(\text{Dyebath})}} = K,$$ n being in, this case, 3, and K 2·1.

Further experiments in which the action of ammoniacal and alcoholic solutions of Alizarin and aqueous solutions of Alizarin Blue on iron oxide, and of alcoholic solutions of Gallein on alumina were investigated, did not lead to definite results. The curves obtained end in an almost horizontal portion, but the distance of this from the base line does not agree with any simple stochiometric formula. Moreover, by comparing these results with those obtained with iron oxide and alcoholic solutions of Alizarin Yellow G G W, Cloth Red G A and Cloth Red 3 G A, the amounts of dyestuff taken up by the same weight of iron oxide were not found to stand in any stochiometric relation. It was also found that, in all cases investigated, the exact physical condition of the iron hydroxide used influenced the results very greatly. (See also this J., 1905, 920).—E. F.

Dyestuff "Fukugi"; The colouring principle of the Japanese ——, and its application to Silk. E. Ito. J. Coll. Engin., Univ. of Tokio, 1905, 2, 267—279.

Fukugi bark contains a phenolic dyestuff, *fukugetin*, which has been investigated by A. G. Perkin (J. Chem. Soc., 1904, 58; this J., 1904, 56), and to which the author assigns the formula $C_{20}H_{16}O_7$. It crystallises in small light-yellow prisms, having no definite melting point, but decomposing at 274°—275° C., and forms a diacetyl compound melting at 251°—252° C. The bark also contains resins possessing no tinctorial properties. The ordinary method of extracting the dyestuff is to boil 100 kilos. of the bark, in the form of chips, with 180 litres of water, strain, evaporate in a large iron pan till viscid and allow to cool in rectangular moulds. The product is so obtained in hard masses of a yellowish-brown colour; 15 kilos. are said to be obtained from 100 kilos. of bark. The author finds that the dyestuff may be isolated by extracting the bark with lime water or dilute alkali and precipitating with acid; or by extracting with boiling water, precipitating with lead acetate and decomposing with sulphuric acid. The crude dyestuff, obtained by any of these methods may be purified by dissolving in absolute alcohol and precipitating with water. Fukugi may be employed for dyeing either in the form of chips, or as extract, or in two forms devised by the author, "fukugiflavin" and "paste." Fukugiflavin is prepared as follows :—Chips of fukugi bark are thoroughly lixiviated with cold or warm lime water or very dilute alkali solution, strained through calico, boiled with a little hydrochloric or sulphuric acid, and allowed to stand for some days. A yellow precipitate settles. This is repeatedly washed with water by decantation, dried on porous tiles at the ordinary temperature and powdered. The average yield of powder was 6·7 per cent. of the original chips. The "fukugiflavin" thus prepared, has a dyeing power many times superior to that of the ordinary extract. It is converted into paste by wrapping it in a fine cloth, and rubbing in hot water until only coarse particles remain in the cloth, or it may be treated with hot water and strained through calico or a fine sieve. Fukugi dyes silk with alumina mordant in bright yellow shades; with chrome mordant, olive-yellow shades, with tin mordant, greenish-yellow shades, and with iron mordant, olive-brown shades are obtained. All these dyeings, especially those with chrome mordant, are very fast to soap, sodium carbonate, acetic acid and sunlight, being faster than Mordant Yellow G. More brilliant dyeings are obtained by single-bath methods than by the ordinary methods of first mordanting and then dyeing. Thus a brilliant yellow shade is obtained on silk as follows :—The goods are entered into the dye-bath containing 5 per cent. (on the weight of the goods) of alum, 5 per cent. of acetic acid, 3 to 7 per cent. of fukugiflavin and "a certain quantity" of water, and then heated slowly for an hour to a temperature of 90°—95° C., which is maintained for half an hour. They are then soaped in a 0·5 per cent. soap solution for 15 minutes at 90°—95° C., and finally rinsed.—E. F.

Sulphur Dyestuffs; Printing with ——. G. Kögler. Färber-Zeit., 1906, 17, 6—7.

The Auronal printing colours are mixed with sodium carbonate and a suitable thickening agent and printed; on steaming, sodium sulphide is formed which acts as a reducing agent, *e.g.*, 10—15 parts of Auronal printing paste are mixed with 8—12 parts of calcined sodium carbonate, 15—20 parts of water added, and 20—30 parts of "light-burnt" starch stirred in; the whole is then made up to 100 parts with cold water. The printing paste is passed through a sieve, printed, and the material dried and steamed for from 10 minutes to one hour without pressure, steam as free as possible from air being employed to prevent the formation of oxides of sulphur. After steaming, the material is washed and soaped if necessary.

Caustic soda can be used in place of sodium carbonate, but the printing colours are not so stable, whilst the sodium sulphide which is produced, especially above 20° C., attacks the printing rollers.—A. B. S.

Photographs on Silk; Production of ——. F. J. Farrell. XXI., page 135.

English Patents.

Fibres or Threads from Cellulose solutions; Manufacture of ——. H. K. Tompkins and W. A. E. Cromble, both of London. Eng. Pat. 28,712, Dec. 29, 1904.

The cellulose is first treated with dilute mineral acids to convert it into hydrocellulose, and then dissolved in a solution of zinc chloride of sp. gr. 1·88. The cellulose solution is squirted through a fine hole into methylated spirit, the tube carrying the fine jet being supported in an adjustable tube, air-tight at its upper end, so that a constant length of fall into the precipitating liquid may be maintained irrespective of the varying level of the latter.—B. N.

Solvents of Nitrocellulose in the manufacture of Artificial Silk; Process and Apparatus for regaining the ——. J. Douge, Besançon, France. Eng. Pat. 15,372, July 26, 1905. Under Int. Conv., April 21, 1905.

See Fr. Pat. 356,835 of 1905; this J., 1906, 71.—T. F. B.

Silk; Method of Winding —— to facilitate Scouring, Degumming, Dyeing, Bleaching, and like treatment thereof. L. Détré, Paris. Eng. Pat. 17,389, Aug. 22, 1905. Under Int. Conv., Dec. 1, 1904.

See Fr. Pat. 348,368 of 1904; this J., 1905, 495.—T. F. B.

Dyeing Machines. D. F. Waters, Germantown, U.S.A. Eng. Pat. 360, Jan. 7, 1905.

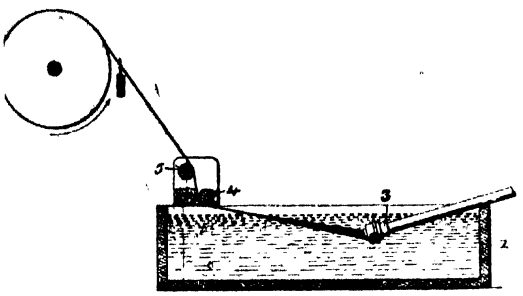
See U.S. Pat. 785,283 of 1905; this J., 1905, 438.—T. F. B.

Discharging Agents; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9982, May 8, 1905.

See Addition of June 24, 1905, to Fr. Pat. 350,407 of 1905; this J., 1905, 1209.—T. F. B.

United States Patents.

Viscose, &c.; Process and Apparatus for forming Filaments from ——. C. A. Ernst, Lansdowne, Pa., Assignor to S. W. Pettit, Philadelphia. U.S. Pats. 808,148 and 808,149, Dec. 26, 1905.



The solution of viscose is forced into the pipe 3 provided with a perforated cap, which dips into a bath 1 containing a "fixing" liquid. The threads then pass over the smooth rollers 4 and 5, whereby they are subjected to a certain tension, and thence are wound directly on to the spool. The friction rollers are so adjusted that the tension of the portion of the thread between the spool and the tension rollers is greater than that of the portion between the two tension rollers, which is itself greater than that of the threads in the fixing bath.—T. F. B.

Printing Fabrics: Process of ——. P. Jeanmaire and H. Schmid, Mülhausen, Germany, Assignor to Arnold Print Works, North Adams, Mass. U.S. Pat. 808,987, Jan. 2, 1906.

See Fr. Pat. 329,747 of 1903; this J., 1903, 1044.—T. F. B.

French Patents.

Silk; Process for the manufacture of Artificial ——. R. Linkmeyer. Fr. Pat. 357,837, Sept. 18, 1905.

Threads obtained in the usual way by coagulating jets of a cuprammonium solution of cellulose in neutral or alkaline solutions, are subjected to tension during the subsequent treatment with acids or other agents for the removal of the precipitated copper. It is stated that threads having an excellent lustre and a very silky appearance are obtained in this way.—A. S.

Dyeing Brown by Oxidation, with white or coloured effects; Process of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 357,472, Sept. 4, 1905. Under Int. Conv., Dec. 20, 1904.

In the oxidation of *p*-phenylenediamine hydrochloride to produce brown dyeings the fibre is always attacked. To remedy this, it is proposed to neutralise the whole or the greater part of the acid by adding sodium formate or acetate, or to use the free base, the oxidation being effected by a chlorate and a trace of a vanadium salt (1 to 10 mgrms. of ammonium vanadate per litre of the bath): the fabrics are steamed after immersion in the bath. These dyeings may be easily discharged by means of hydrosulphite compounds, pure whites being obtainable, it is stated. Coloured discharges on brown grounds may also be produced by printing with tannin lakes of basic dyestuffs in conjunction with the reducing agent. A bath may be made up of 30 to 40 grms. of *p*-phenylenediamine hydrochloride, 20 to 30 grms. of sodium acetate, and 1 to 10 mgrms. of ammonium vanadate per litre of water. Homologues of *p*-phylenediamine give similar results by the above process.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 72.)

Chamber Process [Sulphuric Acid]; Position of the Fan in the ——. H. H. Niedenführ. Z. angew. Chem., 1906, 19, 61—65. (See also this J., 1905, 922, 1170, 1301.)

A reply to Rabe and Schliebs.—J. T. D.

Alkali and Alkaline-earth Carbonates,; Decomposition of mixtures of —— *under the influence of Heat and Vacuum.* P. Lebeau. Ann. Chim. Phys., 1905, 6, [8], 433—441. Chem. Centr., 1906, 1, 217.

By heating mixtures of lithium carbonate with barium carbonate and strontium carbonate respectively, the author found that stable compounds of the alkali and alkaline-earth oxides do not exist at 1200° C. The residual alkaline-earth oxide did not contain a trace of lithia.—A. S.

Ferric Sulphate; Formation of a new —— *from Acid solutions.* V. Komar. Chem.-Zeit., 1906, 30, 15—16.

By concentrating a solution of ferric sulphate $Fe_2(SO_4)_3$ in dilute sulphuric acid containing 400 c.c. of sulphuric acid per litre, to 45°—50° B., a white crystalline precipitate is formed of the composition $Fe^{III}H(SO_4)_2 \cdot 4H_2O$. When treated with water, the salt dissolves completely after some time, forming a green solution, of slightly acid reaction, which does not act upon potassium permanganate. It is unstable at 100° C., turning brownish and giving off sulphuric acid. At a moderate heat sulphuric anhydride vapours are liberated, ferric oxide being left behind. Solutions oxidised with nitric acid or prepared by anodic electrolytic oxidation of ferrous sulphate yield the same salts.—R. L.

Calcium; Phosphates of ——. F. K. Cameron, A. Seidell, and J. M. Bell. J. Amer. Chem. Soc., 1905, 27, 1503—1512, 1512—1514.

The authors have studied the equilibrium of systems containing calcium oxide, phosphorus pentoxide, and water at 25° C. For concentrations of phosphorus pentoxide between 20 grms. and 317 grms. per litre, the only stable solid phase is calcium hydrogen phosphate, but for higher concentrations up to 550 grms. per litre the stable solid phase is the monocalcium salt $CaH_4(PO_4)_2$. In the presence of the dicalcium salt, the concentrations of dissolved phosphorus pentoxide and calcium oxide increase together, from 20:7 to 300:75, but in presence of the monocalcium salt, increase of concentration of dissolved phosphorus pentoxide involves decrease of concentration of dissolved calcium oxide, from 320:77 to 550:35. The curves representing these concentrations meet in a point at which both solids can coexist; and the monocalcium salt can exist in an unstable condition with concentrations of phosphorus pentoxide lower than 317 and of calcium oxide higher than 77 grms. per litre. Agitation of such systems causes rearrangement of the concentrations, with formation of solid dicalcium phosphate. It would appear from these experiments, that the monocalcium salt can never be present in the soil, as the requisite concentration can never be attained. For very low concentrations of phosphoric acid, there seems to be a point, or a narrow range, where the stable solid is tricalcium phosphate, whilst on the higher and lower sides of this, the solid is a solid solution, containing as one of its constituents dicalcium phosphate and lime respectively.—J. T. D.

Potassium Permanganate; Solubility of —— *in Water.* G. L. Voerman. Chem. Weekblad, 1905, 2, 766—767. Chem. Centr., 1906, 1, 124—125.

The author's results were obtained by titrating the saturated solutions of potassium permanganate in water at different temperatures, with oxalic acid:—

Temperature.	Potassium Permanganate in the solution.	Solid Phase.
° C.	Per cent.	
— 0·18	0·58	Ice
— 0·27	0·99	
— 0·48	1·98	
— 0·58	2·91	Ice and $KMnO_4$
+ 10	4·01	$KMnO_4$
+ 15	4·95	
+ 25	7·00	
+ 40	10·40	
+ 50	14·35	

—A. S.

Antimony Sulphate and its Double Salts with Alkali Sulphates. S. Metzl. Z. anorg. Chem., 1905, **48**, 140—155.

NORMAL antimony sulphate was prepared by dissolving antimony oxide in hot concentrated sulphuric acid, cooling the solution, draining the separated crystals on a porous tile and washing with xylene to remove the last traces of free sulphuric acid. It is not possible to remove the last traces of acid by draining; the crystals previous to the washing with xylene invariably contained a small quantity of free sulphuric acid (about 0·65 per cent. of SO_3). The pure normal sulphate crystallises in silky needles. It is decomposed by water and by alcohol, with formation of basic salts, antimonyl sulphate $(SbO)_2SO_4$ being produced by the action of cold water, and the basic sulphate $Sb(SbO)(SO_4)_2$ by the action of alcohol. By the action of hot water, a more profound decomposition is caused, but it was not found possible to obtain pure antimony oxide except by treatment with alkali, *e.g.*, sodium carbonate. With alkali sulphates, antimony sulphate forms double salts, of the type $M_2SO_4.Sb_2(SO_4)_3$, which crystallise in silky needles, and behave in a manner similar to antimony sulphate on treatment with water or alcohol. These double salts are easily soluble in excess of sulphuric acid, and readily crystallise. Their behaviour towards water is of technical importance, since the antimony can be directly extracted from antimony sulphide ores by heating with sulphuric acid in presence of potassium or sodium sulphate. On cooling the resulting solution, crystals of the double sulphate separate, and these can be converted into pure antimony oxide by heating with water and then digesting with sodium carbonate solution.—A. S.

Sulphur in Zinciferous Residues; Determination of ——. G. Lunge and R. Stierlin. XXIII., page 138.

Caustic Pots; Manufacture of ——. V. Portisch. X., page 123.

Sulphides; Conditions of precipitation and solution of Metallic ——. G. Bruni and M. Padoa. XXIII., page 138.

Sodium and Potassium Cyanide; Determination of soluble Sulphides in Commercial ——. G. W. Williams. XXIII., page 137.

Lead [*in Lead Acetate*]; *Volumetric determination of* —— *as Iodate.* L. Moser. XXIII., page 137.

Ammonium Sulphate Statistics. Bradbury and Hirsch, Jan., 1906.

THE production of ammonia, calculated into sulphate (including that used for the manufacture of ammonia-soda and for other chemical purposes) from all sources in the United Kingdom during 1905, is estimated at 257,500 tons, made up as shown in the following table, in which the figures for 1903 and 1904 are added for comparison:—

	1903.	1904.	1905.
Gas works	150,000	150,000	151,500
Iron works	19,000	19,500	20,500
Shale works	37,500	42,500	43,000
Coke and carbonising and producer gas works	27,500	33,500	42,500
	234,000	245,500	257,500

Of this total, it is estimated that England contributed 171,400 tons; Scotland, 83,500 tons; and Ireland, 2,600 tons. [T.R.]

Copper Acetate. U.S. Customs Decision, Dec. 19, 1905.

MERCHANDISE invoiced as "cuprum aceticum crystals" is dutiable at 25 per cent. *ad valorem*, as a "chemical salt," under paragraph 3 of the tariff. The evidence showed that it is largely used by platers, and is distinctly copper acetate, and not a subacetate. It is not known to the trade as verdigris, but is known as verdigris grapes, the crystals being formed on strings suspended in an acid solution. The claim of the importer that it was free of duty as "verdigris," under paragraph 694, was therefore overruled.—R. W. M.

Pyroantimoniate of Sodium. U.S. Customs Decision, Nov. 20, 1905.

PYROANTIMONIATE of sodium is dutiable as a "chemical salt" at 25 per cent. *ad valorem*, under paragraph 3 of the tariff. The claim of the importer that it was free of duty as "antimony ore," under paragraph 476, was overruled.—R. W. M.

ENGLISH PATENTS.

Sulphur Trioxide and other Compounds Exothermic on Formation; Process of making ——. H. S. Blackmore, Mount Vernon, U.S.A. Eng. Pat. 27,907, Dec. 20, 1904.

SEE U.S. Pat. 778,099 of 1904; this J., 1905, 90.—T. F. B.

Iron Pyrites; Preparing —— *for Desulphurisation.* U. Wedge, Ardmore, U.S.A. Eng. Pat. 22,238, Oct. 31, 1905.

SEE U.S. Pat. 804,691 of 1905; this J., 1905, 1302.—T. F. B.

Alkalis; Manufacture of Caustic —— *or analogous Hydrates.* H. W. De Stucklé, Dieuze, Germany. Eng. Pat. 28,433, Dec. 27, 1904. Under Int. Conv., March 22, 1904.

SEE Fr. Pat. 353,480 of 1905; this J., 1905, 1013.—T. F. B.

Brine; Apparatus for evaporating ——. J. H. Walker, Liverpool. From G. R. Ray, Manistee, Mich., U.S.A. Eng. Pat. 29,602, Dec. 31, 1904.

A NUMBER of pipes, connected with a ring pipe, are arranged within the "tube belt" of the vacuum pan, so as to reach nearly to the down-flow tube; these pipes draw off from the centre of the "tube belt" the "dead" air or vapour, which would otherwise accumulate in the belt and lower the efficiency of the central portion of the tube zone. In multiple-effect plant the heating agent is supplied to the heating belt of the first pan, through pipes, and the steam generated in this pan is conveyed to the heating belt of the second vessel, and so on, that from the last vessel of the set being passed into a condenser.—C. S.

Brine; Apparatus for evaporating —— *and at the same time producing high-pressure Steam.* E. Kroll, Lindau, Germany. Eng. Pat. 14,327, July 11, 1905.

SEE Fr. Pat. 356,027 of 1905; this J., 1905, 1231.—T. F. B.

Potassium Sulphide; Process of making —— A. E. Swayze, Danville, U.S.A. Eng. Pat. 13,447, June 29, 1905. Under Int. Conv., July 6, 1904.

SEE U.S. Pat. 786,074 of 1905; this J., 1905, 619.—T. F. B.

Hydrogen Peroxide; Process for preparing a stable Solution of ——. W. Heinrici, Halle a/Saale, Germany. Eng. Pat. 16,151, Aug. 8. 1905.

See Fr. Pat. 356,880 of 1905; this J., 1906, 19.—T.F.B.

United States Patent.

Lead Hydrate; Method of making ——. C. D. Coleman, Boston, Mass. U.S. Pat. 808,141, Dec. 26, 1905.

The process consists in subjecting to attrition and mixing comminuted metallic lead, water, and a limited quantity of an oxidising agent, in a closed vessel, some of the product being continuously drawn off with some of the water. According to other claims the oxidising agent consists of air, or of air deficient in oxygen, and the temperature of the containing vessel is kept below 100° F. Air is introduced slowly to replace the oxygen consumed in the process, but in such quantity as to maintain the proportion of oxygen present below the proportion in which it is contained in the atmosphere.—E. S.

French Patent.

Sulphuric Acid; Furnace for the concentration of —— in Porcelain Vessels by means of Hot Combustion Gases and Hot Air, with partial utilisation of the Heat carried by the Acid vapours. H. E. Lemaitre. Fr. Pat. 357,555, Sept. 8, 1905.

The invention relates to improvements in the concentration of sulphuric acid by the system of Négrier (see Eng. Pats., 4171 and 14,022 of 1890; this J., 1891, 46, 639; also this J. 1903, 1346). The furnace is divided into two parts by the supports on which the porcelain basins rest, and the acid is concentrated by the combined effect of hot products of combustion passing below the basins, and hot air (at about 300° C.) passing over the surface of the acid in the basins. The temperature of the acid is kept uniform by maintaining a rapid flow. The hot acid vapours pass through jacketed leaden vessels, in the jackets of which the cold acid to be concentrated is made to circulate, and thus a partial recovery of heat is attained, the acid being raised to a temperature of 80°—100° C. The vapours pass from the leaden vessels to a coke tower. Towards the front end of the furnace, the porcelain vessels are not heated directly by the combustion gases, the concentration of the acid being completed by hot air alone. Means are provided for an interchange of heat between the incoming acid and the hot concentrated acid, and also, in apparatus where two rows of porcelain vessels are used, for feeding equal quantities of dilute acid to each row.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 73.)

English Patent.

Tiles, Glass, Porcelain and Ceramic Ware, or the like; Apparatus for burning or fixing the Colours upon Printed or Decorated ——. L. W. Stanley, Bromley, Kent. Eng. Pat. 28,078, Dec. 22, 1904.

The object of this invention is to burn and fix colours on glass, ceramic ware, and the like, without using a muffle or saggar, and at the same time to preserve the colours without deterioration. For this purpose a reverberatory furnace is used, heated by hydrocarbon vapours or other combustible gases, burning in air. The hearth, walls, and roof of the furnace are composed of refractory material, and a number of gas jets are arranged on each side of the hearth (which is raised slightly above the actual floor of the furnace), and between it and the walls. The walls and roof are shaped first to direct the gas flames to the centre of the roof, and then to deflect the full heat on to the article to be operated upon. Above and below the furnace two series of chambers are arranged, the former for gradually heating the articles to be burned before inserting them in the furnace, and the latter for gradually cooling them after the burning process.—W. C. H.

United States Patents.

Glass-Furnace. J. A. Frank, Wellsburg, W. Va. U.S. Pat. 808,358, Dec. 26, 1905.

The furnace described comprises a melting and refining chamber, from which glass flows through a port or passage to a working chamber. The ends of the melting and refining chamber are connected to a stack, and at the ends of both chambers means are provided for heating them. A flue is situated at a point approximately halfway along the length of the working chamber, to lead products of combustion to a point approximately midway between the outlets of the melting chamber, to insure an even distribution of heat in both chambers. This flue is arranged so as to heat the port or passage for the flow of glass from one chamber to the other.—W. C. H.

Enamelling; Process of ——. J. H. Hines, Philadelphia. U.S. Pat. 808,542, Dec. 26, 1905.

In this process, the article to be enamelled and coloured is cleaned, and placed in an alkaline bath, to prevent corrosion or oxidation of the surface, on which the alkaline matter is allowed to dry. A coat of enamel is then applied to the article, and colouring matter is applied to the enamelled surface, and burned on to the article in a furnace; and finally another coat of enamel is applied and burned on.—W. C. H.

French Patent.

Silica [Quartz Glass]; Application of Metal to articles of molten ——. J. F. Bottomley and A. Paget. Fr. Pat. 357,665, Sept. 12, 1905.

See Eng. Pat. 21,018 of 1904; this J., 1905, 1109.—T.F.B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 74.)

English Patents.

Wood to be Dyed or Impregnated; Method of producing a liquid-tight joint between a Dyeing or Impregnating Vessel, and a block of ——. C. Kron, Copenhagen, Eng. Pat., 20,791, Oct. 13, 1905. Under Int. Conv., Jan. 9, 1905.

The method described consists in casting a ring of readily solidifying material, *e.g.*, lead, round the block of wood to be treated, and subsequently forcing the block against the impregnating vessel, so that the ring forms a liquid-tight joint with it.—W. C. H.

Silicon Carbide; Process for the Manufacture of Forms from ——. A. G. Bloxam, London. From Gebrüder Siemens und Co., Charlottenburg, Germany. Eng. Pat. 21,347, Oct. 20, 1905.

The process consists in mixing carbon with more than sufficient silicon to form silicon carbide—or mixing the ready-formed carbide with silicon—moulding the mixture into the required forms, which are then heated strongly, and preferably in an indifferent atmosphere, until the mass is fritted together. The claims also include forms manufactured by the process.—W. C. H.

Cement; Manufacture of —— The Associated Portland Cement Manufacturers (1900) Ltd., and A. Brooks, London. Eng. Pat. 5763, March 18, 1905.

This is an invention for producing a hard slow-setting cement of a green colour. Good white gypsum is treated in the same way as for the manufacture of Keene's cement, and a green colour is imparted to it by the use of chrome alum, or a mixture of potassium bichromate and ammonium sulphate. The mixture of gypsum and chrome alum is baked in the usual way and ground to a fine powder. —W. C. H.

United States Patents.

Road-Making. J. C. Butterfield, London. U.S. Pat., 808,339, Dec. 26, 1905.

In this process for road-making, suitable available material is reduced, and the finer separated from the coarser material. The finer material is mixed with granulated asphalt, lime or chalk, sodium silicate, and a saccharine substance, to form a substantially plastic mass, capable of setting hard, and into this the coarser material is afterwards firmly embedded.—W. C. H.

Concrete; Method of mixing ——. P. C. Hains, Washington, D.C. U.S. Pat. 808,836, Jan. 2, 1906.

The method of mixing cement consists in wetting the inert material and agitating it in a cloud of dry cement powder, in order to cover the inert material with a cement paste.—W. C. H.

Sand-lime Bricks; Manufacture of ——. A. Gordon, Weiser, Idaho. U.S. Pat. 809,053, Jan. 2, 1906.

The process consists in moulding the sand-lime bricks by the wet process, transferring them to pallets, on which they are introduced into a receptacle, where they are subjected to a dry heat, and the receptacle being closed, the bricks undergo a preliminary hardening in the steam generated from the moisture contained in them, the hardening operation being continued by further subjecting the bricks to a moist heat. The apparatus for hardening the bricks comprises a receptacle, provided with a track on which a truck provided with pallets for supporting the bricks in a soft state, is run. The receptacle has a steam jacket, and also a pipe for supplying steam to the interior of the receptacle, and means are provided for supplying steam to the jacket or receptacle at will.—W. C. H.

Paving Stones; Process of manufacturing Artificial ——. W. Schumacher, Oberdollendorf, Germany. U.S. Pat. 809,225, Jan. 2, 1906.

The process described of manufacturing artificial paving stones, consists in first heating bauxite, with or without the addition of a flux, until it is perfectly sintered, then reducing it to small pieces of suitable fineness, mixing it with a ground binding material, such as clay, cement, asphalt and the like; this mixture is moistened with water and moulded into blocks, which are then burned. —W. C. H.

French Patent.

Siloxicon; Process of making refractory bodies from ——. C. Thorne. Fr. Pat. 357,639, Sept. 11, 1905. Under Int. Conv., Jan. 6, 1905.

See U.S. Pat. 796,459 of 1905; this J., 1905, 971.—T.F.B.

X.—METALLURGY.

(*Continued from page* 78.)

Cementation Process. A. Ledebur. Stahl u. Eisen, 1906, 26, 72—75.

Though Gay-Lussac, Margueritte, Mannesmann and Roberts-Austen maintained, as the result of experimental work, that cementation occurs through the direct action of solid carbon upon the iron, Guillet has recently upheld the view that it is due to gaseous compounds of carbon, and especially to cyanides, arising from the alkali in the ashes of the charcoal used and the nitrogen of the atmosphere. The author packed bars of Lancashire iron containing 0·144 per cent. of carbon in fresh wood charcoal, previously-used charcoal, and sugar charcoal which had been exhausted with acid, and placed them for 408 hours in the cementation furnace, at a temperature which never exceeded 950° C. The results were as follows:—

	Carbon after Cementation.	Ash of Charcoal.
	Per cent.	Per cent.
Fresh wood charcoal	1·45	2·00
Used wood charcoal	1·23	10·75
Sugar charcoal	1·38	0·75

The sugar charcoal ash contained no alkali; yet the action of the sugar charcoal was as marked as that of wood charcoal. The results thus confirm the view that solid carbon is here operative, and that, in the ordinary cementation process, gaseous compounds can play only a very small part.

The experiments indicate a cause for the weaker effect of used than of fresh wood charcoal in cementation. The high ash of the used charcoal arises partly, of course, from the combustion of part of the carbonaceous matter; but it consists partly of sand or firebrick powder from the covering of the box. These, with the alkali of the ash, form fusible glazes which partly cover the charcoal particles and prevent them to that extent from coming in contact with the iron.

Guillet's assertion that, in case-hardening iron, too high a temperature causes decarburisation, is not borne out by facts. Decarburisation will only occur when the supply of carbon is exhausted, and the carbon from the surface of the metal either burns out in the air, if that has access, or migrates towards the interior.—J. T. D.

Caustic Pots; Manufacture of ——. V. Portisch. Stahl u. Eisen, 1906, 26, 93—95.

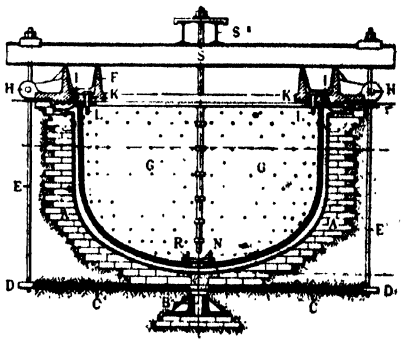


Fig. 1.

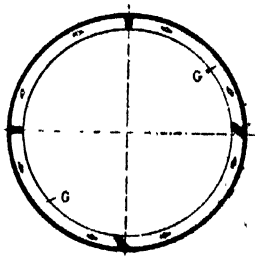


Fig. 2.

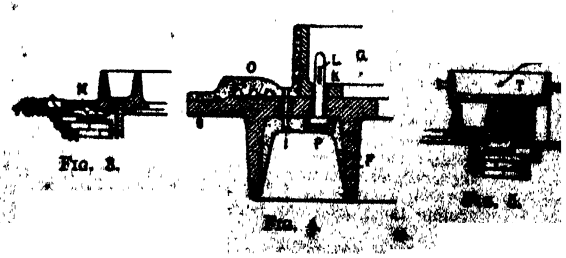


Fig. 3.

The lower form, A, Fig. 1, is built to shape in brickwork, with a foundation B for the axis of the template, and a strong, round cast-iron plate C which has four holes to take the bolts E. Around the brickwork is coke-breeze, which allows a ready exit for any gases. The form is lined with loam about 15 mm. thick to within 3 or 4 mm. of the finished thickness, and allowed to dry overnight; it is then made up with fine sifted loam exactly to shape, aided by the rotating template, dried, the hole in the bottom through which the template-axis went is made up, the channels M, Fig. 3, arranged, and the whole dried.

The upper form consists of the channel-ring F and the quadrants G which are bolted to it. The quadrants have ventilation-holes as indicated, and projections on the outer surface (see Fig. 4) to hold the loam; the junctions of the flanges are shown in the sectional plan, Fig. 2. The channel-ring has four lugs H for the bolts, 20 holes I through which the metal pours, and eight holes K for the bolts L which fasten the quadrants. The ring is made up with loam, inverted, the quadrants bolted to it and to one another, the template-axis put through the hole N, and the loam worked on to within 3—4 mm. of the template; it is then dried, made up to the template with loam, the part O, Fig. 4, of the ring covered, the holes I worked out, the hole N closed by the plate R and filled up with loam, and the whole dried.

The upper form is now set in place, bolted down by the bolts and the bearers S, the pouring-box T, Fig. 5, set in place, and all is ready. The greatest cleanliness is necessary; the metal must be perfectly free from slag or cinder, as any irregularities in the finished pot serve as nuclei for the beginning of action of the soda on it. The pots made in this way are very uniform, and the chilling action of the iron quadrants ensures a close and fine-grained texture.
—J. T. D.

Silver and Copper Chlorides; Reduction of —— by Calcium. L. Hackspill. Comptes rend., 1906, **142**, 89—91.

Silver chloride and calcium, heated together *in vacuo*, yield alloys containing up to 45 per cent. of calcium. They are grey brittle substances, rapidly oxidising when heated in air, and decomposing water in the cold. Those rich in calcium lose that metal when heated *in vacuo*, but when a certain ratio is reached, calcium and silver volatilise together. Similar alloys of copper and calcium can be obtained in an analogous manner.—J. T. D.

Cuprous Silicide. E. Vigouroux. Comptes rend., 1906, **142**, 87—89.

The author has been able to remove from silicon, by successive treatments with nitrohydrochloric acid and hydrofluoric acid, every trace of iron; and from this pure silicon and electrolytic copper has prepared a number of silicides, containing more or less free silicon. After removing the latter, the alloy always contained about 10 per cent. of silicon. He has prepared a crystalline silicide by fusing in a stream of hydrogen 90 parts of copper with 17—18 of silicon. The resulting substance, after removing free silicon and fusing in hydrogen, is silver white, with metallic lustre, hard and brittle, with a density of 7·58. Chlorine attacks it readily below a red heat, and acids have but little action on it, save a mixture of hydrofluoric and nitric acids, by which it is oxidised and dissolved. Its composition agrees closely with the formula Cu_4Si.
—J. T. D.

Pyritic Smelting. R. C. Alabaster and F. H. Wintle. Proc. Inst. Mining and Metall., Jan. 18, 1906. [Advance Proof.]

The authors describe and discuss the process of pyritic smelting (*i.e.*, the smelting of raw sulphide ores in blast-furnaces by using the excess of sulphur as a source of heat) as carried on in various works in the United States. The chief advantages of pyritic smelting over the older method of roasting a portion of the ore to expel the excess of sulphur, are economy of fuel and labour, the estimated saving on these two items being, for fuel, 2 cents per lb. of copper produced, and for labour, 40 cents per ton of ore treated. Further, in pyritic smelting, the fumes from the cupola and converter can be drawn through flues and discharged from a high central stack, so that their injurious effect on vegetation is greatly mitigated, or they may be used for the manufacture of sulphuric acid by the contact process. The chief disadvantage of the process of pyritic smelting is the diminished output for a given set of furnaces.

In applying pyritic smelting to the recovery of gold and silver from ores which are not suitable for the cyanide process, the presence of at least ½ per cent. of copper must be assured. In presence of copper, all the gold can be concentrated in an iron matte, whether it occur in the ore, in the quartz associated with the pyritic mineral, in the gangue, or in the quartz used as flux.—A. S.

Chromium in Steel: Determination of —— by means of Ammonium Persulphate. H. E. Walters. XXIII., page 138.

Sulphur in Zinciferous Residues; Determination of ——. G. Lunge and R. Stierlin. XXIII., page 138.

Mineral and Metal production of the United States of America. Eng. and Mining J., Jan. 6, 1906.

The following table, shows the estimated production of the more important minerals and metals in the United States in 1905, as compared with the preceding year. The estimates are made by authorities on substantial data, and, in many cases, are compiled from reports of all, or nearly all, the producers, who have themselves estimated their probable output during the closing days of December:

	Unit.	1904.		1905.	
		Quantity.	Value.	Quantity.	Value.
CHIEFLY NON-METALLIC—			Dollars.		Dollars.
Arsenic, white	short t.	498	29,504	875	52,481
Bauxite	long t.	48,012	166,121	47,173	200,485
Bromine	lb.	879,312	245,431	896,500	313,775
Carborundum		7,060,380	706,038	5,596,280	394,000
Cement, natural hydraulic	bbl. (*a*)	4,866,331	2,450,150	4,500 000	2,250,000
,, Portland	,, (*b*)	26,505,881	23,355,119	31,000,000	32,000,000
,, slag	,, (*b*)	303,045	226,651	300,000	210,000
Coal, anthracite	short t.	73,674,480	162,151,898	75,501,503	181,257,909
,, bituminous (*c*)	,,	277,065,582	311,667,680	297,706,453	366,178,937
Coke	,,	22,035,292	54,178,015	26,219,071	79,968,166
Copper sulphate	lb.	63,284,557	3,161,728	52,405,009	2,751,263
Copperas (*f*)	short t.	16,956	118,692	20,392	142,744
Crushed steel	lb.	790,000	55,300	812,000	56,840
Fluorspar	short t.	36,452	234,755	49,600	295,650
Garnet	lb.	2,952	89,636	3,694	114,625
Graphite, artificial		3,248,000	217,790	4,439,700	303,162
,, crystalline	long t.	4,357,927	162,332	4,360,656	170,426
Iron ore	short t.	29,462,889	51,559,868	44,054,197	79,372,135
Lead, white	,,	126,386	13,899,913	130,192	15,874,384
,, red	,,	13,988	1,672,569	14,685	1,858,645
,, orange mineral	long t.	1,125	168,681	1,161	203,182
Limestone and dolomite flux	short t.	10,657,086	4,702,768	11,436,900	5,146,155
Litharge	long t	12,487	1,248,691	13,111	1,573,320
Pyrites	,,	173,221	669,124	189,201	650,412
Sulphur	short t.	193,492	8,869,649	—	—
Zinc-lead	,,	6,761	474,670	7,200	540,000
Zinc oxide	,,	57,615	4,824,921	35,403	3,232,340
,, ore, exported	,,	35,911	905,782	26,597	735,553
Total, non-metallic	—				

	Unit.	1904.		1905.	
		Quantity.	Value.	Quantity.	Value.
METALLIC:					
Copper (*a*)	lb.	817,716,005	106,302,950	925,267,840	145,257,798
Gold (fine)	oz. troy	3,904,980	80,723,200	4,178,592	86,337,700
Iron (pig)	long t.	16,276,641	225,268,711	23,010,625	332,666,694
Lead	short t.	302,204	26,043,941	322,587	30,368,840
Mercury	flask (*d*)	35,258	1,489,716	30,256	1,173,932
Silver (fine)	oz. troy	57,786,100	33,515,938	58,938,355	37,437,648
Zinc	short t.	181,803	18,543,906	199,964	23,523,765
Total, metallic	—	—	491,888,362	—	706,765,372
Grand total	—	—	1,134,801,139	—	1,484,615,290

(*a*) Barrels of 300 lb. (*b*) Barrels of 380 lb. (*c*) Includes cannel. (*d*) Flasks of 75 lb. (*e*) Value computed on average of Lake copper at New York. (*f*) Only that marketed as copperas. (*g*) An arbitrary value, since over half the bromine reported was contained in bromides.

NOTE.—Short ton = 2,000 lb.; long ton = 2,240 lb. [T. R.]

Mercury industry of California. C. G. Yale. Eng. and Mining J., Jan. 6, 1906.

THERE has recently been over-production of mercury and a decrease in consumption, consequently prices were low and production in 1905 decreased by between 4000 and 5000 flasks.

The consumption in the mining districts of the United States has fallen off materially in late years, notwithstanding the expansion of the mining industry and the rapid increase in the number of properties being worked. The conditions of ore treatment have greatly altered; much more ore is now smelted than was formerly the case. Very few silver mines are now being worked where the pan-amalgamation process is in use. In the bonanza days of the Comstock (when the famously rich ores of the Consolidated Virginia and California were being worked by pan-amalgamation) the loss of mercury per ton of ore was about 7 lb., and naturally, immense quantities were used. In working gold ores, by the ordinary milling process of the present, the loss of mercury is small: it is used, retorted, condensed, and used over again: so that even large mills require only a few extra flasks each year. In some mines, no mercury at all is used. Many other mines ship their ores, carrying gold and other metals direct to the smelters, having no reduction works of their own.

The grade of cinnabar ore, now being worked in California, is much lower than formerly; seemingly, the high grade ore deposits have been exhausted, except where small bunches are occasionally found. Many mines are now working on ore carrying 0·5 per cent. of metal. The Texas mines have ore up to 2·5 per cent., and are doing well. [T.R.]

Antimony industry of America. Eng. and Mining J., Jan. 6, 1906.

THE principal source of antimony in the United States is the hard lead obtained by the desilverising companies. Since its principal utility lies in its combination with lead in bearing and type-metals, the antimony itself is rarely separated from antimonial lead. Whereas hard lead was formerly discounted, as being suitable only for the roughest purposes, it now commands a premium.

The output of hard, or antimonial lead in the United States during 1905 was 11,037 short tons, of which total about 3,000 tons must be assigned to foreign sources. Estimating the average contents at 23 per cent., the total output contained 2,538 short tons of antimony.

Deposits of ore in which antimony constitutes the chief value are not rare in the United States, but, as a rule, they are too remote from transportation and have never been profitable. [T.R.]

Pig-iron and Zinc production of Upper Silesia. Bd. of Trade J., Jan. 25, 1906.

THE "Neue Hamburgische Börsen-Halle" publishes the following statistics of the production of pig-iron in Upper Silesia, issued by the Association of Iron and Steel Producers of Germany (Eastern Group):—

	1904.	1905.
	Metric tons.	Metric tons.
Foundry pig	79,229	94,350
Bessemer pig	54,438	47,642
Thomas pig	241,669	258,574
Steel and spiegel iron	83,761	98,112
Puddle iron	364,910	362,334
Total	824,007	861,012

The production of zinc in Upper Silesia amounted, in 1905, to 129,916 tons, as compared with 126,493 tons in 1904. [T.R.]

Chromium and Tungsten &c. U.S. Customs Decision, Dec. 9, 1905.

METALLIC chromium and tungsten are dutiable by similitude to ferro-manganese at 4 cents per ton, under paragraph 122 of the tariff. The same decision was reached in the case of metallic manganese, molybdenite, and metallic molybdenum, the assessment of duty in all cases as "metals unwrought" under paragraph 183 being overruled, on the ground that iron was present in small quantities, and that the metals in question were not capable of being wrought.—R. W. M.

Iron Oxide. U.S. Customs Decision, Dec. 11, 1905.

THE Treasury Department has ordered an appeal to the United States Circuit from the decision of the Board of General Appraisers, holding that hematite or red oxide of iron is dutiable at 40 cents per ton as "iron ore," under paragraph 121 of the tariff. The Department adheres to the original assessment of duty at 30 per cent. *ad valorem*, as a "pigment or colour" under paragraph 58.—R. W. M.

ENGLISH PATENTS.

Steel; Manufacture of ——. V. Defays, Brussels. Eng. Pat. 28,570, Dec. 28, 1904.

AT the end of each operation the whole contents of the furnace are run out so as to separate the steel from the scoria, after which a portion of the steel is re-introduced while still liquid, either alone or after having been mixed with fresh pig iron. The arrangement facilitates the making of a constant quantity of ingots at each casting, the remainder of the charge being re-introduced so as to form part of a subsequent casting.—J. H. C.

Steel; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 16,385, Aug. 11, 1905. Under Int. Conv., Aug. 13, 1904.

SEE U.S. Pat. 786,561 of 1905; this J., 1905, 677.—T. F. B.

Separating solid Particles from each other and Apparatus therefor. A. P. S. Macquisten. Eng. Pats. 24,204 and 25,204, Nov. 19, 1904. L., page 112.

Ores or other Substances of different specific gravities; Machines for the concentration of ——. G. F. Wynne, Plasgwyn Minera, Denbigh. Eng. Pat. 1697, Jan. 28, 1905.

See Fr. Pat. 354,740 of 1905; this J., 1905, 1114.—T. F. B.

Precious Metals; Extraction of —— from their Ores. W. H. James, Bedford. Eng. Pat. 27,977, Dec. 21, 1904.

Bromine, preferably in aqueous solution, together with an oxidising agent, is employed under pressure to dissolve the gold; the excess of bromine is subsequently recovered by evaporation under reduced pressure.—J. H. C.

Ores; Treatment of Auriferous refractory or base ——. A. Rollason, Long Eaton, Derby. Eng. Pat. 2286, Feb. 6, 1905.

The ores are fused or heated with nitrogenous substances (horn cuttings, &c.) in a muffle furnace, excluding the air as much as possible, whereby the gold is reduced to metal, which remains unaffected whilst the foreign substances present are removed by subsequent manipulations.
—J. H. C.

Silvering and Polishing Composition. W. Bölsterli, Winterthur, Switzerland. Eng. Pat. 8359, April 19, 1905.

See Fr. Pat. 355,518 of 1905; this J., 1905, 1239.—T. F. B.

United States Patents.

Furnace; Roasting ——. F. E. Marcy, Chicago, Ill. U.S. Pat. 808,293, Dec. 26, 1905.

The furnace has a series of superimposed hearths, and a central hollow rabble shaft having hollow arms operating in the several hearths. A cooling medium is circulated in the shaft through an inlet pipe and a return pipe, and branches or distributing pipes are confined in the hollow arms for conveying the cooling medium from the return pipe through the arms, and back to the return pipe in the shaft. Means are provided for effecting circulation of the cooling medium through the pipes and branches, vertically in series, and "radially consecutively through a multiple." Structural members located within the hearths, and spaced from the furnace walls, support the hollow arms, and are cooled by branches from the pipes carrying the cooling medium.—E. S.

Ores; Process of roasting ——. H. Haas, San Francisco, Cal. U.S. Pat. 808,361, Dec. 26, 1905.

Ores are roasted preparatory to smelting, by sintering a mixture of them with a suitable flux, the mixture being subjected, after heating to "the point of ignition of the sulphur or other metalloids," to an evenly distributed light blast of air, continued only long enough to expel and oxidise "the more easily separable metalloid molecules," the heat meanwhile being kept below the smelting temperature. When this process is completed, the supply of air is increased, and is then diminished "as the amount of sulphur and other metalloids remaining to be oxidised decreases."—E. S.

Ores and Metalliferous Sands; Method of applying heat for the treatment of ——. W. J. Jackson, San Francisco, Cal. U.S. Pat. 808,754, Jan. 2, 1906.

The claim is for the addition to ores or metalliferous sands, of a suitable exothermic material, *e.g.*, quicklime, capable of developing heat when the aqueous solution of the extracting agent is applied thereto.—A. S.

Ores [containing Uranium and Vanadium]: Process of treating ——. J. H. Haynes and W. D. Engle, Assignors to the Dolores Refining Co., Denver, Colo. U.S. Pat. 808,839, Jan. 2, 1906.

The ore is crushed, boiled with a solution of alkali carbonate, the solution run off, and the uranium and vanadium separated—the first by precipitation as sodium uranate by sodium hydroxide, and the second as calcium vanadate by slaked lime.—A. S.

Metal; Method of annealing ——. W. R. Eaches, Reading, Pa., Assignor to J. T. Williams, Easton, Pa. U.S. Pat. 808,911, Jan. 2, 1906.

The metal is introduced into a molten mixture of an alkali carbonate (1 part) and sodium chloride (3 parts), and after removal from the bath, is slowly cooled. According to one claim, the annealing mixture consists of an alkali carbonate and two different alkali chlorides.—A. S.

Steam from Hot Slag; Apparatus for generating ——. G. Mitchell, Los Angeles, Cal. U.S. Pats. 809,123 and 809,204, Jan. 2, 1906.

See Eng. Pat. 2795 of 1905; this J., 1905, 1175.—T. F. B.

French Patents.

[Gold] Ores; Apparatus for grinding or crushing, washing and separating ——. R. Stanley. Fr. Pat. 357,771, Sept. 8, 1905. Under Int. Conv., Nov. 10, 1904.

See Eng. Pat. 24,386 of 1904; this J., 1905, 1113.—T. F. B.

Furnaces for Burning and Calcining Mineral and other Briquettes. F. J. Bergendal. Fr. Pat. 357,042, Sept. 11, 1905. Under Int. Conv., Feb. 28, 1905.

See Eng. Pat. 6388 of 1905; this J., 1905, 958.—T. F. B.

Ores and other Substances; Furnaces for roasting, resulphurising or drying ——. A. V. Leggo. Fr. Pat. 357,661, Sept. 12, 1905.

The furnace comprises a series of horizontal fixed hearths on which the ore is spread. Hollow vertical shafts extend upwards through the hearths and are provided with hollow arms, which, when the shafts are rotated, agitate the ore. Each hearth is furnished with a fire-grate to which hot air is supplied, and a further supply of air for the oxidation of the ore is provided through the hollow shafts and arms. The hot products of combustion mingled with volatile products from the ore pass into a dust chamber where condensable substances and entrained particles of ore are deposited, and thence through flues to the chimney. If desired, the furnace chamber may be closed, and the products of combustion from the fire-grates and the volatile products from the ore discharged through separate flues.—A. S.

Tantalum; Process for hardening soft metallic ——. Siemens und Halske Akt.-Ges. Fr. Pat. 357,714, Sept. 14, 1905. Under Int. Conv., Oct. 13, 1904.

Soft metallic tantalum is hardened by incorporating with it a certain small quantity of another element such as oxygen, hydrogen, carbon, silicon, boron, aluminium, titanium or tin.—A. S.

Briquettes of any Materials; Process for the Manufacture of Hard and Compact ——. L. Weiss, Fr. Pat. 357,801, Sept. 16, 1905. II., page 115.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 80.)

(*A.*)—ELECTRO-CHEMISTRY.

Carbonic Acid; Electrolytic reduction of ——. R. Ehrenfeld. Ber., 1905, 38, 4138—4143.

When ammoniacal ammonium carbonate solution (800 grms. of ammonium carbonate dissolved in 3200 c.c. of water, and 880 c.c. of ammonia of sp. gr. 0·910 added) is electrolysed, the anode being of platinum and the cathode (in an inner porous cell) of amalgamated zinc, formic acid is found in the cathode-liquid. In the electrolysis for 12 hours of 300 c.c. of the liquid, with a voltage of 6 to 9 and a current-density of 0·013 to 0·084 ampère per sq. cm., amounts of formic acid varying from 0·1381 to 0·2992 grm. were obtained. Cathodes of iron, nickel, copper, lead, or platinum gave no reduction, nor was any sensible amount of formic acid produced when the electrolyte was diluted 5- or 10-fold. Sodium carbonate, alone

or mixed with hydroxide, when substituted for ammonium carbonate was not reduced; nor was ammonium carbonate alone. Cöhn and Jahn, who obtained formic acid during the electrolysis of a solution of potassium sulphate in a cell, through the cathode-compartment of which a stream of carbon dioxide was passed, concluded that the HCO_3 ion was reduced; these experiments seem to indicate that the NH_4CO_3 ion is equally susceptible of reduction.—J. T. D.

Rotating Anode and Mercury Cathode; Use of —— in Electro-Analysis. L. G. Kollock and E. F. Smith. XXIII., page 138.

Antimony; Rapid deposition of —— by Electrolysis. J. Langness and E. F. Smith. XXIII., page 139.

Carbon; Powdered ——. U.S. Customs Decision, Nov. 3, 1905.

POWDERED carbon intended for use in making electric dry batteries is dutiable at 35 per cent., *ad valorem*, under paragraph 97 of the tariff, as an "article composed of carbon." The claims of the importer that it was dutiable at 20 per cent., *ad valorem*, under section 6, as a "manufactured article unenumerated," or at 25 per cent., *ad valorem*, as "black," under paragraph 47, or as "coal," under paragraph 415, were all overruled.—R. W. M.

ENGLISH PATENTS.

Incandescence Bodies for Electric Light; Manufacture of [Tantalum] ——. *Incandescence bodies of Tungsten, Molybdenum or similar Metals; Manufacture of [Electrical] Glow Lamps with* ——. Siemens and Halske, A.-G. Eng. Pats. 23,097 and 23,098, Nov. 10, 1905. II., page 115.

Incandescent Lamps; Manufacture of light emitting Bodies for Electric ——. H. Kuzel. Eng. Pat. 28,514, Dec. 22, 1904. II., page 115.

Electric Storage Battery Negative Pole Plates. A. J. Boult, London. From E. W. Smith, Philadelphia, U.S.A. Eng. Pat. 839, Jan. 16, 1905.

THE active mass of the negative electrode consists of a mixture of inert material (1 to 5 per cent. by weight) and very porous lead oxide, or other lead compound (99 to 95 per cent.) of considerably lower specific gravity than commercial lead oxide. This active material completely fills the cavities in the box-like grid which forms the support. The object of using such material is that its porous and open character enables it to expand within itself without increasing its total bulk, or causing a state of substantial compression.

Roasted lead carbonate, hydrated lead oxide, or their mixtures with lead oxide are quoted as suitable compounds and finely divided lampblack is a satisfactory inert material.—R. S. H.

Electrolysing Apparatus [Bleaching liquors]. E. L. Thorp, Nottingham. Eng. Pat. 25,839, Nov. 28, 1904.

THIS invention relates to apparatus for electrolysing brine solutions for the production of bleaching liquors. The intermediate electrodes divide the electrolytic cell into compartments, which in effect are separate cells. The electrolyte enters at one end at the top, and circulates downwards and upwards to the other end; or it may enter at one side of each and all the compartments, and be discharged from the opposite side. The electrodes are formed of a practically flat sheet of platinum or platino-iridium, having active sections on one side for the liberation of one gas, and alternating with active sections on the other side for the liberation of a second gas. These sections are obtained by cementing insulating strips alternately on opposite sides of the electrodes, the strips overlapping slightly and forming narrow neutral or non-active portions. Modifications are described in which the neutral portions are slightly bent, so that the insulating strips lie flush with the active surfaces, or each plate may be divided into alternate active squares. In a further modification, horizontal narrow strips of the metal project on each side, and are separated by narrow vertical insulating strips.—B. N.

Nitrogen; Method of and Apparatus for electrically oxidising atmospheric ——. H. H. Lake, London. From D. Helbig, Rome. Eng. Pat. 3346, Feb. 17, 1905.

SEE Fr. Pat. 352,090 of 1905; this J., 1905, 896.—T.F.B.

UNITED STATES PATENT.

Electrolytic Process; Method of producing Circulation in ——. H. Koller, Vienna, and P. Askenasy, Nuremberg. U.S. Pat. 809,116, Jan. 2. 1906.

SEE Eng. Pat. 23,151 of 1903; this J., 1904, 24.—T.F.B.

FRENCH PATENTS.

Electrodes of Secondary Batteries; Impts. in ——. H. M. Levyher. Fr. Pat. 350,332, Nov. 22, 1904.

THIS invention relates to the peroxidation of plates of nickel for use as electrodes. The plate of nickel, previously rendered porous, is used as anode in a concentrated solution of the double nitrate of nickel and ammonium or other alkali base. A similar plate is used as the cathode and the temperature of the bath is maintained near to its boiling point. The current-density is between 0·5 and 1 ampère per sq. dcm. of anode surface, and the difference of potential between the terminals about 2 volts. As an electrode, such a peroxidised plate possesses the following advantages; it exerts a relatively feeble resistance; the distribution of current is very regular; its durability is considerable; its specific capacity, referred to unit of mass, is very great.—B. N.

Vanadium and its Compounds; Employment of ——, *in Accumulators.* M. M. J. Bouffort. Fr. Pat. 357,601, Aug. 2, 1905.

LEAD in accumulators is replaced entirely or partly by vanadium, in the form of an alloy, mixture, or oxide. The sulphuric acid in accumulators may also be replaced by the oxy-acids of vanadium or their salts.—B. N.

Filaments for Electric Incandescence Lamps; Manufacture of ——. Deutsche Gasglühlicht Akt.-Ges. (Auer Ges.). Fr. Pat. 357,842, Sept. 18, 1905. II., page 116.

Tungsten Filaments; Electric Incandescence Lamps with ——. Deutsche Gasglühlicht Akt.-Ges. (Auer Ges.). Fr. Pat. 357,868, Sept. 19, 1905. II., page 116.

Water and Juices from Mineral, Animal and Vegetable Substances; Continuous process for extracting —— by Electro-osmosis. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,328, Nov. 21, 1904.

SEE Eng. Pat. 24,670 of 1904; this J., 1905, 1072.—T.F.B.

Water; Electrical method of purifying ——. The Electric Water Purifying and Filter Co. Fr. Pat. 357,679, Sept. 12, 1905.

SEE U.S. Pat. 761,044 of 1904; this J., 1904, 676.—W. P. S.

(*B.*)—ELECTRO-METALLURGY.

Tin; Electrolytic deposition of spongy ——. D. Tommasi. Comptes rend., 1906, 142, 86.

IN a bath composed of water, 50 parts; stannous chloride, 10 parts; hydrochloric acid, 1 part were arranged two tin anodes and a copper cathode, consisting of a disc, 30 cm. diameter, rotating on an axis above the surface of the liquid, and furnished with rakes for stripping from it and collecting the spongy tin deposited, and at the same time depolarising the surface of the disc. The liquor and washings from the tin are evaporated to the density of the original electrolyte, and returned to the bath. With a current of 40 ampères at 3 volts., 76 grms. of tin were obtained in an hour, or at the rate of "380" grms. per horse-power-hour. (The calculated quantities are "98" and "440" respectively.)—J. T. D.

ENGLISH PATENT.

Metals or Alloys free from Carbon; Electro-Metallurgical manufacture of ——. G. Gin, Paris. Eng. Pat. 8231, April 18, 1905.

THE process is divided into two operations. In the first

the reduction of the metallic oxides is effected in the presence of a suitable proportion of silica and carbon, with the production of metallic silicides. The second stage of the process consists in using these silicides to reduce a further quantity of metallic oxide, the silicon being eliminated and a metal free from carbon obtained. The latter part of the process can either be carried out on the channel furnace of the author (see Fr. Pat. 342,101 of 1904; this J., 1904, 904), the oxide being introduced on to the surface of the molten silicide; or an arc furnace may be employed with electrodes of cast silicide.—R. S. H.

UNITED STATES PATENT.

Electrodeposition of Metals; Apparatus for the agitation of solutions used in ——. W. C. Wood and B. Oaksford, London, Assignors to W. Canning and Co., Birmingham. U.S. Pat. 808,798, Jan. 2, 1906.

SEE Eng. Pat. 2001 of 1905; this J., 1905, 1116.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

(*Continued from page* 81.)

Oils and Fats; Characteristics of certain foreign ——. A. Schroeder. Arch. Pharm., 1905, **243**, 628—640.

IN determining the amount of glycerol in the different fats examined, the author used the acetin method and the recent direct method of Shukoff and Schestakoff (this J., 1905, 294), the latter yielding the higher results. The indicator, Alkali Blue 6B, recommended by de Negri and Fabris, was used in place of phenolphthalein in the determination of the saponification values of the darker coloured oils. The Reichert-Wollny method was employed in determining the amount of volatile fatty acids, and Hehner's original method for the insoluble fatty acids, whilst the acetyl value was determined by Lewkowitsch's method. In the examination of the liberated fatty acids, Farnsteiner's method (this J., 1898, 804) was used for separating the saturated from the unsaturated acids, and Heintz's method of fractional precipitation for the further separation of the saturated acids.

Oil from the Seeds of Lepidadenia Wightiana Nees – Tangkallak fat.—This tree, which is usually described as *Litsœa sebifera, Bl., Cylicodaphne sebifera, Bl.*, or *Tetranthera calophylla, Miq.* in older works, is indigenous to Java; but is now found also in the neighbouring islands. The seeds extracted by the author with petroleum spirit yielded 51 per cent. of a hard, nearly white fat, solidifying at about 27° C., and possessing no characteristic taste or smell. It gave the following values:—M. pt., 46·2° C.; spec. grav. at 41° C., 0·8734; saponification value, 268·2; iodine value, 2·28; Reichert-Meissl value, 1·47; Hehner value, 76·05; acid value, 3·35; glycerol, 13·03 per cent.; and unsaponifiable matter, 1·44 per cent. It was judged to have the following composition:—Laurin, 95·96 per cent.; olein, 2·6 per cent.; free fatty acids, 1·67 per cent.; and unsaponifiable matter (which gave the phytostero reaction), 1·44 per cent.

Oil from the Seeds of Strychnos Nux Vomica.—The author's results are very similar to those obtained by Harvey and Wilkie (this J., 1905, 718):—Saponification value, 160; iodine value, 64·2; Reichert-Meissl value, 1·76; Hehner value, 94·86; acid value, 27·4; acetyl value, 42·23; glycerol, 8·67 per cent.; and unsaponifiable matter, 16·93 per cent. The amount of oil extracted by means of ether from the seeds was 4·2 per cent. It was deep green in colour, fluorescent, and had an extremely bitter taste. Solid glycerides separated out at the ordinary temperature, but the fat did not liquefy completely until 28° C. was reached. The specific gravity at 20° C. was 0·8826. The average of all the results obtained were the following for strychnos oil, *viz.*, 16·93 per cent. of unsaponifiable matter, 8·6 per cent. of solid glycerides, 74·47 per cent. of olein (with which were calculated the volatile acids), and 13·79 per cent. of free fatty acids (calculated as oleic acid). Arachidic and palmitic acids were identified in the solid fatty acids. The unsaponifiable matter contained phytosterol, a substance resembling colophony, and 3·18 per cent. of strychnine and brucine. The oil, after removal of the alkaloids, had a saponification value of 166·2 and an iodine value of 69·4.

Oil from the Seeds of Hevea Brasiliensis—Oil from Seed of Para Rubber Tree.—The seeds examined by the author yielded 27·5 per cent. of a clear light yellow oil on extraction with petroleum spirit. The bulk of the seeds, however, on extraction with ether gave 24·3 per cent. of a deep green semi-solid oil, which became completely fluid at about 26° C., but at 21° C. yielded a deposit of solid glycerides. It gave the following values:—Specific gravity at 20° C., 0·9293; saponification value, 198·23; iodine value of oil extracted with petroleum spirit, 127·9; iodine value of oil extracted with ether, 117·49; Hehner value, 95·06; acid value, 57·4; acetyl value, 27·9; glycerol, 9·49 per cent.; and unsaponifiable matter, 0·705 per cent. Volatile fatty acids were absent. The insoluble fatty acids solidified to a butter-like mass at 15° C., and had a mean molecular equivalent of 293·3 and an iodine value of 127·29. They were found to contain stearic and palmitic acids.

Oil from the Root of Polygala Senega, L.—10 kilos. of the root extracted by Gehe and Co. yielded 4·55 per cent. of a thick deep brown oil with a bland taste and slightly rancid odour. It was readily soluble in ether, chloroform, benzene, acetone, and carbon bisulphide, with more difficulty in alcohol and xylene, and left a portion completely insoluble in petroleum spirit. It had the following values:—Sp. gr. at 18° C., 0·9616; saponification value, 193·51; iodine value, 82·05; iodine value after separation of unsaponifiable matter, 78·61; Reichert-Meissl value, 6·43; Hehner value, 85·8; acid value, 37·9; acetyl value, 44·46; glycerol, 8·3 per cent.; and unsaponifiable matter, 12·78 per cent.

The unsaponifiable matter was found to consist, in the main, of resinous substances remaining undissolved on treating the oil with petroleum spirit. The separated oil was clear and of a brownish-yellow colour. Salicylic acid separated from the distilled volatile fatty acids on standing. The insoluble fatty acids were separated by Farnsteiner's method into saturated and unsaturated acids. The latter had an iodine value of 82·4, and therefore were judged to contain no more highly unsaturated acid than oleic acid, the presence of which was confirmed by the elaidin test. The saturated fatty acids melted at 52° C., and, after repeated crystallisation at 61° C. The presence of palmitic acid was proved, and the oil was calculated to have the following composition:—Unsaponifiable constituents, 12·78; palmitin, 7·93; and olein, 79·29 per cent., the latter including the volatile fatty acids and the free fatty acids, calculated as oleic acid.—C. A. M.

Fats; Characteristics of certain Animal ——. C. Schneider and S. Blumenfeld. Chem.-Zeit., 1906, **30**, 53—54.

THE methods of determining the different constants of these fats were those ordinarily employed, Lewkowitsch's method being used for the determination of the acetyl value. The following results were obtained:—

Fats.

Fats.	Sp. gr. at 15° C.	Refractometer reading.	Acid value.	Saponification value.	Iodine value (Hübl.)	Hehner value.	Reichert-Meissl value.
Vikare seal, *Phoca fœtida*	0·9321	87 at 20° C.	0·48	188·5	191·35	95·6	1·55
" "	0·9336	—	1·08	189·0	193·3	95·8	0·96
Porpoise, *Phocœna communis*	0·9284	62·7 at 25° C.	1·2	224·8	111·2	85·5	42·1
Coot, *Fulica atra*	0·9163	62·9 at 25° C.	1·66	192·6	87·13	95·2	0·35
Crane, *Grus cinerea*	0·9222	61·5 at 20° C.	9·33	191·2	75·25	95·7	0·13
Lynx, *Lynx europæus* ...	0·9248	70 at 20° C.	0·81	190·22	110·6	95·77	0·43
Glutton, *Gulo borealis*, body fat	0·9153	54·2 at 30° C.	5·84	193·8	54·86	95·4	0·12
Ditto, kidney fat	0·9280	45·2 at 45° C.	—	193·3	50·82	95·8	—
Bear, *Ursus arctos*	0·9156	60·8 at 20° C.	30·6	191·0	80·7	94·5	0·33

Fatty Acids.

Fatty acids.	Sp. gr. at 15° C.	Refractometer reading.	Melting point.	Solidification point.	Neutralisation value.	Iodine value.	Acetyl value.
			°C.	°C.			
Vikare seal, *Phoca fœtida* ...	0·9172	74·1 at 20° C.	14·0	13—14	198·0	195·3	—
,, ,, ...	—	—	—	13—14	196·0	201·8	—
Porpoise, *Phocæna communis*	0·9121	54·3 at 25° C.	—	18·0	207·0	126·0	4·55
Coot, *Fulica atra*	0·9151	44·7 at 35° C.	33·5—34·5	30·5	—	84·8	—
Crane, *Grus cinerea*	0·9005	40·8 at 30° C.	31·0	29·3	201·0	73·5	1·35
Lynx, *Lynx europæus*	0·9412	53·9 at 35° C.	35·5	35·0	202·7	111·8	7·67
Glutton, *Gulo borealis*, body at	0·9118	31·9 at 45° C.	40—41	37·5	203·4	55·5	3·0
Ditto, kidney fat	—	31·7 at 45° C.	40—41	—	203·3	52·8	—
Bear, *Ursa arctos*	0·9347	43·0 at 40° C.	37·5	36·1	203·0	76·5	5·7

With regard to these results, the author points out that the iodine value of the fat of the lynx is the highest yet recorded for the fats of terrestial beasts of prey.
—C. A. M.

Surin Fat. J. Lewkowitsch. Analyst, 1906, **31**, 2—3.

A SAMPLE of fat from Perak, marked "Minyak surin," probably derived from seeds of a species of *Palaquium*, gave the following results after filtration:—Free fatty acids, 43·2 per cent; sp. gr. (60°/60°) 0·9021; solidification commences, 48·9° C., and is complete at 43·9° C.; m.pt., 56·1° C.; saponification value, 179·5; unsaponifiable matter, 4·54 per cent.; iodine value, 42·31 per cent.; Reichert-Wollny value, 0·55 per cent. The fatty acids, which consisted mainly of stearic and oleic acids, had a solidifying point of 59·1° C., mean mol. wt., 284·9, and contained 58·2 per cent. of stearic acid (m.pt. 67·8 C.). The fat would seem to be useful as a raw material in the candle industry on account of its high percentage of stearic acid, although the rather high amount of unsaponifiable matter might militate against this; this latter, however, is possibly due to faulty preparation. The fat differs considerably from that of *Palaquium oblongifolium*, described by De Jongh and Tromp. The retention of its native name "Surin fat" is suggested, at any rate until its true source is known.—T. F. B.

FRENCH PATENT.

Soap Solution; Apparatus for cooling ——. Krefelder Seifenfabrik, Stockhausen and Traiser. Fr. Pat. 357,637, Sept. 11, 1905.

THE apparatus consists of a cylindrical vessel with a conical bottom and surrounded by a jacket, in which the refrigerating liquid circulates. A small tube, also filled with refrigerating liquid, passes down the centre of the vessel, and around this tube is fitted a helical mixing device. An opening at the bottom of the vessel is provided for the removal of the soap.—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc

(*Continued from page* 83.)

(A.)—PIGMENTS, PAINTS.

Colour Lakes. Contribution to the theory of Dyeing. W. Biltz and K. Utescher. V., page 118.

ENGLISH PATENT.

Colouring Matters [*Caramel Borate*]; *Products or Compounds applicable as* ——. T. D. Lichtenstein. Eng. Pat. 28,547, Dec. 28, 1904. XVI., see next page.

FRENCH PATENTS.

Lakes [*from Azo Dyestuffs*]; *Production of* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 357,858, Sept. 19, 1905. Under Int. Conv., May 29, 1905.

LAKES are prepared in the usual manner from the azo dyestuffs produced by combining diazotised *m*-nitro-*p*-toluidine with β-naphthol. They are distinguished from those prepared from *p*-Nitraniline Red in that they are insoluble in oil. They are red in colour, and are stated to be very fast to light.—T. F. B.

Pigment for Printing Inks and method of making same. P. Fireman. Fr. Pat. 357,912, Sept. 21, 1905. Under Int. Conv., Jan. 19, 1905.

SEE U.S. Pat. 802,928 of 1905; this J., 1905, 1180.—T.F.B.

(C.)—INDIA-RUBBER, ETC.

Rubber; New Method of Analysis of Raw ——. R. Ditmar. XXIII., page 139.

ENGLISH PATENT.

Hides; Treatment of ——, *and Manufacture of Tyres or Tyre Covers therefrom.* R. Withey. Eng. Pat. 8514, April 20, 1905. XIV., see next page.

FRENCH PATENT.

Rubber [*Waste*]; *Process for the Regeneration of* ——. A. Ducasble. Fr. Pat. 357,765, Aug. 22, 1905.

RUBBER waste (vulcanised) is ground to an impalpable powder, and mixed with a solution of raw Para rubber. From the paste or mastic thus obtained, the solvent is allowed to evaporate off without the application of heat.
—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 83.)

Gelatin spontaneously rendered insoluble in darkness; Composition of Bichromated ——. A. L. Lumière and A. Seyewetz. Bull. Soc. Chim., 1906, **35**, 14—16.

GELATIN was immersed in a 3 per cent. solution of potassium bichromate, and then placed in a dark chamber (*a*) at the ordinary temperature and (*b*) at 120° C., until it could be submitted to treatment with water at 80° C. without melting. In the first case the gelatin became insoluble after 4½ months, when it was colourless, and contained 1·15 per cent. of chromic oxide, none of which could be extracted by ammonia; on the other hand, the gelatin kept at 120° C. became insoluble after six days, and had the same appearance as if it had been kept in the light; it contained 20·59 per cent. of chromic oxide and 2·72 per cent. of the chromic acid radical; this gelatin became disintegrated by boiling water though not dissolved, being reduced to particles so fine as to pass through a filter. The gelatin treated at the ordinary temperature did not completely resist the action of boiling water. (See this J., 1905, 1125.)—T. F. B.

"Foamine." U.S. Customs Decision.

FOAMINE, an extract obtained from the horse chestnut by boiling with caustic soda solution, was classified for duty at 25 per cent. *ad valorem* as a "chemical compound." The importers claimed it to be a "drug advanced in value or condition," and hence dutiable at ½ cent per lb. and 10 per cent. *ad valorem*. The Board of General Appraisers disposed of this claim by ruling that the horse chestnut is not a drug, and expressed the view that the foamine is dutiable as a "manufactured article unenumerated" under section 6 of the tariff.—R. W. M.

"*Sichel*" *Glue.* U.S. Customs Decision, Nov. 13, 1905.

An article invoiced as Sichel glue, consisting of water, starch, dextrin, and vegetable gum, is not dutiable as "glue" under the rates provided under paragraph 23 of the tariff. The article is used by painters for sizing walls and as a binding agent in calcining, and is dutiable at 20 per cent. *ad valorem*, under section 6 as a "manufactured article unenumerated."—R. W. M.

English Patents.

Hides; Treatment of ——, and the manufacture of Tyres or Tyre Covers therefrom. R. Withey, London. Eng. Pat. 8514, April 20, 1905.

The raw hide is soaked in water for three to seven days, then "blubbered," and afterwards placed in a pit with lime-water for a similar period. The hair is now removed and the hide steeped in a mixture of alum and egg albumin for four to ten days. The hide is then placed in a series of baths containing solutions of sulphuric acid, "red arsenic" (realgar), and sumac, of increasing concentration; about four of these baths may be used, the hide being left in each for twelve hours. It is now placed for two days in a bath containing rubber solution, benzene and naphtha, and finally strained on frames and dried. The hide may be soaked in benzene and naphtha, and the rubber solution afterwards worked into it. Hide thus prepared may be used in the form of a strip, or strips, between the outer rubber cover and the canvas lining of tyres, or it may be attached to the exterior of the cover, or to the rim of the wheel.—W. P. S.

Leather; Process of preparing [*Waterproofing, &c.*] ——. P. Magnus, Northcote, and T. J. Davis, North Fitzroy, Australia. Eng. Pat. 19,443, Sept. 26, 1905.

The leather is dried, buffed up on the flesh side, and treated with a mixture consisting of a 4 per cent. solution of sulphur chloride in carbon bisulphide, 10 parts; benzol, 10 parts; ether, 4 parts; benzine, 3 parts; "naphtha," 8 parts; turpentine, 2·5 parts; and kerosene 2·5 parts. The leather is redried at a temperature of 100° F., and then steeped for 48 hours in a mixture of Para rubber, 6 parts; "naphtha," 68 parts; benzine, 24 parts; and benzol, 2 parts. This mixture is worked into the leather, which is then dried and again steeped in the solution. The leather is now placed in a revolving drum containing rubber solution, in which the amount of "naphtha" is increased. It is left in this mixture for a further 24 hours, then semi-dried, rolled, and finally completely dried. (See also Eng. Pat. 7492 of 1903; this J., 1903, 1201.)—W. P. S.

French Patents.

Tannin; Method and Apparatus for the continuous extraction of ——. G. F. Bögel. Fr. Pat. 357,547, Sept. 7, 1905.

The apparatus consists of a series of upright cylinders, the top of each one being connected by a pipe with the bottom of the next. In each of the connecting pipes is a steam injector. Through each cylinder passes a central tube, in which an endless screw works. The tanning material to be extracted is fed in at the top of the first cylinder, and is carried up the central tube by the endless screw, and discharged into the top of the second cylinder, and so on, whilst water is caused to flow through the series of cylinders in the opposite direction. At each end of the series of cylinders is a centrifugal machine, one for drying the spent tanning material, and the other for separating solid particles from the tannin liquor.—W.B.H.

Leather; Oil for the Preservation of ——. H. Schowalter. Fr. Pat. 357,525, Sept. 6, 1905.

The composition claimed for the preservation of leather consists of fish oil mixed with a solution of three parts of caoutchouc in 100 parts of turpentine, and 1½ parts of aniline oil.—W. B. H.

XV.—MANURES, Etc.

(*Continued from page* 84.)

Calcium; Phosphates of ——. F. K. Cameron, A. Seidell and J. M. Bell. VII., page 120.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 84.)

Starches other than Potato Starch; Reversion and composition of ——. E. Roux. XVII., see below.

Starch; Polarimetric Determination of ——. E. Ewers. XXIII., page 139.

Starch and Amylocellulose; Determination of Coagulated ——. J. Wolff. XXIII., page 139.

English Patents.

Sugar Solutions; Purification of ——. A. Kollrepp, Charlottenburg, and A. Wohl, Danzig, Germany. Eng. Pat. 27,289, Dec. 14, 1904. Under Int. Conv., Dec. 17, 1903.

See Ger. Pat. 156,987 of 1903; this J., 1905, 629.—T. F. B.

[*Sugar*] *Syrups and the like; Apparatus for removing or expelling Water from ——.* E. Shaw, Bexley, Kent. Eng. Pat. 29,329, Dec. 31, 1904.

The syrup is passed down a coil or zig-zag pipe surrounded by a steam-heated chamber, and is discharged into a vessel also surrounded by a steam jacket. The latter vessel may be placed in connection with an air-pump or condenser, and the syrup is then discharged from an opening at the bottom into a suitable receiver.—W. P. S.

Colouring Matters [*Caramel Borate*]*; Products or Compounds applicable as ——.* T. D. Lichtenstein, London. Eng. Pat. 28,547, Dec. 28, 1904.

From 10 to 15 per cent. of sodium meta-borate is added to an aqueous solution of caramel (sp. gr. 1·4) heated to a temperature of 90° C. The product obtained is, in its dry condition, a hard black substance which may be ground to a powder. When dissolved in water it possesses adhesive properties and may be used as a "backing" for photographic negatives, &c.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 85.)

Starches other than Potato Starch; Reversion and composition of ——. E. Roux. Comptes rend., 1906, 142, 95—97.

The author has tested starches of various kinds in a manner similar to that described for potato starch (this J., 1905, 630). When the starch pastes prepared at 100° C. were converted by malt extract at 56° C. under the most favourable conditions, the following yields of maltose, calculated on the weight of dry starch dissolved, were obtained:—Potato, 83·0; maize, 83·3; wheat (paste prepared at 150° C.), 87·1; rice, 85·2; pea, 83·8; tapioca, 81·5 per cent. The differences in maltose yields from pastes prepared at 120° and 150° C., as compared with those prepared at 100° C., were very slight. All these starch pastes reverted, with separation of amylocellulose in the insoluble condition, when allowed to remain at the ordinary temperature. The various specimens of amylocellulose so produced were purified by repeated solution and reversion, and their solutions, prepared with water at 155° C., were converted by malt. Yields of maltose

ranging between 100 and 102 per cent. of the dissolved starch were obtained. Hence it is concluded that all starches resemble potato starch in being composed of amylocellulose and amylopectin in practically constant proportions.—J. F. B.

Invertase; Action of —— in a heterogeneous medium. V. Henri. Comptes rend., 1906, **142**, 97—100.

THE laws of the action of enzymes enclosed in plant cells upon substances diffusing into the cell from the plant juice, are very different from those which regulate the action of enzymes upon substances in homogeneous solution with them. The author has studied the action of invertase upon cane sugar when the two bodies are separated by a permeable membrane. Invertase was dissolved in a 10 per cent. solution of gelatin melting above 40° C. This solution was spread in known quantity over the bottom of a flat-bottomed flask of given area. The jelly was allowed to solidify, and a film, 1 mm. thick, of pure gelatin at a higher concentration was poured over the surface of the jelly in order to represent the cell membrane in the plant. Solutions of cane sugar were then placed in contact with the gelatin, and the rates of inversion were studied for different concentrations and at different temperatures. The results showed that the rate of inversion under these conditions was nearly proportional to the concentration of the cane sugar solution, whereas when the ferment and sugar are present in the same solution, the rate of inversion is nearly independent of the concentration of sugar. In other words, the rate of ferment action in a heterogeneous medium is proportional to the rate of diffusion through the separating membrane. Further, it was found that a change in the temperature had less influence on the rate of inversion in the heterogeneous medium than in the homogeneous solution, owing to the fact that, whereas a rise of temperature of 10° C. accelerates a chemical reaction by about 100 per cent., it only accelerates the rate of diffusion by about 25 per cent.—J. F. B.

Beer; Dantzic Jopen ——. P. Mumme. Woch. f. Brau., 1906, **23**, 13—16.

JOPEN beer is a heavy gravity top-fermentation beer prepared at Dantsic, and also at one place in England; it is characterised by a peculiar flavour and odour of port wine, and is used for making sauces and as a tonic. The quantity produced is very small, and is on the decrease. Jopen beer is brewed only in the winter months, preferably from fresh malt. The mashing process generally adopted is the triple decoction process, and about ¾ lb. of hops are used per cwt. of malt. The wort is prepared in a very concentrated state, and undergoes further concentration during the boiling to such a degree that, after cooling, it has a gravity corresponding to 50—54 per cent. of extract. The wort is cooled in the cooler-back almost to 0° C., and is then passed to the fermentation tuns, in which it is allowed to ferment spontaneously. The wort remains quiet for a considerable time, during which a thick film forms on the surface; this film varies in appearance in different batches. Fermentation sets in gradually, and as the film rises it should be skimmed off; the foam which overflows is collected and the beer is returned to the tun. After a few days, the fermentation dies down and gives place to a quiet secondary fermentation. The beer is allowed to remain in the tuns and slowly clears; this stage of the process may last for a year. In some breweries cask-fermentation is adopted, in which case the frothing over during primary fermentation rarely occurs. In the following autumn the matured beer is strained and packed in small casks of 13 litres capacity, and is exported; it is frequently stored for another year before consumption. An analysis of a typical Jopen beer showed:—Alcohol, 3·52; apparent extract, 43·20; real extract, 45·04; calculated original wort extract, 49·94; apparent attenuation, 13·49; actual attenuation, 9·81 per cent. The species of yeast concerned in the fermentation of this peculiar type of beer has not been definitely determined. Lindner has suggested *S. Budii*, but possibly a mould fungus may be the active organism.—J. F. B.

Arsenic in Wines; Occurrence of ——. H. D. Gibbs and C. C. James. J. Amer. Chem. Soc., 1905, **27**, 1484—1496.

THE authors have examined 329 samples of wine, in 38 of which they found arsenic. Bottled wines and wines from the wood equally contained it. The largest amount at first found was 1 part in 20 millions; though (as stated in a footnote) in later samples larger amounts, up to 1 part in 2½ millions, were present. Probably arsenic never occurs in wines in quantity sufficient to exert any toxic action; but the quantities which do exist are accidental, and can probably be excluded. No one source will account for what has been found; but the most probable sources are arsenical sprays used upon the vines, sulphur burnt for the purpose of sulphuring the wine, and receptacles. In the case of bottles, lead shot used in cleaning them may sometimes be the cause.—J. T. D.

Starch and Amylocellulose; Determination of coagulated ——. J. Wolff. XXIII., page 139.

Hordenine; A new Alkaloid from Malt culms. E. Léger. XX., page 133.

Beer production in Austria. Bd. of Trade J., Jan. 24, 1906.

THE production of beer in Austria from 1st September, 1904, to 31st August, 1905, was 19,008,540 hectol., as compared with 19,820,590 hectol. in the previous year. The duty paid to the Government on the same amounted to 3,042,603*l.*, as compared with 3,153,102*l.* Bohemia is the principal beer-producing district of Austria. [T.R.]

Saké; Japanese ——. U.S. Customs Decision, Nov. 22, 1905.

THE Treasury Department has ordered an appeal to the United States Circuit Court from the decision of the Board of General Appraisers of October 26th, which followed a decision of the United States Circuit Court of Appeals in making saké dutiable at 20 per cent. *ad valorem* under Section 6 of the tariff, as a "manufactured article uncnumerated."—R. W. M.

Lactic Ferment. U.S. Customs Decision, Nov. 15, 1905.

AN article known as Danish lactic ferment is not dutiable, as assessed, at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under section 6 of the tariff, but at 5 cents per lb., as "sugar of milk" under paragraph 239, sugar of milk being the component material of chief value.—R. W. M.

UNITED STATES PATENT.

Beer; Process of Pasteurising ——. C. H. Loew, Lakewood, Ohio. U.S. Pat. 808,668, Jan. 2, 1906.

THE bottles of beer are placed in a suitable chamber, and are subjected to the action of a spray of water, the temperature of which is gradually raised to the necessary point. The desired temperature is maintained for a sufficient length of time, and the water serving for the spray is then gradually cooled to the normal temperature. The water discharged from the spray is collected, after passing over the bottles, in a reservoir at the bottom of the chamber, which is provided with heating and cooling coils, this reservoir also serving to supply water to the spraying devices.—J. F. B.

FRENCH PATENT.

Filters for Wine and other liquids. Soc. A. Dupeux, L. Gibaud et Cie. Fr. Pat. 357,849, Sept. 19, 1905.

THE filter consists of a cylindrical casing covered with a lid. In this casing are placed a number of superposed baskets each of which is divided by a vertical spiral partition, which starts from the centre and ends at the periphery. The filtering material consists of a tubular cloth bag disposed in the spiral channel of each basket. The ends of this bag are tied to the supply ducts for the crude liquor, one of which enters at the centre, and the other at

the periphery. The crude liquor contained in a high-level reservoir enters the spiral bags at each end under pressure, and the filtered liquid, which percolates through the cloth walls, passes through distributing pipes situated in the cover of suitable receptacles.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 87.)

(*A.*)—FOODS.

Starch; Polarimetric Determination of ——. E. Ewers. XXIII., page 139.

ENGLISH PATENTS.

Separators for Liquids [*Milk*]; *Centrifugal* ——. Aktiebolaget Separator, Stockholm. Eng. Pat. 27,875, Dec. 20, 1904. Under Int. Conv., Dec. 21, 1903.

THE liquid (milk, &c.) to be separated is fed by a central vertical pipe into a horizontal ring or set of radial distributing arms, carried by the pipe and fitting into a recess formed by cutting notches on the inner edges of the curved dividing plates of the separator, at a point about midway between the upper and lower edges of the plates. In an alternative form, the central pipe extends to within a short distance from the bottom of the drum or bowl, and ends in a flange which extends into a recess formed by cutting notches on the inner edges of the plates at the bottom. The object in each case is to deliver the liquid to be separated into the neutral zone between the cream and skim-milk which collect at the inner and outer edges of the curved plates.—W. H. C.

Separators for Liquids [*Milk*]; *Centrifugal* ——. Aktiebolaget Separator, Stockholm. Eng. Pat. 27,876, Dec. 20, 1904. Under Int. Conv., Dec. 21, 1903.

THE claim is for a "division contrivance" to be placed within the drum of the separator, and consisting of a series of vertically arranged curved plates. The upper and lower edges of the plates are bent so as to form flanges, in order to partially close the spaces between the edges of adjacent plates, with the object of checking the escape of the liquid. The outer edges of the plates, which fit into notches or grooves on the inner wall of the drum, may also be bent into flanges to increase the separating effect, and the inner edges may be bent into hooks so that the plates engage with, and keep one another in position.—W. H. C.

Butter; Process and Apparatus for the preservation of natural ——. A. Dubusson, Brussels. Eng. Pat. 28,374, Dec. 27, 1904.

THE butter is melted in a tubular apparatus heated to a temperature of 50° C. The melted fat as it flows from this part of the apparatus is led into a water-bath, and from the latter to a separator, where it is kept at a temperature of 40° C., and the complete separation of the curd takes place. From the separator, the clear fat is led into a water-bath where it is allowed to remain for one hour, and is then poured into barrels to be stored. For "reconstituting" the butter, the melted fat is conducted directly from the water-bath to a churn, where it is emulsified with sterilised water or milk at a temperature of about 35° C. The emulsion as it leaves the churn meets jets of cold water. The solidified butter is then separated from the water, placed in a refrigerating chamber for 12 hours, and then treated in the usual way. The fat may be sterilised on leaving the separator or the water-bath. (See also U.S. Pat. 784,394 of 1905; this J., 1905, 341.) —W. P. S.

UNITED STATES PATENT.

Milk Preserve and Process of making same. L. Sarason, Berlin. Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. U.S. Pat. 809,138, Jan. 2, 1906.

MILK, which is prepared so as to contain a substantial amount of living lactic-acid germs, such as buttermilk, is evaporated to dryness at a temperature not exceeding 60° C., and the dry product is powdered.—J. F. B.

FRENCH PATENT.

Food Product from Milk, especially suited for Infants, and Process of making same. J. R. Hatmaker. Fr. Pats. 357,799, and 357,800, Sept. 16, 1905. Under Int. Conv., Sept. 21, 1904.

SEE Eng. Pats. 20,339 and 20,340 of 1904; this J., 1905, 981.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

FRENCH PATENT.

Water; Continuous Purification of ——. M. Schröder et Société Deutsche Erfinder-Genossenschaft m. b. H. Fr. Pat. 357,591, Feb. 11, 1905.

THE crude water is led into the bottom of a conical vessel containing an inner compartment filled with slaked lime. From the top of this vessel the water passes into a mixing and settling chamber, provided at its upper part with a filter through which the clear water is withdrawn. A valve float in the mixing chamber controls the flow of water between the lime and mixing vessels. Means are provided for the removal of sludge.—W. P. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 88.)

ENGLISH PATENTS.

[*Paper*] *Half-stuff from Peat; Process of and Apparatus for the Manufacture of* ——. A. Kirner, Steiermark, Austria. Eng. Pat. 8206, April 17, 1905.

SEE Fr. Pat. 353,538 of 1905; this J., 1905, 1028.—T. F. B.

Pasteboard or Carton; Manufacture of —— *and Apparatus therefor.* R. Krou, Golzern, Saxony. Eng. Pat. 16,433, Aug. 12, 1905.

SEE Fr. Pat. 356,898 of 1905; this J., 1906, 37.—T. F. B.

Fibres or Threads from Cellulose solutions; Manufacture of ——. H. K. Tompkins and W. A. E. Crombie. Eng. Pat. 28,712, Dec. 29, 1904. V., page 119.

UNITED STATES PATENT.

Viscose, &c.; Process and Apparatus for forming Filaments from ——. C. A. Ernst, Assignor to S. W. Pettit. U.S. Pats. 808,148 and 808,149, Dec. 26, 1905. V., page 120.

FRENCH PATENT.

Pulp Strainers. L. Kruse. Fr. Pat. 357,891. Sept. 20, 1905.

IN rotary cylindrical pulp strainers, consisting of a horizontal slotted drum revolving in a trough containing the crude pulp at a higher level than the strained pulp, the latter is discharged through a hollow axis at the end of the drum. The present invention relates to the packing of the joint between the revolving hollow axis and the fixed part of the trough containing the crude pulp. The latter is tapered off in the form of a funnel, through the narrow part of which the hollow revolving axis passes. A conical flap of rubber is attached to the conical funnel, and is pressed, by the pressure of liquid, against an adjustable ring fixed to the hollow axis, thus making a tight packing.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 90.)

Quinine Trade in 1905. Pharm. J., Jan. 20, 1906.

DURING 1905 the estimated contents of the cinchona bark sold at Amsterdam and the London sales amounted to 12,000,000 oz., of which only 1,100,000 oz. were sold at the London auctions. 335 tons of quinine thus passed into currency last year. The estimated contents of quinine in the bark sold at the ten sales in Amsterdam and at 112 sales in London during the last six years were as follows :—

	In Amsterdam.	In London.
	Ounces.	Ounces.
1900	8,800,000	2,000,000
1901	11,500,000	1,800,000
1902	11,300,000	1,400,000
1903	11,980,000	1,150,000
1904	13,100,000	650,000
1905	10,900,000	1,100,000

The stock of quinine in London on December 31, 1905, was 2,806,000 oz., compared with 3,336,000 oz. in 1904; 3,266,000 oz. in 1903; 3,594,000 oz. in 1902; 3,557,000 oz. in 1901; 3,356,000 oz. in 1900; 2,793,000 oz. in 1899.

The average percentage of quinine in the manufacturers' bark offered in Amsterdam has not varied much, the lowest average being 5·21 in 1898, and the highest 5·49 in 1905. The richest bark offered last year contained a percentage equivalent to 13·08 of sulphate; this was a parcel of 16 bales of Ledgeriana stem. On the other hand, the average unit paid has varied very considerably. At the January sale in 1897 the unit dropped to 2·12, while in September, 1900, it reached 12·25. Since the June auction last year the average unit has gradually fallen from 6 to 5·80 in July, 5·75 in August, 5·55 in September, 5·20 in October, 4·75 in December, and 4 in January, 1906. [T. R.]

Hordenine; A new Alkaloid from Malt culms. E. Léger. Comptes rend., 1906, **142**, 108—110.

THIS alkaloid has been extracted from malt culms by means of Stas' method, and was purified by repeated crystallisations from alcohol. Hordenine is obtained as colourless, anhydrous, orthorhombic prisms, almost tasteless, melting at 117·8° C. (corr.). When heated above its melting point it sublimes like camphor; its solutions have no action on polarised light. Hordenine is readily soluble in alcohol, chloroform and ether, less soluble in benzene, very sparingly soluble in toluene and xylene, and nearly insoluble in petroleum hydrocarbons. It is a strong base, reacting as an alkali towards litmus and phenolphthalein and capable of displacing ammonia from its salts. It reduces permanganate in acid solution in the cold, and ammoniacal silver nitrate and iodic acid on warming. Hordenine has a composition and molecular weight corresponding to the formula $C_{10}H_{15}NO$; it is a mono-acidic, tertiary base and the oxygen has a phenolic character. A series of salts and alkyl and acetyl derivatives are described. The alkaloid is soluble in solutions of caustic alkalis, and the solution of the sulphate is coloured slightly violet-blue by ferric chloride. Hordenine has been found to be slightly toxic, causing death by affecting the respiration when administered to animals in relatively large doses.—J. F. B.

Hyoscyamus Oil; New method for the Preparation of [Infused] ——. A. Rasthje. J. Pharm. v. Elsass-Lothring., 1905, 193. J. Pharm. Chim., 1906, **23**, 65—66.

FOUR comparative experiments were made :—(1) One grm. of stearic acid was dissolved in 250 grms. of (olive) oil and 25 grms. of hyoscyamus leaves were infused in the solution for 10 days at the normal temperature; the liquid was then strained, the residue pressed, and the oil filtered. It contained 0·0046 per cent of alkaloids. (2) One grm. of stearic acid was dissolved in 20 grms. of alcohol; 25 grms. of the leaves were moistened with this mixture and left, in a covered vessel, for two hours; the mixture was then heated on the water-bath with 250 grms. of (olive) oil until the alcohol had evaporated. It was then strained, pressed, and filtered. It contained 0·0052 per cent. of alkaloids. (3) Twenty-five grms. of leaves were heated on the water-bath for two hours, under a reflux condenser, with 100 grms. of alcohol and 1 grm. of stearic acid, and then treated as in No. 2. The alkaloidal content of the finished product was 0·0075 per cent. (4) This was prepared according to the official directions of the Ph. G. IV. (moistening the leaves with alcohol, macerating in the cold with oil, then evaporating off the alcohol on the water-bath.) It contained 0·0048 per cent. of alkaloids.—J. O. B.

Hyoscyamus Oil; Preparation of [Infused] ——. W. Kuntz. Apoth.-Zeit., 1905, **20**, 857. J. Pharm. Chim., 1906, **23**, 66.

THE crushed hyoscyamus leaves are macerated for 24 hours in a closed vessel with 90 per cent. alcohol containing 2 per cent. of ammonia solution (sp. gr. 0·960). The mixture is then treated with 6 parts of olive oil and heated on the water-bath for 10 or 12 hours until the alcohol and ammonia are completely driven off. After decantation and pressing, the expressed marc is again extracted in a similar manner with another 4 parts of oil. The bulked oily extracts yield a product containing 0·068 per cent. of alkaloids. (See also preceding abstract.)—J. O. B.

Medicinal Plants; South African ——. [*Umjela* (*Tabernæmontana ventricosa*); *Buphane toxicaria*; *Acocanthera venenata*; *Polygonum tomentosum*.] C. F. Juritz. Trans. S. Afric. Phil. Soc., **16** [2], 111. Pharm. J., 1906, **76**, 87.

THE author describes the properties and some of the constituents of a number of South African medicinal plants. From the bark of the "Umjela" or quinine tree (*Tabernæmontana ventricosa*, Hochst.) 0·2 per cent. of an alkaloid crystallising in needles was obtained, which was not identical with quinine or any other alkaloid of the cinchona group. From the bulb of *Buphane toxicaria*, Herb., 0·4 per cent. of an alkaloid resembling brucine in its physiological action, but differing from the latter in chemical properties, was obtained. The active principle of *Acocanthera venenata*, Don., is an uncrystallisable glucoside, which gives with concentrated sulphuric acid, a yellow colour changing successively to pink, brick-red, and violet. The dried root of *Polygonum tomentosum*, var. *glabrum* contains 2½ per cent. of an acrid resin, which gives with sulphuric acid a pinkish-yellow colour, changing successively to cherry-red, deep crimson, and dirty brown, and finally fading to a greenish tint.—A. S.

4.Amino-antipyrine; Synthetic Bases from ——. M. Luft. Ber., 1905, **38**, 4044—4049.

ONE molecule of ethylene bromide is heated with 2 molecules of aminoantipyrine and a little alcohol on the water-bath. On adding caustic alkali and cooling, diantipyrine-diethylenediamine crystallises out. If the filtrate is evaporated, diantipyrine-ethylenediamine

$$C_{11}H_{11}N_2O.NH.CH_2.CH_2.HN.C_{11}H_{11}N_2O,$$

separates as a yellow oil. From chloroform and ether it is obtained as a colourless flocculent powder, m. pt. 54° C. The picrate crystallises from alcohol in yellow needles, m. pt. 182° C. The base is not changed by alkalis. With ethylene bromide it passes into diantipyrine-diethylene-diamine :—

$$C_{11}H_{11}N_2O.N<\begin{matrix}CH_2.CH_2\\CH_2.CH_2\end{matrix}>N.C_{11}H_{11}N_2O.$$

This base is soluble with difficulty in most solvents. From alcohol it crystallises in pearly colourless tablets, m. pt. 202° C. Antipyryl-piperidine

$$C_{11}H_{11}N_2O.N<\begin{matrix}CH_2.CH_2\\CH_2.CH_2\end{matrix}>CH_2$$

is formed when aminoantipyrine and 1,5-dibromopentane are heated on the water-bath. After several crystallisa-

tions from ether, it forms colourless needles, smelling like piperidine and melting at 144° C. The picrate separates from ether in yellow prisms, m. pt. 198° C. with decomposition. Antipyryl-tetrahydro-*p*-oxazine (antipyrylmorpholine)

$$C_{11}H_{11}N_2O.N<\begin{matrix}CH_2.CH_2\\CH_2.CH_2\end{matrix}>O$$

is best prepared by placing aminoantipyrine, ethylene oxide, and a little water in a sealed tube, which is heated to 60° C. after two days. The mixture is then heated with 50 per cent. sulphuric acid under pressure for several hours at 125°—135° C. The base is taken up with ether from which it separates in rosettes of long colourless needles, m. pt. 157° C. The methiodide melts at 134° C., and is decomposed by warm water. The *bis*-antipyrylpiperazine and the antipyrylpiperidine were examined as to their antipyretic action. The toxic dose of both is about the same as that of antipyrine; the antipyrylpiperidine is active in smaller doses than antipyrine. F. S.

Benzaldehyde; [Gravimetric] Determination of small quantities of ——. H. Hérissey. XXIII., page 139.

Carbonic Acid; Electrolytic reduction of ——. R. Ehrenfeld. XI*A*., page 126.

Oil of Peru Balsam. U.S. Customs Decision, Dec. 6, 1905.

An oil prepared by distilling balsam Peru is dutiable at 25 per cent. *ad valorem* as an "essential oil" under paragraph 3 of the tariff. The claim of the importer that it was dutiable at ¼ cent per lb. and 10 per cent. *ad valorem* as a "drug advanced in value" was overruled.
—R. W. M.

Benzyl Acetate. U.S. Customs Decision, Dec. 8, 1905.

Benzyl acetate is dutiable at 25 per cent. *ad valorem* as a "chemical compound" under paragraph 3 of the tariff, as it is not mentioned by name in paragraph 554 which enumerates the coal tar products which are free of duty.
—R. W. M.

Mercuric Oxycyanide. K. Holdermann. Arch. Pharm., 1905, **243**, 600—617.

It is not possible to prepare pure mercuric oxycyanide by simply heating freshly precipitated yellow mercuric oxide with a solution of mercuric cyanide in the theoretical molecular proportions, since, under these conditions, much less than the requisite amount of the oxide is dissolved. By heating together various proportions of the two substances in different states of dilution, varying yields of mercuric oxycyanide were separated by fractional crystallisation. Only one oxycyanide exists, which has the formula $HgO.Hg(CN)_2$. The amount of oxide in an oxycyanide may be readily determined by direct titration, in the presence of sodium chloride, with N/10 hydrochloric acid and methyl orange as indicator. Commercial mercuric oxycyanide contains, without exception, but little of the basic compound. It is doubtful if the pure oxycyanide has the powerful antiseptic properties attributed to it, since the therapeutic experiments on which its reputation is founded, were made with the impure commercial salt, consisting mainly of mercuric cyanide.
—J. O. B.

English Patents.

Thiosinamine; Concentrated solutions of ——. E. Merck, Darmstadt, Germany. Eng. Pat. 22,533, Nov. 3, 1905. Under Int. Conv., Dec. 12, 1904.

If a solution of thiosinamine and sodium salicylate in water or alcohol or the like is evaporated, a white crystalline powder is produced, which is very easily soluble, even in cold water.—F. S.

Antimony Lactate; Double Salts of ——. G. B. Ellis, London. From Chem. Fabrik. von Heyden Akt.-Ges., Radebeul, Germany. Eng. Pat. 21,751, Oct. 25, 1905.

Antimony sulphate reacts with a solution of sodium lactate forming antimony lactate. On evaporation the sodium sulphate separates out first, leaving antimony-sodium lactate in solution. Other metals giving a soluble sulphate can be used in place of sodium; in the presence of sodium salts antimony sulphate reacts with calcium lactate, producing a crystalline soluble antimony-sodium-calcium-lactate.—F. S.

United States Patents.

Diaminoglycerin; Beta-substituted Ester of —— and Process of making same. F. Hofmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 808,747, Jan. 2, 1906.

See Fr. Pat. 355,367 of 1905; this J., 1905, 1189.—T. F. B.

β-Ethyltetramethyldiaminoglycerin; Benzoyl Chloride Derivative of —— [Anæsthetic]. F. Hofmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 808,748, Jan. 2, 1906.

The benzoyl derivative of β-ethyltetramethyldiaminoglycerol, obtained according to Fr. Pat. 355,367 of 1905 (this J., 1905, 1189) forms two hydrochlorides; the monohydrochloride forms white crystals, of m. pt. 169° C., soluble in water and acetone, and is of value as a local anæsthetic.—T. F. B.

Iron [Peptone] Compounds; Process of making stable Non-Alcoholic ——. K. Dieterich, Helfenberg, Germany. U.S. Pat. 809,101, Jan. 2, 1906.

See Eng. Pat. 20,273 of 1904; this J., 1905, 43.—T. F. B.

French Patents.

Protocatechuic Aldehyde from Piperonal and Piperonal Chloride; Preparation of ——. Schimmel und Co. Fr. Pat. 357,633, Sept. 9, 1905. Under Int. Conv., Oct. 17, 1904.

See Eng. Pat. 18,992 of 1905; this J., 1906, 89.—T. F. B.

Carbon Tetrachloride; Process and Apparatus for Purifying ——. E. F. Côte. Fr. Pat. 357,781, Sept. 15, 1905.

Carbon tetrachloride (freed from carbon bisulphide by a preliminary distillation) and steam are introduced at the bottom of a vertical column filled with a hot solution of sodium or potassium carbonate; this is kept at a temperature above the boiling point of the tetrachloride, so that the latter passes up the column in a state of vapour, whereby it is thoroughly washed, and the sulphur chloride decomposed by the alkali carbonate. The vapours passing out of the top of the column, stated to consist only of pure tetrachloride and steam, are passed through a condenser into a suitable receiver, where they are separated. A detailed description of suitable apparatus for the above process is given.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 90.)

Latent [Photographic] Image; Nature of the ——. J. M. Eder. Z. wiss. Phot., 1905, **3**, 329—353. Chem. Centr., 1906, **1**, 210—211.

According to the author the substance of the normal latent image on silver bromide (negative of the first order) consists of particles of silver bromide reduced to different degrees and hence containing silver subbromide. On exposing a photographic plate to the light, the first effect is the splitting off of bromine and the formation of a silver subbromide, which is closely related to normal silver bromide, but is reduced to metallic silver by reducing agents, more rapidly than the latter; this form of subbromide is decomposed by sodium thiosulphate and by nitric acid. On continued exposure, a subbromide is formed, which represents the substance of the latent imagine of an ordinary negative;

this subbromide is attacked only slightly by nitric acid, but is less soluble than silver bromide in solutions of fixing agents such as ammonia, ammonium bromide and sodium thiosulphate, and hence, after the primary fixing process, is left as a residual image capable of physical development. This subbromide, however, is not entirely unaffected by the fixing process; according to the chemical nature, concentration and temperature of the fixing solution, it is decomposed, to a more or less considerable extent, into silver bromide (dissolved by the fixing solution) and metallic silver, so that the final residue consists of subbromide mixed with more or less metallic silver. If potassium cyanide be used as fixing agent, the decomposition of the subbromide is complete, and metallic silver alone is left. If the primary, fixed latent image be acted upon by nitric acid, any metallic silver present is dissolved, and the residual image consists wholly of subbromide capable of physical development. By prolonged action of concentrated nitric acid, however, the subbromide is decomposed into silver bromide and silver (dissolved by the acid), and the image eventually will consist only of normal silver bromide, which, in absence of light, cannot be developed by physical means, but on exposure to light is again converted into subbromide and rendered capable of development.

The substance of the solarisation image produced by strong over-exposure of a bromide plate is not identical with that of the directly visible blackened silver bromide which usually accompanies it, and is also different from the substance of the latent image of a normal negative. The negatives of the second order, produced by strong over-exposure and subsequent development, are probably composed of a mixture of three chemically different substances, namely, metallic silver, the substance of the solarisation image, and the subbromides which form the negatives of the first order. These three substances can be distinguished not only by their behaviour towards photographic developers, but also by the action of sodium thiosulphate, ammonia, nitric acid, &c., on them.—A. S.

Photographs on Silk; Production of ——. F. J. Farrell. J. Soc. Dyers and Col., 1906, 22, 24—28.

By immersing silk fibres in cold, dilute nitrous acid, diazonium compounds are produced, which, like those obtainable on wool (this J., 1897, 405—7), are sensitive to light, being thereby rendered incapable of combination with aromatic hydroxy or amino compounds. The above fact may be utilised for producing photographs on silk, as follows:—The silk is washed and immersed in a solution containing 0·5 per cent. of sodium nitrite and 1 per cent. of sulphuric or hydrochloric acid for about six hours; it is now rinsed, dried under tension, exposed beneath a positive for 20—30 seconds in sunlight, and developed in a solution containing 0·5 per cent. each of a hydroxy compound and sodium or potassium hydroxide, at 25°—30° C.; after development, the silk is washed, and immersed in dilute acetic acid and dried. The shades obtained were: with β-naphthol, scarlet; α-naphthol, bluish-red; resorcinol, golden orange; these may be modified by treatment with certain metallic salts: for example, the resorcinol colour is changed by cobalt salts into red violet. The silk diazo compounds will also combine with aromatic amino compounds at about 100° C.; α-naphthylamine, for example, produces an orange; this is a true azo compound, not a diazoamino compound, since the dyestuff can be diazotised and further "developed"; a blue shade, for example, being produced by combination with aminonaphtholdisulphonic acid H (1 . 8 . 3 . 6). The silk diazo compound does not change at once, on exposure to light, to a compound incapable of combination, but is converted into a pink (probably nitroso) compound, which gives a permanent brown colour with alkali hydroxides. Photographs may be obtained, thus, by exposing diazotised silk for a very short time under a negative, and treatment with alkali hydroxide; or the silk may be given a longer exposure under a positive, and then exposed for a short time to light, whereby the "shadows" are converted into the nitroso compound, and are developed by alkali. The azo colours obtained by the above process are very fast to light, and to boiling water.—T. F. B.

Gelatin spontaneously rendered insoluble in darkness; Composition of Bichromated ——. A. L. Lumière and A. Seyewetz. XIV., page 129.

Flash-Light Powder. U.S. Customs Decision, Oct. 31, 1905.

A preparation consisting of powdered metallic magnesium and cerium nitrate in separate containers designed to produce flashes of light for photographers, was dutiable at 25 per cent., *ad valorem*, as a "chemical compound" under paragraph 3 of the tariff.—R. W. M.

English Patents.

Photographic Dry Plates, Films, or the like. W. Fraser, C. Kelly, and J. A. Bentham, London. Eng. Pat. 26,066, Nov. 30, 1904.

Photographic dry plates, films or other vehicles are prepared, containing all the necessary developing agents, so that they are developed by immersion in water only. For example, the back of the plate or film is coated with the necessary substances made into a paste with a soluble colloid: the following quantities are given:—Metol, 2 grains; quinol, 4 grains; potassium metasulphite, 0·5 to 1 grain; borax, 10 to 20 grains; and sufficient colloid and glycerin to form the paste.—T. F. B.

Colouring Matters [Caramel Borate]; Products or Compounds applicable as ——. T. D. Lichtenstein. Eng. Pat. 28,547, Dec. 28, 1904. XVI., page 130.

French Patents.

Photography in Colours; Process of ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils. Second Addition, dated Nov. 9, 1904, to Fr. Pat. 339,223, Dec. 17, 1903.

See Eng. Pat. 25,718 of 1904; this J., 1905, 152.—T. F. B.

Flashlight Powders; Preparation of —— and of slow-burning Powders from these by the addition of Colouring substances, for Photography and Cinematography. G. Krebs. Fr. Pat. 357,478, Sept. 4, 1905.

The flash-light and "time" powders are prepared as described in Eng. Pat. 27,269 of 1904 (this J., 1905, 210). Substances may be added to these which impart colour to the flames, and the resulting powders may be utilised in the preparation of ortho- or polychromatic photographs, the lighting powders being used as a source of light, dispensing with the employment of coloured screens.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 91.)

French Patents.

Explosives; Manufacture of Mine-Gas-Proof Safety ——. F. Volpert. Fr. Pat. 357,628, Sept. 9, 1905. Under Int. Conv., Sept. 10, 1904.

See Eng. Pat. 18,275 of 1905; this J., 1905, 1324.—W. P. S.

Explosives in pieces of large size and of any shape; Process for the manufacture of —— from compressed Trinitrotoluene. C. E. Bichel. Fr. Pat. 357,925, Sept. 21, 1905.

Explosives for shells, mines and torpedoes are prepared from compressed trinitrotoluene by first forming small pieces of any desired shape and afterwards uniting these small pieces by means of fused trinitrotoluene.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 93.)

APPARATUS, ETC.

Mercury Pump; Rotating ——. W. Gaede. Physik. Zeits., 1905, 6, 758—760. Chem. Centr., 1906, 1, 1.

The pump is shown in section in Figs. 1 and 2. It consists of a cast iron cylinder *g*, closed by a thick glass plate g_1,

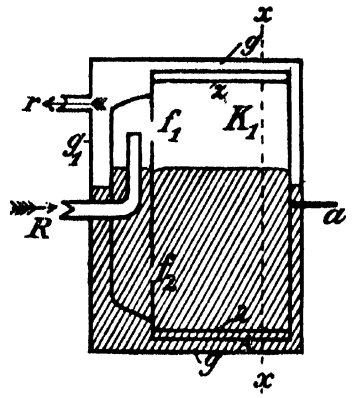


Fig. 1.

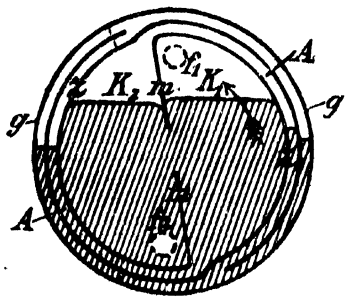


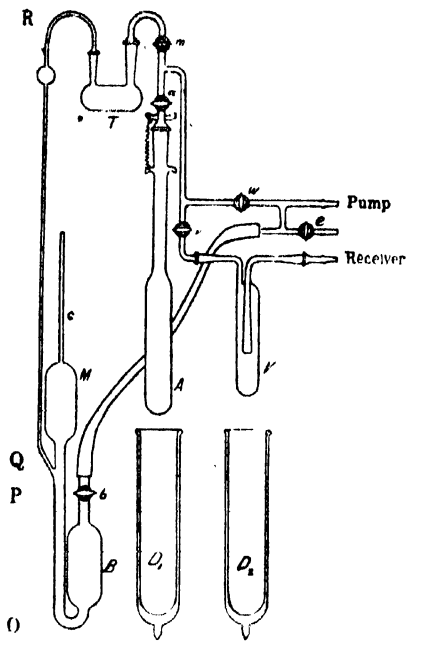
Fig. 2.

and partly filled with mercury. Inside this cylinder is a rotatable porcelain drum A, mounted on the spindle *a*, (Fig. 1) and provided with concentric and radial division-walls *z*, *m*, which divide it into several compartments, K_1 K_2. The vessel to be exhausted is connected to the pump at R, and the air is pumped out as far as possible, by means of a water-pump connected to the apparatus at *r*. The porcelain drum is then set in motion, when the mercury seals off spaces in the porcelain drum, the volumes of which continually alter. The space, K_1, the volume of which becomes larger, communicates through f_1 with R, whilst the space K_2 which becomes smaller, communicates through A (see Fig. 2) only with the water-pump, which removes the gas forced out. It is stated that with the porcelain drum rotating at a speed of 20 revolutions per minute, a space of 6¼ litres volume is exhausted in 20 minutes from 9 mm. pressure to "0·0001 c.c."—A. S.

Distillation in High Vacua; Application of Dewar's method of air-absorption to ——, *and a shortened form of McLeod gauge.* A. Wohl and M. S. Losanitsch. Ber., 1905, 38, 4149—4154.

The authors utilise animal charcoal cooled by liquid air to complete the exhaustion carried so far by a water-pump. The figure shows the apparatus they use when the vacuum-pressure has to be measured.

The apparatus to be exhausted is connected with the vessel V, and the cocks *v* and *w* being opened, is exhausted by the water-pump to, say, 20 mm. A, containing 20—30 grms. of animal charcoal, is either connected with the pump during this operation (in which case the exhaustion must not be so rapid as to disturb the animal charcoal) or is connected after closing *w* and cooling, by slowly opening *a*. After exhaustion, *w* is closed, and the liquid air contained in the Dewar vessels, D_1 D_2, is brought up around A and V. In a few minutes, the pressure is reduced to 0·01 mm; and even if the apparatus be not perfectly tight, the vacuum is kept up for a considerable time by the charcoal. The same charcoal will serve for several successive exhaustions, and, when its capacity is exhausted, it is restored by simply allowing its temperature to rise to the ordinary temperature, when the absorbed air is given off. If the vacuum need not be measured, the apparatus can obviously be greatly simplified.



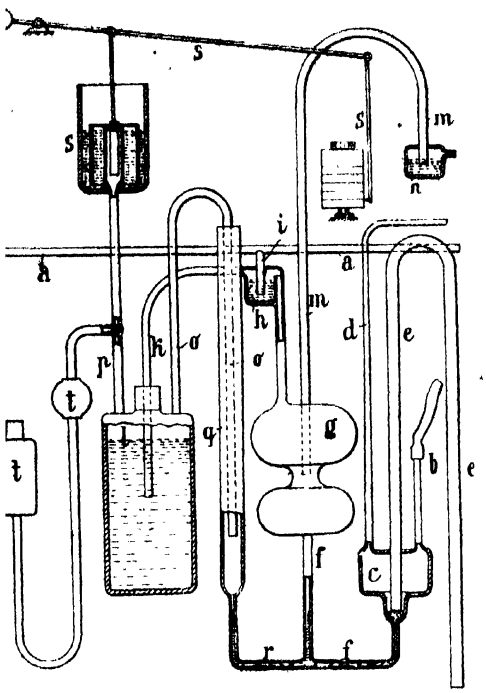
OP = 14 – 17 cm, PQ = 4 – 5 cm, QR = 60 cm.

The modified McLeod gauge is shown in the figure. The gauge M and the cylinder B are in one piece; *B* can be connected with the pump by the cock *b* and the rubber tube, and is completely filled with mercury. To make a measurement, cock *c* is opened, and then *b* (furnished with a filed channel in the key, see this J., 1902, 1413) very gradually opened, when the pressure of the atmosphere drives the mercury up into M and compresses the gas into the capillary *c*. By closing *c*, and setting the water-pump in action, the mercury is brought back again, the cock *b* being closed as soon as the connection between M and R is clear. The mercury thus never comes in contact with rubber. The vessel T contains phosphorus pentoxide, and the cock *m* is always kept closed save during a measurement, so as to lessen the possibility of moisture finding its way into the gauge. —J. T. D.

French Patent.

Gas; Apparatus for analysing ——. Allgemeine Feuertechnische Ges.m.b.H. Fr. Pat. 357,426, Sept. 1, 1905. Under Int. Conv., Sept. 2, 1904.

The apparatus is adapted for the automatic analysis of gas, and is shown in the accompanying figure. The pipe *a*, with the short tube *i*, is a by-pass from the main stream of gas; *h* is a mercury seal, communicating on the one hand with the tube *k*, which dips into an appropriate absorbent solution in the vessel *l*, and on the other with the sample-measuring vessel *g*; *b*, *c*, *d*, *e*, *f* and *g*, constitute a hydraulic pump, by means of which a definite volume of the gas to be analysed is drawn into *g* and subsequently driven over into the absorbent liquid; *m* is a tube which projects into *g* and has a liquid seal *n*; the tube *o* extends downwards into the wider tube *q*, which is open at the top; and the three-way cock *p* establishes communication



between the vessel *l* and either the burette *t* or the pressure recorder *s*. The apparatus works as follows:—When water enters by the tube *b*, it gradually fills *c*, *d*, *f*, *g*, *r* and *q*. At first the excess of gas sample present in *g* is driven out through *m* and *n*, but when the water reaches the lower end of *m* the remainder of the gas (forming a definite, measured volume) can only escape through *h* and *k*, and it is therefore driven forward into the absorbent solution. Before that, the water rising in *q* has sealed the lower end of the tube *o*. According to the proportion of the sample absorbed by the solution in *l*, more or less pressure is set up in *l*, and is indicated by the recorder *s*, which thus gives the result of the analysis; or the volume remaining unabsorbed may be measured by means of the burette *t*. As soon as the inflowing water reaches its highest point in the siphon tube *c*, the latter overflows and empties the apparatus. As the water flows out of *g*, a fresh sample is drawn in at *i*, the seal at *n* preventing any access of air: and when the water in *q* falls below the end of the tube *o*, the excess of unabsorbed gas in *l* escapes, the pressure in *l* falling to that of the atmosphere. The above described series of operations is then repeated in performing a new analysis.—H. B.

INORGANIC—QUANTITATIVE.

Iron; Determination of ——, in the presence of Zinc. V. Komar. Chem.-Zeit., 1906, **30**, 31–32.

The mixed salts of zinc and iron are converted into sulphates, and these dissolved in the least possible quantity of cold sulphuric acid, containing 400 c.c. of the monohydrate per litre. The solution is completely oxidised by nitric acid, and is then evaporated, first over a water bath, and finally to dryness on a sand bath, an acid ferric salt, $FeH(SO_4)_2.4H_2O$ being formed during this process. The dry substance is transferred to a crucible, and heated to constant weight over a burner. After 30—45 minutes the contents of the crucible are treated with water, which dissolves the unchanged zinc sulphate, leaving all the iron as ferric oxide.—F. Sdn.

Lead [in Lead Acetate]; Volumetric Determination of —— as Iodate. L. Moser. Chem.-Zeit., 1906, **30**, 9.

The process described is based on the formation of lead iodate when a soluble lead salt is treated with an excess of potassium iodate. The precipitate obtained is practically insoluble in water, difficultly soluble in nitric acid, but readily soluble in hydrochloric acid with evolution of chlorine. As most of the other heavy metals also give insoluble iodates, the application of the method is limited, but it is useful for the valuation of commercial lead acetate (sugar of lead). One grm. of the latter is placed in a 200 c.c. flask, dissolved in water, a drop of acetic acid being added if necessary, about 70 c.c. of N/10 potassium iodate solution are added and the volume made up to the mark. After mixing and allowing the precipitate to settle, 50 c.c. of the clear supernatant liquid are withdrawn by means of a pipette and mixed with potassium iodide solution. The small quantity of iodine set free by the free acid present in the sample is titrated with N/10 thiosulphate solution. Sulphuric acid is now added and the main quantity of iodine titrated.—W. P. S.

Arsenic; Determination of traces of —— by the Marsh-Berzelius Method, and the "Insensitiveness" of Zinc. A. C. Chapman and H. D. Law. Analyst, 1906, **31**, 3—16.

In the Marsh-Berzelius method of determining arsenic, the addition of certain metallic salts to the flask containing "sensitive" zinc, has the effect of preventing the reduction of the arsenic to its hydride; thus salts of palladium, platinum, nickel and cobalt exhibit this "retentive" action, whilst those of cadmium, tin, and lead, and also aluminium, magnesium and the alkali metals, have no such effect. In a similar way, it was found that alloys of most metals with "sensitive" zinc were not capable of reducing arsenious oxide; the alloys of zinc with tin and cadmium are exceptions. If, however, 2 grms. of cadmium sulphate, or stannous chloride, or lead acetate be added to the test flask containing one of these insensitive alloys, the whole of the arsenic is evolved as hydride; an exception to this are nickel-zinc alloys, but in this case a certain amount of the nickel becomes separated from the zinc during solution, and particles of it are deposited on the cadmium surface. It was further found that the addition of 2 grms. of cadmiun sulphate rendered "insensitive" zinc capable of reducing arsenic compounds; also that the addition of a cadmium, zinc, or lead salt rendered magnesium sensitive. When using the electrolytic method for determining arsenic, it was found that arsenite solutions were completely reduced in presence of sulphuric acid, when a cathode of lead, tin, or cadmium was used; with other cathodes, a large proportion of the arsenic was retained in the cell; this applies equally to iron cathodes, which have been previously credited with having no such retentive action; when arsenate solutions were reduced electrolytically, similar results were obtained, although in no case was all the arsenic evolved as hydride. It was found experimentally that the addition of any metal which causes insensitiveness had the effect of lowering the potential of the hydrogen formed. The above results show that all metals known to possess low supertension values prevent the reduction of arsenious oxide by zinc, whilst others (*e.g.*, cadmium, tin, zinc) which possess high values have no appreciable effect.

—T. F. B.

Sodium and Potassium Cyanide; Determination of soluble Sulphides in Commercial ——. G. W. Williams. J. Chem. Metall. and Min. Soc., S. Africa, 1905, **6**, 170.

Two portions of 5 grms. each of the sample to be tested are dissolved in 100 c.c. of previously boiled distilled water. To one portion about 0·5 grm. of lead carbonate is added, the liquid well shaken for a few minutes and filtered, the filtrate forming a check solution, free from sulphides, but otherwise, especially with regard to incidental impurities, similar to the actual sample to be tested. 50 c.c. of each solution are then placed in Nessler tubes, and 1 c.c. of alkaline plumbate, prepared by digesting litharge in 5 per cent. sodium hydroxide solution, is added. A solution of sodium sulphide containing 1 mgrm. per c.c. is added to the check solution from a burette until the colour in the two tubes is matched. The colour is distinct, and immediately attains its maximum intensity

Sulphides; Conditions of precipitation and solution of Metallic ——. G. Bruni and M. Padoa. Atti R. Accad. dei Lincei Roma, 1905, **14**, [2], 525—528. Chem. Centr., 1906, **1**, 215—216.

In 1894 Ostwald stated that by treatment with sulphuretted hydrogen under pressure, it should be possible to precipitate, for example, zinc from acid solutions, and, inversely, if the hydrogen sulphide exert only a very small pressure, lead sulphide and antimony sulphide should be soluble in acids. The authors have experimentally tested these statements. Concentrated sulphate solutions of iron, manganese, zinc and cadmium, and chloride solutions of cobalt and nickel were treated, in presence of hydrochloric acid, with hydrogen sulphide under strong pressure. For this purpose the solution under examination was introduced into a cooled tube containing some liquefied hydrogen sulphide, and the tube sealed. On allowing to stand, the temperature of the tube gradually rose; at the ordinary temperature, the pressure inside the tube amounted to 14·34—16·38 atmospheres. All the solutions gave abundant precipitates of sulphide, except that of manganous sulphate, thus confirming Ostwald, who gave manganese sulphide as the most soluble sulphide in its group. On opening the tubes, contrary to expectation, none of the precipitated sulphides redissolved; even on heating, only the sulphide of zinc went into solution. With respect to the second part of Ostwald's statement, it was found that an acid solution of cadmium sulphate, which under ordinary conditions yielded a precipitate of cadmium sulphide, gave no precipitate with hydrogen sulphide under diminished pressure.—A. S.

Chromium in Steel; Determination of ——, *by means of Ammonium Persulphate.* H. E. Walters. J. Amer. Chem. Soc., 1905, **27**, 1550—1553.

The author uses a method by which chromium and manganese can both be determined. It is not directly applicable to tungsten- or molybdenum-steels, which often contain a chromium carbide insoluble in sulphuric acid. If, after solution of the steel, this carbide be filtered off, fused with sodium carbonate, and the product added to the main solution, the process can then be proceeded with. The method is as follows:—The sample, 1·25 grms., is weighed into a No. 3 beaker, dissolved in 35 c.c. of 1 : 5 sulphuric acid, and a little ammonium persulphate added to the hot solution to oxidise iron and carbonaceous matter; the solution is diluted to 100 c.c., 40 c.c. of silver nitrate solution (0·4 per cent.) and 5—7 grms. of ammonium persulphate are added, and the whole boiled till excess of persulphate is destroyed, say, for five minutes. The solution is transferred to a 500 c.c. flask, cooled, made up to volume, 100 c.c poured into a 100 c.c. flask, and the remaining 400 c.c. treated in a beaker with a known volume of ferrous sulphate solution of known strength, and titrated with permanganate. The ferrous sulphate oxidised by the sample represents the manganese and chromium in 1 grm. of steel. The smaller portion of 100 c.c. is now titrated in a porcelain dish with sodium arsenite solution till the colour is bright yellow. From this the amount of manganese is calculated, and the chromium is then obtained by difference.—J. T. D.

Sulphur in Zinciferous Residues; Determination of ——. G. Lunge and R. Stierlin. Z. angew. Chem., 1906, **19**, 21—27.

Watson's method (this J., 1888, 305), as modified by Lunge, gives results far below the truth in burnt ores containing zinc, or in those which, even though free from zinc, contain high percentages of sulphur. In such cases the authors find that the addition of chlorate, which Watson proposed to dispense with, is necessary. For burnt ores with less than 5 per cent. of sulphur, their method is as follows:—2 grms. of sodium bicarbonate of ascertained alkalinity are accurately weighed into a nickel crucible of 20—30 c.c. capacity, and thoroughly mixed with 3·206 grms. of the finely-powdered sample and about 2 grms. of potassium chlorate, by means of a flat-headed glass rod. The crucible is heated for 30 minutes by a flame 3—4 cm. high, the tip of which is 2—3 cm. below the bottom of the crucible, 20 minutes with the flame raised so as just to touch the bottom, and 10 minutes with a larger flame which will raise the bottom of the crucible to just visible redness, but not melt the contents. The crucible must be covered, and no attempt made to stir the contents. The crucible is emptied and washed out into a porcelain dish, and the contents boiled with 25 c.c. of concentrated neutral solution of sodium chloride till solid salt begins to separate. The mass is now filtered through a Schleicher and Schüll's 590 filter, and washed with water containing sodium chloride till free from alkalinity. The filtrate is then titrated with N/1 or N/5 hydrochloric acid and methyl orange. From the difference between the amount required and that required by 2 grms. of the bicarbonate used, the percentage of sulphur is calculated. This method answers not only for burnt zinciferous pyrites, but also for burnt blendes. When the zinc content is high, the liquid is sometimes slightly turbid from zinc oxide or carbonate; it is best then to carry all the titrations to distinct red.

If the sulphur content be above 6 per cent. the proportions used should be—1·603 grms. of sample, 2 grms. of bicarbonate, 4 grms. of chlorate, and 2—3 grms. of sulphur-free ferric oxide, which keeps the mass porous. Raw blendes can also be treated in the same way, using 0·3206 grms. of blende, 2 grms. of bicarbonate, 2 grms. of chlorate, and 2 grms. of ferric oxide; and the same proportions, omitting the ferric oxide, give a quick and fairly accurate sulphur assay of raw pyrites.—J. T. D.

Rotating Anode and Mercury Cathode; Use of ——, *in Electro-Analysis.* L. G. Kollock and E. F. Smith. J. Amer. Chem. Soc., 1905, **27**, 1527—1549.

The arrangements formerly described (this J., 1905, 1127) have been applied to the electrolytic deposition of other metals. Some of the results, and the essential data, are given in the table below, to compare with that formerly given (*loc. cit.*). The experiments with silver, mercury and bismuth showed that nitrates can be used, or nitric acid added to the solution, without affecting the accuracy of the process. An attempt was made to use metallic halides, and at the same time to determine the halogen by using a silver anode. It was found, however, that the coating of silver halide could not be obtained sufficiently adherent, but that portions dropped into the cathode basin. By reverting to the platinum anode, however, and floating toluene or xylene on the liquid, it was found that the electrolysis of halides could be successfully carried out without injury to the anode, the toluene completely absorbing the halogen formed.

The authors have also found that in this way perfect separations of iron can be effected from uranium, aluminum, thorium, lanthanum, praseodymium and neodymium, cerium and zirconium.

Metal.	Weight of metal present	Sulphuric acid or nitric acid present (or toluene).	Volume of electrolyte	Current.	E.M.F.	Speed of anode.	Time.	Weight of metal found.
	Grms.	c.c.	c.c.	Ampères.	Volts.	Revs per min.	Mins.	Grms.
Cadmium	0·9480	S. 0·125	5	3·5	10—7	360	12	0·9481
Tin	0·4106	S. 0·2	5	4	5	360	9	0·4109
Silver	0·2240	N. 0·16	5	4·5—3·0	6·5—6	1200	4	0·2240
Mercury	0·3575	N. 0·2	5	3	7—5	—	4	0·3578
Bismuth	0·2773	S or N. 0·5	12	3—4	5	—	15	0·2777
Cobalt chloride	0·1250	T. 10	5	2—4	5	—	5	0·1250
Gold „	0·1200	T. 10	5	2—3	10	—	5	0·1200
Ferric „	0·1030	T. 10	5	2—4	9	—	12	0·1029
Mercuric „	0·2525	T. 10	5	1—3	10—7·5	—	10	0·2524
Stannous „	0·1600	T. 10	10	2—8	7—6	—	15	0·1597
Cadmium bromide	0·2219	T. 10	5	2	5	—	10	0·2215

Antimony; Rapid Deposition of ——, *by Electrolysis.* J. Laugness and E. F. Smith. J. Amer. Chem. Soc., 1905, **27**. 1524—1527.

The authors have repeated Exner's experiments (this J., 1903, 1150), and endeavoured to give the conditions more precision, and thus secure uniformity in the results. The antimony solution (10 c.c., containing about 0·25 grm. of antimony) was placed in the platinum basin used as anode, and to it were added 15 c.c. of sodium sulphide solution (sp. gr. 1·18), 3 grms. of potassium cyanide, 1 c.c. of 10 per cent. sodium hydroxide solution, and water to make up 70 c.c. The solution was heated nearly to boiling and electrolysed with a current of 6 ampères per sq. dcm., at 3·5—4·0 volts, with rotating anode, and in 15 minutes the whole of the antimony was deposited as a bright grey adherent coating (results, 0·2402 to 0·2410 grm. instead of 0·2406). With roughened dishes 1 grm. could be accurately deposited in 20—25 minutes.

Two analyses of stibnite were made, 0·5 grm. of the mineral being dissolved in 20 c.c. of sodium sulphide solution, filtered and washed from the insoluble matter, and the solution electrolysed under the above conditions (7 amp., 3 volts, 20—25 minutes). The two results were 71·09 and 70·72 per cent.

The same process affords a means of completely separating arsenic from antimony. Solutions containing 0·1268 grm. of antimony and 0·2000 grm. of arsenic gave in six experiments deposits of antimony weighing from 0·1267 to 0·1269 grm.—J. T. D.

ORGANIC—QUANTITATIVE.

Carbon Bisulphide in Benzene; Determination of ——. D. Stavorinus. J. Gasbeleuchtung, 1906, **49**, 8.

The author applies Peterson's method (this J., 1903, 1017) based upon the formation of xanthogenate from carbon bisulphide and quantitative oxidation of its sulphur with hydrogen peroxide in alkaline solution, to the determination of the small quantities of carbon bisulphide present as impurities in commercial benzene. 25 c.c. of benzene are mixed in a beaker with 70 c.c. of 96 per cent. alcohol and 10 c.c. of 8 per cent. sodium hydroxide solution added. After standing for half-an-hour, 5 c.c. of concentrated hydrogen peroxide solution free from acid are added, and the alcohol is distilled off on the water-bath. The solution is diluted with 200 c.c. of water, acidified with hydrochloric acid, and the sulphuric acid formed precipitated with barium chloride. The method may be adapted to volumetric working by using N/1 sodium hydroxide solution for the xanthogenate reaction and titrating back with N/5-acid using methyl orange as an indicator after oxidation with hydrogen peroxide; 1 c.c. of N/1 sodium hydroxide solution = 0·019 grm. of carbon bisulphide. Thiophene is not attacked by an alkaline hydrogen peroxide solution.—R. L.

Paraffin Scale; Determination of the Oil in ——. L. Neustadtl. Chem.-Zeit., 1906, **30**, 38.

Advantage is taken of the fact that the oil is completely soluble in acetone, whilst only a small proportion of the wax is dissolved, and this can be entirely removed by cooling the solution to —15° C. One grm. of the finely powdered scale is digested with 10 c.c. of acetone at the ordinary temperature for one or two hours. The mixture is then placed in a freezing bath and cooled to —15° C. The solution is filtered through cotton wool in a filter tube surrounded by a freezing mixture, and the insoluble scale is washed with cooled acetone. The filtrate is collected, the acetone is distilled off, and the oil is dried at 100° C. and weighed. This method gives results which agree perfectly among themselves, but which are always higher than those obtained by the old method of pressing the oil out of the scale mechanically, since the removal of oil in the latter case is never complete.—J. F. B.

Rubber; New method of analysis of Raw ——. B. Ditmar. Gummi.-Zeit., 1906, **20**, 364—366.

To determine moisture, 1 grm. of the raw rubber is dried at 60° C. For the ash, 1 grm. of the masticated rubber is incinerated in a platinum crucible. For resins, 4 grms. of the masticated rubber are extracted with acetone in a Soxhlet apparatus, whilst for total impurities, 1 grm. of the rubber, after extraction of the resin, is dissolved in 100 c.c. of benzene on the water-bath, and the solution is centrifugalised. By subtracting from the weight of insoluble matter that of the inorganic impurities (ash), the percentage of organic impurities (albuminoids, sugars, albanes, &c.) is obtained. The pure rubber is either estimated by difference, or the benzene is distilled off from the clarified solution and the residue weighed.

The following results were obtained in the case of five different rubbers, *viz.*, (1) Guatemala, sandy, from *Castilloa elastica*; (2) Mozambique, unripe, from *Landolphia*; (3) Pará, fine, from *Hevea brasiliensis*; (4) fine, large Mozambique balls, from *Landolphia*; (5) Gambia balls, from *Landolphia Senegalensis*:—

No.	Moisture.	Inorganic impurities.	Resins.	Organic impurities.	Pure rubber.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	3·155	35·40	9·91	23·26	28·275
2	5·15	14·91	7·04	39·81	33·09
3	3·88	0·31	1·49	0·06	94·36
4	2·47	0·62	11·51	3·0	82·4
5	2·32	40·59	3·48	2·76	50·76

—E. W. L.

Starch; Polarimetric Determination of ——. E. Ewers. Z. öffentl. Chem., 1905, **11**, 407. Chem.-Zeit., 1905, **29**, Rep., 382.

By continued treatment with glacial acetic acid, dilute hydrochloric acid and hot water, starch may be readily and completely dissolved. The author states that this method of dissolving starch is well suited to the quantitative estimation of starch in commercial starches and flours, the amount of starch present in the solution being determined polarimetrically.—T. H. P.

Starch and Amylocelluloses; Determination of Coagulated ——. J. Wolff. Ann. Rev. Chim. anal., 1905; through Woch. f. Brau., 1906, **23**, 31.

Equal quantities of starch are placed with water in three flasks of equal capacity, they are then gelatinised, heated under pressure, and allowed to cool. To flask *a*, 20·5 c.c. of a filtered 10 per cent. infusion of malt are added, and the mixture is maintained at a constant temperature of 60° C. To flask *b* only 0·5 c.c. of the same malt infusion is added; flask *c* receives the same. The contents of flasks *b* and *c* are allowed to remain for three hours at the ordinary temperature until coagulation has taken place. The contents of flask *b* are then diluted to 200 c.c. after the addition of 20 c.c. of the same malt infusion which has been boiled. The contents of flask *c* are then fully saccharified after treatment with 20 c.c. of the unboiled malt infusion, and are also diluted to 200 c.c. The contents of flask *a* are also fully saccharified and are likewise diluted to 200 c.c. All the liquids are filtered and 100 c.c. of each filtrate are heated in the autoclave at 120° C. for 20 minutes. The solutions are neutralised, made up to equal volumes and the dextrose is determined in each, the results being calculated as starch. The difference between *a* and *b* gives the weight of the coagulum; the difference between *a* and *c* gives the weight of the amylocellulose.—J. F. B.

Benzaldehyde; [Gravimetric] Determination of small quantities of ——. H. Hérissey. J. Pharm. Chim., 1906, **23**, 60—65.

Benzaldehyde is precipitated as its phenylhydrazone, formed according to the reaction

$$C_6H_5.NH.NH_2 + C_6H_5.CHO = C_6H_5.CH{:}N.NH.C_6H_5 + H_2O.$$

The reagent employed, consists of 1 c.c. of freshly redistilled phenylhydrazine and 0·5 c.c. of glacial acetic acid dissolved in 100 c.c. of distilled water.

Fifty c.c. of an aqueous solution of benzaldehyde, or the same volume of distillate, obtained after the hydro-

lysis of a glucoside, such as amygdalin, sambunigrin, or prulaurasin, with a ferment, is mixed with 50 c.c. of the above reagent, heated on the water-bath for 20 to 30 minutes, and set aside for 12 hours. The precipitate is then collected in a Gooch crucible, washed with 20 c.c. of cold water, and dried to constant weight over sulphuric acid *in vacuo*. The weight of phenylhydrazone obtained × 0·54081, gives the equivalent of benzaldehyde.

Experiments conducted with the hydrolysis of anhydrous amygdalin by means of emulsin, and subsequent distillation of the benzaldehyde formed, have given results in the determination of the latter, which, although slightly below theoretical requirements, indicate the practical value of the method. —J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 93.)

Radium; Effect of high temperatures on the rate of decay of the active deposit from ——. H. L. Bronson. Phil. Mag., 1906, **11**, 143—153.

Curie and Danne (Compt. rend., 1904, **138**, 748) concluded from the results of experiments on the exposure of the active deposit from radium to high temperatures, that the "rate of decay" of the active material was permanently altered, and that as the temperature to which the deposit was exposed, was raised, the "period" (*i.e.*, the time in minutes required for the activity to fall to half its original value) reached a minimum at about 1100° C., and then began to increase again. The author, however, by heating a copper wire coated with the active substance, in a sealed tube, finds that temperatures between 700° and 1100° C. do not permanently affect the rate of decay of the active deposit from radium, Curie and Danne's results being apparently due to neglect of taking into account the volatilisation of one or more of the constituents of the active deposit.—A. S.

Quartz; Adsorption of Water vapour and of certain Salts in aqueous solutions by ——. L. F. Briggs. J. of Phys. Chem., 1905, **9**, 617—640. Chem. Centr., 1906, **1**, 215.

The powdered quartz used in the experiments was composed of particles of from 0·005 to 0·25 mm. diam.; 100 grms. were shaken with 150 c.c. of the solution at 22° C. Alkali hydroxides were adsorbed to a much greater extent than alkali carbonates; the amount of adsorption increased with the concentration of the solution. From a N/10-solution of potassium hydroxide, $2{\cdot}3 \times 10^{-5}$ grm.-equivalents were adsorbed by 80 grms. of quartz sand with a total surface of about 14,000 sq. cm.; with the powdered quartz, the adsorption was much greater. Neutral salts were not adsorbed to any appreciable extent. Experiments on the adsorption of water vapour, *e.g.*, from dilute sulphuric acid, by powdered quartz, were also made.—A. S.

Solid Solutions. F. Wallerant. Comptes rend., 1906, **142**, 100—101.

Mixtures of isomorphous crystals have sometimes been likened to solutions of one solid substance in another, since their physical properties vary with their composition. The author's results tend to strengthen this view, since they show that both diffusion and re-crystallisation can take place in these solid mixtures. If a mixture of potassium nitrate and ammonium nitrate, containing 80—93 per cent. of the latter salt, be fused and then allowed to solidify, there is obtained, above 104° C., a conglomerate of two kinds of crystals, one being isomorphous with potassium nitrate and containing 80 per cent. of the ammonium salt, the other being quadratic and containing 93 per cent. of ammonium nitrate. At 104° C. the mass becomes cloudy, the crystals can no longer be discerned, and movements take place within the mixture. As a result of this diffusion, uniform zones of crystals are gradually formed, which crystals belong to the monoclinic system, and have a composition intermediate between that of the two components. The converse phenomenon takes place in the case of a mixture of two parts of ammonium nitrate and one part of cæsium nitrate, mixed by fusion and allowed to solidify. The mass first solidifies in the form of cubic crystals, which on further cooling change into rhombohedral crystals isomorphous with those of cæsium nitrate. These latter are slowly transformed into a conglomerate of two kinds of crystals, quadratic and rhombohedral, both of which are mixed crystals of the two nitrates of different compositions.—J. F. B.

Prizes.

Alcohol; Prizes for denatured ——. Chem. & Drug., Feb. 10, 1906.

The Commission appointed by the French Government to inquire into the methods of examining and methylating alcohol have decided to offer the following prizes for open competition, irrespective of the nationality of the competitors: (1) A prize of 20,000f. for a method of methylating alcohol which shall be preferable to that now in vogue in France, and at the same time prevent any defrauding of the revenue; and (2) a prize of 50,000 fr. for a method which shall permit of the use of alcohol for illuminating purposes under the same conditions as those applying to petroleum. Further details may be obtained from the Commission.

Trade Report.

British Chemical Trade in 1905.

The following are further details of the British Chemical trade in 1905. (See this J., 1906, 94):—

Imports.

Article.		Quantity.	Value.
			£
Dyestuffs (other than dyewoods) and substances used in tanning or dyeing:			
Bark, for tanning	Cwts.	563,604	243,580
Cutch	Tons	3,247	72,543
Dyes, Coal tar:			
Alizarin and Alizarin Dyes	Cwt.	57,703	217,636
Aniline	,,	174,363	975,644
Synthetic Indigo	,,	32,240	121,269
Other coal tar dyes	,,	1,331	8,890
Extracts		—	652,174
Gambier	Tons	7,078	148,172
Indigo	Cwt.	8,201	116,902
Myrabolans	,,	576,924	159,474
Valonia	Tons	25,652	262,819
Painters' Colours and Pigments:			
White lead	Cwt.	306,113	250,703
Nickel oxide	,,	17,406	85,615
Zinc oxide	,,	288,384	282,858
Other sorts	,,	1,464,453	814,603
Total	,,	2,076,356	1,433,779
Manures:			
Bones, burnt or unburnt	Tons	47,346	200,913
Guano	,,	29,223	138,906
Nitrate of soda (cubic nitre)	,,	104,436	1,104,687
Phosphate of lime, and rock phosphate	,,	421,026	616,131

Exports.

Article.		Quantity.	Value.
			£
Coal products, not dyes:			
Aniline and coal tar oils	Cwts.	901,416	236,565
Carbolic acid	,,	135,767	157,571
Naphthalene and anthracene	,,	99,917	20,545
Other sorts	,,	9,187,689	932,993
Total	,,	10,324,789	1,347,674
Dyestuffs:			
Products of coal tar	,,	60,356	196,828
Other sorts	,,	185,743	181,486
Total	,,	246,099	378,314

Exports—(continued).

Article.		Quantity.	Value.
Glycerin	Cwts.	147,169	301,141
Manure, chemical	Tons	561,204	3,466,768
Salt, white rock	,,	576,170	431,074
Painters' Colours and Materials :			
White lead	Cwts.	349,914	339,414
Nickel oxide	,,	1,518	8,283
Zinc oxide	,,	61,938	73,291
Other sorts	,,	1,373,440	1,740,680
Total	,,	1,786,610	2,161,668
Soda Compounds :			
Soda ash	,,	1,491,625	314,957
,, bicarbonate	,,	426,390	149,018
,, caustic	,,	1,513,598	741,521
,, crystals	,,	200,103	32,885
,, sulphate (saltcake)	,,	742,332	64,175
,, other sorts	,,	347,187	133,968
Total	,,	4,721,235	1,436,524

New Books.

A Handbook for Cane-Sugar Manufacturers and their Chemists. By Guilford L. Spencer, D.Sc., Formerly Chief of Sugar Laboratory, U.S. Department of Agriculture, &c. Fourth Edition, Rewritten and Enlarged. First Thousand. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1906. Price $3.00.

Small 16mo volume, bound in morocco and gilt, containing 320 pages of subject matter with 52 illustrations, and the alphabetical index, followed by list of tables and formulæ. The subject is divided into two parts. I. The Manufacture of Cane Sugar, and II. Sugar Analysis. The sub-divisions of these branches are as follows :—I. (i) Extraction of the Juice. (ii) Its Purification. (iii) Filtration of the Juice and Scums. (iv) Chemical Reagents used in Purifying the Juice. (v) Evaporation of the Juice. (vi) Preservation of the Juice and Syrup. (vii) Crystallisation of the Sugar. (viii) Curing the Sugars. Disposal of Low-grade Sugar. II. (i) Composition of the Sugar-cane and Molasses. (ii) Properties of the Sugars in the Cane. (iii) Optical and Chemical Methods of Sugar Analysis. (iv) Density Determinations. (v) General Analytical Work. (vi) Chemical Control of Sugar-house Work. (vii) Examination of Bone-black. (viii) Analysis of Limestone, Lime, and Sulphur. (ix) Lubricating Oils. (x) Analysis of Flue-gases. (xi) Quality of the Water-supply and Treatment of Impure Water. (xii) Fermentation. (xiii) Special Reagents. (xiv) Reference Tables.

Chapters on Paper Making. Vol. II. Comprising Answers to Questions on Paper Making set by the Examiners to the City and Guilds of London Institute. By Clayton Beadle. H. H. G. Grattan, 17, The Borough, London Bridge, London, S.E. 1906. Price 5s. nett. (See this J., 1904, 565, for notice of Vol. I.)

Small 8vo volume, containing 168 pages of subject matter and the alphabetical index. The work is divided into thirteen chapters, as follows :—I. Technical Education as Applied to Paper-making. II. The Use of Specially prepared Size in Dry Sheets for Paper Sizing. III. to VII. Questions set at the City and Guilds of London Institute's Examination for 1901, 1902, 1903, 1904, and 1905. VIII. Answers to 1901, Ordinary Grade. IX. Answers to 1901, Honours Grade. X. Answers to 1902, Ordinary Grade. XI. Answers to 1902, Honours Grade. XII. Answers to 1903, Ordinary Grade. XIII. Answers to 1903, Honours Grade.

Anregung zum Studium der auf Capillaritäts- und Absorptionserscheinungen beruhenden Capillaranalyse. Von Friedrich Goppelsroeder. Halbing and Lichtenhahn's Verlag, vorm. Reich-Detloff, Basel. 1906.

8vo volume, containing 239 pages of subject matter. The subject is treated under the following divisions or heads : I. History and General Significance of Capillarity. II. Introduction to "Capillary Analysis." III. Capillary- and Absorptive-Behaviour of the Dyestuffs, Alkaloids, Oils and Naphthas. IV. Application of Capillary Analysis in Inorganic Chemistry. V. Application of Capillary Analysis in the Testing of Foodstuffs, &c., as also in Pharmaceutical Chemistry. VI. Application also in Physiology.

Einfuhrung in die Thermodynamik auf Energetischer Grundlage. von Dr. Julius Meyer. Privatdozent an der Universität Breslau. Wilhelm Knapp's Verlag. Halle a. S. 1905. Price M.8.

8vo volume, containing 209 pages of subject matter, and alphabetical indexes of authors and subjects. The entire subject is treated under the following heads : Introduction. I. Mathematical Introduction. II. and III. Energy and its two Prime Factors. A., IV. Calorimetry. V. Thermometry. VI. Equations of Condition. VII. Thermodynamic Co-efficients. B., VIII. First Principle of Thermodynamics. IX. Employment of Ideal Gases. X. Thermochemistry. XI. Dependence of the Internal Energy on the Temperature. C., XII. Carnot's Process. XIII. The Second Principle of Thermodynamics. XIV. Irreversible Processes. XV. Entropy. XVI. Entropy of Ideal Gases and Gaseous Mixtures. XVII. Applications of the Entropic Theory. XVIII. Absolute Temperature. XIX. Thermodynamic Potentials. XX. Conditions of Equilibrium. XXI. Theory of Phases. D., XXII. Free Energy. XXIII. Application of Isothermal Processes. XXIV. Dilute Solutions. XXV. Law of Mass Action. XXVI. Applications. XXVII. Electrical Energy. XXVIII. Free Energy of Formation. XXIX. Heat of Reaction and the Isochore.

The Laboratory Book of Dairy Analysis. By H. Droop Richmond, F.I.C. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1905. Price 2s. 6d. nett.

Small 8vo volume, containing 86 pages of subject matter and the alphabetical index. The text contains 38 illustrations, and is sub-divided as follows :—I. Introduction, Constituents of Milk, and its Products, &c. II. Analysis of Milk. III. Analysis of Liquid Milk-Products. IV. Application of Analysis to the Solution of Problems. V. Analysis of Butter. VI. Analysis of Cheese.

Fabrication des Produits Chimiques Proprement Dits. Royaume de Belgique, Ministère de l'Industrie et du Travail. J. Lebègue et Cie., Rue de la Madeleine, 46, Brussels. Price, 4 fr. 50. post free.

Royal 8vo volume, containing 353 pages of subject matter, a classified table of contents, and a frontispiece representing the chemical manufactory at Baelen-Wezel. The work gives a description of the various chemical industries of Belgium ; its scope may be judged from the following extracts from the index :—*First Part. Sulphuric Acid and Superphosphates.* I. Mineral Acids and By-products. (1) Sulphuric Acid. (2) Nitric Acid. (3) Sodium Sulphate and Hydrochloric Acid. II. Calcium Phosphates. (1) Superphosphates. (2) Dissolved Guano. (3) Basic Phosphates. III. Accessory Products : Copper Precipitate, Copper Sulphate, Copper Nitrate, Ferrous Sulphate, Ferric Chloride, Barium Salts, Sodium Silicofluoride, Arsenic; Nickel and Copper Arsenides. *Second Part.*

Soda, Chlorides and Potash Salts. I. Sodium Carbonate and By-products. II. Bleaching Powder and Caustic Soda. III. (1) Soda Crystals. (2) Sulphurous Acid and Bisulphites. (3) Magnesium Sulphate, Sodium Hypochlorite, Zinc Chloride, Sodium Sulphide. IV. (1) Potassium Carbonate and Caustic Potash. (2) Potassium and Ammonium Nitrates. (3) Refined Salt. *Third Part. Other Products of Natural Minerals.* I. (1) Alumina and Aluminium Sulphate. (2) Potash Alum. (3) Various Aluminium Salts. II. (1) Phosphoric Acid. (2) Double Superphosphates. (3) Alkali Phosphates. (4) Phosphorus and Copper Phosphide. III. Mineral Colours. (1) Cerussite, Massicot and Minium. (2) Zinc White, Grey Oxide, and Zinc Powder. (3) Lithopone. (4) Ultramarine. (5) Ferric Oxide Pigments. (6) Various Colours. IV. Compressed Gases. (1) Oxygen and Hydrogen. (2) Sulphur Dioxide. (3) Carbon Dioxide. (4) Anhydrous Ammonia. V. (1) Sulphur. (2) Barium Sulphate. (3) Borax and Boric Acid. (4) Sodium and Potassium Silicates. *Fourth Part. Coal and Wood Products*: I. By-products of Coal-tar Distillation. II. Secondary Coal-tar Products, Ferrocyanides and Thiocyanates, Ammonia, Ammonium Sulphate, Tar Oils and their Products, Pitch. III. Direct Wood Products. A (1) Tannic Extracts. (2) Salicin. B. Pyroligneous Acid. IV. Secondary Wood Products. (1) Methyl Alcohol and its Derivatives. (2) Calcium Acetate and Products derived therefrom. (3) Wood Tar derivatives. V. Various Organic Products. (1) Ethyl Ether and Acetic Ester. (2) Nitrocellulose and Collodion. (3) Acetaldehyde and Paraldehyde. VI. Fine Chemicals. (1) Laboratory Products. (2) Pharmaceutical Preparations.

JOURNAL OF THE

Society of Chemical Industry.

No. 4.—Vol. XXV. SUPPLEMENT. February 28, 1906.

HON. TREASURER:—
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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (8e.).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Members are reminded that the subscription of 25*s.* for 1906, payable on January 1st, should be sent at once to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

INDEX FOR 1905.

The Index for 1905 is in the press and is expected to be ready for issue with the March 15th number to those members entitled to receive it.

LONDON SECTION.

The next meeting of the London Section will be held at the Chemical Society's Rooms, Burlington House, Piccadilly, on Monday, March 5th, 1906, at 8 p.m., when Dr. W. D. Borland will read a paper on "The Ignition of Nitro-compound Explosives in Small Arm Cartridges."

On April 2nd, Mr. E. J. Watkins will read a paper on "The Ropiness in Flour and Bread, and its detection and prevention."

MANCHESTER SECTION.

The next meeting of the Session will be held at the Grand Hotel, on Friday, March 2nd, at 7.30 p.m., when Mr. Herbert Porter will read a paper entitled, "Beetroot Sugar Industry in England," the subject being treated under the following heads:—Reasons why it should now succeed. History of its development. Value of sugar-beet for sugar, cattle feeding, and manure. Its cultivation. The sugar factory and sugar extraction.

NEWCASTLE SECTION.

The Annual Dinner of the Section will be held at Tilley's Restaurant, Blackett Street, Newcastle, on March 7th, at 7 p.m. The President of the Society, Dr. E. Divers, F.R.S., has accepted the invitation of the Section for the occasion.

LIST OF MEMBERS AND JOURNAL ABBREVIATIONS.

The List of Members for 1906, with which is included a list of Journals abstracted, with the abbreviations of their titles and addresses where they may be obtained, is issued with this number of the Journal to every member of the Society.

List of Members Elected.

February 22nd, 1906.

Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.

Appleby, L. C. B., c/o Messrs. R. Bishop & Sons, Newark-on-Trent, Maltster.

Bauer, H. F., c/o Edwardsburg Starch Company, Cardinal, Ontario, Canada, Chemist.

Benson, Richard W., Public Analyst's Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.

Brooks, Cecil J., 26, Gt. Ormond Street, London, W.C., Metallurgist.

Clark, Wm. B., 42, Robertson Street, Greenock, N.B., Chemist.

Coffman, Herbert, 233, South Albany Street, Ithaca, N.Y., U.S.A., Chemist (Portland Cement).

Cooper, Wm., Public Analyst's Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.

Craven, John I., 15, Hutchinson Street, Winthrop, Mass., U.S.A., Chemist and Salesman.

Davis, V. P., Naugatuck, Conn., U.S.A., Chemist.

Dobson, S., 22, Dangan Road, Cambridge Park, Wanstead, N.E., Paint Works Manager.

Dushman, Saul, School of Practical Science, Toronto, Canada, Electro-Chemist.

Friend, G. Clausen, c/o The D.B. Martin Co., Claremont, Baltimore, Md., U.S.A., Chemist.

Fuchs, Herman C., 83, Marlborough Road, Brooklyn, N.Y., U.S.A., Dry Colour Chemist.

Gaunt, Percy, Norman Road, Rusholme, Manchester, Chemist.

Gerkensmeyer, H. H., 109, South Eastern Avenue, Joliet, Ill., U.S.A., Chemist.

Gorrie, David, c/o D. Gorrie & Son, South Methven Street, Perth, N.B., Engineer.

Green, Ernest, 113, Hulton Street, Moss Side, Manchester, Science Teacher.

Hanfeld, Fred. C., 5, West 95th Street, New York City, U.S.A., Wall Paper Manufacturer.

Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

Herty, Prof. Chas. H., University of North Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.

Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.

Ingalls, Robert C., 53, Commercial Street, West Lynn, Mass., U.S.A., Sales Manager, Fine Chemicals.

Kirby, Oswald F., The Leeds Institute, Leeds, Lecturer on Chemistry.

Knapp, Walter R., c/o Semet-Solvay Co., Ensley, Ala., U.S.A., Chemist.

Macdougald, G. D., City Laboratory, 13, Shore Terrace, Dundee, City Analyst.

McDowell, Alex. H., c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.

McGregor, Russell, Public Analyst's Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.

Mason, Frederic S., 54, Rue Rennequin, Paris, France, Manufacturing Chemist.

Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Manure Maker.

Mills, W. H., Northern Polytechnic Institute, Holloway, London, N., Lecturer on Chemistry.

Murphy, Fred. W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.

Myles, C. D., 16, St. Loo Mansions, Cheyne Gardens, London, S.W.

Nathan, Albert, c/o Warfield & Duell, 220, Broadway, New York City, U.S.A., Patent Lawyer.

Nestell, Raymond J., 115, West 68th Street, New York City, U.S.A., Instructor in Analytical Chemistry.

O'Brien, John W., c/o Grasselli Chemical Co., Grasselli, Lake Co., Ind., U.S.A., Acid Manufacturer.

Ogilvie, Alex. M., 7, Millbrae Crescent, Langside, Glasgow.

Parke, Jas., School of Practical Science, Toronto, Canada, Chemist.

Rossi, A. J., c/o Roessler & Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Mining Engineer.

Rossi, L. M., Perth Amboy Chem. Works, Perth Amboy, N.J., U.S.A., Mining Engineer.

Schneible, Joseph, 14th Floor, Rector Building, Chicago, Ill., U.S.A., Chemical Engineer.

Schroeder, C. M. E., 221, Pearl Street, New York City, U.S.A., Analytical Chemist.

Scott, Arthur P., c/o Dominion Iron and Steel Co., Sydney, Cape Breton, Canada, Chemist.

Seiter, F. J., 3401, Charlton Street, Chicago, Ill., U.S.A., Chemist.

Small, Frank E., Foyle Villa, Merton Road, Bootle, Liverpool, Works Chemist.

Smith, Arthur D., 91, Avenue C., Bayonne, N.J., U.S.A., Chemist.

Smith, Arthur G., Washington Portland Cement Co., Baker, Wash., U.S.A., Chief Chemist.

Smith, Robert C., 425, Home Avenue, Oak Park, Ill., U.S.A., Chemical Engineer.

Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.

Straus, Louis, 18, West 83rd Street, New York City, U.S.A., Merchant.

Symes, Langford P., Parcora Freezing Works, Timaru, N.Z., Chemist.

Tempany, H. A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.

Tolman, Frank S., 451, State Street, Flushing, N.Y., U.S.A., Superintendent (Oakes Manufacturing Co.).

Warwick, Philip H., c/o Messrs. J. Richardson & Son, Millgate, Newark-on-Trent, Maltster.

Webb, Frank H., P.O. Box 104, Apponang, R.I., U.S.A., Chemist.

Weiss, Philip, jun., Wharton Furnaces, Wharton, N.J., U.S.A., Chemist.

Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.

Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Allen, Charles A., l/o Irlams; 188, Harwood Street, Darwen, Lancashire.

Baron, W. Briscoe, l/o Manchester; c/o Jos. Crosfield & Sons, Ltd., Warrington.

Bartripp, G. F.; all communications to 51, Pulteney Road, South Woodford.

Bielecki, Dr. Jan, l/o Marzalkowska; 66, Krakowski Przedmiescie, Warsaw.

Bond, Josiah, l/o Somerville; Patagonia, Arizona, U.S.A.

Braman, W. W.; all communications to Box 353, State College, Pa., U.S.A.

Bruce, Jas., l/o Belfast; Craik, Saskatchewan, Canada.

Buchanan, E. F., l/o Akron; Nürnbergerstrasse 3, Berlin, W., Germany.

Burnside, C. F., l/o Parlin; California Powder Works, Santa Cruz, Cal., U.S.A.

Carter, Stewart F.; Journals to Park Place, Suffern, N.Y., U.S.A., Superintending Chemist.

Charlton, Thos., l/o San Francisco; 325, Irvington Place, Denver, Colo., U.S.A.

Chilwell, John, l/o Wednesbury; Post Office, Auckland, New Zealand.

Collingridge, Frank, l/o Beaufort Road; 73, Fountain Road, Edgbaston.
Crighton, W. H., l/o Newington Green; 33, Ardleigh Road, Southgate Road, London, N.
Davis, Charles B.; all communications to c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A.
Davis, Emerson, l/o Cass Avenue; 30, Watson Street, Detroit, Mich., U.S.A.
De Blois, W. H., l/o Pulaski; c/o General Chemical Co., Hudson Heights, N.J., U.S.A.
Edgerley, D. W., l/o New York; c/o The Chilton Paint Co., 120, High Street, Boston, Mass., U.S.A.
Fudge, Thos., l/o 397; 604, Avenue E., Bayonne, N.J., U.S.A.
Goodchild, W. H., l/o Borneo; Elmwood Lodge, Long Lane, Finchley, N.
Hammersley, W. S., l/o Longjumeau; 15, Rue des Carriers, Soignies, Belgium.
Hasting, J. J., l/o Water Street; c/o Louis Leavitt, North 11th Street and Driggs Avenue, Brooklyn, N.Y., U.S.A.
Humphrey, R. L., l/o Philadelphia; U.S. Geological Survey, Exposition Grounds, St. Louis, Mo., U.S.A.
Johnson, Edw., l/o Rua do Commercio; c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil.
Johnson, F. M. G.; communications to University College, London, W.C.; Journals as before.
Krause, Dr. G.; Journals to Verlag der Chemiker Zeitung, c/o Otto von Halem, Cöthen, Anhalt, Germany.
Lane, Fred H., l/o Park Place; 418, Sackett Street, Brooklyn, N.Y., U.S.A.
Le Maistre, F. J., l/o Philadelphia; Eastern Laboratory, Chester, Pa., U.S.A., Research Chemist.
Levy, Arthur G., l/o Maida Vale; 45, Clifton Hill, Abbey Road, London, N.W.
Main, Wm., l/o Brooklyn; Piermont, N.Y., U.S.A., Chemist.
Mardick, Jno. R., l/o Du Bois; Westminster, Md., U.S.A.
Masujima, Prof. B., l/o 19; 23, Midoricho-Itchome, Honjoku, Tokyo, Japan.
Maxim, Hudson, l/o Sterling Place; 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A.
Mellen, E. D., l/o Curtis, Davis & Co.; President (Pilot Range Mining Co.); Journals to Cambridge, Mass., as before.
Mercer, C. A.; all communications to 34, Camomile Street, London, E.C.
Milroy, Andrew; all communications to 48, Dinmont Road, Shawlands, Glasgow.
Morris, Harry, l/o Avenue House; The Hall, Hexthorpe, Doncaster.
Munton, Fred. T., l/o Runcorn; The Oak House, Winsford, Cheshire.
Neave, Geo. B., l/o George Street; Technical College, Montrose Street, Glasgow.
Neech, Herbert R.; l/o Huelva; St. Catherine's, Lincoln.
Paine, Augustus G., l/o Times Building; 41, Park Row, New York City, U.S.A.
Palmenburg, O. W., l/o West 70th Street; 80, St. Nicholas Avenue, New York City, U.S.A.
Park, James, l/o 51; Hillside House, 42, Millburn Street, Glasgow.
Parker, Charles E., l/o New Brunswick; 1361, Fairmont Street, Washington, D.C., U.S.A.
Pettit, Alf., l/o Glenwood Road; 375, State Street, Brooklyn, N.Y., U.S.A.
Pierce, Ira L., l/o Atlantic Manufacturing Co.; c/o Eastern Dynamite Co., Barksdale Plant, Washburn, Wis., U.S.A., Superintendent.
Saxe, Sigmund, l/o New York City; Bradford, Pa., U.S.A.
Sisson, George, jun., l/o Washington; 13, Grey Street, Newcastle-on-Tyne, Technical Chemist.
Strayer, D. W.; all communications to c/o Oxford Copper Co., Camden Works, corner State and Tenth Streets, Camden, N.J., U.S.A.
Swindells, Seth, l/o Scholar Green; Holly Villas, Lawton, Stoke-on-Trent.
Tobey, C. R.; Journals to Burks Falls, Ont.; and (subscriptions) Collingwood, Ontario, Canada.
Tufts, C. G., l/o Syracuse; c/o Solvay Process Co., Detroit, Mich., U.S.A.
Van der Linde, Harold; all communications to 101, Tyndall Avenue, Toronto, Canada.
Vogel, G. C., l/o Cass Street; c/o Pfister and Vogel Leather Co. (Journals) Milwaukee, Wis., U.S.A., and (subscriptions) 18 Market Street, Bermondsey, S.E.
Walker, Dr. Wm. H.; Journals to Massachusetts Institute of Technology, Boston, Mass., U.S.A.
Watt, H. E., l/o Dartford; 226, Ladywood Road, Birmingham.
Watson, John C.; The Bleachery, Saylesville (not Taylersville), R.I., U.S.A.
Whowell, Fred., l/o Bolton; Croich Hey, Tottington, Bury, Lancashire.
Woodward, Horace A.; Journals to 1268, Amsterdam Avenue, New York City, U.S.A.
Zimmele, H. B., l/o Howe Street; 200, Bellfield Avenue, Pittsburg, Pa., U.S.A.

Deaths.

Bardsley, Robt., Messrs. Jowsbury and Brown, Manchester. Feb. 20.
Clark, Augustus, Fundicio do Bowman, Pernambuco, Brazil.
Hurst, G. H., 22, Blackfriars Street, Salford. Feb. 5.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (1) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 2316. Renshaw. Tank wagons for transporting petroleum, naphtha and other liquids. Jan. 30.
" 2419. Critien. *See under* XVIIIB.
" 2535. Soc. C. et G. Grimmeisen. Cooling apparatus. [Fr. Appl., Feb. 3, 1905.]* Feb. 1.
" 2591. Higginbottom. Washing, rinsing and whizzing granular matter, sugar, ores, minerals, and the like. Feb. 2.
" 2718. Brook. Furnaces. Feb. 3.
" 2755. Ruttkamp. Mixing machines.* Feb. 5.
" 2991. Boult (Goldman and Co.). Filters.* Feb. 7.
" 2992. Boult (Goldman and Co.). Filters.* Feb. 7.
" 3080. Politz. Furnaces.* Feb. 8.
" 3135. Kapf. Method of reducing organic or inorganic compounds.* Feb. 8.
" 3229. Dewrance. Filter presses. Feb. 9.
" 3240. Stoddart. Manufacture of filtering media from slag. Feb. 9.
[C.S.] 2097 (1906). Stocker. Drying various substances, such as clay. Feb. 7.
" 2102 (1905). Stocker. *See under* IX.
" 2520 (1905). Fieldhouse. Tanks for producing a liquid free from suspended solids. Feb. 14.
" 5668 (1905). Spooner (Cie. pour la Fabr. des Compteurs et Matérial d'Usines à Gaz). Apparatus for measuring high temperatures. Feb. 14.
" 7961 (1905). Lennox and Mackenzie. Means for evaporating liquids and concentrating the solids in the same. Feb. 14.
" 7962 (1905). Lennox and Mackenzie. Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale, waste or spent dyes, &c., and concentrating the solids in the same. Feb. 14.
" 8342 (1905). Lennox and Mackenzie. Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale, waste or spent dyes and the like. Feb. 7.
" 19,277 (1905). Spooner (Aktiebolaget Separator). Centrifugal separators. Feb. 14.
" 26,622 (1905). Dickins. Combined measuring glass and pestle and mortar. Feb. 7.

II.—FUEL, GAS, AND LIGHT.

[A.] 2213. Goodwin. Suction gas producers. Jan. 29.
" 2245. Hoering and Wielandt. Gasifying raw combustible materials.* Jan. 29.
" 2250. Simpson. *See under* X.
" 2368. Tully and Shadbolt. Apparatus for the manufacture of gas. Jan. 30.
" 2437. Zerning. Manufacture of filaments for incandescent lamps.* Jan. 31.
" 2440. Hugershoff. Carburetting apparatus.* Jan. 31.
" 2498. Milne. Manufacture of gas for illuminating, heating and power purposes. Feb. 1.
" 2554. Zerning. Manufacture of filaments for electric incandescent lamps.* Feb. 1.
" 2831. Spieske. Heat storing compound. Feb. 5.
" 2907. Wilton. Purification of gases produced in the destructive distillation of coal or other carbonaceous substances.* Feb. 6.
" 2929. Sims and Bowes. *See under* VII.
" 3003. Stuart-Bailey. Coking coal and ovens therefor. Feb. 7.
" 3006. Winand. Production of a working medium for internal combustion engines. [Ger. Appl., Feb. 8, 1905.]* Feb. 7.
" 3060. Griffin. Suction gas producers. Feb. 8.
" 3089. Jensen (Maemecke). Thermic mixtures.* Feb. 8.
" 3145. Streubel. Incandescent mantles. [Ger. Appl., March 24, 1905.]* Feb. 8.
" 3213. Just, Hanaman, Landesberger, Salzmann, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Feb. 9.
" 3225. Just, Hanaman, Landesberger, Salzmann, and Verein. Electricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Feb. 9.
" 3339. Clama. Manufacture of oil gas and apparatus therefor. Feb. 10.
[C.S.] 5008 (1905). Bowman and Southworth. Gas producers. Feb. 7.
" 10,496 (1905). Lane. Gas producers. Feb. 14.
" 18,403 (1905). Siemens und Halske A.-G. Incandescence bodies of tantalum wire for electric glow lamps. Feb. 7.
" 24,137 (1905). Dürr and Hudler. *See under* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 2269. Wynne. Purifying hydrocarbon oils. Jan. 30.
" 2316. Renshaw. *See under* I.
" 2606. Lockwood. Process for incorporating mineral oils with saponaceous or saponified materials. Feb. 2.
" 2680. Crowley and Payne. Lubricating oil.* Feb. 3.
" 2907. Wilton. *See under* II.
" 3192. Wetter (Rud-Rütgers Chem. Fabrik. f. Theerprodukte). Manufacture of pitch from tar. Feb. 9.
[C.S.] 11,191 (1905). Braschler-Kurtz. Method of treating bituminous substances, resins, oils, waxes, &c. Feb. 7.
" 21,518 (1905). Roth. *See under* XXIII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 2622. Imray (Meister, Lucius und Brüning). Manufacture of yellow azo dyestuffs. Feb. 2.
" 2797. Imray (Meister, Lucius und Brüning). Manufacture of pure bordeaux-red sulphurised dyestuffs. Feb. 5.
[A.] 2927. Belart. Manufacture of synthetic indigo and other products formed by condensation. Feb. 7.
" 3107. Lerman, Schwartz and Pikos. Manufacture of a black dye with by-products including a tanning agent or a second black dye.* Feb. 8.
" 3341. Imray (Basle Chemical Works). *See under* V.
[C.S.] 15,170 (1905). Abel (Act.-Ges. f. Anilinfabr.). *See under* XIIIA.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 2220. Zillessen. Apparatus for dyeing fabric.* Jan. 29.
" 2330. Summers. Preparation of vegetable fibre.* Jan. 30.
" 2359. Lorrain (Schmid). Process for simultaneously ungumming and dyeing raw natural silk.* Jan. 30.
" 2720. Selbach. Method of printing books, calico and the like.* Feb. 3.
" 2830. Simon and Weckerlin. Process and apparatus for steaming fibres and fabrics. [Fr. Appl., May 22, 1905.]* Feb. 5.
" 2906. Bousfield (Soc. Anon. Fabr. de Soie Artificielle de Tubize). Manufacture of artificial silk and apparatus therefor. Feb. 6.
" 2939. Wilson. Reproduction of designs or the like on textile or other fabrics or substances. Feb. 7.
" 3025. Bousfield (Soc. Anon. Fabr. de Soie Artificielle de Tubize). Manufacture of artificial silk. Feb. 7.
" 3194. Wansleben. Machines for dyeing bobbins and the like. [Ger. Appl., March 1, 1905.]* Feb. 9.
" 3222. Imray (Meister, Lucius und Brüning). Manufacture of formaldehyde sulphoxylate. Feb. 9.
" 3341. Imray (Basle Chemical Works). Production of black to brown disazo dyestuffs on wool fibre. Feb. 10.
[C.S.] 5214 (1905). Lilienfeld and Tedesko. *See under* XIX.
" 7962 (1905). Lennox and Mackenzie. *See under* I.
" 8342 (1905). Lennox and Mackenzie. *See under* I.
" 10,195 (1905). Imray (Meister, Lucius und Brüning). Production of shaded effects on fabrics by padding. Feb. 14.
" 10,347 (1905). Page. Washing machines. Feb. 14.
" 12,650 (1905). Knopf, and Bremer Baumwollwerke C. Knopf und Co. Process and apparatus for treating cotton-seed hulls or other waste products containing fibrous materials. Feb. 7.
" 15,029 (1905). Dietl. Manufacture of artificial silk. Feb. 7.

VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

[A.] 2998. Martinet and Dulac. Apparatus for dyeing hides and skins.* Feb. 7.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 2442. Stoneham and Pearson. Manufacture of ammonia. Jan. 31.
" 2450. Elworthy. Process for solidifying carbonic acid and apparatus therefor. [Fr. Appl., Jan. 31, 1905.]* Jan. 31.
" 2466. Hermite. Method and apparatus for obtaining saturated solutions of salts. Jan. 31.
" 2506. King's Norton Metal Co., Ltd., Bayliss, Brownsdon and Smith. Solvent for lead and alloys of lead. Feb. 1.

[A.] 2531. Read. Treatment of minerals or compounds of the alkaline earth metals. Feb. 1.
„ 2619. Ogle and Carson. Production of zinc and other oxides. Feb. 2.
„ 2708. Tchernisc. Manufacture of sulphocyanides.* Feb. 3.
„ 2802. Küsel, and Deutsche Solvay-werke, A.-G. Electrolytic manufacture of salts of oxy-acids of halogens. Feb. 5.
„ 2823. Teichner and Askenasy. Process for electrolytically producing persulphates.* Feb. 5.
„ 2929. Sims and Bowes. Recovery of cyanogen compounds from crude gases and from by-products in the manufacture of cyanides.* Feb. 7.
„ 2960. Böhm. Manufacture of ozone. Feb. 7.
„ 3121. Winand. Production of oxygen for internal combustion motors. [Ger. Appl., Feb. 9, 1905.]* Feb. 8.
„ 3122. Chem. Fabrik Rhenania, and Projahn. Process for obtaining sulphur from sulphuretted hydrogen or gaseous mixtures containing the same.* Feb. 8.
[C.S.] 4334 (1905). Sanders. *See under* X.
„ 20,454 (1905). Reaney. Process of hydrating lime. Feb. 14.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 2879 (Chambers. Apparatus for drawing glass. [U.S. Appl., Feb. 15, 1905.]* Feb. 6.
[C.S.] 17,890 (1905). Seaboldt. Process of treating siloxicon. Jan. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 2207. Boult (Cöln-Müsener Bergwerks Aktien-Verein). Manufacture of artificial stone, blocks, pipes and briquettes from slag.* Jan. 29.
„ 2260. Johnson. Plaster for walls. Jan. 30.
„ 2345. Kelly. Heat insulating materials.* Jan. 30.
„ 2685. Winstanley. Manufacture of artificial building blocks. Feb. 3.
„ 2878. Ford. Manufacture of artificial stone or sand lime bricks. Feb. 6.
„ 3014. Thom. Artificial stone. Feb. 8.
„ 3182. Alexander-Katz. Process of manufacturing artificial stone. [Ger. Appl., Sept. 22, 1905.]* Feb. 9.
„ 3344. Connolly. Material for coating metal and other surfaces.* Feb. 10.
„ 3345. Connolly. Manufacture of insulating material.* Feb. 10.
[C.S.] 2097 (1905). Stocker. *See under* I.
„ 2102 (1905). Stocker. Drying of clays and other materials. Feb. 14.

X.—METALLURGY.

[A.] 2201. Cowper-Coles. *See under* XI.
„ 2250. Simpson. Process of treating coke, ores, minerals and mineral products. Jan. 29.
„ 2476. Cowper-Coles. Process for blending and coating metals. Feb. 1.
„ 2506. King's Norton Metal Co., Ltd., Bayliss, Brownsdon and Smith. *See under* VII.
„ 2591. Higginbottom. *See under* I.
„ 2768. Mower and Bassett. Method and apparatus for condensing and collecting fumes from zinc and like furnaces. Feb. 5.
„ 2988. Newton (Westman Process Co.). Process of reducing iron ore.* Feb. 7.
„ 2989. Lafontaine. *See under* XI.
„ 3240. Stoddart. *See under* I.
„ 3252. Callmann and Bormann. Process of refining zinc and other metals. [Ger. Appl., March 20, 1905.]* Feb. 10.
„ 3318. Gutensohn. Treatment of slags for the recovery of metals. Feb. 10.
[C.S.] 3179 (1905). Soc. Anon. "La Neo-Metallurgie." Alloys. Feb. 7.
[C.S.] 4334 (1905). Sanders. Treatment of galvanisers' waste products for the recovery of metal and other substances. Feb. 14.
„ 6001 (1905). Anderson. Smelting ores, iron sand and the like, and subsequent conversion into steel or other metals or alloys. Feb. 7.
„ 7714 (1905). Elworthy and Williamson. Preparation of nickel. Feb. 14.
„ 13,626 (1905). Gebauer and Zenses. Restraining the ebullition of a blown charge of molten iron in a converter. Feb. 7.
„ 17,123 (1905). Hobson. Alloy. Feb. 14.
„ 19,941 (1905). Blood. Utilising iron ore waste in the manufacture of iron and steel. Feb. 14.
„ 22,932 (1905). Hamfeldt. Apparatus for disintegrating slag. Feb. 7.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 2201. Cowper-Coles. Process for coating and alloying one metal with another. Jan. 29.
„ 2456. Cowper-Coles. Electrolytic production of copper wire, strip, or the like. Jan. 31.
„ 2465. Hermite. Electrolytic apparatus. Jan. 31.
„ 2562. Betts. Electric furnaces.* Feb. 1.
„ 2691. Moseley. Electric heating, cooking and smelting. Feb. 3.
„ 2802. Küsel, and Deutsche Solvay-werke. *See under* VII.
„ 2823. Teichner and Askenasy. *See under* VII.
„ 2989. Lafontaine. Electrolytic process for extracting metals from their ores and treatment of copper waste for the recovery of pure copper.* Feb. 7.
„ 3004. Soc. Electro-Metall. Française. Electric mixing furnace. [Fr. Appl., Feb. 11, 1905.]* Feb. 7.
[C.S.] 4100 (1905). Thompson (Decker Manufg. Co.). Electrolytic apparatus. Feb. 14.
„ 4287 (1905). Marino. Secondary electric batteries. Feb. 7.
„ 5882 (1905). Candau and Candau. *See under* XIII*A*.
„ 6790 (1905). Potthoff. Apparatus for electro-plating tubes or other hollow articles. Feb. 7.
„ 9522 (1905). Bottomley and Paget. Electric resistance furnaces. Feb. 7.
„ 9657 (1905). Gouin. Accumulators. Feb. 7.
„ 11,040. (1905). Fuller. Electric batteries. Feb. 7.
„ 13,909 (1905). Lawson. *See under* XVIII*A*.
„ 20,217 (1905). Vareille. Apparatus for the electrolysis of water. Feb. 14.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 2877. Paul and Gillmann. Cleansing material. Feb. 6.
„ 3132. Pryor (Chem. Fabrik von Heyden, A.-G.). Manufacture of iodine fats.* Feb. 8.
[C.S.] 11,191 (1905). Braschler-Kurtz. *See under* III.
„ 10,387 (1905). Fresenius. Purification of fats, fat oils, resins and the like. Feb. 14.
„ 24,935 (1905). Oelwerke Stern-Sonneborn A.-G. Manufacture of ricinus oil product. Feb. 14.
„ 24,936 (1905). Oelwerke Stern-Sonneborn A.-G. Manufacture of ricinus oil product. Feb. 14.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

[A.] 2826. Flack, and Humidine, Ltd. Non-corrosive and antifouling paints. Feb. 5.
„ 2962. Brindley. Manufacture of pigment oxide of iron from waste liquors. Feb. 7.
[C.S.] 5882 (1905). Candau and Candau. Manufacture of lithopones by electrolysis of sulphate or chloride of soda, and production of caustic soda. Feb. 14.
„ 15,170 (1905). Abel (Act.-Ges. f. Anilinfabrik.). Manufacture of new colour lakes. Feb. 14.

(*B.*)—Resins, Varnishes.

[C.S.] 10,387 (1905). Fresenius. *See under* XII.
„ 11,191 (1905). Braschler-Kurtz. *See under* III.

(*C.*)—India-Rubber.

[A.] 2478. Nicholson. Vulcanising apparatus. Feb. 1.
„ 2791. Jackson. Material for use in the manufacture of rubber substances. Feb. 5.
„ 3052. Bonnefin. Process for extracting india-rubber from plants. Feb. 8.
„ 3234. Gubbins and Harnett. Apparatus for treating india-rubber waste. Feb. 9.
[C.S.] 16,691 (1905). Marter. Rubber composition. Feb. 7.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 2230. Glasel. Tanning and depilating skins.* Jan. 29.
„ 3107. Lerman, Schwartz and Pikos. *See under* IV.
„ 3141. Laurent. Treatment of leather.* Feb. 8.
„ 3191. Weill and Stewart. Treatment of leather waste and production of manure. Feb. 9.
[C.S.] 18,338 (1905). Bögel. Process and apparatus for the uninterrupted extraction of tanning substances. Feb. 7.

XV.—MANURES, Etc.

[A.] 3191. Weill and Stewart. *See under* XIV.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 2591. Higginbottom. *See under* I.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 2242. Wagner. Brewing material derived from starch and analogous farinaceous materials and process of making same.* Jan. 29.
„ 2559. Hartley. Method and apparatus for improving the flavour of carbonic acid gas used for carbonating beer. Feb. 2.
„ 2584. Felix. Manufacture of malt preparations.* Feb. 2.
„ 2693. Hunt. Treatment of spirituous liquors in a rapid and economical manner for the production of matured potable spirits. Feb. 3.
[C.S.] 7962 (1905). Lennox and Mackenzie. *See under* I.
„ 8372 (1905). Crossman. Spargers for obtaining extract from malt, grain, &c. Feb. 14.
„ 18,748 (1905). Roche. Process of sterilising and preserving beers. Feb. 14.
„ 21,928 (1905). Imray (Rach). Brewing apparatus. Feb. 14.

XVIII.—FOODS, SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—Foods.

[A.] 2390. McDonnell. Butter substitutes. Jan. 31.
„ 3206. Galbraith. Treatment of milk, cream, and butter. Feb. 9.
[C.S.] 4304 (1905). Sarason. Milk preparation. Feb. 7.
„ 13,909 (1905). Lawson. Electric purifier for purifying flour, grain, rice, &c. Feb. 7.
„ 23,982 (1905). Salomons. Preservation of alimentary substances. Feb. 14.

(*B.*)—Sanitation; Water Purification.

[A.] 2419. Critien. Solution for the prevention and removal of incrustation in boilers, evaporators and distillers. Jan. 31.
[C.S.] 7962 (1905). Lennox and Mackenzie. *See under* I.
„ 8342 (1905). Lennox and Mackenzie. *See under* I.
[C.S.] 8944 (1905). Adams. Sewage purification apparatus. Feb. 7.
„ 9216 (1905). Zerbe. Apparatus for purifying water. Feb. 7.
„ 12,092 (1905). Swallow, Swallow and Filburn. Composition for purifying sewage and other foul waters. Feb. 7.
„ 12,481 (1905). Spivey. Treatment of sewage, trade effluents, and other foul or polluted waters. Feb. 14.
„ 24,402 (1905). Schmidt. Clearing vats for sewage. Feb. 7.
„ 27,240 (1905). Cameron and Commin. Treatment of sewage and similar waste products. Feb. 7.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 2817. Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of celluloid-like masses. [Ger. Appl., Feb. 6, 1905.]* Feb. 5.
„ 2902. De Briailles. Nitration of cellulose by means of acid concentrated by electricity. Feb. 6.
„ 3013. De Briailles. Manufacture of artificial cork. Feb. 7.
„ 3211. Oelmühle and Müller. Cellulose substitute. [Ger. Appl., Feb. 10, 1905.]* Feb. 9.
[C.S.] 5214 (1905). Lilienfeld and Tedesko. Coating paper, fabrics, &c., with viscose or mixtures thereof with pigments, and apparatus therefor. Feb. 14.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 2520. Imray (Soc. Chem. Industry in Basle). Manufacture of camphor.* Feb. 1.
„ 2682. Rosenberg. Therapeutical preparation containing formaldehyde. Feb. 3.
[C.S.] 8544 (1905). Bibus and Scheuble. Production of salicylic acid menthol ether. Feb. 7.
„ 17,511 (1905). Knoll, Daege and Knoll. Manufacture of santalol esters from sandalwood oil. Feb. 7.
„ 26,275 (1905). Meister, Lucius und Brüning. Manufacture of dialkylmalonylureas. Feb. 7.
„ 26,821 (1905). Hoffmann-La Roche. Compounds or salts of theobromine. Feb. 14.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 2609. Hoffsümmer. Process for making photographic papers.* Feb. 2.
[C.S.] 9537 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a photographic developer. Feb. 7.
„ 12,867 (1905). Bühler. Pigment printing process. Feb. 14.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 2241. Maguire and Maguire. Matches. Jan. 29.
„ 2819. Silberrad. Explosives. Feb. 5.
„ 2820. Silberrad. Explosives. Feb. 5.
„ 2985. Laszczynski. Manufacture of explosives.* Feb. 7.
„ 3005. Bloxam, and Maganite Explosives Synd., Ltd. Manufacture of explosives. Feb. 7.
„ 3216. James. Matches. Feb. 9.
[C.S.] 2776 (1905). Centralstelle f. Wissenschaft.-Techn.-Untersuch. G.m.b.H. Manufacture of nitroglycerin. Feb. 14.
„ 26,310 (1905). Reese. Process for making nitroglycerin. Feb. 7.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 21,518 (1905). Roth. Instruments for testing benzine, petroleum spirit, and other liquid hydrocarbon mixtures. Feb. 7.
„ 24,137 (1905). Dürr and Hudler. Means for indicating the quality of gas flowing from generators. Feb. 7.

Official Notices.

EXTRAORDINARY GENERAL MEETING OF THE SOCIETY.

Notice is hereby given that an Extraordinary General Meeting of the Society will be held at 3.30 o'clock, precisely, in the afternoon of Tuesday, the twenty-seventh day of March, 1906, at the House of the Society of Arts, John Street, Adelphi, W.C., by kind permission of the Council of that Society, with the object of considering and adopting the resolution mentioned in the Requisition hereinafter set forth:—

"To the President and Council of the Society of Chemical Industry."

We, the undersigned Members of the Society of Chemical Industry, hereby request that, in accordance with Bye-Law 40, you will convene an Extraordinary General Meeting of the Society with the object of considering, and if approved by the said Extraordinary Meeting, of adopting the following resolution (that is to say):—

Resolution.

"That it is desirable that the Society of Chemical Industry as now existing should be incorporated under and subject to the grant of a Royal Charter and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation."

Dated this twenty-second day of December, 1905.

Here follow signatures of the following:—

George Beilby.
V. G. Bloede.
Jas. H. Bowman.
Eugene A. Byrnes.
Eustace Carey.
Prof. Frank Clowes.
Frederick P. Dewey.
Dr. Edward Divers.
Dr. A. R. L. Dohme.
Thos. Fairley.
Dr. Fred. W. Frerichs.
Oscar Guttmann.
Samuel Hall.
Jas. Otis Handy.
Dr. B. J. Harrington.
Dr. Edward Hart.
Otto Hehner.
E. Grant Hooper.
David Howard.
H. Aug. Hunicke.
C. C. Hutchinson.
Prof. Edward H. Keiser.
Prof. W. R. Lang.
Ivan Levinstein.
Arthur R. Ling.
Anthony McGill.
Edward Mallinckrodt.
N. H. Martin.
Prof. R. Meldola.
Dr. Rudolph Messel.
Dr. W. Lash Miller.
Dr. Ludwig Mond.
Henry de Mosenthal.
Prof. Chas. E. Munroe.
Jas. P. Murray.
Robert W. Neff.
A. L. Norton.
D. H. T Peploe.
Dr. W. H. Perkin.
Dr. Frederick B. Power.
Sir William Ramsay.
Sir Boverton Redwood.
Walter F. Reid.
President Ira Remsen.
Sir Henry E. Roscoe.
George D. Rosengarten.
Dr. Samuel P. Sadtler.
Alfred Gordon Salamon.
Dr. Karl F. Stahl.
H. E. Stuart.
Sir Joseph W. Swan.
H. P. Talbot.
M. J. Taylor.
E. C. Thompson.
Dr. T. E. Thorpe.
Prof. W. A. Tilden.
Thos. Tyrer.
John H. Usmar.
W. H. Van Winckel.
S. S. Voorhees.
Dr. W. H. Walker.
R. A. Wallace.
Charles Wightman.
Dr. H. W. Wiley.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

The attention of Members is drawn to the Notice which accompanied the February 15th issue of the Journal.

The Executive of the Congress have arranged with Messrs. Thos. Cook & Son, of Ludgate Circus, E.C., 54, Piazza Esedra di Termini and 1B Piazza di Spagna, Rome, to procure suitable accommodation for members during the Congress, and a list of hotels has been prepared at which accommodation can be provided, with prices. Messrs. Thos. Cook & Son will also furnish, on application, full information as to train services.

The General Secretary will be obliged if those members who have made arrangements directly with the Congress Committee in Rome, will forward their names to the Society, in order that arrangements may be made for a headquarters in Rome and for combined travelling. It would also be of service if they would indicate their contemplated date of departure and proposed route, and also whether they have a preference for any particular hotel in Rome.

Deaths.

Bardsley, Robt., Messrs. Jewsbury and Brown, Manchester. Feb. 20.

Clark, Augustus, Fundicio do Bowman, Pernambuco, Brazil.

Hurst, G. H., 22, Blackfriars Street, Salford. Feb. 5.

Canadian Section.

Meeting held at Toronto on Thursday, October 19th, 1905.

DR. F. J. SMALE IN THE CHAIR.

A STUDY IN CRYSTALLISATION.

BY PROF. JAS. H. BOWMAN.

Those engaged in practical crystallisation are frequently confronted with the fact that many influences, some apparently trivial, affect the process. Great concentration or rapid cooling gives small crystals, less dense solutions or slow cooling produces larger ones. Agitation is also a factor to be reckoned with, as it diminishes the size, while quiescence furthers a large growth. Glauber's salt crystals, for instance, may be reduced to the size of those of Epsom salts, or increased to the dimensions of walnuts, according as these conditions are observed. Not only do we have the same substance crystallising in varying sizes, but in differing forms, so that in a large crystallisation it is sometimes difficult to find a typical shape. If this is true of chemically manufactured crystals, how much more does it apply to those produced in nature which engage the attention of the mineralogist? The crystals of the rocks are often distorted, twisted and compounded, in many cases being only partially formed and defective. The same mineral may vary in form as greatly as a cube differs from a fibre.

One is led to think that the force which causes matter to crystallise is either subject to many vagaries, or that the laws which govern it are frequently interfered with. These considerations suggest the desirability of a study of the force directing the tendency to crystallise.

It is common knowledge that the tendency to crystallise varies widely. The colloids do not crystallise; other substances assume the crystal form only under most favourable conditions and then, perhaps, but obscurely; and still others exist only in a crystalline state.

In studying the influences which affect crystallisation, it is necessary to keep this in mind, as it is assumed that the force with which we are dealing is the measure of this tendency to crystallise, so that in those substances which crystallise with difficulty interference would more readily take place than in those which are strong crystallisers.

If, with a fused crystalline substance, there be mixed a colloid, crystallisation will be interfered with. If, with a crystallised substance in solution, there be mixed a soluble colloid, interference with crystallisation will take place in a similar way. This interference will produce one or more of the following results:—

(a) Total prevention of crystallisation.
(b) Suppression of some of the lines of crystallising growth.
(c) Extension of the crystal to abnormal proportions, causing it to become a compound crystal.
(d) Blending, gyrating, and curving of the crystal or its

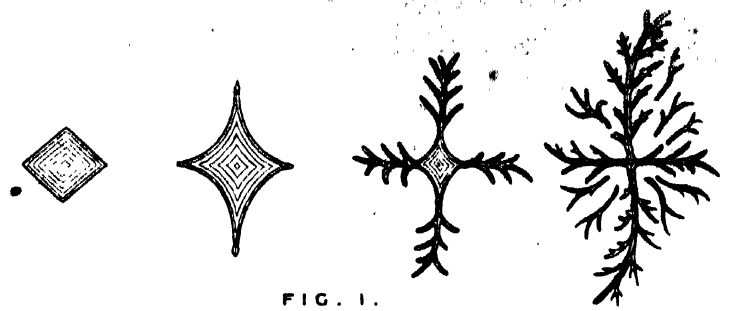


FIG. 1.

Sodium chloride series—showing transition from solid crystal to extended framework; does not polarize.

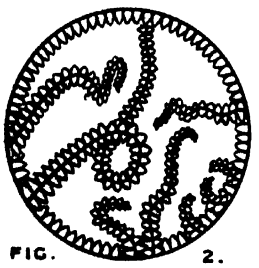


FIG. 2.

Santonine crystals in colloidal medium.

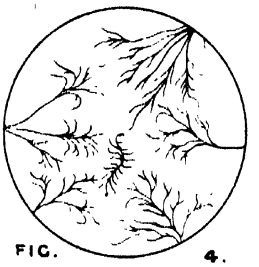


FIG. 4.

Grass-like crystals of potassium platinocyanide and gum arabic.

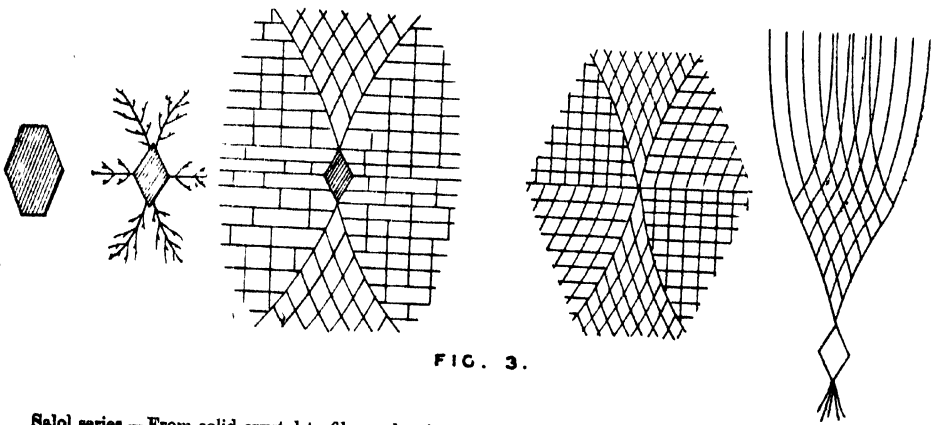
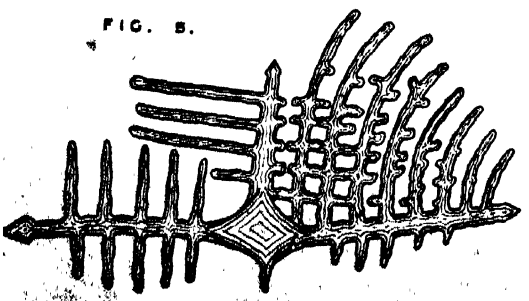


FIG. 3.

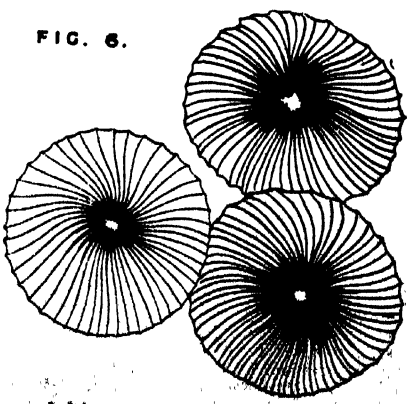
Salol series.—From solid crystal to fibres, showing reticulated "relay" crystals grown to many times their normal size, and relay taking place in both principal and subordinate lines of growth. Crystallized from fused salol and balsam.

FIG. 5.



Pyrogallic acid and castor oil showing "relay" on both principal and subordinate lines of growth.

FIG. 6.



A rounded form of crystal converted into radiating fibres, quite common in colloidal

In explanation of these results, I offer the following hypotheses:—

(1) That there are lines of force along which crystallisation takes place which differ in intensity according to the shape of the crystal and also to their nature whether principal or subordinate.

(2) That the interference with crystallisation referred to occurs because the supply of material is not available to the growing crystal as quickly as the crystallising force requires it.

Method of investigation.—I selected a number of crystallisable substances having the following characteristics:—

(1) They covered a large range, so far as crystallising tendencies were concerned.

(2) They had strong polarising action on light.

(3) They were readily dissolved or fused.

(4) They were miscible with some colloid and not too easily decomposed.

A small quantity of one of these substances was fused or dissolved on a glass slide, together with a suitable colloid, and allowed to crystallise by cooling or evaporation. This was repeated with varying proportions of the ingredients, thus forming a series.

The first clause of the hypothesis, *viz.*, that there are directing forces in a crystal and that they manifest themselves in lines, of which there are principal ones leading from the centre of growth, and subordinates lateral to them, may be readily shown by crystallising a solution of common salt in gum arabic water, on a glass slide. (See Fig. 1, which is a fair sample of the result which may be obtained from a large number of substances treated in this way.)

The second clause, *viz.*, that crystallisation is interfered with by lack of supply, was demonstrated in these experiments by introducing a colloid with the solvent or fused substances. Fig. 2 is a slide of santonine. The medium with which the santonine was mixed in this case was a colloid, which is solid at ordinary temperatures and is soft, but not liquid, at 100° C., at which temperature the substance was allowed to crystallise. The determined efforts of the santonine to crystallise are here well illustrated in its gyrations and loopings. By increasing the proportion of colloid, crystallisation was completely prevented.

The following principles are operative, under the conditions of the experiments, in the formations of the crystals:—

(1) Initiation; (2) Repression; (3) Relay; (4) Curving.

Initiation.—It is a familiar fact that if a crystal be introduced into a solution of the same substance, crystallisation will be induced. As an illustration, I may instance fused salol, which, when touched with a small salol crystal adhering to a needle point, immediately begins to crystallise. This "initiation" is a very important principle in all stages of the process of crystallisation.

Repression.—When crystallisation is taking place in a liquid, currents are set up, to and from the forming crystals. The rate of the currents is affected by the strength of the crystallising force and, also, by the thickness or viscosity of the liquid. If the supply of material is not brought to the crystal as fast as the crystallising force demands, the growth will follow the principal lines, *i.e.*, the lines of strongest force, and result in the suppression or partial suppression of the subordinate lateral lines, this giving the crystal a tendency to become fibrous or filiform.

Relay.—By this I designate a process by which a compound crystal is formed. It may be described as follows:—The growing point of a crystal pushes itself into new material and becomes the cause of initiation. The advancing crystal is repeatedly relayed by the force of other crystals, and in this way will grow indefinitely, unless prevented, either by obstruction or lack of supply. Not only does relay take place along the principal force lines, but along the subordinate ones as well. When the latter are "relayed" they initiate lines equal, or nearly equal, to the principal ones. (See Figs. 3 and 5.)

Curving.—Where the crystallising force is nearly equalled by the resistance of the medium due to its viscosity, the crystal seeks the line of least resistance, which seems to be a gyratory one. The result is the twisting and curving of the crystal or its parts into feathery, fern-like or arborescent shapes.

Between the normal crystal and the fibre many stages exhibit themselves, as shown in the illustrations, *viz.*, reticulated, grass-like, fern-like, arborescent, &c. See Figs. 3, 4, 5 and 6. To exhibit these forms there were projected on the screen slides of tartaric acid, antipyrin, potassium quadroxalate, salicylic acid, oxalic acid, pyrogallol, &c. Illustrations of these forms may also be found among minerals, in zinc, on the surface of galvanised iron sheets, and more familiarly still in the frost-work on our windows in winter. The logical inference from these experiments is that all crystals, if treated by some suitable method, may be made to elongate or twist or even become fibrous. I have found this result in so many cases that I think it may prove true of all, save where the crystallising force is so strong that no colloid, equal to the task of restraining it, can be found.

In crystals having one diameter longer than the other, the conversion to the fibrous form is easier than where the diameters are alike. In studying the building of a crystal, the growing edge should be the point of observation. The foregoing demonstrations make this very apparent.

A crystallisation which admirably illustrates my position, and at the same time gives extremely beautiful effects with the projection apparatus, is that of camphor monobromide. The crystal is formed by fusing a small quantity of the salt with some fir balsam on a glass slide, placing over the mixture a cover glass and allowing it to crystallise. It forms a mass of curving, feathery, concentric rainbows of brilliant colours, and, as an exhibition of crystal growth, can hardly be excelled. Heated to about 70° C. it will fuse, and if then placed in the lantern or on the microscope stage, in a few seconds it will begin to crystallise and for some time will give very beautiful and instructive results. By varying the proportion of the salt and the balsam, the principles I have been contending for, may be illustrated. A mica plate improves the exhibit.

Liverpool Section.

Meeting held at Liverpool, on Wednesday, 10th January, 1906.

MR. EUSTACE CAREY IN THE CHAIR.

HURTER MEMORIAL LECTURE.

THE UNION OF CHLORINE AND HYDROGEN.

BY HAROLD B. DIXON, M.A., F.R.S., late Fellow of Balliol College, Oxford; Professor of Chemistry in the University of Manchester.

That one, who has devoted a large part of his scientific life to the study of the influence exerted by minute traces of matter on chemical reactions, should be invited to give the Hurter Memorial Lecture is, I take it, not only a compliment to me, but a tribute to the catholicity of the man in whose honour we meet here to-night. Those who knew Ferdinand Hurter admired him not only as a man of indomitable energy and remarkable insight, and of wide reputation in the domain of applied chemistry, but also as a man whose soul, soaring above mere results, ever desired to penetrate the mysterious mechanism of chemical change. I make no apology then in asking you to consider, in this lecture dedicated to Hurter's memory, the mode of combination of chlorine with hydrogen, and the extraordinary influence exerted by traces of foreign matter on the reaction, a study interwoven with that so ably worked out by Hurter on the decomposition of hydrochloric acid by oxygen.

My own work on chlorine was begun with the object of

testing the law of mass action in gases. I had studied the division of oxygen between hydrogen and carbonic oxide (the original problem attacked by Bunsen), and had found it complicated by the fact that oxygen and carbonic oxide are largely inert towards one another in an explosion. A simpler case seemed to be presented by the division of hydrogen between oxygen and chlorine. In conjunction with my pupil Mr. J. A. Harker, I measured the small contraction which took place when electrolytic hydrogen and chlorine combined in a glass vessel, and found it to be due to the condensation of hydrogen chloride on the surface. Mr. Harker carried out the experiments on the explosion of the three gases, and found that an equilibrium was reached between two opposite chemical changes:

$$4HCl + O_2 \rightleftarrows 2H_2O + 2Cl_2$$

similar to that found for hydrogen, carbonic oxide and oxygen:—

$$H_2O + CO \rightleftarrows H_2 + CO_2.$$

In the next place we were driven to measure the velocity of explosion of electrolytic hydrogen and chlorine. Among the many possible reactions of gases, I think no one would choose those of chlorine as a subject for exact quantitative study, if he could find any other gas that would answer his purpose. In my case, I could find no other gas having the desired properties, *viz.*, that it should explode with another elementary gas, that the product should be nearly a perfect gas, and that no alteration of chemical volume should accompany the change. A mixture such as hydrogen with nitrous oxide gives water-vapour on explosion; a mixture of cyanogen with oxygen in equal volumes gives a product of sufficiently perfect gases (carbonic oxide and nitrogen), but there is an increase from two volumes to three. Now I had been led to develop a theory of the explosion-wave in gases which attributes the propagation of the explosion to the movement of an intense sound-wave through the gases, a wave which is re-inforced and kept uniform from layer to layer by the chemical action accompanying the collisions of the molecules in the wave-front. The theory did not fit with the facts observed when carbon compounds were burnt to carbonic acid, or when hydrogen compounds were burnt to water-vapour at the highest temperatures of the explosion. The explanation appeared* to be the dissociation of the carbon dioxide or water formed in the wave-front, for, on diluting ordinary electrolytic gas with excess of hydrogen or oxygen or nitrogen, the found rates approximated more and more to the rates calculated by the theory. On the other hand, when the chemical volume was altered by the change, the products would be, for the moment, hotter or colder according as the volume was increased or diminished—just as if they had been suddenly compressed or rarified mechanically. In calculating the theoretical rate of the "sound-wave" in the explosion of such gases, I assumed the temperature must be raised or lowered by the adiabatic compression or rarefaction corresponding to the change in volume. But obviously such an assumption required to be confirmed by experiments with mixtures which did not alter in volume. What mixture would give the same volume on explosion, and also a nearly perfect gas as product of the explosion? The *only* mixture I could think of was that of chlorine with hydrogen, exploding to hydrochloric acid. Accordingly this mixture had to be tried.

The first difficulty was to obtain a tube sufficiently long to measure the explosion-wave in; for the theory indicated that it would travel about 1700 m. per second. A platinum tube 50 m. long, and about 10 mm. in diameter would have answered the purpose. In default of this I tried various baser metals, hoping that a coating of chloride once formed might protect the tube from further action. But the tubes had voracious appetites which could not be allayed; the chlorine seemed, like Cleopatra, to make them hungry when most she satisfied. Then I turned to glass. I thought that a long tube might be drawn out and coiled as it was drawn, but my request to manufacturers to make me such a coil met with expressions of derision which left me a little sore. At length I received an invitation from a firm in Manchester to visit their works, where I had the pleasure of seeing such liberties taken with hot glass that I had great hopes they could easily draw me a tube say—to be modest—60 ft. long. But when I put my hopes into words I was met by the crushing rejoinder:—"You have seen our works; *where* do you think we have got room to draw a tube 60 ft. long? The thing is impossible!" I retired crest-fallen; but the firm were better than their words. A month afterwards I received a note from them saying "we have drawn you two straight tubes 34 and 31 ft. long, come and take them away." I had not thought about the tubes being *straight*, and for a moment their transport presented some difficulty. But very early one morning four men might have been seen marching through Manchester with a long ladder on their shoulders. The tubes were loosely tied to the ladder, and by the removal of a window frame, the ladder was introduced into a corridor of the laboratory, where the two tubes were joined together and my dream of a 60 ft. glass tube became in reality one of 65 ft. The apparatus was completed by attaching a short metal tube at either end to carry the silver-bridges, taps, firing wires, &c.—the interior of these tubes being coated with paraffin and filled with hydrogen and oxygen. They were joined on to the glass tube (when the latter was filled with hydrogen and chlorine) immediately before the gases were fired. A year later it was possible to obtain 6 ft. iron tubes lined with glass, tubes which could be screwed up tight to one another with paraffined asbestos washers. In this way I built up a glass tube 120 ft. long, and confirmed the earlier experiments.

The first point to determine in the explosion of hydrogen with chlorine, was whether aqueous vapour retarded or facilitated the explosion. I knew of no published researches on this point, when our measurements began; most experimenters had used moist gases. But Pringsheim's work (1887) showed that moisture has a great effect on the union of hydrogen with chlorine under the influence of light, and our work confirmed this in a striking way. We found the light required to explode hydrogen and chlorine, when dried by phosphorus pentoxide, was 25 times more intense than that required to explode the moist gases.* I can easily demonstrate to you the effect of drying the gases, by submitting a dry and a wet bulb to the light from a "magnesium flash" equidistant from the two bulbs. The wet bulb is shattered to powder, the dry bulb remains intact. But this is not the case when the gases are fired by an electric spark. The mean velocity of the explosion-wave in dried hydrogen and chlorine is 25 m. per second *faster* than the mean velocity in the moist gases. In other words, once the explosion-wave is set up by the spark, it appears to travel independently of the moisture present which merely acts as a diluent. The velocity of explosion in electrolytic chlorine and hydrogen was found to be rather less than the velocity calculated by my sound-wave formula, but much nearer to the calculated number than in the case of the explosion of electrolytic oxygen and hydrogen. When a mixture of two volumes of hydrogen with one of chlorine was exploded, the found and calculated velocities were in close agreement. I interpret this to mean that, in the explosion of equal volumes of hydrogen and chlorine, the temperature in the wave-front is high enough to dissociate some hydrogen chloride. In the following table I compare the found and calculated rates of explosion for some very different mixtures of gases:—

Rates of the explosion-wave in metres per second.

Mixture.	Found.	Calculated.
$8H_2 + O_2$	3,535	3,554
$H_2 + 3O_2$	1,712	1,740
$2H_2 + Cl_2$	1,849	1,832
$C_2N_2 + O_2$	2,728	2,725
$C_2H_2 + 2O_2 + 8N_2$	1,734	1,727

It is almost inconceivable that the rates of explosion for such very different mixtures of gases could be given

* These experiments have been repeated with great care by H. B. Baker and by Mellor and Russell with chlorine and hydrogen prepared in different ways. The thoroughly dried gases not only resist the action of sunlight, but require a much higher temperature to start their combination.

by the formula unless the mode of propagation were similar in each case. I believe, therefore, that chlorine combines directly with hydrogen at the high temperature of the explosion wave.

The first observation on the union of hydrogen and chlorine under the influence of light is due to W. Cruickshank in 1801. Dalton, in the summer of 1809, experimenting with the mixed gases over water, noticed that a diminution did not take place immediately on exposure to light, but only after a minute or two; that the more powerful the light the more rapid is the combination; that the combination is checked by shading the eudiometer; and that bright sunlight causes an explosion. Gay-Lussac independently observed the explosion of the mixed gases in bright light.

The systematic study of the action of light on hydrogen and chlorine was taken up by Draper in 1843. He devised an ingenious U tube for preparing the gases electrolytically, and storing them over water saturated with chlorine in the closed arm of the U. The diminution in volume, owing to the formation of hydrogen chloride and its solution in the water, was read off on a scale attached to the open arm. This instrument he called a tithonometer, and the action of light on the mixture he called tithonisation. The name is a somewhat puzzling one. The only derivation I can think of is from the Greek demi-god Tithonos, the husband of Aurora. Now Tithonos is pictured in Greek mythology as a decrepit old man shrinking before the brilliance of his wife—the goddess of the dawn. Tithonisation would, therefore, be the process by which a man absorbs the penetrating shafts directed upon him by his more brilliant wife, and finally shrinks up when she casts the light of her countenance too continuously upon him. The name may be appropriate for the absorption of light and the subsequent shrinking of hydrogen and chlorine—though we cannot help wondering whether Dr. Draper was a confirmed misogynist. Sir Henry Roscoe, with greater gallantry, has rejected the name in favour of "actinometer."

Armed with his tithonometer Draper proved that a large amount of radiant matter is absorbed before chemical combination takes place, that combination then begins slowly and increases in rapidity until a constant rate is attained. He showed that the change impressed on the chlorine by the absorption of light prior to the combination was not lost on standing in the dark for some hours. Draper also showed that the maximum sensitiveness to light was attained when the gases were present in exactly equal volumes, a small excess of either gas retarding the rate of combination considerably.

Draper established the fact that after the rate of combination had become constant the movement of the tithonometer was proportional to the quantity of the incident rays.

One of the most important observations made by Draper is that chlorine, when exposed to sunlight, and then mixed (in the dark) with hydrogen, combines *immediately* with the hydrogen when the mixture is exposed to diffused daylight; whereas "non-insolated" chlorine, when mixed with hydrogen in exactly the same way, shows a long period of inactivity. This change in the chlorine produced by sunlight lasts a long time, and is not due to any temporary elevation of temperature. Draper, therefore, regarded the light as being absorbed by the chlorine and as exalting its affinity for hydrogen: insolated chlorine being thus an allotropic form of ordinary chlorine. It has always appeared to me difficult to explain away the fact recorded by Draper; but other observers, working with apparently more delicate instruments, failed to detect any difference between insolated and non-insolated chlorine. It remained for Bevan to explain this discrepancy.

Bunsen and Roscoe greatly improved the apparatus for observing the action of light on the mixed gases, and their actinometer has served as the model for all subsequent instruments used in these investigations. It will be interesting, therefore, for you to examine the actinometer on the table, one of the original instruments devised by Bunsen and Roscoe. I think the chief improvement we have since made in this apparatus is in the electrolytic cell, where we use for the electrodes carbon rods *fused* into glass tubes. Working with this actinometer, Bunsen and Roscoe proved conclusively that pure electrolytic chlorine and hydrogen, in equal volumes, when exposed to light, form no hydrochloric acid for the first few moments, but after a time they begin to combine with a gradually-increasing rapidity until a permanent constant action is attained. This "period of induction," as Bunsen and Roscoe called it, was attributed by them to the breaking down by the action of light of a resistance to the combination of the two gases; they did not consider that the chlorine was altered *per se* by the light, or its affinity exalted. In fact, their experiment of bringing the insolated gases by separate tubes into the induction vessel appeared to show that chlorine, when illuminated by itself, was just in the same condition as unilluminated chlorine. This discrepancy, Bevan has shown, is due to the action of the water in the induction vessel. If chlorine is illuminated over water (as in Draper's experiment) and hydrogen is added to it, the mixture is found to be sensitive to light; if the chlorine is illuminated in a tube and then bubbled through water, the "activity" of the chlorine may be destroyed by the water (as in Bunsen and Roscoe's experiment). It still remains to be explained why the water should so act, and on this problem I hope to show you some very recent experiments that throw light on it.

On another important feature of the "Induction" Bunsen and Roscoe's experiments differ from those of Draper. Draper thought that the induced gases retained their sensitiveness indefinitely; Bunsen and Roscoe found that the induction effect gradually died away in the dark, although the diminution of activity in the dark was much slower than the increase in the light. Here, again, an explanation of this gradual diminution of sensitiveness has only recently been attained. Bunsen and Roscoe also showed the great effect on the amount of combination due to the presence of a small excess of either of the gases, hydrogen or chlorine; and the still more marked diminution caused by the presence of small amounts of oxygen. This marked effect of small quantities of the reacting gases shows that the combination in the light is not governed by the ordinary law of mass action.

When the chlorine and hydrogen mixture brought to the sensitive state is illuminated for an instant, *e.g.*, by an electric spark from a Leyden jar, there is a sudden expansion of the gases, followed immediately by a contraction. This effect was described by Draper. Pringsheim, who seems to have rediscovered this "Draper effect" independently, attributes it to the dissociation of the molecules and the recombination of the dissociated atoms. He considered that he had shown that no hydrochloric acid was produced by the momentary illumination, and, therefore, that the expansion could not be a heat effect. Pringsheim was the first to produce evidence that water took part in the reaction between chlorine and hydrogen under the influence of light. His idea was that the steam was decomposed by the chlorine forming an intermediate compound, *e.g.*, an oxide of chlorine, which, in turn, was decomposed by the hydrogen with formation of hydrochloric acid and water:—

i. $H_2O + Cl_2 = H_2 + Cl_2O$.
ii. $Cl_2O + 2H_2 = 2HCl + H_2O$.

The rate of production of hydrochloric acid depends, then, on the amount of hypochlorous oxide present, and this depends on the length of exposure and the intensity of the light. When the rates of formation and decomposition of the hypochlorous oxide have become equal, the formation of hydrochloric acid will continue at a constant rate which will depend upon the intensity of the light.

Among those who have worked in the Owens College during recent years on the union of hydrogen and chlorine Dr. J. W. Mellor has particularly studied the "Draper effect." He has shown, I think conclusively, that the sudden expansion is always accompanied by the formation of hydrochloric acid, and is probably due to the heat evolved in its formation. Mellor has proved that if an intermediate body is formed in the period of induction, it cannot be either hypochlorous oxide or the corresponding acid, hypochlorous acid, for the addition of either of these bodies does not hasten the combination. To account for the period of induction

Mellor assumes that an intermediate "associated" compound is formed by the chlorine, water and hydrogen. Bevan, on the other hand, having shown that moist chlorine is made active by light, as Draper had stated, assumes that an intermediate compound of chlorine and water is first formed, and that this reacts with hydrogen forming hydrochloric acid and water.

Another mode of attacking the problem of the mode of action of light is to determine the filtering effect of chlorine on the actinic rays. Bunsen and Roscoe found that a mixture of chlorine and hydrogen absorbed more light than a mixture of chlorine with an inert gas; and Mellor has found that moist chlorine forms a better light-screen than dry chlorine. Further experiments on these lines are wanted.

I have now to bring before you a short account of the recent work which has been carried out in the Owens College by Messrs. D. L. Chapman and C. H. Burgess. The details of their experiments and their theoretical conclusions are not yet published, but I am permitted to show you experimentally with one of their actinometers the important fact they have established, *viz.*, that mixtures of hydrogen and chlorine may be made which retain their sensitiveness to light for an indefinite period—mixtures that have in short no period of induction. According to Chapman and Burgess the pure gases always combine instantaneously; it is the presence of impurities in minute traces that produces the period of induction.

In their earlier experiments, Chapman and Burgess proved that the gaseous mixture, rendered active by light, lost its activity on standing over water in the dark, but that this loss became less marked on each repetition of the experiment with the same water. Finally, however, the loss, though slight, *did not entirely disappear*. This led them to suspect that the induction period might be due to some impurity, and that the water might acquire from the glass vessels something that retarded the rate of combination. These experiments clearly established the necessity of making the water "active" as well as the gases themselves. When salt solutions, *e.g.*, calcium or barium chloride were employed instead of water, far longer induction periods were observed. But after sufficient insolation and shaking of the solution with the gases the latter became as sensitive as over water. The substitution of a quartz vessel for the glass actinometer appeared to confirm the view that glass destroyed the activity; but the effect was really due to the fact that the quartz vessel had been heated in order to drive out the air. Experiments at 100° C. soon demonstrated that water and salt solutions heated with chlorine became rapidly "active." The question whether the decay of activity on standing in the dark was increased by raising the temperature was also tested; the rate of decay of thoroughly insolated gas over barium chloride solution was *diminished* by heating. If light produces some "active principle" in chlorine capable of bringing about the combination of hydrogen and chlorine, heat also has the power of producing the same principle in chlorine water, and water saturated with this "activity" no longer dissolves out the active principle from the active gases in contact with it. Moreover, the "activity" cannot be pumped out of the solution with the dissolved chlorine; on the contrary, a solution from which the chlorine had been pumped away was found to be more "active" than the solution saturated with chlorine.

Chapman and Burgess had now shown that solutions of certain salts had the power of stopping the formation of hydrochloric acid for many hours, but that once the induction period was over the gases combined rapidly under the action of light. This was difficult to reconcile with any theory of the gradual formation of an intermediate compound, since such a compound should be formed at the same rate that it is afterwards decomposed when the constant state is reached. Again, Chapman and Burgess introduced into an active mixture of hydrogen and chlorine, standing over an active solution, an equal volume of an uninsolated mixture of the gases. If an intermediate compound were already present in the active gas, one would expect that its effect would be diminished by the dilution, but the formation of hydrochloric acid was absolutely stopped for a considerable period.

The difficulty of reconciling these several results with any theory of the formation of an intermediate compound led Chapman and Burgess to consider another possible explanation. Could the solution contain some impurity which alone or by reacting with chlorine could give off a volatile body capable of stopping the reaction until completely destroyed? Ammonia seemed such a possible impurity, and experiments promptly showed that it possessed the required properties. Solutions rendered "active" by boiling with chlorine were rendered "inactive" by the addition of a trace of ammonia when cold. On exhaustion, the ammonia or its chlorine derivative was removed, and, of course, on boiling the solution with chlorine the ammonia was destroyed. Chapman and Burgess have shown that the induction period is proportional to the quantity of ammonia in the water. They have further shown that the very slow decay of activity, found when the active actinometer is allowed to stand for several days in the dark, is due to the oxidation of some trace of albuminous substance in the water with the formation of ammonia or its derivatives. Water or salt solutions which have been well boiled with chlorine show no "decay."

The actinometer on the table before you was prepared by Mr. Chapman and has now been standing some 28 hours in the dark. I will ask you to observe the position of the index on the scale while I flash on to the bulb the rays from an incandescent electric light. Notice the instantaneous expansion (the Draper effect) followed by the steady movement of the liquid along the scale towards the bulb. There is no period of induction but a uniform formation of hydrochloric acid.*

But if Chapman and Burgess have explained the induction period by their laborious research and close reasoning, we have still to answer the question "How does the water-vapour influence the combination?" If chlorine can act on hydrogen in presence of water, why does it not do so so long as the ammonia-impurity is present? It is conceivable that chlorine slowly forms a compound with water, and that this compound rapidly acts on the ammonia-impurity by chlorination, hydrochloric acid being formed only when all the impurity is destroyed. But to my mind there are great difficulties in this view. The facts established by Chapman and Burgess can, however, be otherwise interpreted. I have not seen their interpretation, but, on thinking over their experiments, several possible solutions presented themselves to me, and one interpretation which I think worthy of your notice was suggested to me by the phenomena—so much under observation at this moment—of a large political meeting. The individuals—the molecules of the meeting—were not reacting under the stress of collisions in a more or less heated state; they—like our hydrogen and chlorine molecules in light—were being acted on from a distant platform by mere vibrations of a sympathetic kind, and were being induced and stirred to future action. Suddenly a young lady waved a banner and lifted up her voice—unsympathetically. If it had been a question of a change brought about by *collisions* between individual *bodies*, the young lady would have had very little chance to effect anything among so many more powerful bodies; but her effect on the *harmony* of the meeting was instantaneous and complete. The whole programme of proceedings was stopped for half an hour.

Suppose that the system Cl_2, H_2O, H_2 is set gradually vibrating by light and that, when the proper harmonic vibration is set up, then it is possible for chemical change to occur. Now the presence of a small quantity of a vibrating body "out of tune" might stop the harmonic vibration of the other molecules, and so stop the chemical action. A very small proportion of the discordant body might suffice.

I told Mr. Chapman my interpretation of his facts when he at once said, "That is the essence of the explanation I have worked out."

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* On repeating the experiment after the lecture, a drop or two of the liquid from the scale tube entered the bulb. On drawing the liquid back and re-illuminating the bulb, there was a distinct period of induction lasting 2 or 3 minutes. The trace of impurity in the index liquid was then destroyed, and further experiments showed no induction.

I have in conclusion to invite your inspection of the apparatus which Mr. E. C. Edgar and I have recently used to redetermine the atomic weight of chlorine by combining it directly with hydrogen. When we commenced this work, four years ago, it required some courage to think that any useful purpose could be served by redetermining a constant which the highest living critic declared had been measured with "the magnificent accuracy of Stas' determination." But, by the time our measurements were completed, evidence began to come in indirectly that possibly even Stas might have made a mistake. But apart from any considerable error in any of Stas' determinations, the very indirect method by which the atomic weight of chlorine had been determined made it certain that an error in any part of the chain connecting chlorine with hydrogen would be repeated from link to link, and would become evident only when the two ends of the chain were connected up.

A direct comparison between hydrogen and chlorine might not only serve to detect any systematic error in this chain of ratios, but such a comparison, inasmuch as it does not involve the probable errors of other ratios, would be *cæteris paribus* more exact. Again, the closing of the chain between hydrogen and chlorine with reasonable accuracy would permit the accidental errors to be distributed and prevent their accumulation at the unconnected end. The accumulated probable error in Clarke's recalculated value for chlorine is 0·0048; the probable error of the mean of our nine experiments is 0·0019.

The suggestion to carry out this work was made to us by Professor Edward W. Morley, who happened to visit our laboratories when pure chlorine was being prepared by the electrolysis of fused silver chloride. He suggested that we should burn weighed hydrogen and chlorine in a closed vessel, just as he had burnt weighed hydrogen and oxygen.

Chlorine was prepared for our determination by the electrolysis of silver chloride fused in a Jena glass U-tube, to the arms of which purified carbon poles were *fused*. The chlorine was condensed to a liquid and weighed in a glass bulb connected with a sealed tube and tap. After the bulb had been weighed and brought into position, the sealed tube was broken by a small glass rod falling on it inside the apparatus. The gas could then escape by the tap and ground tubulure into a large combustion-globe. The tap had the peculiarity that its smaller diameter was at the top, so that instead of the key having to be *pushed* into its sheath, it had to be *pulled* into it to fit. The pressure of the chlorine, therefore, instead of tending to loosen the key, only made it fit more tightly. The hydrogen, prepared by the electrolysis of a hot solution of barium hydroxide, was dried by potash, passed over heated spongy platinum to eliminate any oxygen, then through long U-tubes filled with purified phosphorus pentoxide, and was finally absorbed by palladium. After the apparatus had been well washed out with hydrogen, the palladium bulb was sealed off and weighed. The hydrogen was introduced slowly from the palladium into the combustion-globe previously filled with chlorine. A spark lighted the jet which was kept burning by regulating the supply of the two gases until all the chlorine had been volatilised. About 2 per cent. of chlorine remained unburnt in the globe, which contained pure water to absorb the hydrogen chloride as it was formed. The residual gases were then analysed.

The mean of our nine determinations gives the atomic weight of chlorine as 35·195 if H = 1, or 35·463 if O = 16. Our value is considerably higher than that given in Prof. F. W. Clarke's "Recalculation of the Atomic Weights," *viz.*, 35·447. But that Stas' figure is too low has been confirmed indirectly by the work of Prof. Theodore Richards on the ratio between silver and chlorine, and by the work of Dr. Scott and of Mr. R. W. Gray on the atomic weight of nitrogen. It may indeed turn out that the highest of the values found in our nine experiments are more nearly correct than the mean. Mr. Edgar is continuing the investigation and hopes to avoid one source of error by burning the chlorine at a jet in an atmosphere of hydrogen.

We have to thank our glass-blower, Mr. Otto Baumbach, for the skill with which he has made this apparatus.

London Section.

Meeting held at Burlington House on Monday, February 5th, 1906.

MR. R. J. FRISWELL IN THE CHAIR.

THE LOSS OF NITRE IN THE CHAMBER PROCESS.

PART II.

BY J. K. H. INGLIS.

(See also this J., 1904, 643.)

Up till the last few years the methods which have been available for the analysis of a mixture of gases have been those in which the changes in volume of the gases have been measured either when the gases were passed through some liquid which absorbed one of the constituents, or when chemical action between two or more of the constituents was brought about by means of a spark. Now although these methods are quite satisfactory when the percentages of the different constituents are all tolerably large, they are not at all accurate or convenient when the constituents which are to be estimated form only a very small percentage of the whole. Thus, for example if the percentage of carbon dioxide in the air is to be determined by measuring the contraction that takes place when a given volume of the air is treated with potash, an extremely elaborate and complicated apparatus is necessary in order that the changes in temperature and pressure may be compensated. Hence such a determination is more conveniently carried out by determining the carbon dioxide itself by chemical methods, *e.g.*, by absorbing it in standard baryta and titrating the excess of baryta with oxalic acid. But in a case in which the constituent cannot be absorbed in such a way (*e.g.*, nitrous oxide), the analytical methods have almost completely failed.

The discovery of convenient methods for preparing liquid air at a moderate cost has placed a new method in the hands of the analyst. For many years the chemist has been in the habit of separating liquids from one another by the process of fractional distillation; and since by means of liquid air nearly all gases can be turned into liquids or solids, one has only to devise methods for the convenient fractionation of these solids and liquids in order to produce the desired separation. In the case of the ordinary distillation of liquids the process is usually carried out at constant pressure and the separation of two miscible liquids can be carried out completely only if the line representing the dependence of the boiling point upon the composition of the liquid presents no minimum or maximum. In the case of the distillation of liquefied gases, however, it is more convenient to carry out the distillation isothermally; and although the above limitation still remains valid, yet the conditions of temperature and pressure can be changed so readily that the separation is more likely to be complete.

The methods for the fractionation of liquefied gases were first worked out and used by Ramsay and Travers (Proc. Roy. Soc., 1898, **63**, 438; **64**, 183; Phil. Trans. 1901) in their work on the new gases of the atmosphere, and the fact that krypton and xenon were discovered although they amount to only one part in several millions by volume, shows what an extremely good separation can be effected by this method. It seemed possible that the same process might be suitable for the solution of some of the difficult problems in gas analysis; and Sir William Ramsay kindly suggested that I should attempt to solve in this way a problem which arises in connection with the chamber process for the manufacture of sulphuric acid. In this manufacture an amount of nitre has to be continually supplied which is equal in weight to about 5 per cent. of the total sulphur burnt. A large number of investigators have attempted at different times to discover what becomes of this nitre, but their efforts have not been very successful. The result has been that manufacturers have not known to what this loss was due, and therefore have not been able to prevent it.

Now, whatever view we take of the theory of the reactions in the chambers, the nitre must be considered as being present either as nitric oxide, nitrogen trioxide, or nitrogen peroxide, and if there is sufficient excess of oxygen the nitre should not be present as nitric oxide for any length of time. Hence, since nitrogen trioxide and peroxide are both soluble in sulphuric acid (C.O.V.) forming nitrosulphonic acid NO_2SO_3H (and possibly nitric acid) they should be retained by the acid which passes down the Gay-Lussac tower. This acid, when it is passed down the Glover tower, is denitrated by the sulphur dioxide coming from the burners, and the reaction may be written as

$$2NO_2SO_3H + SO_2 + 2H_2O = 3H_2SO_4 + 2NO.$$

Hence, since the nitric oxide formed passes on into the chambers, all the nitre should be retained in the plant and theoretically no fresh supply should be needed. When it was found that, in spite of the Gay-Lussac towers, a steady supply of nitre was necessary, two rival theories arose to explain the loss. According to the one theory (Vorster, "Dingler's Journal," **213**, 506), which was brought forward as an objection to the use of the Glover tower, there took place in this tower, in addition to the action already given, the following reaction:—

$$2NO + SO_2 + H_2O = H_2SO_4 + N_2O.$$

In this way a portion of the nitrous gases was supposed to be reduced to nitrous oxide, and as this is not absorbed by the sulphuric acid in the Gay-Lussac tower, and, in addition, is of no use in the manufacture of sulphuric acid, it would be a total loss. Lunge ("Dingler's Journal," **225**, 474) showed, however, that the conditions under which Vorster carried out his experiments never obtained in the Glover tower, and maintained that the loss due to the formation of nitrous oxide could never be very great. The other theory was that the loss took place solely because of incomplete absorption in the Gay-Lussac tower. This incomplete absorption might be due (1) to the nitre remaining as nitric oxide, and therefore being unabsorbed, (2) to insufficient contact between the gases and the sulphuric acid, or (3) to the fact that the nitrous vitriol formed would have a certain dissociation pressure, and that therefore a certain proportion of the nitrous gases would always remain unabsorbed. But since, in the Gay-Lussac tower, the gases come in contact with a stream of sulphuric acid flowing the opposite way, they should, as they leave the tower, be in equilibrium with the acid entering the tower, *viz.*, pure sulphuric acid, and therefore should contain no nitrous gases. For many years a controversy raged between the exponents of the "chemical" loss and those of the "mechanical" loss, and the question has never been satisfactorily settled. There is no doubt that the chemical loss was at first greatly exaggerated, some chemists (this J., 1884, **3**, 134; 1889, **8**, 167) even saying that the chemical loss could account for 31 per cent. of the nitre lost. But in the same way, Sorel ("Traité," pages 313, 393) declared that the unavoidable mechanical loss amounted to 95 per cent. of the whole loss. In all probability the loss was due to both causes.

Since, according to both theories, the nitre was carried away in the flue leading from the Gay-Lussac tower, it might be thought that an analysis of these flue gases would prove which theory was the correct one. But in these flue gases there was a very large proportion of nitrogen and oxygen, and therefore analyses were difficult to carry out. Some nitrogen peroxide and some nitric oxide were certainly present, but it was difficult to absorb them completely. In addition to this, the flue gas usually contained a small quantity of sulphur dioxide, and when the gases were passed through any absorbent a complicated series of side reactions took place between the nitrogen peroxide and the sulphur dioxide, and the result was that the analytical data could not be interpreted. In addition to this, there was no absorbent for nitrous oxide when its partial pressure was so small, and, therefore, its presence could not be detected much less estimated. This problem, therefore, seemed to be one which might be solved by carrying out analyses by means of fractionation at low temperatures.

Since the nitre lost (calculated as sodium nitrate) is equal in weight to about 3 per cent. of the sulphur burnt, it is possible, if we assume that the whole nitre lost is carried away in the flue gases, to calculate what proportion by volume this loss represents. In the pyrites burners about 48 per cent. of the ore is sulphur which burns to form sulphur dioxide, another 48 per cent. is iron, which burns to form ferric oxide, and the remaining 4 per cent. remains more or less unchanged. Now, 32 grms. of sulphur will require $\frac{3}{2} \times 22{\cdot}4$ litres of oxygen to form sulphur trioxide, and 56 grms. of iron require $\frac{3}{4} \times 22{\cdot}4$ litres to form ferric oxide. Hence 100 grms. of ore require $\left(\frac{48}{32} \times \frac{3}{2} + \frac{48}{56} \times \frac{3}{4}\right) \times 22{\cdot}4$ litres of oxygen $= 64{\cdot}8$ litres. The flue gases usually contain about 6·5 per cent. of oxygen, which is 5·5 per cent. of the original volume of air. Hence $21 - 5{\cdot}5 = 15{\cdot}5$ per cent. of the air passing through the burners is the quantity of oxygen used to form sulphur and iron oxides. Therefore, each 15·5 vols. of oxygen used means 84·5 vols. of flue gas, *i.e.*, 100 grms. of ore mean 353 litres of flue gas.

The loss of nitre corresponding to 100 grms. of ore is $\frac{3 \times 48}{100}$ grm. sodium nitrate which would give a volume of nitric oxide $= \frac{3 \times 48}{100} \times \frac{22{\cdot}4}{85}$ litres $= {\cdot}380$ litre $= 380$ c.c. The loss of nitre should therefore give rather more than 1 c.c. of nitric oxide or an equivalent amount of any other oxide per litre of flue gas.* This calculation shows, therefore, that if a workable quantity of the nitrogen oxides is to be obtained, the volume of gas dealt with must amount to 10—20 litres. Now, although this volume of gas can be easily worked with when once condensed to a liquid, yet it would not be easy to carry gaseous samples of 10—20 litres from the sulphuric acid works to the laboratory. It was, therefore, necessary to carry out the first stages of the fractionation at the works themselves.

The flue gases consist of (1) a mixture of *nitrogen* and *oxygen* containing about 6·5 per cent. of the latter. This mixture does not liquefy under atmospheric pressure at the temperature of liquid air boiling in an open vessel (—189° C.); (2) *nitric oxide*, at —189° C., this is a white solid which has a vapour pressure of about 0·75 mm.; (3) *carbon dioxide* coming from the atmosphere; (4) *nitrous oxide*; (5) *nitrogen trioxide and peroxide*; (6) *sulphur dioxide*; (7) *sulphur trioxide and the vapour of sulphuric acid.* These latter substances 3—7 are all non-volatile solids at —189° C., and therefore it should be easy to separate them at that temperature from nitrogen, oxygen and nitric oxide by pumping away these three gases by means of a mercury pump. By this method, of course, the nitric oxide would be lost; but it seemed worth while to carry out a few experiments to determine the amounts of the other oxides of nitrogen which were present in the flue gases. In order to test the method of separation, a quantity of air containing a known amount of nitrous oxide—the most volatile of the other oxides—was passed through a glass spiral which was cooled to —189° C., by immersing it in liquid air. This spiral could be evacuated by means of a Töpler pump; and, after the whole mixture had passed through it, the spiral was evacuated, thus leaving only the solid nitrous oxide behind. The liquid air was then removed and the nitrous oxide pumped off and collected. Its volume was then measured and compared with the volume taken. Two results, which are given in Table I., show that the amount of nitrous oxide lost is not more than 0·003 per cent. of the whole volume fractionated. Hence this method should give almost the whole of the nitrous oxide, &c., contained in the flue gases.

Table I.

Vol. of air used.	N_2O taken.	N_2O found.	Vol. per cent. of N_2O lost.
1000 c.c.	1·31 c.c.	1·28	0·003
1200 c.c.	1·44 c.c.	1·42	0·002

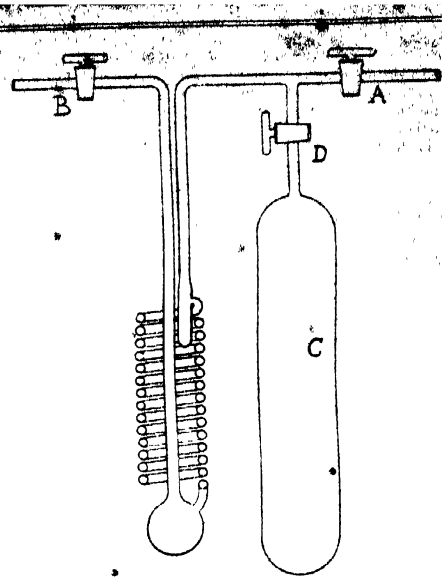
* Mr. E. C. Thompson has kindly checked this calculation by direct measurements made on a sulphuric acid plant, and his figures agree fairly closely with this calculation.

The analysis of the mixture of substances which could be separated in this way from the flue gases still presented some difficulties. It was impossible to use aqueous absorbents until the sulphur dioxide had been separated from the nitrogen trioxide and peroxide so that this stage of the separation had to be done by means of a second fractionation. It was found that at —122° C. the melting point of crude ether, only the nitrous oxide and carbon dioxide were volatile, so that these two could be separated from the other bodies at that temperature. At —95° C. the sulphur dioxide begins to distill over, and at the same time nitrogen trioxide decomposes giving nitric oxide and peroxide, of which only the nitric oxide distills over. Hence, at —95° C. sulphur dioxide and nitric oxide could be pumped away from the peroxide and separated from one another by a second fractionation at —189° C. In this way, the flue gases were divided into the following fractions :—

1. Nitrogen, oxygen and nitric oxide.
2. Nitrous oxide and carbon dioxide.
3. Nitric oxide (from trioxide).
4. Sulphur dioxide.
5. Nitrogen peroxide and sulphuric acid, and possibly nitrosulphonic acid.

The analyses of these different fractions then presented no difficulty. Fraction (2) was measured, then mixed with oxygen (or air) and treated with caustic potash. (The addition of oxygen or air lowered the partial pressure of the nitrous oxide, and therefore lowered the amount dissolved by the potash.) The residue was then again fractionated at —189° C., and the nitrous oxide thus obtained pure. It was then measured, and its volume deducted from the original volume, the difference being the volume of the carbon dioxide. Fractions (3) and (4) required only to be measured. Fraction (5) which was left in the spiral, after the fractionation was complete, was shaken with air and water, thus forming sulphuric and nitric acids. The solution formed was titrated with N/10 barium hydrate, and the amount of barium sulphate formed was determined gravimetrically. From the figures thus obtained, the amounts of nitrogen peroxide and sulphuric acid could be calculated.

A method for analysing the flue gases having thus been worked out, experiments were made in a sulphuric acid works in order to see what conclusions could be drawn; and Dr. Messel, of Spencer Chapman and Messel, Ltd., very kindly gave me leave to carry out some analyses at the works in Silvertown. The plant which was tested consisted of two sets of chambers which had one Gay-Lussac tower each and a third one in common, and the samples were taken direct from the flue which led from this last tower to a large chimney. Two large carboys, fitted with corks and tubes and filled with water, served as aspirators, the volume of gas taken being equal to the volume of water run out, the pressure being shown by means of a small mercury gauge. The water was run out at the rate of about 5—6 litres per hour. In order to cool the gas thoroughly, it was passed through a spiral of the design shown in Fig. 1. The gas entered by the tap A,



and passed down the spiral and then out by the tap B. Since the volume at ordinary temperatures and pressures of the gas, which would be condensed in the spiral, might be considerably greater than the volume of the spiral, the bulb C was evacuated before each experiment and then the tap D closed. In this way after the whole volume of gas had been passed through the spiral, the taps A, B were closed, and then D opened, so that the condensed gas could, on warming up, expand into the bulb C.

The samples of gas were in some cases aspirated directly from the flue through the spiral, but, in the earlier experiments, a wash bottle containing concentrated sulphuric acid was placed between the spiral and the flue. By this means, the last traces of nitrogen peroxide and trioxide were removed, and all risk of the formation of chamber crystals in the bulbs was avoided. Since, however, it was found to be impossible to estimate the nitrous gas absorbed by the sulphuric acid—the quantity being so very small—in the later experiments the washing was omitted, and the gas taken direct from the flue through the spiral. In the earlier experiments the nitrogen and oxygen remaining in the spiral when the taps A, B were closed were not pumped out; and therefore, when the gases warmed up, any nitric oxide was turned into peroxide. But in the later experiments the spiral was evacuated by means of a small mercury pump while it was still in the liquid air, so that any nitric oxide that had been condensed remained unacted upon. The results obtained are given in Table II.

Table II.

Expt.	Date.	Volume in litres.	Nitric oxide c.c. in 10 litres. A.	Nitric oxide c.c. in 10 litres. B.	Carbon dioxide c.c. in 10 litres.	Nitrous oxide c.c. in 10 litres.	Sulphur dioxide c.c. in 10 litres.	Residual acidity.*	Barium sulphate gr. per 10 litres.	Sulphur trioxide gr. per 10 litres.	Nitrogen oxides as NO c.c. per 10 litres. In residue.	Nitrogen oxides as NO c.c. per 10 litres. Total.	Total acidity. Calcd.	Total acidity. Found.
1	June 11	22·6	1·93	—	6·46	0·12	1·90	—						
2		20·4	0·94	—	7·70	0·27	2·87	—						
3	July 1	25·6	—	—	6·15	0·08	2·52	7·15	Gases	washed				
4		27·0	0·35	—	6·5	0·06	3·8	5·8	with	C.D.V.			grains sulphur trioxide per sub. ft.	
5		9·13	1·53	—	5·32	0·25	1·03	0·87						
6	Oct. 13	13·2	1·56	—	5·66	0·09	1·37	0·93						
7		20·0	—	—	5·65	0·09	0·11	3·61						
8		20·3	—	—	5·63	0·33	—	4·6	0·0388	0·0123	2·87	3·33	1·23	1·0
9	Nov. 19	20·5	0·27	—	5·53	0·22	—	4·35	0·0383	0·0121	2·39	2·10	0·99	1·2
10		16·4	2·04	—	4·86	0·11	—	3·05	0·0200	0·0069	3·09	5·26		
11		15·7	1·71	—	4·38	0·09	—	2·6	0·0203	0·0070	1·95	3·84	1·65	1·7
12		18·6	1·8	0·80	4·63	0·10	—	4·1	0·0257	0·0088	4·25	7·05		
13	Dec. 22	16·5	0·2	1·40	5·4	0·16	—	3·9	0·0270	0·0093	3·54	5·80	1·4	1·6
14		17·0	1·06	0·49	5·2	0·12	—	4·4	0·0286	0·0098	4·40	6·24		
15		16·5	1·54	0·62	5·9	0·06	—	3·5	0·0262	0·0090	2·80	5·16		

* Residual acidity is given as c.c. of N/10 baryta per 10 litres.

These 15 analyses fall into two classes. In the first seven experiments, the gases were washed with strong sulphuric acid (C.O.V.) before they passed through the cold spiral; while in the last eight cases, the gases passed direct from the flue into the spiral. The effect of this washing was that all the nitrogen peroxide and water vapour were removed, and therefore the sulphur dioxide, which was caught in the spiral, remained unacted on when the gases warmed up. In the last eight cases the sulphur dioxide formed chamber crystals in the spiral and bulb, and was, therefore, found as sulphuric acid. An attempt was made to preserve the sulphur dioxide from action by drying the gases with phosphorus pentoxide, but this seemed quite ineffective.

In considering the different nitrogen compounds found in the flue gases, it will be simplest to begin with the question of *nitrous oxide*. According to the exponents of the "chemical loss" theory, the loss as nitrous oxide should be a considerable proportion of the whole loss. The analyses, however, at once dispose of this possibility. It is true that nitrous oxide is found, but it seldom exceeds two parts in 100,000 (equivalent to four parts of nitric oxide per 100,000); and since the total loss is somewhat greater than one part per 1000 calculated as nitric oxide, the loss as nitrous oxide does not account for more than 3 or 4 per cent. of the whole loss. As such small quantities of nitrous oxide were found, its identification was somewhat difficult. It can, however, be analysed fairly accurately by measuring the contraction that takes place when it is exploded with hydrogen and by measuring the volume of nitrogen generated. The reaction with hydrogen takes place according to the equation:

$$N_2O + H_2 = N_2 + H_2O$$

Hence, it may be seen, that if the substance is nitrous oxide, both the contraction and the volume of nitrogen formed should be equal to the volume taken. In Table III. are given the results of three analyses which serve to show that gas was really nitrous oxide.

Table III.

Volume taken.	Volume of hydrogen added.	Volume after explosion.	Contraction.	Volume of nitrogen.
c.c.				
1·08	1·51	1·51	1·08	—
0·695	1·06	0·95	0·80	0·695
0·79	1·39	1·37	0·81	—

The analyses of the flue gases show therefore that Lunge was quite right in stating that the loss as nitrous oxide is very small ("Sulphuric Acid and Alkali," Vol. I., pp. 641, 708), and there is very little evidence to support a theory of reduction to nitrogen.

Taking next the question of the *nitric oxide* it is at first sight surprising that any is found. It has already been shown (page 150) that the vapour pressure of nitric oxide at —189° C. is too high for it to be separated at that temperature from the flue gases. The conclusion must, therefore, be drawn, that the nitric oxide was not condensed as such, but was formed in the bulb. Now, in the fractionation, the nitric oxide was found at two stages, namely, in the first fraction when it was obtained mixed with nitrogen, and in the later fraction when it was obtained together with the sulphur dioxide; being formed by the decomposition of the trioxide. In the earlier analyses these were not kept separate; but the two parts were analysed separately, for all the samples collected on Dec. 22. The nitric oxide found as such is given in column A., and that obtained from nitrogen trioxide is given in column B. It seems probable then that the nitric oxide was partly condensed with nitrogen peroxide as nitrogen trioxide, and that it was partly formed in the bulbs by the action of sulphur dioxide.

From the figures for the residual acidity (stated as c.c. of N/10 baryta per 10 litres) and for the barium sulphate (grms. per 10 litres), we may calculate the quantity of sulphuric acid in the residual acidity and also the quantity of acid oxides of nitrogen. The latter is best stated as c.c. of nitric oxide per 10 litres, and these figures are given in the table. From these figures, combined with those for the nitric oxide and those for the nitrous oxide (1 c.c. of nitrous oxide is equivalent to 2 c.c. of nitric oxide), we may calculate the total amount of nitrogen oxides found. The figures thus obtained vary from 3·10 to 7·05, and in the mean (4·93) account for about half the quantity of nitre lost, the total loss being equivalent to 10·8 c.c. of nitric oxide per 10 litres.

The conclusion to be drawn, therefore, from these analyses is that half the nitre is lost as nitrogen peroxide and trioxide, so that the loss is mainly mechanical, being due to incomplete absorption in the Gay-Lussac tower. This conclusion is supported by the experience of many manufacturers, who find that if two Gay-Lussac towers are used in series, instead of a single tower, the second tower catches a not inconsiderable amount of nitrous gases.

From the amounts of nitric oxide, nitric peroxide, sulphur oxides, and carbon dioxide, one can easily calculate the "total acidity." The results are given in the column headed "Total acidity calculated," the next column, giving the result found by the ordinary works method on the same day as my experiments, but not at the same time. The agreement between these figures is not particularly good, but the results are of the same order. It is to be noted that quite a high proportion of total acidity is due to carbon dioxide.

During these experiments one peculiar fact was noticed, but not fully explained. In the experiments 5, 6, and 7, of Oct. 13, the bulb seemed to contain a colourless gas, but when it was cooled with liquid air the solid that separated was red and not white, as one would expect. During the fractionation of 5 this red substance got into the pump, and at once acted on the mercury. Special precautions were taken in analyses 6 and 7 to isolate this red substance, but there seemed to be only a small quantity and it could not be identified. The flue gases on that day, however, contained a chloride, and it seemed possible that the gas was nitrosyl chloride NOCl. This substance, however, on being prepared pure condensed to a yellowish-white, and not a red solid, so no definite conclusion can be drawn. It is possible that nitrosyl chloride was present, and that its solid solution in the other substances was red; but such a supposition needs further proof. Unfortunately, this red substance was not obtained in any other samples.

The above method, though it gives definite results in regard to the nitrous oxide and the peroxide is, as already stated, unsatisfactory in so far as the nitric oxide cannot be estimated by means of it, since its vapour pressure is by no means negligible at —189° C. In order, therefore, to get the nitric oxide condensed its partial pressure above the condensed portion must be lowered, and this can be done in two ways—either by lowering the temperature or by dissolving out the nitric oxide by means of a liquid in which it is very soluble. As nothing was known regarding the solubility of solid nitric oxide, it was decided to try the effect of lowering the temperature, and it was found that its vapour pressure became very low <0·1 mm. at —193° C., a temperature easily attainable by boiling liquid air under diminished pressure. Hence, by working at —197° C., at which temperature nitrogen and oxygen condense very readily, the vapour pressure of nitric oxide and consequently its loss during fractionation would be negligible. It was therefore decided to make a few analyses by condensing the flue gases and fractionating them at a temperature not higher than —197° C. In this way it was expected that almost the whole of the nitric oxide would be left behind condensed in the bulb, so that an accurate estimation of the total loss of nitre would be possible. The only difficulty lay in measuring the volume of gas dealt with. Since the condensed gases would have to be fractionated by making them boil in the vacuum of a Fleuss pump, there was no means of measuring the volume of gas pumped off, so that the measurement had to be made by measuring the volume of the liquid formed at a known temperature; and then, from Baly and Donnan's (J.C.S., Vol. 81, p. 907) measurements of the densities of liquid nitrogen and

oxygen, the volume of gas corresponding to 1 cb. cm. of liquid could be calculated on the assumption that no contraction took place on mixing liquid oxygen and nitrogen. Now, at —197° C. the densities of these liquids are 1·2104 and 0·8171 respectively. Hence 2240 litres of a mixture containing x per cent. of oxygen and (100—x) per cent. of nitrogen would give a volume of liquid = $\frac{32x}{1{\cdot}2104} + \frac{28\,(100-x)}{0{\cdot}8171}$ c.c.

$= 3427 - 7{\cdot}83x$

Now, in the flue gases x = 6·5 per cent.

∴ 2240 litres of gas form 3376 c.c. of liquid

or 1 c.c. of liquid = 0·663 litre of gas.

The bulb used in these experiments is shown in Fig. 2. The lower part of the tube was about 20 mm. diameter and 120 mm. long, and was graduated in millimetres. In order to make the fractionation effective it was necessary that boiling should be regular, and it was found that a few tetrahedra of platinum, such as are used in a Beckmann's boiling point apparatus, quite prevented bumping and ensured steady boiling. After these had been introduced into the bulb, the volume of the bulb, up to different graduations, was determined by running in measured amounts of water. The volumes so obtained were corrected for the contraction that takes place on cooling the bulb to —197° C.

In order to measure the temperature, use was made of a long narrow bulb C, filled with oxygen under pressure and communicating with a manometer D. When this bulb was placed in liquid air some of the oxygen condensed to a liquid and the manometer then registered the vapour pressure of the oxygen. By measuring this pressure the temperature could be read off the vapour pressure curve for liquid oxygen. (See Travers Phil. Trans., 1903.)

In carrying out a fractionation the bulb and thermometer were put through holes in a rubber cork which fitted the mouth of a large cylindrical unsilvered vacuum vessel; and a tube leading to the flue was joined to the bulb at A. The vessel was then filled with liquid air and placed in a larger silvered vacuum vessel also containing liquid air. A Fleuss two-cylinder pump (two cylinders working in parallel) was then connected to the tube E, and the pump being set in action the air in the inner vessel was made to boil vigorously, thus lowering the temperature. In this way the temperature was lowered to —197° C., and then the tap A, being opened, the flue gas rushed into the bulb and there condensed to a cloudy liquid at the rate of about 1 litre of gas a minute, the pump being kept working slowly in order to keep down the temperature. When sufficient gas had condensed, the tap A was closed, and the inner vacuum vessel lifted out of the silvered one. Through the walls of the vessel one could then read off the volume of the liquid in the bulb, the temperature indicated by the thermometer being noted also. The Fleuss pump was then connected to the tap B, and this being opened the liquid was made to boil off into the vacuum of the Fleuss pump. By this evaporation the liquid air in the vacuum vessel was continually cooled, so that its temperature did not rise. When the whole of the liquid had evaporated the tap B was closed, and the bulb removed from the liquid air. The further analysis of the contents of the bulb was then carried out according to the methods employed in the earlier experiments. Since the condensed nitrogen and oxygen on being

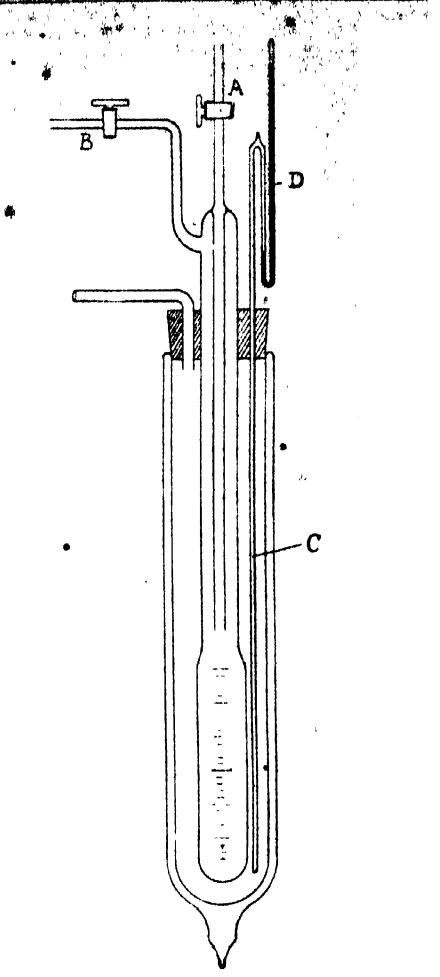


Fig. 2.

fractionated give off a vapour much richer in nitrogen than the liquid, towards the end of the fractionation almost pure oxygen was left behind and the last traces of this were not removed from the bulb. Hence, in the subsequent fractionation, nitric oxide was not usually found, as it acted on the excess of oxygen forming nitrogen peroxide. The results of four analyses carried out in this way are given in Table IV.

Table IV.

Date..	No.	c.c. of liquid.	Litres of gas.	Nitric oxide c.c. per 10 litres.	Carbon dioxide c.c. per 10 litres.	Nitrous oxide c.c. per 10 litres.	Residual acidity.*	Barium sulphate grms. per 10 litres.	Nitrous gas as c.c. of nitric oxide per 10 litres.
Sept. 6 ..	1	27·3	18·1	—	3·42	0·10	5·74	0·0439	4·75
	2	34·0	22·5	—	3·78	0·10	6·21	0·0869	7·85
Sept. 13 ..	3	39·3	26·1	0·16	5·14	0·19	11·2	0·1090	9·75
	4	29·9	19·9	—	5·16	0·25	7·86	0·0745	6·85

* Residual acidity is given as c.c. of N/10 baryta per 10 litres.

The last column in the table shows the total amount of nitrogen oxides found in the flue gases. It will be noticed that the fluctuations are very considerable, but, on the whole, the results agree with those already found in the earlier experiments. If, therefore, this method for the estimation of nitric oxide is a sound one, the conclusion must be drawn that only a small quantity of nitric oxide is present in the flue gases, and that a considerable proportion of the nitrous gases must be reduced to nitrogen. On the other hand, as only four analyses were carried out at the lower temperature, and these analyses show considerable fluctuations, there is hardly sufficient ground for stating that these analyses represent the average composition of the flue gases. Hence, since the question of the presence or absence of nitric oxide depends really upon the difference between these analyses and the earlier ones, one cannot safely say that nitric oxide is not present. This question can, however, be completely settled by carrying out a larger number of analyses at the lower temperature, and I hope to be able to do this during spring 1906.

The results of this research may be summed up as follows:—

(1) Only very small quantities of nitrogen peroxide and trioxide are reduced to nitrous oxide in the sulphuric acid chambers.

(2) About 50 per cent. of the total loss of nitre takes place owing to incomplete absorption of the nitrogen trioxide and peroxide in the Gay-Lussac tower.

In conclusion, I wish to express my thanks to Sir William Ramsay, Dr. Messel and Mr. E. C. Thompson for the kind interest they have taken in these experiments, and for the valuable advice and help I have received from them.

Discussion.

The Chairman said the results obtained seemed to do away with many theories which had been propounded. There was great reason to believe that the contention which Lunge had long made as to the real cause of this loss was correct. This was a remarkable instance of the perfection to which a chemical process could be brought, to some extent, in the dark. When the difficulty of bringing the enormous volumes of gas drawn from the chambers into contact with the acid in the towers was borne in mind, it was really marvellous that so very small a percentage as 0·01 per cent., which Mr. Inglis mentioned as constituting really the whole of the gas corresponding to a loss of 3 per cent. of nitre, should be all that escaped. The author was to be congratulated on the fact that he had succeeded in accounting for about 50 per cent., and, in some cases, for as much as 70 per cent. of this loss. There was still, of course, an unresolved residue, and he hoped in the course of the further researches some light would be thrown on that matter. It struck him as remarkable in looking at Table II. in the paper, that there was such a high percentage of carbon dioxide found. As the outflow of gases amounted roughly to 84½ per cent. of the volume of the air entering the plant, it might be thought the carbonic acid would go up to about 4·7, whereas Mr. Inglis found it was 6·5 to 7·5; in other words, very nearly 140 to 170 per cent. higher than it should be if it were merely to be accounted for by the reduction in the volume of the air due to loss of oxygen. He presumed there must be some reason for the excess of carbonic acid, possibly in the form of carbonaceous matter which adhered to the ore, and was burnt with it, or it might arise from the oxidising action of the acid on the coke in the towers.

Sir William Ramsay said what Mr. Inglis proposed would no doubt separate the nitric oxide from the nitrogen. After the mixture of gases was condensed the liquid nitrogen existing at the temperature of —197° had a very considerable vapour pressure, and with a good mercury pump that could be removed, leaving the nitric oxide behind; it was simply like boiling away the water from a saline solution, and leaving the salt.

Dr. Divers (the President) congratulated Mr. Inglis on the importance of the work he was doing. The result of it was one of the greatest additions to the knowledge of the processes of the lead chamber.

Mr. Oscar Guttmann said the author would probably find that the measurements of the quantity of gases dealt with were not reliable. He came to this conclusion, not by any discrepancy, but by the close agreement between the calculated quantity and that found. Anyone who had had to do with the measurement of gases, and especially by means of an anemometer, knew that discrepancies must of necessity be very large. A rough mental calculation showed him that the quantity of gas was calculated on the basis of 27 cb. ft. per second. Assuming the exhaust pipe to have a diameter of, say, 2 ft. 6 in., it would give a velocity of 5½ ft. per second, which is extraordinary. A large quantity of the oxides of nitrogen came out of the last chamber and passed to the Gay-Lussac tower for the purpose of being absorbed by means of sulphuric acid. A considerable portion of these gases was not absorbed in the tower, but passed out of the system; then the mere passage of air at the rate of 5½ ft. per second, or even at 1 ft. per second, carry away some of the oxides of nitrogen which thereby become a mechanical loss. This could easily be ascertained, and he would suggest that Mr. Inglis might direct his investigation in that direction. He could examine the gases at the inlet to the Gay-Lussac tower, and determine accurately the quantity of sulphuric acid that ran down, and the composition of the gases after they had passed the tower. He could thus find what loss there was in the Gay-Lussac tower, and whether and how much of it was due to decomposition or to mechanical abstraction. Mr. Inglis had based all his calculations on a loss of 3 per cent. of nitre on the sulphur burned, and no doubt that was a very reasonable allowance in the system in question; but he might mention that this loss had been much reduced in other systems, and it was not uncommon to have it amount to only 1·8 per cent.

Mr. W. Pearce said there was a difficulty in coming to any conclusion about a gas that varied so enormously in quality. He could quite understand that a number of the figures obtained were comparatively irreconcilable, by reason of divergence in the constitution of the gas. Another point was the very large quantity of resulting sulphuric acid, which went into consumption direct from the chambers, without having passed down the towers; a good deal of nitre was absorbed by that acid, and was lost in the process of distribution for sale. There seemed no chance of escaping such a loss. Those were practical difficulties that presented themselves to the sulphuric acid manufacturer.

Mr. J. K. H. Inglis, in reply, said the figures of carbon dioxide, referred to by the Chairman, were quoted from a table which he had not exhibited, but would appear with the paper, but he did not wish too much reliance to be placed in them; they were the result of the first experiments, and the later quantities found were much more constant. One point he had forgotten to mention with regard to sulphur dioxide, In the first experiments the gases were washed with sulphuric acid before being taken into the bulbs, and in that case he found a small quantity of sulphur dioxide amounting to about two parts per 10,000 in the flue gases. In later experiments, however, as this washing meant the loss of the nitrogen oxides, he decided that instead of passing it through sulphuric acid he would take the gas direct into the bulbs; thus any sulphur dioxide present was promptly attacked by the nitrogen peroxide and tetroxide. That was why the results given showed no sulphur dioxide.

In reply to Mr. Guttmann, concerning the errors in the measurement, based on the rate of flow of the gas, he believed his figures were quite correct; they were obtained for him by Mr. E. C. Thompson, but, as a matter of fact, they did not very much affect the question, because they did not come into the calculation at all. The two figures he gave were those obtained by calculating the rate of flow from the chamber, and the quantity actually found. These experiments were only made in order to see whether it was possible to calculate the rate of flow at the end of the chambers from the reactions at the beginning, and the agreement between the two sets of results—quite independent of their absolute value—proved that conclusively. Anyhow, the error was only 2 or 3 per cent., and in this sort of work 10 per cent. was not excessive. As to

a loss of 3 per cent. of nitre being rather high, he could only say that it was a fairly usual figure in that particular plant. In some cases, the loss had been reduced to about one-fifth of that, and he quite agreed that 3 per cent. was higher than it need be, but the question arose, was it worth while to put up extra plant in order to recover that amount of nitre? He should endeavour to carry out some of the work Mr. Guttmann suggested on the gases before they passed through the Gay-Lussac tower; the chief difficulty was that the gas then contained a large proportion of condensible gases, and, therefore, it was necessary to work with a small amount, or else with large tubes, which would not get choked. He also intended to experiment on the composition of the chamber gases themselves.

CARBURETTED WATER GAS IN THE BUNSEN BURNER.

BY MASUMI CHIKASHIGE.

The defects of water gas as a fuel in the chemical laboratory were experimentally tested some time ago, in Kyoto, Japan, by H. Matsumoto and the author. The results were given in a paper read before the London Section of the Society of Chemical Industry, and printed in the Journal of the Society for 1904 (page 50). There being no coal gas available for the use of the Kyoto University laboratories, a method of preparing carburetted water gas, much on the lines followed by Prof. V. C. Lewes, was devised by a committee appointed by the University, and including the author. In this process, heavy petroleum oils are injected with steam into the water-gas generator filled with ignited coke. The gas produced is passed through a superheater, loosely packed with fire-bricks, and then through a scrubber, after which treatment and purification it enters the gas-holders. It is not now the purpose of the author to go into the details of this process, as worked out by the committee. His object is only to make known the behaviour of this gas when used as a laboratory fuel.

The mean composition of the gas does not differ much from that of coal-gas;—

	Vols. per cent.
Heavy hydrocarbons	5·3
Methane	16·8
Hydrogen	51·7
Carbon monoxide	15·4
Carbon dioxide	0·6
Oxygen	0·5
Nitrogen	9·7

There have been, occasionally, some wide deviations from the mean composition, one of which will be noticed in the next paragraph. Only a brief account of the behaviour of the carburetted water gas is necessary, because this hardly differs from that of coal gas to which it approximates in composition.

Partial combustion of the gas.—The carburetted gas was tested in the same way as simple water gas itself had been, by the Smithells and Ingle's apparatus, in order to find out what are the proportions of the constituents of the partially-burnt gas. Two samples were examined in this way—one (*a*) which had very closely the mean composition shown in the table, and another (*b*) which deviated largely from that in having about 20 vols. per cent. of carbon monoxide, and only 3 vols. per cent. of heavy hydrocarbons. Side by side with the results obtained are placed those given in the former paper.

	Coal gas. (Sm. & Ing)	Carbur. gas. *a*	Carbur. gas. *b*	Water gas.
Water	14·9	16·7	16·7	17·0
Hydrogen	10·9	12·8	12·1	20·0
Methane	trace	0·9	0·9	0·8
Carbon dioxide	2·6	3·1	3·2	3·8
Carbon monoxide	10·2	10·4	9·8	10·5
Oxygen	—	—	—	0·1
Nitrogen	60·3	56·1	57·8	34·8

The carburetted gas in burning soon becomes similar to burning coal gas in composition. Even the (*b*) sample did so, notwithstanding the defects in its composition at first, and in consequence of the fact that the hydrocarbons present in it made it possible to let in, through the Bunsen tube, a sufficient proportion of air without causing the flame to descend the tube as it would then do in the case of unenriched water gas (see former paper).

Size of the Bunsen flame.—It was pointed out in the former paper how much greater a flow of gas was needed to produce with non-carburetted water gas the same sized flame as that given by coal gas in the Bunsen burner. To the numbers there given can now be added that for carburetted gas. To get the usual flame, one about 15 cm. long, the flow of gas per hour has to be in the case of—

	Litres.
Coal gas	120
Water gas	200
Carburetted gas	160

Therefore, the triangular orifice of the ordinary Bunsen burner for coal gas requires to be only slightly enlarged; that is, in the proportion of 4 to 3, in order to get the same sized flame with the carburetted water gas.

Effects of the flame upon laboratory vessels.—The carburetted gas has no action upon copper, platinum, or porcelain vessels, greater than that of coal gas. A porcelain crucible placed in the Bunsen flame only gets a deposit of carbon on it when it is placed so low as to touch the inner cone of the flame. Similarly, a platinum vessel only loses in weight in the flame when kept for a long time touching the inner cone, or when the flame is surrounded by a muffle.

Effects upon the air.—The products of the nearly finished combustion of the carburetted gas being, unlike those of plain water-gas, the same in composition as those of coal gas, the use of the gas in insufficiently ventilated laboratories is not more injurious to health than that of coal gas.

DISCUSSION.

The CHAIRMAN said he had used the apparatus, manufactured by Müller, of Birmingham, in which air was enriched by passing it through light hydrocarbons. It was at first rather difficult to manage on account of the varying proportions of the amount of air to the mixture, and also because of the shortness of the flame, but he had no trouble from attacks on platinum vessels, or anything of that kind.

Sir WILLIAM RAMSAY said his only experience of the use of small gas plants was in India, where the usual device was the introduction of oil gas, the method most in vogue being that of dropping the oil into a red-hot retort. The difficulty was that the life of the retort was not long, only six or eight months, and the trouble of constant attendance; but in India, where labour was cheap, that gave little trouble. A boy looked after it, and regulated the dropping; the gas went into a small gas-holder, and was thence distributed.

Mr. T. C. CLOUD said he had used Müller's machine for 28 years in a large chemical laboratory in connection with a metallurgical establishment. This machine was well worth bringing to the notice of the Society, because a number of the members were in places where coal gas was not available. He had not found any difficulty in the working of the machine provided it was placed in a cool situation—the best place was in an underground room or cellar. One slight addition was required, an extra small pipe should be brought to the laboratory from the air chamber, so that the final adjustment of rich gas and air could be made in the laboratory itself, instead of going down to the machine. The gas was made slightly rich at the machine, and then, in the laboratory itself, a small amount of air was allowed to pass in to a mixing reservoir, from which the gas was distributed. They had a machine capable of supplying about 120 lamps, and had no trouble. They used the same Bunsen burners as were used for gas without any alterations. There was no action on platinum or other vessels.

Dr. H. G. COLMAN said he could confirm the [illegible] experience with regard to the use of carburetted [illegible]

gas. He had frequently had occasion to use, for laboratory purposes, ordinary carburetted water gas, now largely made in this country, for admixture with coal gas, and there was no difficulty in the matter, although the percentage of carbon monoxide might rise much higher than that given in the paper, sometimes amounting to 32 or 33 per cent. With regard to the figures as to the interconal gases, when the gas was burnt in a Smithells' separator, there was a valuable series of researches on this subject which had recently appeared in the Journal für Gasbeleuchtung, 1905, 48, 1035; 1057; 1081 and 1107; and largely confirmed the figures given in the paper.

Mr. W. F. REID said he had found petroleum made a good substitute. In a private laboratory it was rarely worth while to put up an installation for water gas, but he found a blue petroleum flame would do most of the work he required. There were several lamps now in the market which would produce a perfectly blue, and, therefore, smokeless flame. The one he most used was the Primus lamp, burning ordinary heavy petroleum oil. They might recollect that that was the lamp which Nansen used on his Arctic travels. The lamp gave no trouble, and a crucible could be got nearly white hot with it.

Mr. OSCAR GUTTMANN sent a sketch of an apparatus which he has used in laboratories for more than 20 years. It consists of three cylinders, made of lead or iron. Cylinder A serves as a regulator for the air. This can be either compressed air or produced by a gas-holder. The air arrives through the tube *a* and is used through the tube *b*. A small dead-weight safety valve *c* insures that the pressure of air, entering through the gas producers, has always the same pressure. There can be one or two gas producers B B, which are constructed in exactly the same way as the cylinder A, with the exception that, instead of the safety valve, they have a cap for filling in gasoline. The cylinders can be emptied by means of the tap *d*. This apparatus has always given complete satisfaction.

THE REMOVAL OF NITROUS ACID FROM CONCENTRATED NITRIC AND SULPHURIC ACID. *

BY OSWALD SILBERRAD, PH.D., AND BERTRAM J. SMART.

It has been frequently observed that the removal of nitrous acid presents much greater difficulties in presence of concentrated acids than in dilute aqueous solution. The following experiments were carried out to determine to what extent the reaction between nitrous acid and amines or amides occurs in concentrated acids, and to throw some light on the nature of the reactions which occur under such conditions. For the experiments, nitric acid containing a small percentage of nitrous acid was taken, either alone or in admixture with sulphuric acid. Various reagents, which are known to react readily with nitrous acid in aqueous solution, were added in the form of powder to the concentrated acid, and allowed to stand at ordinary temperature. From time to time, the amount of nitrous acid present was determined by titration with potassium permanganate.

The following table shows the results of a number of such experiments:—

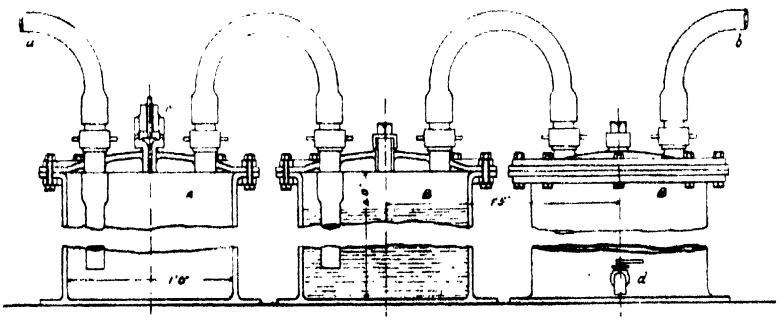
Rate of removal of nitrous from nitric acid.

Acid.	Reagent.	Percentage of nitrous acid.		
		0 hours.	5 hours.	24 hours.
Nitric acid, sp. gr. 1·42	Urea	0·075	0·00	0·00
„ 1·50	Urea	0·915	0·48	0·52
„ „	Lead peroxide	0·915	0·76	0·87
„ „	Hydrazine sulphate	0·915	0·84	0·17
„ „	Oxamide	0·915	0·90	0·17
„ „	Methylamine nitrate	0·996	0·96	0·93
„ „	Aminoguanidine nitrate	0·996	0·76	0·93
Mixture of:—				
Sulphuric acid, H_2SO_4, 60·6 parts	Urea	0·081	0·076	0·078
Nitric acid, HNO_3, 37·2 „				
Water, 2·2 „				
„ „ „	Urea	0·317	0·292	0·298
„ „	Lead peroxide	0·317	0·261	0·292
„ „	Hydrazine sulphate	0·317	0·093	0·084
„ „	Methylamine nitrate	0·347	0·342	0·340

The addition of hydrazine sulphate was accompanied by explosions, a smell of azoamide being observed; the formation of azoamide is evidently to be traced to the action of the nitrous acid upon the hydrazine, in presence of strong acids.

It is seen that, with the exception of hydrazine sulphate, the reagents are very inert towards nitrous acid in presence of concentrated nitric acid, although they react readily in dilute solution. It appears that the reaction takes place between the nitrous acid and the ions formed by the salt of the amine or amide, and is not due to the salt itself.

The observation of Franchimont (Rec. trav. chim., 1883, 2, 96; 1884, 3, 219) that urea nitrate decomposes with evolution of carbon dioxide and nitrous oxide, was confirmed in the present work. Analyses of the gases evolved gave the following results:—



* Taken as read.

	CO_2.	N_2.	N_2O	NO	O_2.
From nitric acid sp. gr. 1·42	44·8	55·0	—	0·2	—
" " 1·50	39·6	38·9	19·8	—	—
From a mixture of nitric and sulphuric acids ..... —	34·7	37·4	26·4	—	—

Ammonium salts were found in the residual acids, from which it appears that the primary action of the nitric acid is to hydrolyse the urea, forming ammonium nitrate, which is then dehydrated to nitrous oxide.

Our thanks are due to the Explosives Committee for permission to publish these results.

Manchester Section.

Meeting held at Manchester on Friday, January 5th, 1906.

DR. G. H. BAILEY IN THE CHAIR.

IRONMOULDING OF CLOTH IN THE LOOM.

BY WILLIAM THOMSON, F.R.S.E., F.I.C.

The manufacturer, and more especially those engaged in the production of heavily sized grey cloths, find from time to time that, on leaving the warp in the loom overnight, the reeds become rusted, and on commencing to weave in the morning a rust or iron-mould band of from 5 to 9 in. wide is formed across each piece of cloth. Many reasons have been given as to the cause of the rusting. Most commonly it has been attributed to the employment of excessive quantities of salts in the size, such as magnesium or zinc chlorides. These might have some action, but the constituent of the size which would be most likely to cause rusting of the reeds, is a substance frequently found in solutions of zinc chloride employed for sizing purposes, *viz.*, chlorates existing as potassium or sodium chlorate. (See Lunge, this J., 1885, 32.)

Zinc chloride is prepared chiefly from zinc ashes, the refuse from galvanising works; this refuse contains ammonium chloride, metallic iron and iron oxide, zinc and zinc oxide. These ashes are dissolved in hydrochloric acid forming zinc chloride and ferrous chloride. When nearly all the acid is neutralised, to remove the iron requires its oxidation to the ferric state. For this purpose I (as the deviser of the first process for the manufacture of zinc chloride from this refuse) employed a solution of bleaching powder. It had this disadvantage, however, that a combination took place between the nitrogen of the ammonium chloride present, and the chlorine of the bleaching powder forming, presumably, nitrogen trichloride, which exploded with a series of somewhat alarming detonations which, however, did no damage. This was overcome by employing sodium or potassium chlorate, and these are most commonly used at the present time. Unfortunately, the calculated quantity of chlorate is not sufficient to oxidise all the iron present in the zinc chloride solution; in fact, ferrous salt can exist in presence of an excess of chlorate even in hot solutions of the zinc chloride, and it is only after the chlorate has been added in considerable excess that all the iron becomes oxidised. Most of the zinc chloride solutions of commerce contain quantities of sodium or potassium chlorates varying from 0·1 to 1·4 per cent., and these salts rapidly rust the steel reeds of the loom when they come in contact with them.

It is obvious further that the greater the quantity of such zinc chloride solutions contained in cloth the greater will be the oxidising action of the warp threads on the reeds with which they remain in contact. Pure zinc chloride and pure magnesium or calcium chlorides, which are usually contained in heavily sized warps, have little oxidising action on the iron of the reeds, and warps containing these pure salts, even in large quantity, will not produce iron-moulding of the warp or the cloth.

It becomes, therefore, important to find some agent to oxidise the iron in zinc chloride solutions, which will not remain in it afterwards and injuriously affect the reeds. Bleaching powder when so employed does not rust the reeds, whilst it has the additional advantage that the lime combines with any sulphuric acid which may be present as sulphates forming calcium sulphate, which becomes largely precipitated with the ferric oxide after neutralising. A good plan for oxidising the iron in the zinc chloride solutions is to add to the hot solution the quantity of manganese dioxide (preferably that contained in Weldon mud) required to oxidise the iron present. The manganese dissolves, and is afterwards found in the zinc chloride solution, but it does not produce rusting of the reeds, and does not injuriously affect the colour of the cloth in the small proportions present. Potassium or sodium manganate or permanganate may be used, as these substances need not be in excess to complete the oxidation of the iron. Chromic acid or potassium bichromate may also be used, the reduced chromium being removed with the iron. From an economical point of view, it might be well to oxidise most of the iron present with sodium chlorate, and complete the oxidation by means of chromic acid, potassium bichromate or manganese dioxide.

Sodium peroxide acts very efficiently as an oxidising agent, and the caustic soda formed partially neutralises the liquor, and thus aids in the precipitation of the iron peroxide, whilst the resulting zinc chloride solution does not oxidise the reeds. Hydrogen peroxide acts very well as an oxidising agent, and any excess would doubtless be removed on drying the warp, but if a trace of this substance be left in the liquor it produces rusting of the reeds almost immediately.

The following table shows the quantities of the different oxidising agents required to oxidise 1 lb. of ferrous into ferric oxide in fractions of 1 lb.

	lb.
Manganese dioxide	0·604
Bleaching powder (35% avail. Cl.) ..	0·140
Sodium chlorate	0·346
Potassium chlorate	0·263
Chromic acid	0·452
Sodium bichromate	0·606
Potassium permanganate	0·439
Sodium peroxide	0·541
Hydrogen peroxide (containing 3·04% H_2O_2)	0·236

I made a number of experiments by putting knitting needles on cloth and on blotting paper soaked with the various substances, and observing how rapidly rusting took place. Chlorates in a neutral solution did not produce rusting, but when the solution contained a trace of acetic acid, rusting took place rapidly, and as size nearly always contains free acid, it may be taken that the conditions necessary for the rusting of the reeds always exist in the warp if chlorates be present in the size.

The following table shows the influence of different substances in producing rusting of the reeds. The experiments were continued for 48 hours in solutions made acid to litmus paper with acetic acid.

Pure zinc chloride	did not rust
" magnesium chloride	"
" ammonium chloride (saturated solution)	4 hours
" sodium chlorate (saturated solution)	10 minutes
Solution of zinc chloride containing 1 per cent. of sodium chlorate	10 minutes
Ditto, but containing 0·25 per cent. of sodium chlorate	4 hours
Ditto, containing 1 per cent. sodium chlorate, but as *free acid*	did not rust

The following gives the results of two analyses of samples of zinc chloride solutions for sizing purposes:—

Analyses of zinc chlorides.

	I.	II.
Zinc chloride	44·63	44·94
Zinc oxide	0·38	1·49
Ammonium chloride	2·05	absent
Sodium sulphate	1·27	trace
Sodium chlorate	0·28	0·31
Water	51·39	53·26
	100·00	100·00
Specific gravity at 60° F.	1·5265	1·5300
Equal to degrees, Twaddell	105·3	106·0

In conclusion, I have to thank my assistant, Mr. Charles Norman Exley, for the ability and care he has shown in carrying out this investigation.

DISCUSSION.

Mr. F. A. ERMEN said he had a case which somewhat resembled the oxidation of iron on cloth. He was given some bronze printing on calico to investigate, which had entirely turned green, and he found that this bronze had been printed on with the help of gum arabic. The calico contained a small amount of zinc chloride, and he presumed the oxidation was brought about by the free acids always present in gum arabic and which produced a chemical action when the cloth had been kept in a damp place. He might add that cloth kept in a dry place was not so affected.

Dr. R. S. HUTTON did not think Mr. Thomson had included another class of zinc chloride solution, *viz.*, that produced by electrical means, although a considerable amount came from this source as well as from other sources. He presumed that no such difficulties were met with where no oxidising agents were employed for the separation of iron as happened in the process to which he (Dr. Hutton) had referred.

Some time ago he had a number of complaints of oil stains on white cloth, which, on investigation, were attributed to some trace of iron in the oil used for the machinery, but they had never assumed that the stains were due to the chemical action to which Mr. Thomson had referred. In cloths with an alkaline tendency this action did not take place.

Mr. E. A. FASNACHT said in a recent paper by Prof. Dunstan and others on "The Rusting of Iron" (J.C.S., Oct., 1905; this J., 1905, 1235), it was shown that in all probability hydrogen peroxide was produced, although they were not able to detect it. Prof. Dunstan considered that chromic acid prevented the formation of rust, and that it did so by decomposing the hydrogen peroxide. It was somewhat remarkable that chromic acid prevented the rusting of iron and that chlorates did not.

Mr. W. H. COLEMAN thought the paper showed that chemical manufacturers should leave no deleterious matters behind in their products which might cause subsequent trouble to the users. He considered that blowing with air alone was one of the most difficult means of oxidising iron compounds.

Mr. WM. THOMSON, in reply, said the bronze powder referred to by Mr. Ermen hardly came under the same category as ironmould. The powder would become green and oxidise by moisture alone, aided perhaps by a little free acid in the gum. Dr. Hutton referred to zinc from other sources. As a matter of fact the chief source of the zinc chloride was from zinc ashes. A small quantity was, however, produced by electrical means which was very good for sizing purposes, and there was also a certain quantity produced from spelter which was free from ammonium chloride, but that did not remove the difficulty, as iron must still be separated from the zinc chloride solution by some oxidising agent. Oil stains on cloth were caused by the metallic iron present in the oils from the machinery, which was liable to form rust if the cloth were left in a damp condition for some time. The presence of alkali prevented rusting, and a trace of acid would aid oxidation. With regard to the hydrogen peroxide theory, chromic acid, which Prof. Dunstan thought decomposed hydrogen peroxide and thus prevented rusting, probably formed a very thin film of magnetic iron oxide on the iron. He had found that a thin coating of the magnetic oxide had been formed on iron which had been painted with red lead. This coating was equivalent to "Barffing," preventing the iron from rusting easily after removing the paint; chromic acid would probably have the same effect.

A RE-DETERMINATION OF THE CONSTANTS OF CARNAÜBA WAX.

BY LIONEL GUY RADCLIFFE.

A sample of Ceará wax melting at 84° C., was used for the experiments, and also a bleached sample, which melted at 61° C. The figures recorded for the acid value vary from 4 to 8, and O. Eichhorn (Zeits. anal. Chem., 1900, 39, 640—645; this J., 1901, 74) states that by dissolving 3 grms. of the wax in 120 c.c. of boiling amyl alcohol he obtained an acid value of 9·71. A repetition of the above method gave for the Ceará wax 5, and for the bleached sample 0·56. The saponification values stated by various observers vary from 79 to 95. A series of experiments were made in order to ascertain which method gave the maximum value, and it was found that by treating 5 grms. of the wax with 60 c.c. of amyl alcohol and 50 c.c. of ordinary alcoholic potash (60 grms. to the litre) and boiling for six hours, the figure 88·3 was obtained, the bleached sample giving 33 to 34. The iodine value by Wij's method was, after 24 hours, 13·17 per cent.

The values obtained on one and the same sample of Carnauba wax are:—

Melting point (in capillary tube)	84° C.
Acid value	2·9
Saponification value	88·3
Ester value	85·4
Iodine value	13·17

I have pleasure in expressing my thanks to Messrs. E. Barber and W. H. Maddocks for their assistance in the above work.

New York Section.

Meeting held at Chemists' Club on Friday, November 24th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

THE GRADING AND USE OF GLUES AND GELATINE.

BY JEROME ALEXANDER.

In this paper it is desired, firstly, to describe a connected series of selected tests which may be run consecutively and used as a basis of grading; secondly, to define standards for use in these tests; and, thirdly, to give some practical hints on the proper selection and use of glues and gelatines. For convenience, the product will be referred to as "glue," gelatines being regarded as very clean or high grade glues, and the suggestion of Rideal, followed by Watson and others, will also be observed, spelling the name of the commercial article gelatine, and that of the chemically purified substance gelatin.

Before describing the tests, it is necessary to consider the different kinds of glue met with in commerce. H. J. Watson, in an excellent article on "Glue and Glue Testing" (this J., 1904, 23, 1189), has given a classification of glues, based partly upon the nature of the raw material

used, and partly on the way in which the "runs" or successive boilings are combined; but, as he remarks, "this grouping does not by any means exhaust the variations in these products." I think that a more thorough understanding of the differences in glues may be obtained if we consider, first, the various raw materials or glue stock; second, the treatment of the glue stock before boiling; and, third, the separation or blending of the various "runs." The chief sources of glue are bones and trimmings, cuttings and fleshings from hides and skins. Sinews, feet, tails, snouts, ears and horn pith are also largely used. The various parts from cattle, calf, goat, sheep, pig, horse and rabbit all yield characteristic glues having peculiar properties. The liquid glues obtained from the heads, bones and skins of fish form a class of their own, and are not here considered.

The treatment of the stock depends upon the technique of the particular factory, and the use for which the finished glue is intended. In some factories bones are boiled without even washing; in others, most of the grease is steamed out or removed by volatile solvents. The clearest and best bone glues are obtained by leaching the bones with dilute acid which dissolves out the lime salts and leaves the gelatinous matters. Such crushed leached bone is sold as a glue stock under the name of osseine. Hide pieces, sinews, osseine and leached horn pith are limed until properly "plump"; the subsequent treatment before boiling varies, being usually regarded as a trade secret.

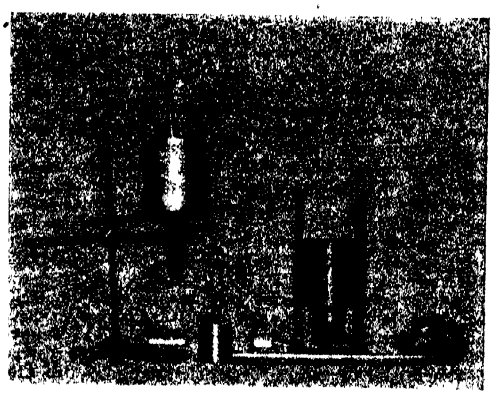
One extraction of the stock does not exhaust all the glue in it, so it is necessary to make a number of consecutive extractions or "runs," as they are called. The condition of the stock, the temperature and time of boiling, and the apparatus employed are the main factors controlling the proportion of glue in each run. Sometimes as many as ten or fifteen runs are taken from the same kettle of stock, and these runs may be finished alone, or blended with each other or with runs from other kettles containing perhaps different kinds of stock. It will be readily seen that the kinds of glue are practically unlimited in number, as indeed the great variation in appearance would seem to indicate. But in glue, above all things, appearances are very deceptive. Even after a manufacturer has finished his glue, he is obliged to test it in order to establish the grade of his finished product.

To the chemist or analyst, glue presents itself in the form of sheets, flakes, nodules, small grains or powder, varying in colour from black to white and all shades of brown and yellow. It may be clear, cloudy or opaque. How shall a value be assigned to each glue? Purely chemical tests, as at present known, are for the most part of little value. The determination of water is without much practical significance, for all desired is that the glue be commercially "dry." The presence of any considerable amount of phosphates in the ash is supposed to indicate that the glue was made from bone stock.

Numerous articles have appeared from time to time in the journals and in technical books, describing methods and instruments for testing glue, and while many of these are good as far as they go, the writer has as yet seen none that may be regarded as complete. What is most striking is the lack of glue standards or units of measurement.

Thin blown glasses about 8—8·5 cm. high and 5·5 cm. in diameter are convenient for tests. 25 grms. of each glue to be tested is broken into small pieces and soaked in 100 c.c. of water until softened (overnight if possible); and at the same time a number of standard glues, described later on, are treated in like manner. All the glasses are at the same time placed in a water-bath, heated to 80° C., and stirred until a perfect solution is obtained. More or less than 25 grms. per 100 c.c. can be used as long as the standards and unknown glues are all treated alike. The *reaction* is determined with litmus paper. In cases where the degree of acidity or alkalinity is desired, a separate titration is made.

Viscosity or running test.—Keeping the temperature uniform, the viscosity is determined by running the hot solution from a pipette, noting the time of efflux by a stop-watch. The relative viscosities are thus fixed in seconds. We use a pipette of 45 c.c. capacity, which will permit the efflux of hot water from the glue bath in exactly 15 seconds. After each determination, the pipette is washed with hot water, and care must be taken that no partially evaporated glue or slime clogs the outlet. While running, the pipette may be kept in a specially constructed thermostat. More complicated viscosimeters, as Engler's or the Rideal-Slotte instrument, may, of course, be used.



Viscosity Pipette in Thermostat. Jelly-strength Tester with Cups.

Care must be taken to make two pipettes that will give concordant results. The size and shape of the outlet, and the length and diameter of the effluent tube are the chief factors controlling the time of delivery. I have tried metal tips, but find them unsatisfactory, for it is not easy to duplicate them exactly, or to make a good connection with the glass.

The pipette that was finally adopted as standard has the following dimensions:—

Capacity	45 c.c. of water at 80° C.
Internal diameter of effluent tube..	6 mm.
External diameter of effluent tube	9 mm.
Length over all of effluent tube ..	7 cm.
Smallest diameter of outlet (about)	1·5 mm.
Outside diameter of bulb	3 cm.
Length of bulb	9·5 c.m.
Length of upper tube	22 cm.

The efflux hole was made by cutting the effluent tube square across, and holding it vertically in a Bunsen flame with constant rotation. As the glass softens, the hole gradually draws together, and after a few trials can be brought to the desired size. It is desirable to have the lower graduation point just where the effluent tube joins the bulb, for otherwise in glues of high viscosity there is much uncertainty caused by dribbling of the last few drops.

The most convenient thermostat is a simple water-bath. The projecting effluent tube is protected by a mica cylinder through which the end point is observed. When the thermostat is used a small piece of rubber tubing controlled by a pinch cock is slipped over the upper end of the pipette, or a glass stopcock may be fused on.

The *odour* of the hot solution is then noted, and the glue rated as sweet or "off." Decomposition is readily detected, although it is often masked by phenol or ethereal oils. Besides, the smell gives some indication of the stock from which the glue was made.

Grease.—The glue solution is painted on a piece of white paper with a little aniline or dry colour, and spots of "eyes" appear roughly proportionate to the amount of grease present.

Foam is determined by agitating the solution with a rod or mechanical agitator. An egg beater serves very well. Like grease, foam is estimated on a comparative basis.

Comparative set.—The glues are then taken from the bath, allowed to cool, and the comparative set or speed with which the jellies harden is noticed.

Jelly strength or "test."—When the jellies have reached the room temperature, the jelly strength or "test" is determined. For speed and perhaps also accuracy, I prefer the "finger test," and grade the jellies comparatively by pressure with the finger tips, the unknown glues naturally grouping themselves as stronger or weaker in jelly than the several standards. Notwithstanding the personal equation, expert operators obtain much more uniform results in this way than are given by the various mechanical devices. A special instrument for the determination of jelly strength will be referred to later.

Melting point.—The melting point of the jelly as described by R. Kissling (Chem. Zeitung, 1901, **25**, 264; see this J., 1901, **21**, 509) is also of considerable value, for, generally speaking, it is proportionate to the jelly strength. It may be determined by the simple apparatus described by N. Chercheffsky (Chem. Zeitung, 1901, **25**, 413; see this J., 1901, **25**, 731).

Strictly speaking, a glue jelly has no absolute melting point, for it softens up gradually and shows no sharp line of demarcation between solid and liquid. I have tried to determine the melting point by filling a small test tube and observing the temperature at which shot of the size known as B.B. would sink, but the results were very uncertain and then only comparative. Perhaps, the best way is to put the test glasses back into the water bath, and gradually raise the temperature, noting comparatively how the jellies melt.

Binding or adhesive strength.—For this there is no one test that can have a general application; the glue must be tried under actual working conditions. It stands to reason that if a glue is to be used to hold clay to paper, it is of small interest what its binding strength is on mahogany, maple or porcelain blocks. Very often, in fact, a glue that will size paper perfectly will not make a joint.

Keeping properties.—The glasses are then allowed to stand uncovered at room temperature for several days to observe the relative keeping qualities of the jellies. If the keeping property under special conditions is desired, these conditions are simulated.

Standards.—The choice of standards is a very important matter, for once they are taken all unknown glues are measured by them. Few published results of glue tests can be used for comparison, because seldom, if ever, have any two investigators worked on the same glue or glues, which have been described sometimes by their cost, sometimes by the stock from which they were manufactured, and upon which only partial determinations were made. That definite standards will simplify and harmonise the grading of glue is self-evident.

We arbitrarily fix 16 nearly equidistant grades and assign to them values running from 10 to 160, allowing 10 points between each grade.

160	80—1 3/8
150	70—1 1/2
140	60—1 5/8
130—A extra	50—1 3/4
120—1 extra	40—1 7/8
110—1	30—2
100—1 X	20
90—1 1/4	10

Opposite these grades I have set the corresponding grades long ago established by Peter Cooper, which are used for comparison by many American manufacturers and dealers.

The following determinations were made to establish such definite figures on our standards as will enable anyone to pick out glues of the same characteristics, so that we may all speak in the same language as it were.

The higher standards from 60 and upwards, are neutral hide glues, clear, clean, well made, free from any odour of decomposition, and practically free from foam and grease. For the lower standards bone glues were chosen, because most low test glues are bone glues and, furthermore, low test hide glues usually show abnormal viscosities.

The viscosities were taken as above described, with solutions containing 25 grms. of standard glue to 100 c.c. of water. For the standard viscosities I have taken the average of numerous laboratory tests; and inasmuch as standards of the same jelly strength are apt to vary somewhat in viscosity, I have indicated what, according to my experience, are the reasonable limits of such variations. (See table.)

Standard	Viscosities (in secs.) at 80° C. solution 25-100.	Allowable variation of viscosities (in secs.).	Jelly strength (in ozs.) at 10° C.	Jelly strength (in grms.) at 10° C.
10	15½	± ½	—	—
20	16	± ½	—	—
30	16½	± ½	—	—
40	17	± ½	60	1701
50	18	± ½	82	2324
60	19	± ½	104	2948
70	20	± ½	126	3572
80	21	± ½	148	4196
90	22	± ½	170	4820
100	23	± ½	192	5443
110	24	± ½	214	6067
120	25	± 1	236	6691
130	26	± 3	258	7314
140	28	± 5	—	—
150	34	± 8	—	—
160	40	± 12	—	—

To determine standard jelly strength the "shot" test was found unreliable, and a special instrument was devised. It consists of a brass cylindrical vessel supported like a gas tank by four vertical rods, against which it slides with almost frictionless roller bearings. This brass cup is allowed to rest on a truncated cone of jelly of definite size, composition, and temperature; and shot are gradually poured into the cup until a definite expression of the jelly is observed. Beneath the cup are two vertical adjustable brass uprights 3·5 cm. high, connected with an electric bell circuit; so that when the cup reaches their level, it completes the circuit and the bell rings.

The weight of the brass cup *plus* the weight of the added shot gives a figure which expresses the jelly strength.

The jellies were cast in brass cups 6 cm. high, 5·5 cm. in diameter at the open top, and 5 cm. at the bottom, which is closed with a tight fitting external friction cap. The jellies are removed by dipping the cups for an instant in hot water, taking care that no material loss results. The liberated truncated cones should be 4·5 cm. high, the cups being filled only to that level. They are placed in a thermostat until they reach the required temperature, 10° C.

In order that the various standards may be used for cross reference, I am now preparing a table which will define the jelly strength of each standard in terms of every other standard. For instance, standard 90 made up 22 grms. to 100 c.c. water has the same jelly strength as standard 80 made up 25 grms. to 100 c.c. In this way it may be possible to do away with a multiplicity of standards; at any rate the table will still further define the standards.

Discussion of results.—Now, supposing that we have run a careful test, and have a series of accurately determined figures, what do they mean? Do they express numerically the value of the glue for any work? Most assuredly not. E. G. Clayton (this J., 1902, **21**, 670), after carefully comparing many of the methods used and the resulting figures, says: "In conclusion, the observations seem to show that whilst it would be rash to form a judgment on glue from a single test, the evidences

afforded by a number may be irresistible. The experts' surest system appears to be, not to rely on single short cut tests of general quality, but to employ a number of methods, including any having especial bearing on the prospective or present uses of the glue, and then to base his conclusions on a consideration of all the results together."

The truth of the matter is that the figures have a partial value and then only to a glue expert. For instance, as a general rule hide glues have a higher viscosity and make better wood joints than bone glues; yet some bone glues, notwithstanding their lower viscosity, make magnificent joints, surpassing most hide glues. The only test that can be accepted as conclusive is a practical trial of the glue under actual working conditions, which vary in each case.

Use.—Glue is used for a multitude of purposes. Each line of work has its special requirements, and years of experience are necessary to pick out the right glue for the work. Trouble may be caused by a glue that is too strong as well as by one that is too weak. Although in using glue the most important thing is the selection of the right glue for the work, much depends upon its proper preparation and application. If anything that is glued up comes apart, the immediate verdict is "bad glue," which is often unjustifiable, for poor judgment or unskilful workmanship may be responsible.

Many users cling with blind prejudice to some brand they have confidence in, and pay, consequently, prices far above the market. This state of mind is easily understood, for they have often been deceived by unscrupulous or ignorant dealers who sell glue on its appearance only; and, furthermore, a small amount of glue may enter into the make-up of a large value of finished product, causing heavy loss if deficient. It makes no difference, *per se* whether a glue is cut in thin or thick sheets, or ground or pulverised. Nevertheless some users will pay extra prices for glues cut in special shapes.

In preparing glue for use the following points should be observed:—

1. Use definite weights of glue and water. Glue is sold by the pound and should be used by the pound. 2. Soak the glue in cold water until it has thoroughly softened. Ground glue softens more quickly than sheet or flake glue, and is therefore preferable, other things being equal. 3. Melt in a water or steam bath, and keep at as low a temperature as is consistent with the work. Prolonged heating injures glue, so that it is advisable to heat up successive small lots of the soaked up material, rather than have a large lot remain heated for a long time. 4. Make good evaporation from the glue-pot by the addition of water if necessary. 5. Use clean utensils. 6. Fit the stength of the solution to the work—don't use the glue too thick or too thin. 7. If surfaces are to be joined, have them dry and warm, if possible, and apply pressure until the glue has sufficiently "set."

Glues for particular purposes should be chosen as follows:—

Wood joints.—Most preferable are hide glues from 70 up. Lower test hide glues may give trouble. While some bone glues answer admirably, in general they should be avoided. The pieces to be joined should be thoroughly fitted, dry, and of seasoned wood.

Veneers.—Most advantageous is a bone and hide, or bone and sinew mixture, testing between grades 50 and 70. Higher test glues are apt to set too quickly. Pure hide or sinew glue is better, but more expensive, while, for cheap large surface work, bone glue may be used. If worked on a veneering machine, freedom from foam is essential.

Sizing.—As most sizing is done with special machinery, each case must be considered individually. Generally a free flowing glue, free from foam, is required. If used to surface paper, grease is undesirable, as is any marked acidity or alkalinity which might turn the shade of the colours with which the size is mixed.

Paper boxes.—For "setting up," quick setting hide glues, grades 70 to 90 are best. For "covering," lower test is necessary to prevent the glue setting too quickly; bone glues, testing grades 40 to 60, are most desirable. Of course, to the relatively higher test glues more water can be added; consequently they go further, and it is only a matter of proportion between strength and cost to determine the value.

Leather goods and belting.—Here the main points are flexibility, tenacity, and resistance to moisture. Nothing under grade 100 should be used, and higher test goods are to be recommended, because they are less sensible to moisture, and interpose less mass between the surfaces joined. Fish glue, once largely used, is in disfavour, being too hygroscopic. Most leather belt manufacturers make their own special "cement," using high grade glue or gelatine as a base, and mixing it with glycerin and other ingredients.

Bookbinding.—For rounding and backing, hide glues testing between grades 80 and 100 serve very well. If brittle low test or bone glues are used, the books are apt to crack down the back. Where simple pasting work is to be done, any sweet low-grade glue will answer.

In all cases especial machinery requires glue suited to its particular requirements.

Gelatine.—Only high testing glues, grade 100 or over, made from selected clean stock should be sold as gelatine to be used for food purposes. Nevertheless, nice looking glues of dubious origin, as long as they will pass muster, are often palmed off upon the unsuspecting purchaser. For photographic uses there are many special requirements which the gelatine must answer; and work on these, together with some investigations on the chemical nature of glues and gelatins is now being conducted in the laboratory of the National Glue and Gelatine Works, where the work described in this paper has been done.

THE CUBAN SUGAR INDUSTRY.

BY W. D. HORNE, PH.D.

The relative importance of Cuba as a sugar-producing country may be seen from the fact that of the 12,000,000 long tons of raw sugar produced annually in the world, Cuba furnishes about 1,000,000 tons. Excepting the small amount used on the island for local consumption the total product is shipped to the United States refineries.

This constitutes about 40 per cent. of the sugar consumed in this country, the total U.S. supply coming last year as follows:—

	Tons.
From Cuba	1,101,611
„ Foreign countries	438,383
„ Hawaii, Porto Rico, Philippines ..	516,098
„ domestic cane	355,402
„ „ beet	220,722
Total	2,632,216

The sugar cane was early brought to the West Indies by the Spaniards, and it soon became an important crop, flourishing phenomenally in the fertile soil and hot, damp atmosphere of these tropical islands. In Cuba the sugar crop amounts in value to some 75,000,000 dols., and constitutes by far the largest part of the total exports.

Prior to the late Cuban insurrection, in 1895, the annual crops had amounted to a million tons, but during 1896 and 1897 it dropped to a little over one-fifth of this amount, and remained at only about one-third of a million for several years, owing to the widespread devastation of canefields and destruction of factories during the period of hostilities between the Spaniards and the Cubans. But since the war the rehabilitation of the sugar industry has been continuous and rapid. Cuba is about 700 miles long by 50 miles wide on the average, and consists principally of limestone formation with some hills and mountains of older geological periods occurring at both ends and in the centre of the island. The principal cane belt is the comparatively level strip of country extending almost round the island near the coast. The sugar lands are commonly known as of the red and the black varieties. The former are derived from highly ferruginous limestone and constitute the best sugar lands in Cuba. While this soil is very sticky and heavy when wet, it is extremely pervious to water, drains well, and is easily worked when not freshly

drenched by rain. The black land occurs largely in the hilly parts, where it is underlaid by white calcareous subsoil, and in the level districts, where it is underlaid by a yellow or brown clay subsoil. The black land is heavier and more tenacious than the red, loses water very slowly, and until it is fairly well dried is difficult to work.

The rainy season extends from June to December. The manufacture of sugar is restricted to the dry season, extending from December to June, for during the wet weather the cane cannot be handled from the fields in the ox carts used.

Usually cane is planted in hills 3 ft. apart in rows 5 ft. apart. Of late the system of Dr. Zayas, in which the hills are planted 9 ft. by 12 ft. apart, has been strongly advocated as affording means of cultivating by machines drawn by animals and yielding a greater number of successive crops of richer cane. It is apt to yield less than the ordinary method during the first year, and, as yet, there have not been enough data collected to show conclusive results.

Ten successive crops can commonly be harvested in as many years from one planting, although in some cases many more can be had. The yield gradually diminishes, though the juice increases in density and in purity as the plants grow older in years. The average yield is probably 15 to 20 tons of cane per acre, though it may run up to four times this amount. When the land becomes exhausted the custom is to let it lie for some years, using it for pasture land. Only about one-fifth of the arable land is under cane cultivation, and intensive methods of agriculture are little known. Some experiments with fertilisers have been conducted with results indicating success when the price of sugar is not abnormally low. On some estates it is customary to spread the filter press cakes and the bagasse ash upon the fields, while in other places these are wasted.

In some experiments in Matanzas Province the yield of cane was increased from 28·73 tons per acre to 41·08 tons by the use of about 200 lb. sulphate of potash and 400 lb. of acid phosphate on plots of an acre, while the further addition of 2000 lb. of slaked lime to the above brought the yield up to 45·94 tons per acre.

The principal varieties of cane grown are the crystalina, blanca, and a red or purple-striped variety. Cuban cane does not suffer so much from the ravages of disease and the attacks of insect and parasitic enemies as the cane does in some other countries. But great losses of cane are sustained annually through destructive fires which often sweep through scores of acres before they can be checked. As a precautionary measure against the spread of fire, it is customary to leave lanes about 30 ft. wide unplanted between the rows at distances of about 100 yards, and broader avenues at right angles to these lanes and about twice as far apart. The latter are commonly planted in rows of plantain trees, which serve the double purpose of affording protection against the spread of fire and a very acceptable article of food in their fruit. As the cane ripens the leaves dry up and fall into a thickly-tangled and very inflammable mass which is almost impassable. A fire once started in this, whether by design or by chance spark, spreads rapidly, and in a high wind such as frequently prevails, sweeps along with fearful rapidity. Strangely enough, the cane itself survives the fire pretty well, being protected by its very tough siliceous rind and its abundant internal juice. But burnt cane must be cut, transported and crushed within four days or it will ferment. Should it be rained upon it will deteriorate sooner. Sugar made from it is usually dark and less desirable for refining. So disastrous is a cane fire apt to be that its intentional malicious setting has at times been treated as a capital offence.

In Cuba the factories usually obtain their supply of cane in part or altogether from farmers who raise it on their own land or on land belonging to the factory. These "colonos," or managers of cane colonies, contract with the factory to furnish cane to be paid for in 96° raw sugar, varying in amount from about 4 per cent. to 6½ per cent. of the weight of the cane as delivered to the mill. When cash is paid, it is still on the same basis, and the cash value of the sugar is estimated from the average daily quotations in the Havana market. Colonos operating on land owned by the factory usually have a five or ten year contract.

The cane is cut by hand with broad-bladed machettas or cutlasses, stripped of all leaves and tops, cut into pieces about 3 ft. long, and thrown into piles, whence it is picked up and carefully packed into ox carts, which transport it directly to the mill or else to the railroad, where it is loaded upon the cars either by hand or by mechanical hoists which raise the entire cartload at once.

It is well known that cane once cut will deteriorate if allowed to remain long on the ground. In order to ascertain the rate of deterioration, I made a series of analyses on cane exposed to the weather during six days. I cut 15 canes as nearly alike as possible and crushed five in a handmill at once, after having divided them into thirds of equal length, marked bottom, middle and top. The other 10 canes constituted the sample whose deterioration upon standing was to be noted. I cut one-sixth off the bottom of each, pressed them, and analysed the composite juice. Next day I took the next sixth off, and so continued for six days. There was a natural deterioration, as I took samples nearer to the top each day, but there was a further falling off in test due to deterioration of the juice itself with time, and this latter can be arrived at by comparing with the other figures as a guide.

The five canes first tested:—

	Brix.	Sucrose.	Purity.	Glucose.
Bottom third	18·85	16·95	89·90	0·37
Middle ,, ...	18·95	16·60	87·59	0·62
Top ,, ...	17·65	14·20	80·47	1·27

The 10 canes exposed to weather:—

	Brix.	Sucrose.	Purity.	Glucose.
Bottom sixth, fresh	19·10	16·97	88·85	0·62
Next sixth, 1 day old ...	18·75	16·40	87·48	0·75
,, ,, 2 days' old ..	18·70	15·93	85·20	0·93
,, ,, 3 ,, ...	18·50	15·62	84·46	0·96
,, ,, 4 ,, ...	17·85	14·35	80·42	1·29
Top ,, 5 ,, ...	17·00	11·86	69·77	2·25

A careful study of the above will show that the deterioration in purity during the first day is about 0·25 per cent.; in the next two days, about 1·75 per cent; and, in the next two days, about 4 per cent. It has been suggested that this rate of deterioration may be partly due to the relatively rapid deterioration in the freshly-exposed ends presented by each day's cutting.

The ox carts carry from about two to five tons of cane, and the railroad cars employed hold from 10 to 15 tons.

Many estates rely wholly upon the public railway service, while others supplement this with standard or narrow-gauge tracks, cars and locomotives of their own for operation within the confines of the estate.

About one-twentieth of the area of Cuba is under cane cultivation, which is said to be about one-fifth of the area on which cane could be suitably grown. The paucity of population has been the limiting factor in sugar production.

Just before the war there were about 180 factories manufacturing raw sugar, while in 1897 there were only 77 operating, the number rising last year to 177, making on the average per factory about 45,000 bags of 325 lb. of sugar each.

Many of the factories which were more or less demolished during the late war have been rebuilt, while others have remained in an abandoned condition. Meanwhile a new era has begun, with the advent of large amounts of American capital, in the building of new factories, some of which exceed any of the old ones in magnitude. But most striking of all the advances made are the improvements in scientific operation of the plants and the great attention paid to chemical control.

Cuban sugar factories are, as a rule, well equipped with modern machinery. The old muscovado sugar, boiled in open kettles and drained by long standing, is practically obsolete; while a high grade of centrifugal sugar, polarising about 95·5 to 96·0 is the almost universal product

of the factories, equipped with modern sugar machinery from France, Germany, England and the United States.

The march of improvement in sugar machinery is rapid and continuous, the efforts of the administrators of estates to perfect their plants are unflagging, and everybody on the island seems keen to learn of any advance and to apply it to his needs. The pride of excelling runs high, and on every hand one finds estates famed for and priding themselves upon some point of transcendent superiority. One claims the finest milling department, another the broadest acreage of cane, a third the most economical arrangement of working parts, while the strife to produce the greatest output in bags of sugar and the highest yield of sugar from cane are never-ending. A number of the factories are veritable show places, and not a few of the owners' residences are little short of palatial.

From the time when the cessation of the rainy season permits the cutting and hauling of cane, and the mills begin to grind, work is continuous day and night, with the exception of Sundays, until the rains come again late in the spring. The men work in alternate shifts of six hours each, the heat rendering a longer period less satisfactory.

Cane arriving at the factory by cart or railroad is unloaded upon the cane carrier either by hand or mechanically by a cane hoist lifting five or six tons at a time. Chains or wire ropes are pushed under the load of cane between transverse slats on the platform of the car or cart, the ends attached to the support above, and the load lifted bodily into the air, transported to a suitable hopper above the carrier, and there dropped by the pull of a trigger. In some cases, the cane is gradually discharged from the hopper upon the carrier by means of a revolving drum or travelling apron provided with strong hook-like teeth; in other cases, the hopper is built at the bottom of a trough 6 ft. or 7 ft. wide about half as deep, and leading up at an angle to the crusher. In the bottom of this trough is the carrier, an endless apron of wooden or metal slats or plates, or in the later models of steep ascent a link belt conveyor of great strength provided with strong steel teeth 18 in. long, curving slightly forward to elevate the heavy tangled mass of cane which falls upon it. The mass of canes in a rough layer, 12 in. or 18 in. deep, falls precipitously over the upper apex of the carrier into a hopper-like receptacle, which feeds it into the preliminary crusher, consisting of two enormously strong horizontal steel rools provided with interlocking ridges to grip, crush and tear the cane. The Krajewski crusher, with zigzag serrated corrugations, appears to give the best results. The Marshall, with alternating plain rings and rings of interlocking teeth, also gives very good results, although it appears to allow of more slipping than the other. These rolls are usually 30 in. to 34 in. in diameter and 6 ft. or 7 ft. long. They are set an inch or two apart, and can separate still farther by pushing back against very heavy spiral steel springs. The crusher is generally driven by a separate engine and exerts a tremendous pressure upon the incoming cane. Nearly half the juice of the cane is extracted here, and the cane, torn open and often cut into short lengths, passes by a travelling conveyor to the first mill proper, which consists of three rolls set closely together, the lower two in the same horizontal plane and the upper one centrally above the other two, and so placed as to leave an aperture of about 2 in. between the upper roll and the lower roll on the entering side and 1 in. between the upper roll and the lower roll where the crushed cane or bagasse passes out. Immediately beneath the upper roll, and bridging the space between the two lower rolls, is a curved plate, called the trash turner, which prevents the bagasse from passing down between the lower rolls, but feeds it across into the space between the upper and the second lower roll. One or two other similar sets of rolls follow, set with successively decreasing apertures between rolls so as to exert even greater pressure on the more and more exhausted bagasse. These mills are preferably provided with hydraulic pressure pistons, either pressing directly downward upon the upper roll or horizontally against the lower roll at the outgoing side. From 300 to 420 tons pressure or more can thus be exerted. It is usual to have the highest pressure upon the last mill and to operate this by a separate engine.

It is of great advantage to macerate the bagasse issuing from the first and second mills by sprinkling water upon it. This is very rapidly absorbed, and diluting the juice remaining in the cane, permits of a greater extraction of sugar at the next compression. The hotter the maceration water the more rapid is its diffusion, but if it is very hot it causes the roll journals to become overheated. For this reason, cool or tepid water is generally used. Some rolls are made with hollow shafts which permits of cooling by means of cold water. The amount of water of maceration added thus at the mills usually varies from 3 to 8 per cent. of the weight of the cane, being limited by the expense of its subsequent evaporation. This leaves in the bagasse about 7 to 9 per cent. of sucrose, equal to from 2 to 2¼ per cent. of sugar on the weight of cane. In Hawaii, where 20, 30 or even 40 per cent. of water of maceration is added in two or three instalments, the extraction of sugar is much more thorough, only 4·5 per cent. of sugar being left in the bagasse, equal to 1 per cent. on the weight of cane. A crusher and three triple mills will extract about 72 lb. of juice from 100 lb. of cane, when no maceration water is added, the crusher and first mill extracting 45 lb., the second mill 20 lb., and the third mill 7 lb. approximately. The juice first extracted comes from the soft interior, and has a higher density and purity than that which is extracted by the subsequent milling under higher pressure. The second and third mills extract a greater relative quantity of juice from the rind, and it has a darker colour as well as lower density and purity. The following determinations were made on juice from the different mills in different factories:

Plantation.	Crusher and first mill.			Second mill.			Third mill.		
	Brix.	Pol.	Purity.	Brix.	Pol.	Purity.	Brix.	Pol.	Purity.
1—1904	18·11	16·0	88·34	17·16	15·2	88·52	15·56	13·0	83·55
1—1905	17·63	15·64	88·76	16·95	14·66	86·51	16·40	13·7	83·56
2—1904	20·1	18·3	91·04	19·06	16·4	86·04	18·68	15·8	84·57
2—1905	19·75	16·9	85·5	19·05	16·05	84·2	18·5	15·2	82·16
3—1905	20·00	18·19	90·97	18·85	16·49	87·46	18·68	16·10	86·21
3—1905	18·70	16·76	89·60	18·55	15·99	86·21	17·25	14·68	85·09
4—1905 (no crusher)	17·4	15·51	89·13	16·6	13·88	85·97	—	—	—
5—1905 (no crusher)	19·16	17·09	89·12	18·01	15·11	83·9	17·98	14·98	83·36

The greatest economy of evaporation is reached when double or triple maceration is practised, but with only a single application of water. The water is always applied before the final crushing, but the diluted juice thus obtained may be carried back and used for macerating before the second mill. Or the thin runnings from filter presses may be used in the same way. This system has found its highest development in Egypt, where the juice is carried back twice, and where two-thirds of the extracted juice is taken from the crusher, the rest from the first mill.

When the utmost pressure is applied at the last rolls they emit a groaning or singing tone, and the bagasse, heated considerably by this enormous compression, issues like a mat of shavings and contains from 48 to 53 per cent. of moisture. It is conveyed in this condition by travelling slats through long shallow wooden troughs to the furnaces, where it is burnt upon special grates, and, under suitable conditions, constitutes the sole fuel required for the plant.

The combined juice from the crusher and all the mills flows through a finely perforated brass straining plate into a small receiving tank, and is pumped into the liming

tanks, where milk of lime is added to it immediately to neutralise acidity and to precipitate those impurities which form insoluble lime salts. Some mix powdered burnt lime with a pailful of juice and add this to the general mass, but the use of milk of lime kept constantly at 12° or 15° B. is greatly to be preferred. The amount of lime required to give the best results is an unsettled matter, some adding enough to produce a neutral or slightly alkaline reaction to litmus, others carrying it further, to alkalinity to phenolphthalein. In my experience, the lime continues to give a precipitate after mere neutrality to litmus has been reached, and to obtain a bright and clear defecated juice, it is necessary to add lime up to a point somewhere between neutrality to litmus and neutrality to phenolphthalein. In juice from cane of several years growth from lands long under cultivation and having a purity of 90, I found that lime added to cover 20 per cent. of this range was sufficient, while in a juice of 80 purity, obtained from new cane on virgin soil it was necessary to cover the full range to get the best results. I doubt whether it is ever necessary to add more lime than to reach neutrality to phenolphthalein, to effect a good clarification, while for other reasons an excess is objectionable. Liming tanks almost always serve as measuring tanks also, the juice over-flowing through an overflow pipe or marking its height by some float device. In the older establishments, it is customary to heat the limed juice in the same tanks as limed and measured in, by means of steam-jacketed bottoms or closed steam coils. In this case, a portion of the precipitate of lime salts, albuminous and pectinous matter, &c., falls to the bottom, and part rises to form a heavy blanket scum on top. The heating continues until this blanket cracks, at about 190° F., after which a period of subsidence is allowed and then the clear juice is suitably drawn off. In some of the newer plants, the Deming system of superheat defecation, so widely employed in Louisiana, is used. In this, the limed juice is heated to 130° or 140° F. under pressure, cooled again, and then passed through continuous settling tanks, of 5000 galls. capacity, having an internal conical diaphragm to direct the current of juice, and an inverted conical bottom to collect the precipitate. If the current flows slowly (5 ft. an hour), and the mud is removed from the bottom frequently (15 minutes), a pretty clear juice can be had, but it seldom is so bright as that obtained by open defecation. The slight turbidity can be removed, however, by filtration through Danek or gravity filters.

This system effects no materially better precipitation of impurities than the ordinary process, as shown by a set of experiments in which some limed juice with a purity of 83·65 showed a purity of 84·53 after being heated to boiling in an open vessel and filtering, as against 84·62 after being heated in the Deming to 240° and filtered. Prinsen-Geerligs has arrived at a similar conclusion from experiments in Java. Still, the apparatus is economical to operate and has a very great capacity. Probably better results in settling could be had if the tanks were used as intermittent instead of continuous settlers.

In all the modern factories filter presses are now used for treating precipitates and scums. This muddy mass is diluted with tank washings in special blowups, rather heavily limed and heated to near the boiling point. After settling the clear liquor is withdrawn and the muddy bottoms pumped through filter presses, having iron frames and jute or cotton cloths. It is difficult to wash the sugar out of the cake with either water or steam, and the best way to reduce the sugar is to dilute the scums sufficiently before filtering. The press cake is a good fertiliser, but in many cases it is thrown away. It contains 60 per cent. of water and from 6 to 12 per cent. of sugar.

The clarified juice is always concentrated in a multiple effect evaporator from about 9° or 10° B. up to 20° or 30° B., before being taken into the vacuum pan. The usual multiple effect for concentration *in vacuo* is a standard triple effect of one type or another. In the lower part of these upright cylindrical vessels are a large number of vertical tubes of about 1 in. diameter, and 3 ft. to 5 ft. long, their ends expanded into tube sheets. The space among the pipes and between the tube sheets constitutes the steam heating chamber, while the juice, admitted to the lower part of the effect rises through the tubes, is rapidly boiled and its vapour passes into the steam chamber of the second effect. The vapour arising from the boiling juice in the second effect is led into the steam chamber of the third effect. The vapour space of the third effect is connected with a vacuum pump maintaining in the third effect a vacuum of 26 ins. or 27 ins., as represented by the gauge. In this effect the juice is densest and the temperature of the heating steam the lowest, necessitating this high vacuum to effect evaporation. The vacuum in the second and first effects stands at about 16 and 5 respectively. The steam chamber of the first effect receives exhaust steam at a pressure of 10 or 5 lb., or less. The juice valves are carefully set, so as to allow the juice to pass gradually from one effect to another, while a pump removes the water of condensation from the steam chambers through suitable traps. Various other types of multiple effect evaporators are also in use, among them the Lillie evaporator, in which film evaporation is effected. Here the juice is evenly distributed over a great number of 3 in. horizontal pipes internally heated by steam. As the juice trickles down over these tubes in thin films evaporation is very rapid. The vapour from the juice evaporated in the first effect becomes the heating medium for the second, and so on. The juice is passed continuously from one effect to the other by means of centrifugal pumps driven by Westinghouse engines having a speed of about 300 revolutions per minute. Instead of a vacuum pump a Bulkley condenser is used working on the same principle as the Korting injector or the Sprengel air pump. The Lillie evaporator requires great care and must be reversed frequently to prevent incrustation of the tubes.

A common fault in Cuba is the failure to carry this preliminary concentration far enough. The best density to concentrate to is 30° or 32° B., anything less than this throwing unnecessary work upon the vacuum pans, which require nearly three times as much heat to evaporate a pound of water as the triple effect uses.

The usual vacuum pan in use is an iron pan of upright cylindrical shape, fitted with about six or eight copper steam coils varying from 3 ins. to 5 ins. in diameter placed one above the other in the bottom part of the pan. It is usually arranged so that the lower coils can receive live steam, and the upper coils either live or exhaust steam. Some of the newer pans are of copper, and 12 ft. or 13 ft. in diameter, while the older ones are usually smaller, 8 ft. to 10 ft. being common. Vapours from the vacuum pan are condensed in a water spray condenser, usually connected with a dry vacuum pump, and a Torricellian water column. Frequently a central condenser serves for several pans. On account of the relatively low position of the pans in most Cuban factories it is common to build the condenser high in the air, outside, with the vapour, water and vacuum pipes all leading up to it, while the barometrical water column pipe drops from it to a water overflow tank below. Water is so scarce in the island that it is usually necessary to use the condensing water over and over. This necessitates the repeated cooling of the water as it flows from the condenser, which is effected by discharging it upon the top of the cooling tower, a succession of slat floors placed one above the other at the distance of 3 ft. or 4 ft. The water is so broken into spray that evaporation cools it down to about 90° or 95° F., at which temperature it is used again.

The methods of "boiling sugar," as it is called, or extracting all the sugar possible from the juice are very numerous, for nearly every factory has its own modifications, introduced on account of the exigencies of apparatus, juice, and so forth. The most direct way, and one followed in some places, is to boil the thickened juice or "meládura" to grain in the vacuum pan, discharge the thick massecuite into iron sugar wagons holding about 20 cb. ft. each, allow it to stand about a day until it has cooled to about 105° or 110° F., and purging it in centrifugals to obtain a first or centrifugal sugar polarising about 96, and a first molasses with a purity of about 58 to 60. This first molasses is then boiled by itself to string proof, that is, until it is very thick, but

free from crystals and of such consistency that it can be pulled out into a string between the fingers. This stands about a week in wagons to crystallise as it cools, and is purged in centrifugals, yielding a second or molasses sugar and a residual molasses having a purity usually of 40 to 45. However, it is found more advantageous to begin boiling a pan of second sugar with thick juice and to build thus a grain in the pan, on which the first molasses, which is subsequently taken in, will deposit a good portion of its sugar so that one more thoroughly exhausts the molasses. This massecuite requires a shorter time, about three days, for cooling and crystallisation in the sugar wagons. Instead of starting the second sugar with thickened juice, some prefer to hold back a small part of a panful of first massecuite on which to build with first molasses, for in the massecuite the grain is already formed. Some factories, too, boil an intermediate grade of sugar by starting with about half a charge of thick juice or first massecuite, and finishing with first molasses, washing the resultant sugar with a little water in the centrifugals to raise it to 96 polarisation.

The progressive factories are provided with crystallisers for receiving the massecuite directly from the vacuum pan. Massecuite is frequently forced from pan to crystalliser through an 8 in. to 12 in. pipe by compressed air. The Westinghouse air compresser is very good for this purpose. The crystallisers are merely great tanks usually built in the shape of a horizontal cylinder 8 ft. in diameter by 20 ft. to 28 ft. long, and provided with an internal longitudinal shaft on which slowly revolves a helical stirrer which keeps the stiff mass in motion, affording better contact between the sugar crystals already formed and the molecules of sugar held dissolved in the mother liquor. This "crystallisation in motion" as it is called, is a marked advance upon the older process of allowing crystallisation to continue in wagons. Besides the better contact the cooling is more rapid, and this may be still further hastened by proper water-jacketing or by exhausting the hot vapour either with a blower or by a vacuum pump.

First magmas are purged within a day after being boiled, in some cases almost immediately, for if it is to be purged hot the magma can be boiled very dry, so as to contain only 8 per cent. of water. Second magmas usually crystallise well in three days in crystallisers, and it is possible by means of them to exhaust the molasses more thoroughly than by quiet crystallisation, as shown by the low purity of such residual molasses.

The centrifugals used for purging the sugar crystals from the mother liquor are of the Weston or of the Hepworth type, in the older factories 30 ins. in diameter, in the newer 40 ins. Most of the machines are belt driven, but the water drive is used in a few factories. The latter is more delicate in its adjustment and apparently more difficult to keep up to the desirable speed of 800 revolutions per minute, but it dispenses with much driving gear, and is very simple to operate. Some electric, directly driven centrifugals are also in use.

From the centrifugals the sugar drops through hoppers directly into bags usually holding 325 lbs., is accurately made up to this figure, and the bag sewn up, numbered, branded with the name of the estate, and shipped or stored for shipment.

Following are a few analyses of typical Cuban raw sugars:—

Grade.	Pol.	Ash.	Water.	Glucose.	Organic.
Centrifugal	97·00	0·32	1·40	0·52	0·76
"	94·30	0·63	1·01	1·74	2·32
"	94·50	0·61	1·21	1·79	1·89
"	95·10	0·67	1·37	1·15	1·71
"	94·50	0·60	1·53	1·47	1·90
"	96·10	0·57	0·73	1·36	1·24
Molasses	89·10	2·21	2·78	2·22	3·69
"	89·80	1·40	2·87	2·08	3·85

Large quantities of sugar are stored in the principal Cuban ports for shipment after the sugar crop is past, and such sugars are apt to ferment, causing a loss of several degrees in polarisation. Such a case is well illustrated in the following analyses of raw sugars received at a refinery here through the year from a single estate and all of the same polarisation (within a tenth of two) originally:—

	Jan. 1905.	Feb. 1905.	Mar. 1905.	Aug. 1905.	Dec. 1905.
Pol.	96·30	96·40	96·10	95·30	93·50
Ash	0·46	0·54	0·56	0·50	0·51
Water	1·02	1·11	1·21	1·10	1·27
Glucose	1·11	0·76	0·91	1·44	2·98
Organic	1·12	1·19	1·22	1·66	1·74

The residual molasses is often sold to local distillers for about two or three cents a gallon; a little is burned on the bagasse and more is run out into streams, or even spread upon the land. Very little is exported. Following are a few analyses:—

Samples	*a*	*b*	*c*	Analysis of ash. Per cent.	
				Fe & Al,	0·85
Pol. (direct)	35·8	28·60	31·80	Ca	9·60
" Clerget	40·85	35·40	31·96	Mg	0·56
" by inversion ...	—	35·72	—	K	28·34
" Sawyer's method	—	27·50	—	Na	2·95
				SO_4	9·86
Ash	6·96	—	15·54	Cl	10·32
Water	25·27	20·84	18·92	PO_4	6·06
Glucose	15·70	—	13·33	SiO_3	3·21
Organic	11·22	—	20·25	CO_2	24·18
				H_2O	0·79
			Undete	rmined	3·28
					100·00

A useful by-product has been developed of late in the form of a cattle food called "Molassecuite" formed by drying and shredding bagasse and then mixing it with as much thick molasses as it will hold. Such a product, upon analysis, showed the following composition:—

	Per cent.
Moisture	29·42
Fibre, crude	20·93
Sucrose	26·05
Glucose	6·06
Organic non-sugar	9·27
Ash, soluble	7·76
" insoluble	0·51
	100·00

Some efforts have been made also to utilise the fibre of bagasse for paper making, but this has not yet been adopted in Cuba.

As the idea of scientific control of the manufacturing operations gains ground in Cuba, the chemist is coming to the front, and the superintendence and management of the factory is entrusted to him rather than to the chief sugar boiler, as formerly. The modern chemical superintendent, through continuous systematic samples promptly analysed, and through constantly kept records in every department of the work, is able to see the correlation of its parts far more clearly than before.

Future advance in this great industry will depend upon the close adherence to scientific methods of investigation and control, and judging from the progress that has been made thus far, it is easy to believe that Cuba will always hold her place as one of the foremost sugar producers of the world.

Obituary.

HERMANN JOHANN PHILIPP SPRENGEL, PH.D., F.R.S.

Hermann J. P. Sprengel was born in 1834, at Schillerslage, near Hanover, and was educated in the Universities of Göttingen and Heidelberg, taking his degree of Ph.D. at the latter university in 1858. In the following year he came to England, which he thenceforth made his home. For three years he was an assistant in the chemical laboratory of Oxford University; then, coming to London, he worked in the laboratories of Guy's and St. Bartholomew's Hospitals. In 1865, he became connected with a firm of manufacturing chemists in London, but retired in 1870.

Dr. Sprengel was elected a Fellow of the Royal Society in 1878. In special recognition of his varied merits, he was created a Royal Prussian Professor (titular) by the German Emperor in his capacity of King of Prussia. His air-pump, which he described to the Chemical Society in 1865, though apparently a simple piece of apparatus, depending for its operation on the fall of mercury in narrow tubes, led to results quite disproportionate to its simplicity, and in many respects it may be said to have had an important influence on the development both of science and industry in the latter part of last century. The most important of Professor Sprengel's researches may, indeed, be said to have been concerned with the two extremes of the gaseous state of matter, namely, high vacua and explosions, though it is by his well-known mercury pump that his name will be best remembered. On the one hand, this apparatus enabled Sir William Crookes to carry out experiments leading him to his theory of radiant matter, whilst, on the other, it assisted at the birth of the incandescent lamp. Sir Joseph Swan's earliest attempts at making a carbon glow-lamp were foiled by the impossibility of getting a good enough vacuum. It was the mercury pump which enabled him to overcome this difficulty, and later on to establish the incandescent lamp as a useful commercial article.

Sprengel devoted much time to the study of a class of explosives, and, in 1871, took out patents for them; they are capable of being rapidly prepared when wanted, by mixing together two or more ingredients, which can be stored or transported without danger, because when separate, they are not explosive. One of these ingredients was a liquid, usually nitric acid, and the other picric acid or some other nitro-benzenoid dissolved in the liquid. Or, porous cakes of potassium chlorate were drenched with a liquid such as carbon bisulphide or nitrobenzene. Doubtless the employment of a mixture of ammonium nitrate and nitrobenzene for blasting powders, &c., followed as a consequence of Sprengel's researches. He was the first to call attention to the value of picric acid as an explosive, when fired by a detonator, and it may be said with truth that the employment of this class of substance, generally, owes its origin to his experiments and observations.

He died suddenly on Sunday, January 21st.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 113.)

ENGLISH PATENTS.

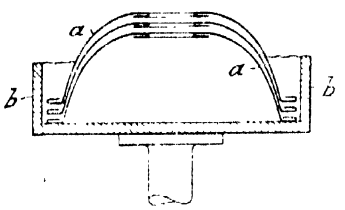
Drying Machines; Cylinder ——. J. R. Hatmaker, Paris. Eng. Pat. 1177, Jan. 21, 1905.

THE invention relates to a drying cylinder heated by means of gas jets disposed inside it. The claim is for the interposition of a layer of sand or other heat-resisting and distributing material between the flames of the gas jets and the inner side of the drying surface. The material is contained in an annular space between the cylinder wall and an inner concentric lining wall. In this way local overheating of the surface of the cylinder is stated to be avoided. (Reference is directed to Eng. Pat. 2273 of 1901.)—W. H. C.

Air Drying Apparatus; Improved ——. E. W. Cooke, and J. F. Kelly, New York. Eng. Pat. 14,856, July 19, 1905.

A NUMBER of vertical cells, fitted with a moisture-absorbing material such as calcium chloride, are arranged round a vertical shaft in a casing. The latter is provided with partitions so arranged that while a current of air is being dried by passing through one of the cells, the others are being regenerated. This is effected by passing a current of heated products of combustion from an oil burner through the cells. The shaft is rotated so that the cells are alternately drying air and being themselves dried. The air to be dried is warmed, before reaching the drying cells, by being passed through a chamber at the top of the casing which is heated by the waste gases after they have passed through the cells that are being dried.—W.H.C.

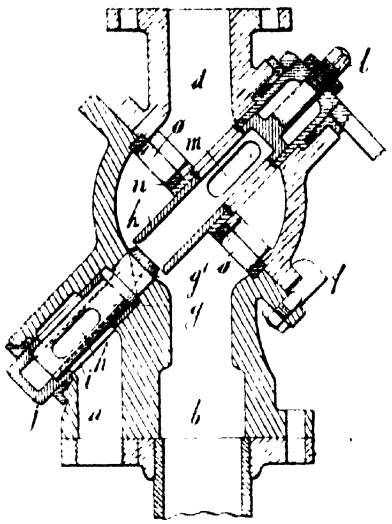
Separators; Impts. in centrifugal ——. A. F. Spooner, London. From Aktiebolaget Separator. Stockholm. Eng. Pat. 1606, Jan. 26, 1905.



THE claim is for forming a liner for the bowl *b*, of a centrifugal separator, of a number of superposed domed plates *a*, of the shape shown in the figure.—W. H. C.

Heating of Water or other liquids; Apparatus for the ——. C. Barter, Birmingham. Eng. Pat. 8340, April 19, 1905.

STEAM entering by the tube *a*, and passing through the openings *i*, *h*, issues from the jet *g*, and enters the tube *k*, drawing with it some water through the annular space g^1, from the tube *b*. The water is heated and passes through *m*, into the delivery pipe *d*. The latter is connected to the supply pipe *b*, by a planed joint, inclined at an angle of 45°, and secured by hook-bolts *f*. By rotating the faces of the joint the pipe *d*, may either form a prolongation of the pipe *b*, or may be set at an angle to it. The valves *g*, and *k*, can be regulated by turning the nuts *j*, and *l*, and a disc-valve *n*, provided with orifices *o*, which can be opened



or closed by rotating the disc, allows the cold water to continue to flow when the steam is shut off.—W. H. C.

Mixing or combining liquids or fluids; Method of mechanically —— and Apparatus therefor. F. J. H. M. Berberich, Kiel, and W. G. Schröder, Lübeck, Germany. Eng. Pat. 8895, April 27, 1905.

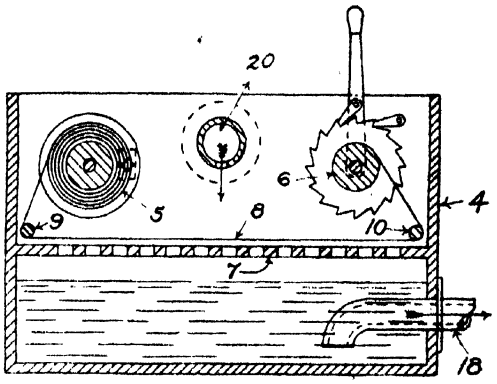
After a preliminary mixing in a vessel provided with an agitator, the mixed fluids are forced through a tube in which is placed a cylinder of less diameter than the tube, and whose surface is covered with angular projections. These projections are preferably formed by the intersection of right- and left-handed screw-threads cut upon the cylinder. The fluids are then forced through another tube in which there is a cylindrical plug with a conical end, which has a screw-thread cut upon it. The passage of the fluid through this tube causes the plug to rotate, and the fluids are ground or pulverised between the plug and tube, and thoroughly mixed together.—W. H. C.

Compressing air or gases; Method of ——. F. Windhausen, jun., Berlin. Eng. Pat. 11,140, May 27, 1905. Under Int. Conv., May 28, 1904.

One or more turbine compressors are used to effect the first or low-pressure stage of compression, and reciprocating compressors are used to complete the compression in the high-pressure stage. By this combination it is stated that the inconvenience due to the necessity of using cylinders of large dimensions when reciprocating compressors are used for the low-pressure stage and to the low efficiency of turbine compressors for the higher stages is avoided.—W. H. C.

Filters for purifying fluids, especially for extracting the oil and other impurities from condensation water, emanating from steam-engine exhausts. J. S. Milne, Camden, N.J., U.S.A. Eng. Pat. 12,716, June 20, 1905.

The filter cloth, wound upon the spool 5, passes over the roller 9, across the perforated plate 7, and round the roller 10, and is then wound on to the spool 6. The liquid to be filtered enters at 20, passes through the filter-cloth 8, and the perforated plate 7, and is drawn off through 18. The filter-cloth is drawn across the plate by turning the spool 6, at such a speed that fresh portions of the cloth come into use as the previous parts become covered with deposit. When the whole roll has been used, the spools are removed bodily from the filter-tank



and washed. (Reference is directed to Eng. Pat. 13,612 of 1894; this J., 1895, 736.)—W. H. C.

Acid-Proof Vessel for distilling and other purposes. G. W. Liddiard, Manchester. Eng. Pat. 14,092, July 8, 1905.

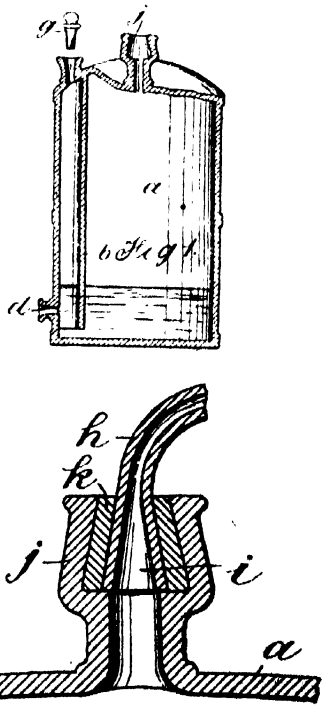


Fig. 2.

The improved construction consists in forming a partition *b*, within the vessel *a*, which is made of porcelain or other acid-proof material. The partition extends to below the level of the draw-off plug *d*, forming a liquid seal so that when the test plug *g*, is withdrawn, only a small amount of gas or vapour can escape. Further claim is made for an improved joint shown in Fig. 2; the end of the connecting pipe *h*, is opened out into a cone *i*, and is inserted into a conical cavity *j*, formed in the neck of the vessel. Packing material *k*, is then inserted between *i*, and *j*, and the greater the pressure in the vessel the tighter the joint is stated to become.—W. H. C.

Obituary.

HERMANN JOHANN PHILIPP SPRENGEL, PH.D., F.R.S.

Hermann J. P. Sprengel was born in 1834, at Schillerslage, near Hanover, and was educated in the Universities of Göttingen and Heidelberg, taking his degree of Ph.D. at the latter university in 1858. In the following year he came to England, which he thenceforth made his home. For three years he was an assistant in the chemical laboratory of Oxford University; then, coming to London, he worked in the laboratories of Guy's and St. Bartholomew's Hospitals. In 1865, he became connected with a firm of manufacturing chemists in London, but retired in 1870.

Dr. Sprengel was elected a Fellow of the Royal Society in 1878. In special recognition of his varied merits, he was created a Royal Prussian Professor (titular) by the German Emperor in his capacity of King of Prussia. His air-pump, which he described to the Chemical Society in 1865, though apparently a simple piece of apparatus, depending for its operation on the fall of mercury in narrow tubes, led to results quite disproportionate to its simplicity, and in many respects it may be said to have had an important influence on the development both of science and industry in the latter part of last century. The most important of Professor Sprengel's researches may, indeed, be said to have been concerned with the two extremes of the gaseous state of matter, namely, high vacua and explosions, though it is by his well-known mercury pump that his name will be best remembered. On the one hand, this apparatus enabled Sir William Crookes to carry out experiments leading him to his theory of radiant matter, whilst, on the other, it assisted at the birth of the incandescent lamp. Sir Joseph Swan's earliest attempts at making a carbon glow-lamp were foiled by the impossibility of getting a good enough vacuum. It was the mercury pump which enabled him to overcome this difficulty, and later on to establish the incandescent lamp as a useful commercial article.

Sprengel devoted much time to the study of a class of explosives, and, in 1871, took out patents for them; they are capable of being rapidly prepared when wanted, by mixing together two or more ingredients, which can be stored or transported without danger, because when separate, they are not explosive. One of these ingredients was a liquid, usually nitric acid, and the other picric acid or some other nitro-benzenoid dissolved in the liquid. Or, porous cakes of potassium chlorate were drenched with a liquid such as carbon bisulphide or nitrobenzene. Doubtless the employment of a mixture of ammonium nitrate and nitrobenzene for blasting powders, &c., followed as a consequence of Sprengel's researches. He was the first to call attention to the value of picric acid as an explosive, when fired by a detonator, and it may be said with truth that the employment of this class of substance, generally, owes its origin to his experiments and observations.

He died suddenly on Sunday, January 21st.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 113.)

ENGLISH PATENTS.

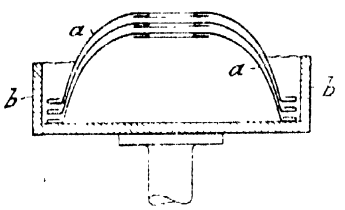
Drying Machines; Cylinder ——. J. R. Hatmaker, Paris. Eng. Pat. 1177, Jan. 21, 1905.

THE invention relates to a drying cylinder heated by means of gas jets disposed inside it. The claim is for the interposition of a layer of sand or other heat-resisting and distributing material between the flames of the gas jets and the inner side of the drying surface. The material is contained in an annular space between the cylinder wall and an inner concentric lining wall. In this way local overheating of the surface of the cylinder is stated to be avoided. (Reference is directed to Eng. Pat. 2273 of 1901.)—W. H. C.

Air Drying Apparatus; Improved ——. E. W. Cooke, and J. F. Kelly, New York. Eng. Pat. 14,856, July 19, 1905.

A NUMBER of vertical cells, fitted with a moisture-absorbing material such as calcium chloride, are arranged round a vertical shaft in a casing. The latter is provided with partitions so arranged that while a current of air is being dried by passing through one of the cells, the others are being regenerated. This is effected by passing a current of heated products of combustion from an oil burner through the cells. The shaft is rotated so that the cells are alternately drying air and being themselves dried. The air to be dried is warmed, before reaching the drying cells, by being passed through a chamber at the top of the casing which is heated by the waste gases after they have passed through the cells that are being dried.—W.H.C.

Separators; Impts. in centrifugal ——. A. F. Spooner, London. From Aktiebolaget Separator. Stockholm. Eng. Pat. 1606, Jan. 26, 1905.



THE claim is for forming a liner for the bowl *b*, of a centrifugal separator, of a number of superposed domed plates *a*, of the shape shown in the figure.—W. H. C.

Heating of Water or other liquids; Apparatus for the ——. C. Barter, Birmingham. Eng. Pat. 8340, April 19, 1905.

STEAM entering by the tube *a*, and passing through the openings *i*, *h*, issues from the jet *g*, and enters the tube *k*, drawing with it some water through the annular space g^1, from the tube *b*. The water is heated and passes through *m*, into the delivery pipe *d*. The latter is connected to the supply pipe *b*, by a planed joint, inclined at an angle of 45°, and secured by hook-bolts *f*. By rotating the faces of the joint the pipe *d*, may either form a prolongation of the pipe *b*, or may be set at an angle to it. The valves *g*, and *k*, can be regulated by turning the nuts *j*, and *l*, and a disc-valve *n*, provided with orifices *o*, which can be opened

THE general construction of the producer is shown in Fig. 1; its essential characteristic is the arrangement of the two grates 50, and 52. The outer grate 50, is composed of a number of bars, laid in a frame, like the laths of a Venetian blind. The inner grate consists of a flat tube, which is filled with water, and coiled in a helix, loosely enough to allow air, &c., to pass through into a gas-collecting chamber 53, but overlapping to prevent the passage of coal. Air is supplied to the centre of the apparatus, spreads under the gasification chamber, or the space between the grates, and enters the same through the spaces between the bars. The lower portion of the outer grate, 51, is hinged to allow the removal of ash, &c. The grates may be curved at their upper or lower ends, or both, so as to leave wider spaces between them at the top and bottom, in order that the gasification process may be most active in the narrowest (central) portion; and as the lower portion contains a large amount of de-gasified fuel, less air is supplied to it.

To regulate the supply of air to the grate, and to vary

Fig. 2.

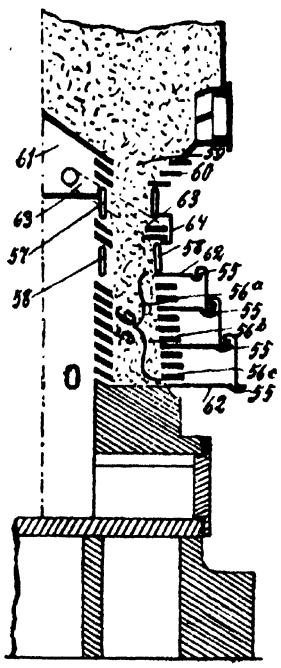
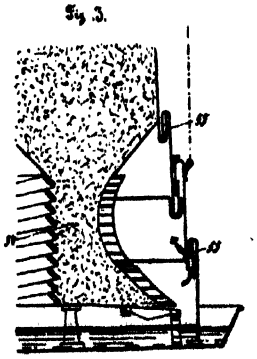


Fig. 3.



the amount of grate space required, according to the variations in the demand for gas, a series of rims or bells are arranged round the outer grate, and can be raised to allow air to pass to other portions of the grate, if more gas is required, or lowered to cut off those portions, if less gas is required. Projecting shelves are attached at intervals to the outer grate, and have at their outer extremities cups or troughs 55, into which the curved edges of the bells fit; the method of working is shown in Fig. 3.

The arrangement for decomposing the tar produced in the gasification of bituminous fuel is explained by reference to Fig. 2. The hearth is divided into (*a*) a low burning fire zone 60, (*b*) a clearing zone 59, and (*c*) a gasifying zone 56, the latter being divided into other zones provided with shutters and rims. The zones 56, 59, and 60, are separated from one another by a transverse wall 57, and by "interruptions" 58, in the grates. The tar-laden gases collect in the chamber 61, and pass by a conduit 63, to the chamber 64, which surrounds the outer grate of the zone 59, or "glowing" zone, where the tar is decomposed. The zone 56, is sub-divided by the transverse plates 62, and the shutters 55, which are regulated to meet the demand for gas. To work the producer as a pressure apparatus, the outer grate of the zone 60, must be surrounded by a chamber similar to chamber 64, and air under pressure introduced into the chambers of the zones 60, and 56^c, 56^b, and 56^c.

The whole apparatus is thus arranged to supply a gas practically free from tar, and to regulate the supply according to the demand.—W. C. H.

Lime Burning and the recovery of power-gas as a bye-product; Impts. in and apparatus for ——. The Chalk Power Gas Synd., Ltd., and H. S. Stoneham. Eng. Pat. 2684, Feb. 9, 1905. IX., page 182.

Gas maker for heavy oils. A. Eveno, Paris. Eng. Pat. 3408, Feb. 18, 1905.

GAS for use in internal combustion motors is made from heavy oils by gasifying these in a retort of graphitic iron coated with plumbago. The presence of the free carbon favours the decomposition of the heavy oils. The retort is surrounded by a jacket in which the exhaust gases of the engine circulate. To increase the surface and duration of the contact of the products of distillation and the oxygen or air used for gasification, the mixture descends through a channel to the base of the retort and then rises, circulating between the coils of a helix formed round this central passage in the retort, before passing into the carburettor. —R. L.

Gas for power purposes; Process for preparing compressed ——. O. Assmann, Tegelen, Holland. Eng. Pat. 11,413, May 31, 1905. Under Int. Conv., June 1, 1904.

SEE Fr. Pat. 354,837 of 1905; this J., 1905, 1103.—T. F. B

Gas Purifiers; Impts. in ——. S. Cutler, London. Eng. Pat. 7324, April 6, 1905.

IN gas purifiers fitted with "Jager" grids, the gases pass horizontally through the purifying mass. To maintain a uniform density throughout the mass of the purifying material, the bars or slabs of a similar net-like grating are now fitted in rectangular frames, and arranged in the purifier casing in superimposed horizontal layers in such a manner that the individual bars form obliquely ascending rows, the gas passing in this direction through the material. Distributing and collecting chambers are provided beneath and above the mass, and the bottom layer is placed on a tier of horizontal grids or sieves in the usual manner.—R. L.

Gas; Burner for testing ——. C. C. Carpenter. Eng. Pat. 24,828, Nov. 30, 1905. XXIII., page 199.

UNITED STATES PATENTS.

Fuel; Manufacture of artificial ——. A. Stillesen, New York. U.S. Pat. 809,998, Jan. 16, 1906.

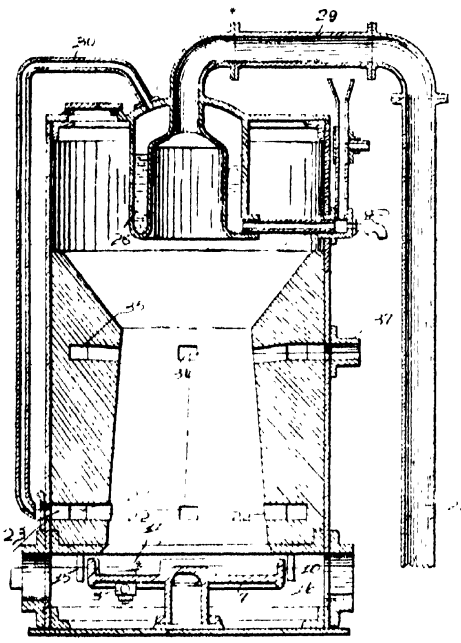
APPROXIMATELY 75 parts by weight of petroleum, 16 of turpentine and 2 of sodium palmitate or stearate, are mixed together and heated, with agitation, along with 5 parts of caustic soda and 2 of water.—C. S.

Gas mixtures; Producing combustible ——. C. K. Harding, Chicago, Ill. U.S. Pat. 803,534, Oct. 31, 1905.

PETROLEUM or kerosene of high flashing-point is vaporised in a suitably constructed lamp by passing a current of air over a wick impregnated with the oil; the mixture is submitted to the action of a catalytic substance such as platinised tripoli, placed in proximity to the vaporising surface of the wick. By the catalytic action, partial combustion takes place and the gases formed are burned in connection with an incandescent mantle. A shield localises the heat of the catalytic surface to a portion of the vaporising surface; its initial heating is effected by a flame from a small auxiliary wick.—R. L.

Gas-Producer. E. Krenz, St. Louis, Mo. U.S. Pat. 804,814, Nov. 14, 1905.

A WATER heating vessel 28, is arranged in the upper part of a suction gas-producer, and the steam generated by the heat given off during the preliminary carbonisation of the fuel, is conducted by the pipe 30, to the air inlet 23, where it is injected into the annular air and steam distributing chamber 21, 22. The generator is charged with bituminous coal, which is partially burnt and coked in the upper part of the chamber, the smoke produced passing away by the flue 29. In the lower part of the chamber, the incandescent coked fuel is decomposed by the steam and air into fuel gas, which is drawn off through openings 36, the annular chamber 35, and the pipe 37. By adjusting the suction on the pipes 29, and 37, the smoke and fuel gases are kept apart. The ashes collect on the saucer-shaped bottom piece 7, which can be turned horizontally by the handle 8 to allow the openings 10, and 11, in the upturned edge to come into line with corresponding openings 15, 16, in the projecting flange, so that the ashes can be raked out. These openings also serve for the admission of air during the preliminary heating of the producer.—W. H. C.



Gas Apparatus; Power ——. G. M. S. Tait, Montclair, N.J., Assignor to Combustion Utilities Co., New York. U.S. Pat. 810,685, Jan. 23, 1906.

THE gas is drawn from a suction-producer through a scrubber and gas-purifier by a blower or fan, and is delivered to an internal explosion engine. The fan or blower has a liquid-seal by-pass so that the gas can be delivered to the engine under a constant predetermined pressure.—W. H. C.

Calcium Carbide; Apparatus [Electric Furnace] for the production of ——. E. F. Price, G. E. Cox and J. G. Marshall, Asignors to Union Carbide Co., U.S. Pat. 809,842, Jan. 9, 1906. XI*A*., page 180.

FRENCH PATENTS.

Drying-oven with superposed floors for drying coal or the like. P. Ostertag. Fr. Pat. 358,035. Sept. 26. 1905.

THE oven is specially intended for drying bodies such as coal which can be submitted to a high temperature when wet, but which take fire easily if exposed to a high temperature when nearly dry, and which must therefore be dried by exposing them to successively lower temperatures. The coal to be dried is fed from a hopper on to the topmost of a series of superposed inclined drying floors arranged in an oven. The coal is moved over the floor by an agitator, and is dropped through a trap on to the floor next below, being finally delivered to a conveyor. The hot products of combustion from a furnace situated in the same building, but separated from the drying floors by a hollow bridge-wall, are led either directly to the top floor or through the hollow bridge to the other floors, over the coal and away to a chimney carrying the vapour with them from each floor separately. By means of dampers a regulated amount of air is admitted with the gases to each of the lower floors, so that the temperature in each is kept at the desired degree.—W. H. C.

Combustible or artificial coal composed of house refuse and nightsoil, ground together with coal or charcoal dust and an agglomerant composed of water, molasses and glucose. J. P. Reneaux, and A. Perrier. Fr. Pat. 358,200, Oct. 2, 1905.

ABOUT 25 parts of coal or charcoal dust are thoroughly ground and mixed with about 75 parts of house refuse and nightsoil, and the resulting mass is mixed with a boiling solution composed of about 85 parts of water, 10 parts of molasses and 5 parts of glucose. When the mixture has attained a sufficient degree of consistence it is briquetted.—W. H. C.

Gas Generator and appliances. J. J. Deschamps. Fr. Pat. 357,953, June 5, 1905. Under Int. Conv., June 7. 1904.

THE inventor claims, in gas generators, the practice of making the body of metal unlined with refractory material, and cooling it by means of gills and an external water jacket; also, in suction-gas plant, surrounding the ash-box and part of the body by a casing open at the top only, to produce a down-draught, and heat the air by contact with the walls and charge it with vapour; the provision of means for admitting this air above and below the fire-bars; the provision of a regulator, consisting of a closed vessel, in the gas pipe, which vessel contains a liquid the expansion of which (when the gas temperature becomes unduly high) causes a piston to open a water tap supplying a tank communicating with a water-seal round the base of the generator body, thus causing the water to overflow and trickle down into the ash-box, where it is vaporised and reduces the temperature of the fuel in the generator; the application of the same principle to regulate the supply of cooling water to the motor; the provision of a refractory covering for the mouth of the gas pipe, and the arrangement of the upper part of the same to facilitate charging the generator; the provision, in the attached scrubber, of a water jacket for cooling the lower portion of the gas pipe, and the provision of a needle-valve in the gas pipe, to regulate the pressure in intermittent suction plants.—C. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 117.)

Paraffin Wax; Cause of the transparency of ——. L. Neustadtl. Chem.-Zeit., 1906, **30**, 61—62.

TRANSPARENT paraffin wax fetches a better price in the market than "milky" paraffin wax, but hitherto the cause of the milkiness has not been studied. The author shows that it depends upon the melting points of the different constituents of the wax. When these lie within fairly close limits the product is invariably transparent, the reverse being the case when the different paraffins present differ widely as regards their melting points. Products intermediate between these varieties are transparent, but contain numerous milky particles. The cause of this appears to be due to the subsequent separation of paraffins of lower melting point after those of higher melting point have solidified. It is possible to prevent this subsequent crystallisation, and thus to render a "milky" wax transparent, by rapidly cooling when near its melting point. But this can only be done in very thin layers of 2 to 5 mm. in thickness. For the further investigation of the differences between the different kinds of paraffin wax the author has determined the speed at which they cool in a vacuum-jacketed tube, the temperature readings being taken at intervals of one minute from 60° C. downwards. It was found that when curves were plotted in which the abscissæ represented the time, and the ordinates the corresponding temperatures, there was a marked difference in the behaviour of the three kinds, *viz.*, milky paraffin wax of m. pt. 52·6° C., spotted wax of m. pt. 54·2° C., and transparent wax of m. pt. 55·2° C. Above the melting point the curves fell very rapidly, then ran nearly horizontal for some minutes near the melting points, and then slowly fell, forming very different arcs between the points of 50° and 40° C. The "milky" paraffin wax required 58 minutes to cool to the lower temperature, as against 7 minutes for the "spotted" paraffin wax and 22 minutes for the transparent wax.—C. A. M.

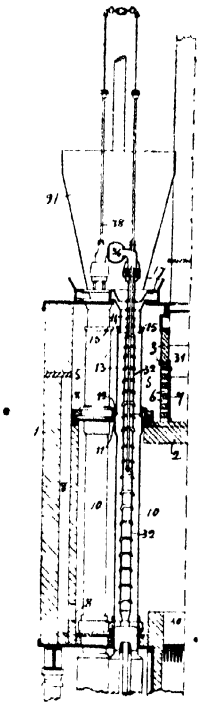
ENGLISH PATENTS.

Distillation of Coal and other substances; Destructive ——. J. Bowing, Tilbury, Essex. Eng. Pat. 580, Jan. 11, 1905.

THE destructive distillation of coal and other substances is effected by the action of superheated steam passed through chambers or passages in the walls of the retort. A practically uniform temperature of about 650° C. is maintained over the whole area of the retort.—R. L.

Charcoal; Kilns for making or revivifying animal or other ——, *or for carbonising other substances.* J. Buchanan, Liverpool. Eng. Pat. 4925, March 9, 1905.

THE drawing is a vertical section of part of the kiln, the walls 1, being made considerably higher than has been the practice hitherto. A horizontal division wall 2, is arranged about one-third of the depth from the top, through which the kiln pipes 10, pass. 3, is a wall with openings 6, and dampers 7, between the division wall and the top plate. The kiln pipes are of the usual construction and operation, the upper ends passing through openings 11, in the division wall and sockets 12, in which rest drying pipes 13, provided with feeding funnels 14, fitted into the pipes by sliding ring joints 15, to allow of expansion, contraction, and lateral motion, while preventing entrance of air. 18, is a false top plate with openings above each drying pipe, and 21, is a large hopper resting on the top plate, from which, as the charcoal passes down the kiln pipes, fresh supplies are continually fed through the funnels into the drying pipes. The products of combustion from the furnace 30, circulate through the kiln pipes, then through openings and flues 8, into the chamber 5, and finally through the drying pipes. They then escape through the openings and flue 31, to the chimney. 32, are perforated outlet pipes for the escape of steam and gases liberated from the charcoal. The upper ends are formed with annular channels for containing water, into which dip pipes attached to a box 34, so that water seals are formed, thus preventing leakage of steam into the hopper. The



dip-pipes are provided with hoods to prevent any of the charcoal in the hopper entering the water-seals or outlet pipes. 38, are small pipes arranged within the outlet pipes connected to an external compressed-air supply, and having deflecting cups, perforations or branches for directing air against or among the charcoal passing down the kiln pipes, whilst for regulating the quantity and position of the air supply, valves, sliding pistons and other controlling devices are used.—D. B.

Benzene; Manufacture of non-inflammable products from ——. H. Birkbeck, London. From E. B. Barboni, Paris. Eng. Pat. 1202, Jan. 21, 1905.

SEE Fr. Pat. 350,312 of 1904; this J., 1906, 117.—T.F.B.

UNITED STATES PATENTS.

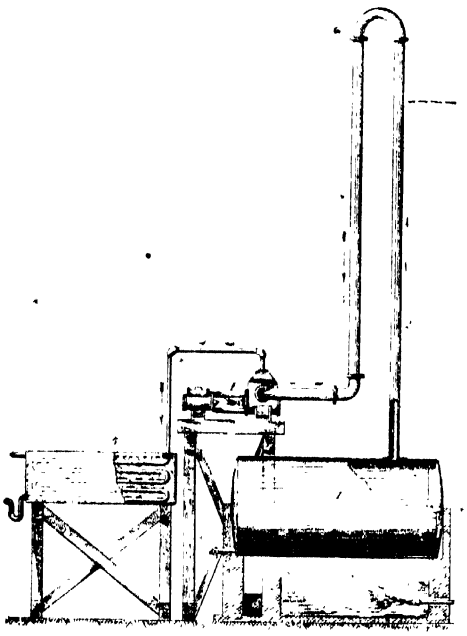
Resinous Woods; Apparatus for obtaining the products of ——, *by dry Distillation.* J. Friis, Gamla, Russia. U.S. Pat. 805,848, Nov. 28, 1905.

THE apparatus comprises an oblong oven made of boiler-plate, dished at the bottom, and rounded at the ends. It is supported on a brick foundation surrounded by inclosing walls with furnaces at opposite ends and chimneys midway in the length of the complete apparatus. The space between the oven and the walls contains a series of inclined partitions and the oven is provided with transverse pipes, so arranged that the hot gases from the furnaces are made to follow circuitous paths to ensure the thorough heating of the interior of the oven as well as the exterior. The gaseous products of distillation pass progressively through a series of condensers immersed in water vessels connected with each other, where they are gradually condensed, the final condensation being effected in a coil condenser at the end of the series.—D. B.

Wood-Distilling; Retort for ——. J. T. Denny, Cromartie, North Carolina. U.S. Pat. 806,877, Dec. 12, 1905.

The retort comprises a heavy iron or steel shell closed at the top by a cover provided with a ring bolt, by which it may be lifted. To protect the shell from the high heat necessary to char the wood, and thereby increase its life, it is incased in asbestos "lagging," held in position by segments, preferably of cast iron, provided with lugs and bolts. The retort is enclosed by brickwork, which extends nearly to the top and is spaced from the shell to form an annular heating chamber, in which are disposed two baffles, arranged diametrically opposite each other to deflect the currents of heated air. The bottom of the retort is provided with a double floor, the upper one being conical and the lower one flat, "lagging" being disposed between the floors. The shell extends below the double bottom and contains suitable inlet and outlet passages, so that the products of combustion pass beneath the bottom of the retort, and then in an upward direction to the annular heating chamber; after circulating round one-half of the retort, they pass over the baffles and finally escape through a flue to the chimney.—D. B.

Distillation [of 'Crude Petroleum']; Process of ——. G. H. Bradford, Stockton, Cal., Assignor to J. Treadwell, San Francisco. U.S. Pat. 805,116, Nov. 21, 1905.



The vapours leave the still 1, by the vertical pipe 2, which is carried upwards to a greater height than that to which the liquid in the still can rise in a vacuum. The vapour pipe then returns downwards 3, and is connected to a vacuum pump 4, which delivers the vapours to a condenser 5. It is stated that owing to the height of the pipe 2, no liquid can pass over from the still to the condenser along with the vapour, and that consequently the distillates obtained are much purer than with an ordinary vacuum still.—W. H. C.

Benzine and the like; Apparatus for continuously distilling ——. A. H. L. Gerhardt, Bettenhausen, Germany. U.S. Pat. 810,637, Jan. 23, 1906.

See Fr. Pat. 335,034 of 1903; this J., 1904, 111.—T. F. B

Fibres; Solvent to be used in effecting the incipient subdivision and decomposition of the semi-liquid cambium layer and epidermis of Bast ——. [*Utilisation of waste from petroleum refining.*] M. H. Colahan. U.S. Pat. 806,954, Dec. 12, 1905. V., page 177.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 118.)

Amines; Action of Formaldehyde and Alkali Bisulphites on primary —— and synthesis of Indigo. R. Lepetit. Bull. Soc. Ind. Mulhouse, 1905, 75, 379—384.

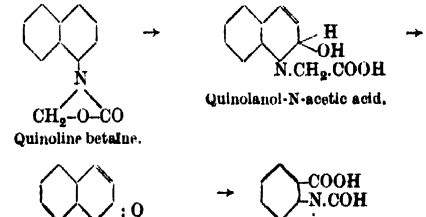
Anilinemethylene-exo-sulphonic acid, $C_6H_5.NH.CH_2SO_3H$, formed by the action of sodium bisulphite (5—6 litres of a solution at 36° B.) and formaldehyde (1300 grms. of a 40 per cent. solution) on aniline (1000 grms.), is a crystalline compound which is sparingly soluble in cold water and in alcohol. It dissolves, with partial decomposition, in alkali solutions. When heated with acids, it is decomposed, giving an orange-coloured solution. It combines with diazo salts, yielding compounds which, on heating with alkalis, are decomposed with liberation of formaldehyde and sulphurous acid. When acidified, compounds appear to give products containing free amino-groups, which can be diazotised and combined with dyestuff components, giving rise to a series of new dyestuffs.

Methylene-exo-sulphonic acids, similar to the compound derived from aniline, are obtained by the joint action of bisulphites and formaldehyde upon other primary arylamines, *e.g.*, *o*-toluidine, phenetidine, anthranilic acid, &c. In aqueous solutions of potassium cyanide they dissolve, giving, when heated, oils, or when the action occurs at the ordinary temperature, crystalline deposits, of nitrile compounds of the general formula, $R.NH.CH_2.CN$. These are insoluble in water, but dissolve readily in alcohol, from which they are precipitated by water in brilliant crystalline plates. The compound obtained from aniline, namely, phenylacetonitrile, when fused with caustic soda, yields ammonia and indoxyl, phenylglycine apparently being formed as the first phase of the reaction, and becoming transformed into indoxyl, as observed by Biedermann and the author (this J., 1891, 41) On pouring the melt into water and exposing the solution to the air, indigo is produced.

G. Freyss points out that the Badische Co. in a patent (Ger. Pat. 132,621 of July 13, 1901), taken out after the date (March 6, 1900; sealed note, 1170) of Lepetit's paper, refer to the product of the action of sodium bisulphite and formaldehyde on aniline as anhydroformaldehyde-aniline bisulphite. Further, Freyss finds that the m.pt. of the crude phenylacetonitrile obtained as described is 40—43° C., whilst that of the pure compound is stated by A. Braun to be 47—48° C. The nitrile dissolves gradually in a dilute solution of caustic soda with the formation of ammonia.—E. B.

Indigo from Quinoline; Formation of ——. H. Decker and C. Kopp. Ber., 1906, **39**, 72.

The addition product of chloroacetic ester with quinoline is oxidised with a hot solution of permanganate. The filtrate is made alkaline, evaporated to dryness, and heated to 200° C. The melt is then treated precisely as the phenylglycinecarboxylic acid melt in the technical preparation of artificial indigo. The mechanism of the reaction is explained by the following formulæ:—



Quinoline betaine. Quinolanol-N-acetic acid. Quinolone-N-acetic acid. Formyl-phenyl-glycin-o-carboxylic acid.

—H. L.

Lakes from aniline and its homologues; Black ——. S. Kirpitschnikoff. Z. Farben-Ind., 1906, **5**, 41—44.

The author has studied the oxidation products of aniline, *o*- *m*- and *p*-toluidine, cumidine and xylidine. The aniline lake was prepared from a mixture of 7·2 parts of sodium chlorate solution (1 in 2), 35 parts of potassium ferrocyanide solution at 12° B., 12 parts of water, and 26 parts of a mixture of aniline hydrochloride, 20 parts and water 53 parts. The other amino lakes were prepared from mixtures consisting of 52 parts of sodium chlorate solution (1 in 2), 25·5 parts of potassium ferrocyanide solution at 12° B., 8·5 parts of water, and 22 parts of a mixture of amino compound, 4 parts, hydrochloric acid at 15·5° B. 4 parts, and water, 14 parts. After adding 10—20 parts of hydrochloric acid at 15·5° B. to each of the mixtures, they were heated gradually to the following temperatures:—For aniline black, 60° C.; *o*-toluidine black, 75° C.; *m*-toluidine black, 60° C.; *p*-toluidine black, 60° C.; cumidine black, 80° C.; and xylidine black, 66° C. The different mixtures were then allowed to stand for 1—2 days, filtered, and the precipitates washed with cold dilute hydrochloric acid. The lakes from aniline and xylidine gave green, toluidine blackish-brown and cumidine greenish-yellow solutions. On extracting the precipitates with alcohol and ether, and boiling the extracts with water, a soluble product and an insoluble residue was obtained. For the preparation of pure lakes, as hydrochlorides or bases, it is necessary to boil the precipitates repeatedly and for some time with hydrochloric acid to remove ferric oxide, which is not easily separated and mars the colour effects, as will be seen from the following table:—

Lakes with Admixtures of Iron.

	Salts.	Bases.
Aniline black	Dark blue (hard lumps)	Dark violet
o-Toluidine black	Dark blue (fine powder)	Black with brown tinge
m-Toluidine black	Dark blue (hard lumps)	Black
p-Toluidine black	Light blue	Brownish-black
Xylidine black	Dark blue	Dark brown
Cumidine black	Dark blue	Dark brown

Lakes without Iron.

Aniline black	Dark blue, almost black powder	Dark green (powder)
o-Toluidine black	Light blue	Dark brown (fine powder)
m-Toluidine black	Dark blue	Black powder
p-Toluidine black	Blue, fine powder	Dark brown
Xylidine black	Greenish-brown	Dark brown powder
Cumidine black	Dark blue powder	Black, turning brown on grinding

The greatest difference in colour is that exhibited by aniline black, the red of the ferric oxide masking the green of the pure base, a circumstance, which accounts for the growing use of ferrocyanides in aniline black dyeing.—D. B

Diamines; Diazo derivatives of the aromatic ——. L. Vignon. Comptes rend., 1906, **142**, 159—161.

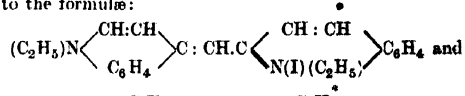
The diazotisation of the two amino groups of the diamines only resembles that of the monamines when the amino groups are joined to two different benzene nuclei, as in benzidine. When both amino groups are joined to the same nucleus, no diazo derivative is obtained in the case of the orthodiamines, whilst in the case of the meta- and para-diamines, the diazo derivatives are very unstable and are not available for making diazoamino compounds. Attempts to obtain diazoamino compounds by the combination of two molecules of diazobenzene chloride with one molecule of the phenylenediamines led to no result in the case of the ortho- and para-diamines. In the case of the meta-diamine a diazoamino compound was formed, but it was so unstable that it could not be isolated, breaking down with production of Chrysoïdine.—J. F. B.

Diazo-salts; Action of water on ——. J. C. Cain and G. M. Norman. Chem. Soc. Trans., 1906, **89**, 19—26.

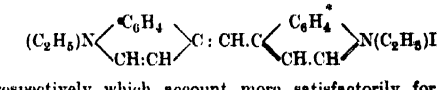
The decomposition products of the tetrazo salts prepared from *oo*-dichlorobenzidine and dianisidine are not the corresponding dihydroxy-compounds, as in the case of benzidine and tolidine, but are substances of a quinonoid character. In order to determine whether this difference is due to the presence of a substituted group in the ortho-position to the diazonium group, the authors examined a number of ortho-substituted diazo salts of the benzene series, especially those from which other investigators had failed to obtain hydroxy compounds. In every case examined, however, it was found possible to obtain the hydroxy compounds by the method described in Eng. Pat. 7233 of 1897 (this J., 1898, 269). In an addendum, J. C. Cain summarises the general results of his researches on the diazo reaction (Chem. Soc. Trans., 1902, **81**, 1412; 1903, **83**, 206, 470, 688; 1904, **85**, 7; 1905, **87**, 5; Ber., 1905, **38**, 2511; this J., 1903, 89, 548; 1905, 82).—A. S.

Cyanine Dyestuffs; Constitution of ——. W. König. J. prakt. Chem., 1906, **73**, 100—108.

The author considers that the formulæ proposed by Miethe and Book (this J., 1904, 712, 802) for Ethyl Red or Diethylisocyanine and for the blue Cyanine obtained from quinoline-methyl iodide and lepidine-methyl iodide are not satisfactory, and thinks it probable that these dyestuffs contain two hydrogen atoms less, and correspond to the formulæ:



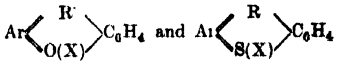
and



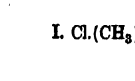
respectively, which account more satisfactorily for the analogy in properties which exists between them and the dyestuffs obtained from secondary amines and furfual or furfuracrolein. Both classes of dyestuffs combine with two atoms of iodine without essential alteration of shade, and possess the peculiar property of rendering photographic plates almost equally sensitive to all the visible rays of the spectrum. The dyestuff obtained by the author (this J., 1906, 63) from monomethylaniline and furfuracrolein possesses a pure blue shade in alcoholic solution, *i.e.*, it has the same shade as the above-mentioned blue cyanine from quinoline-methyl iodide and lepidine-methyl iodide, which is almost analogous in constitution, if one excepts the fact that the former compound contains a hydroxy group.—E. F.

Oxazine and Thiazine Dyestuffs; Nature of ——. A. Hantzsch. Ber., 1906, **39**, 153—159.

The author characterises Kehrmann's "oxonium" and "thionium" formulæ for the above dyestuffs (see Ber., 1905, **38**, 2577) as arbitrary and devoid of foundation. Dyestuffs of this class, *e.g.*, Meldola's Blue and Methylene Blue dissolve in water as neutral salts without hydrolysis, and the free bases are occasionally (*e.g.*, Methylene Blue) comparable in strength with the alkalis. On the other hand, all undoubted "oxonium" and "sulphonium" salts of the general formulæ

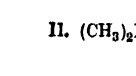


are entirely decomposed by water, and are therefore derived from very weak bases. The mother substances of Meldola's Blue and Methylene Blue fall under the above formulæ, according to Kehrmann's views, which are thus incompatible with the known facts. Further, the behaviour of Methylene Azure (see Formulæ I. and II.), and Binschedler's Green is in favour of the older assumption that these substances are quinonoid ammohium salts. Methylene Azure dissolves in water as a neutral salt. According to the azthionium formula (II.) it must, as a sulphonic acid chloride, be decomposed by water into the sulphonic acid and hydrochloric acid. The free base, which has been isolated by Bernthsen (Annalen, **230**, 180), must contain the group $OH.(CH_2)_3N:C_6H_3$, and cannot contain the group $>SO_2OH$, as it is a base and not a sulphonic acid.



I. $Cl.(CH_3)_2.N:C_6H_3\langle{}^{>N}_{SO_2}\rangle C_6H_3.N.(CH_3)_2$

Ammonium formula.



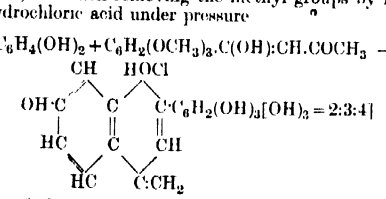
II. $(CH_3)_2N.C_6H_3\langle{}^{N}_{SO_2Cl}\rangle C_6H_3.N.(CH_3)_2$

Azthionium formula.

—H. L.

2-(2.3.4-*Trimethoxyphenyl*)-4-*anhydromethyl*-7-*hydroxy*-[1.4-*benzopyranol*] *and its derivatives.* C. Bülow and C. Schmid. Ber., 1906, **39**, 214—225.

In addition to the compounds previously described (this J., 1901, 704, 799, 1106), 2-phenyl substituted pyranol derivatives, containing two methoxy or hydroxy groups in the attached phenyl residue in the *o*- and *p*- position to the connecting carbon, as well as in the conjugated benzene nucleus, have also been prepared (see Bülow and Sautermeister, Ber., 1904, **37**, 354 and 4715). These substances, particularly the unmethylated bodies, are distinguished by good tinctorial properties. The authors have now prepared derivatives of 2-phenyl-4-anhydromethyl-[1·4-benzopyranol], which contain only one auxochrome hydroxyl group in the benzene nucleus and three neighbouring hydroxyls in the attached phenyl ring, by condensing resorcinol with 2.3.4-trimethoxybenzoylacetone, and then removing the methyl groups by means of hydrochloric acid under pressure



$C_6H_4(OH)_2 + C_6H_2(OCH_3)_3.C(OH):CH.COCH_3 \rightarrow$

CH HOCl

OH·C C C·$C_6H_2(OH)_3$[OH]$_3$ = 2:3:4]

HC C CH

HC C:CH_2

They find that the dyeings of this substance, apart from their deeper tone, do not differ materially from those of the resorcinol-benzoylacetone condensation product, since the auxochrome groups are not in the chromogen nucleus.—H. L.

Isohæmatein; a brown Dyestuff [*Logwood derivative*] *suitable for tissue printing.* L. d'Andiran. Bull. Soc. Ind. Mulhouse, 1905, **75**, 385–388.

Hummel and Perkin (this J., 1882, 448) showed that when hæmatein is dissolved in sulphuric acid, there is produced isohæmatein sulphate, $C_{16}H_{11}O_5(SO_4H)$, a compound almost insoluble in water, but resolved, by prolonged contact with this, into sulphuric acid and a "basic" sulphate of the formula $(C_{16}H_{12}O_6)C_{16}H_{11}O_5(SO_4H)$. The latter in dyeing properties differs considerably from the dyestuff from which it is derived, giving, for instance, in combination with iron oxide and chromic oxide dark brown, and with alumina and tin oxide, dull red colour-lakes. Owing to its too sparing solubility, however, it has little or no technical value. It is now found that the dyestuff in question when treated (in the form of a 15 per cent. paste) with sodium bisulphite (5 to 10 per cent. of a solution at 36° B.) and a little sodium acetate, is converted into an easily soluble compound, considered likely to be of great value for tissue printing. A suitable mixture for the application of the new compound consists of starch paste containing acetic acid, (150 parts), the compound "isohæmatein brown" in the form of paste (20 parts), chromium acetate (10 parts of a solution at 20° B.) and calcium acetate (4 parts of a solution at 16° B.). This is printed, and the printed tissues are steamed for 1½—2 hours and then rinsed and soaped. The bronze colour thus produced is, it is stated, very fast to light, air, soaping, &c., being, it is stated, much superior to the chrome lake of hæmatein in this respect. Compared with alizarin dyestuffs, the new compound has the advantages of printing without staining the "whites" and of penetrating well into the texture of the tissue, the latter property rendering it of especial value in the printing of raised (flannelette, &c.) and pile (velvets, &c.) tissues.

Isobrasilein; a claret coloured dyestuff [*Brazilwood derivative*] *suitable for tissue printing.* L. d'Andiran. Bull. Soc. Ind. Mulhouse, 1905, **75**, 388.

Isobrasilein sulphate (this J., 1882, 448), formed from brasilein by the action of sulphuric acid, followed by prolonged washing of the product with water, yields, on treatment with sodium bisulphite, a dyestuff-compound analogous to "isohæmatein brown" (see preceding abstract). This gives, when printed with a chromium mordanting salt and steamed, &c., a claret colour-lake which is considered to be of technical interest. As technically pure brasilein, unlike technically pure hæmatein, is not an article of commerce, the preparation of the "isobrasilein claret" compound cannot, at present, be undertaken on an industrial scale.—E. B.

English Patents.

Indigo-white; Manufacture of preparations of ——. O. Imray, London. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 4647, March 6, 1905.

The application of indigo-white, either dry or as aqueous pastes, meets with some difficulties, as dry indigo-white cannot easily be converted into paste form and is readily oxidised in the air. Moreover, the indigo-white in pastes tends to separate out in consequence of its crystalline structure and high specific gravity. According to the present invention, pastes are prepared, preferably from the moist indigo-white, in which the particles of the latter are surrounded by a viscid organic body soluble in water and of such nature as not to adversely influence the vat. Such bodies are syrupy mono-, di- and tri-saccharides, especially molasses. Thus indigo-white may be kneaded with molasses and, if preparations of a high percentage are desired, the product so obtained may be evaporated *in vacuo* to a syrup or solid. Or the indigo-white may be subjected to pressures of 200 atmospheres, preferably hydraulically, and kneaded with molasses. The concentrated sugar solutions have a preservative effect, rendering the usual preservatives unnecessary, but small quantities of fluorides or acids, such as formic acid, or of alkalis or alkaline-earths may be added. The indigo-white may be partially or entirely replaced by its soluble alkali salts. As an example of suitable proportions, 1000 parts by weight of indigo-white, containing 25 per cent. of water, made by pressing at about 200 atmospheres pressure, may be stirred in a kneading-machine with about 400 parts of viscid molasses, syrup, invert sugar or the like.—E. F.

Dyes [*Sulphide Dyestuffs*]; *Manufacture of black Sulphur* ——. G. E. Junius, Asnières, and H. R. Vidal, Paris. Eng. Pat. 644, Jan. 12, 1905.

See Fr. Pat. 349,873 of 1904; this J., 1905, 840.—T. F. B.

United States Patents.

Dyestuff and process of making same · *Violet* [*Anthracene*] ——. O. Bally and M. H. Isler, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 809,892, Jan. 9, 1906.

See Fr. Pat. 349,531 of 1904; this J., 1905, 726.—T. F. B.

Anthracene compounds [*Dyestuffs*] *and process of making same.* O. Bally, Mannheim, and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 809,893 and 809,894, Jan. 9, 1906.

See Additions dated Feb. 22 and March 20, 1905, to Fr. Pat. 349,531 of 1904; this J., 1905, 964 and 1010.

—T. F. B.

French Patents.

p-Aminophenolsulphonic Acid; Manufacture of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 350,415, Dec. 20, 1904.

See Ger. Pat. 160,170 of 1904; this J., 1905, 886.—T. F. B.

Dyestuffs; Manufacture of brown Sulphide ——. Act.-ges. f. Anilinfabr. Fr. Pat. 357,986, Sept. 22, 1905.

A MIXTURE of *m*-phenylene- and *m*-toluylenediamine is heated with sulphur at a high temperature and the melt is subsequently treated with sodium sulphide.—H. L.

Dyestuffs varying from yellow to orange; Production of Sulphide ——. Act.-ges. f. Anilinfabr. Fr. Pat. 358,017, Sept. 25, 1905.

A MIXTURE of diformylbenzidine and *m*-toluylenediamine is heated with sulphur at temperatures exceeding 200° C. —H. L.

Dyestuffs; Production of blue to greenish-blue [Sulphide] ——. Badische Anilin und Soda Fabr. Fr. Pat. 357,600, July 29, 1905. Under Int. Conv., Jan. 21, May 25, 27 and 29, 1905.

THE process claimed consists essentially in (1), causing the following substances to react upon each other in any order:—(*a*) Quinone and its halogen derivatives; (*b*) thiosulphates, alkali sulphides, sulphuretted hydrogen, potassium thiocyanate, or other sulphurising agents; (*c*) monoalkylated or unsymmetrically dialkylated *p*-diaminothiosulphonic acids, or their mercaptans or disulphides, or the corresponding diamines in the presence of thiosulphates. Alternatively, (2), thioderivatives of hydroquinones containing one or more S R groups (R = an acid radical) or their mercaptans, sulphides or disulphides, may be isolated and condensed with the above-mentioned thiosulphonated *p*-diamines. The thio-derivatives in question are prepared by treating quinones, their derivatives and substitution products with a compound of the general foumula H.S.R., of which the most active are stated to be thiosulphonic, monothiocarboxylic, xanthogenic and thiocyanic acids. The operations specified are in general carried out in the presence of mild condensing agents; where necessary the dyestuff first formed is converted into a true "sulphide" dyestuff, by treatment with an alkali or alkali sulphide. Among the 19 examples given are the two following, which describe (1) the preparation of the potassium salt of hydroquinonemonothiosulphonic acid, and (2) the preparation of a blue sulphide dyestuff by condensing this substance with dimethyl-*p*-phenylenediaminethiosulphonic acid in alkaline solution.

(1) 43·2 kilos. of quinone (2/5 mol.) are dissolved in 150 kilos. of glacial acetic acid and allowed to drop, warm (40° or 50° C.), into a solution containing 150 kilos. of sodium thiosulphate (theory, 99·2 kilos.) and 200 litres of water at a temperature not exceeding 10° C. The solution is then saturated with potassium chloride and the potassium salt of hydro-quinone-thiosulphonic acid is filtered off. (2) To 150 kilos. of this substance, dissolved in 500 litres of water, are added, with cooling, a solution of 100 kilos. of dimethyl-*p*-phenylenediaminethiosulphonic acid in 500 litres of water and 60 kilos. of caustic soda (40° B). The mixture is allowed to slowly drop into a solution of 160 kilos. of caustic soda in 500 litres of water, which is kept at 60°—70° C. After standing for one hour, air is passed in and the dyestuff is isolated by acidifying the solution with hydrochloric acid. The product obtained is a violet powder which dissolves with a brown colour in dilute sodium sulphide solution.

The preparation of a number of sulphurised derivatives of hydroquinone and quinone is described in other examples, such as the monothiosulphonic acid, the mercaptan, the mono- and disulphide, the *a*- and *β*-dithiosulponic acids, the corresponding dimercaptans, and the tetrathiosulphonic acid of hydroquinone; benzoylhydroquinone-mercaptan, $C_6H_3(OH)_2S.CO.C_6H_5$

$$[(OH)_2 : S.CO.C_6H_5 = 1 : 4 : 2]$$

(from quinone and thiobenzoic acid in ethereal solution); the xanthate of hydroquinone, $C_6H_3(OH)_2S.CS.OC_2H_5$

$$[(OH)_2 : S.CS.OC_2H_5 = 1 : 4 : 2];$$

2.6.dichloroquinone and 2.6.dichlorohydroquinone mono- and dithiosulphonic acids, &c. The preparation of dyestuffs from several of these products is also illustrated by examples. In general, the dyestuffs obtained are stated to dye cotton from baths containing sodium sulphide in blue or greenish-blue shades of remarkable fastness to light, washing and acids. The fastness to chlorine is stated to be, at least for sulphide dyestuffs, very satisfactory.—H. L.

Dyestuffs varying from violet to blue from Indophenols derived from Paradiamines and α-Naphthol; Manufacture of Sulphide ——. C. Ris. Fr. Pat. 357,587, Sept. 9, 1905. Under Int. Conv., July 17, 1905.

ACCORDING to Fr. Pat. 284,387 of 1894 (which deals with the conversion of indophenols into sulphide dyestuffs) indophenols, such as the "well-known product derived from *a*-naphthol," which do not possess at least one phenol, cresol or phenolcarboxylic acid residue, are not suitable for conversion into sulphide dyestuffs. The present inventor on the contrary, finds that the indophenols derived from *a*-naphthol and *p*-diamines yield valuable products varying in shade from pure blue to violet, when heated with polysulphides, and claims the preparation of these dyestuffs.

For example, a press cake containing 20 kilos of the indophenol obtained from *p*-aminodimethylaniline and *a*-naphthol is dissolved in presence of 30 kilos. of crystallised sodium sulphide. To the clear solution 15 kilos. of sulphur dissolved in 40 kilos. of crystallised sodium sulphide are added. The mixture is evaporated until its boiling point reaches 115° C., and is then boiled under a reflux condenser for about eight hours. The dyestuff separates out and is filtered off, redissolved in sodium sulphide and reprecipitated in the usual way. *p*-Aminodiethylaniline, or *p*-aminomonomethyl- or ethyl-*o*-toluidine may be employed in place of *p*-aminodimethylaniline. Blue dyestuffs of different shades are obtained. The indophenols obtained from *p*-phenylenediamine or *p*-toluylenediamine ($CH_3 : (NH_2)_2 = 1 : 2 : 3$) yield dyestuffs which are stated to produce with only 3 per cent. a heavy shade of violet. The above dyestuffs possess, it is said, good affinity for cotton in the form of their leuco-bodies. The shades are developed by oxidation on the fibre, and are then stated to be fast to light, washing, alkalis, and weak organic acids, but not to mineral acids. The dyestuffs are soluble in alcohol and benzene.—H. L.

GERMAN PATENTS.

Lakes [from Azo Dyestuffs]; Process of preparing colour ——. F. Bayer und Co. Ger. Pat. 160,172, May 28, 1903. XIII*A*., page 189.

Dianthraquinone-imides; Process of preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 162,824, Oct. 30, 1903.

DIANTHRAQUINONEIMIDES, stated to be of value in the production of dyestuffs, are prepared by condensing halogenated anthraquinones with aminoanthraquinones in presence of metallic salts, such as cupric chloride. —T. F. B.

Dyestuffs; Process of preparing yellow Sulphide ——. Chem. Fabr. vorm. Weiler-ter-Meer. Ger. Pat. 163,001, April 19, 1904.

BENZIDINE or tolidine is heated with *p*-nitro-*o*-toluidine or with *o*-nitro-*p*-toluidine and sulphur, to a temperature of 220°—300° C. The dyestuffs are pure yellow in colour, and similar to those obtained from *m*-toluylenediamine with benzidine or tolidine (see Addition to Fr. Pat. 321,183 of 1902; this Journal, 1904, 57).—T. F. B.

Hydroxyphenylrosindulines [Azine Dyestuffs]; Process of preparing ——. Kalle und Co. Ger. Pat. 163,239, April 19, 1904. Addition to Ger. Pat. 158,077, Dec. 4, 1902 (see this J., 1905, 614).

HYDROXYPHENYLROSINDULINES are obtained by heating *p*-amino-*o*-cresol with benzeneazo-*a*-naphthylamine or benzeneazophenyl-*a*-naphthylamine and water or alcohol under a reflux condenser. The sulphide dyestuffs prepared from the product, are purer and more yellowish-red than those obtained when *p*-aminophenol is employed (compare Ger. Pats. 158,101, 160,789 and 160,815; this J., 1905, 614 and 886).—T. F. B.

Indigo and its Homologues; Process for preparing Chloro-derivatives of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 162,670, May 3, 1904. Addition to Ger. Pat. 160,817, Feb. 24, 1904.

Organic acid chlorides are used for chlorinating indigo or its homologues, instead of the halogen compounds of phosphorus or sulphur, as in the principal patent (see this J., 1905, 1224).—T. F. B.

Dyestuff for Lakes; Process for preparing a Monoazo ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 163,055, Aug. 24, 1904.

p-Chlorobenzenesulphonic acid is chlorinated, nitrated and reduced; the resulting *o*-dichloranilinehomosulphonic acid ($SO_3H : NH_2 : (Cl)_2 - 1 : 2 : 4 : 5$) is diazotised and combined with β-naphthol, the dyestuff thus produced, being capable of forming clear red lakes when precipitated by a suitable metallic salt.—T. F. B.

[*Magenta*] *Fuchsin Preparations easily soluble in water* [*Triphenyl-methane Dyestuffs*]; *Process for preparing colourless* ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 163,104, Aug. 13, 1904.

Fuchsins containing 21 or 22 carbon atoms in their molecule are allowed to react for a long time, at the ordinary temperature, with concentrated hydrochloric acid; on addition of four mols. of water, colourless products are obtained, dissolving easily in water to stable, colourless solutions.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 120.)

Naphthylamine Claret; Discharging —— with sodium hydrosulphite, in the presence of alkaline iron compounds. L. Baumann and G. Thesmar. Bull. Soc. Ind. Mulhouse, 1905, 75, 374—378.

The alkaline discharge-mixture containing sodium hydrosulphite in solution and suspension, described in a *pli cacheté* dated 1903 (this J., 1905, 435; see also Addition to Fr. Pat. 297,570, this J., 1905, 87), suffers from the disadvantage, inherent to mixtures in which crystalline precipitates are present, of scratching the printing rollers. A mixture free from this defect, giving, moreover, like the mixture referred to, an excellent white discharge on tissues dyed with *a*-Naphthylamine Claret, is composed of 160 parts of British gum, 160 parts of precipitated calcium carbonate (64 per cent. paste), and 80 parts of china-clay mixed into a paste with 120 parts of cold water, to which are added 340 parts of concentrated sodium hydrosulphite-formaldehyde ("100 per cent."), 210 parts of caustic potash and, finally, after these compounds have been dissolved, 130 parts of an alkaline iron solution, prepared by dissolving 20 parts of ferric chloride in 20 parts of water and adding the solution gradually, while agitating carefully, to a solution of 24 parts of caustic potash and 40 parts of glycerin in 26 parts of water. The tissues printed with this mixture are steamed for three to four minutes. They are then thoroughly rinsed in water, soured, preferably with dilute ($\frac{1}{2}$—1° B.) hydrochloric acid, again washed, and soaped. Certain other metallic salts act similarly to iron salts in this connection, but mostly in a much lower degree. For example, the salts of tin and of nickel show considerable activity; those of cobalt, silver and mercury act very feebly; whilst the salts of most other metals are quite without action. Coloured discharges are produced with the white discharge-mixture in admixture with Flavanthrene (for yellow), Melanthrene (for grey), Indanthrene (for pale blues), Cyanosine, "soluble in spirit," dissolved in phenol and thus incorporated with the white discharge mixture (for pink) and Indigo. Indanthrene appears to be partially decomposed and is suitable only for pale shades of blue. Deeper shades of this colour may be obtained with Phenocyanine V, which is made into a paste with phenol before being added to the printing mixture. Other gallocyanine dyestuffs may be similarly applied.

C. Favre states that very fast coloured discharges may be obtained with the alkaline iron mixture recommended, by admixing this with sulphur dyestuffs; thus, a yellow discharge is produced with Immedial Yellow D (40 grms. per litre), a blue discharge with Immedial Sky blue (40 grms. of the dyestuff in the form of paste per litre), and a green from a mixture of the yellow and blue printing colours. The printed tissues, after being steamed for four minutes, are treated for a minute at the ordinary temperature with dilute (1 :100) hydrochloric acid and are then washed, &c.—E. B.

Naphthylamine Claret; Discharging —— with Sodium Hydrosulphite, in the presence of neutral iron compounds. L. Baumann, G. Thesmar and A. Hug (of La Société E. Zundel). Soc. Ind. Mulhouse, Procès-verbaux, 1905, 217—218.

Experience has shown that the process of discharging tissues dyed with a *a*-Naphthylamine Claret by means of a mixture containing sodium formaldehyde-sulphoxylate, a caustic alkali, and an alkaline solution of iron (see preceding abstract) is unsuitable for finely engraved patterns, probably owing to the alkali present in the mixture absorbing moisture during the steaming operation. A satisfactory discharge for such patterns is obtained from a suitably thickened mixture of sodium formaldehyde-sulphoxylate, an iron salt, and sodium nitrite, the effect on the azo dyestuffs being increased by the further addition to the mixture of sodium citrate or sodium ricinoleate. The sodium nitrite may be omitted from the printing mixture and applied to the tissues in the form of a preparation-solution.—E. B.

English Patents.

Washing and drying fabrics, fibrous substances and the like; Mechanism for ——. J. T. and J. S. Moore, Keighley, Yorks. Eng. Pat. 1120, Jan. 20, 1905.

An open-work cage, mounted to rotate horizontally, serves as a receptacle for materials which are to be washed, dyed, &c. Beating or lifting devices are fitted within the cage, for the purpose of raising the materials and distributing through them the washing, &c., liquors in which the cage is immersed, while it is being turned. The cage, with its contents, after the washing, &c., has been effected, is transferred to a chamber in which the materials are dried by a current of hot air.—E. B.

Aniline Black on vegetable fibres, yarns and fabrics; Production of ——. J. Singer and The Bradford Dyers' Association, Ltd., Bradford. Eng. Pat. 17,218, Aug. 25, 1905.

In order to produce animal black on vegetable fibres or fabrics, these are first impregnated with an aqueous solution of chromic acid, or of a mixture of chromates or bichromates with sufficient mineral acid to liberate chromic acid, and are then exposed to aniline vapour. A good black is said to be produced if 10 per cent. of chromic anhydride (CrO_3) is used, calculated on the weight of the material. The impregnation with aniline vapour is carried out by exposing the materials in a chamber at 80° to 100° C., into which the vapour, obtained by blowing air or steam through aniline oil, heating aniline oil, or heating a mixture of aniline oil and water to 90° C., are introduced. By keeping the chamber at the above-mentioned temperature, the process of formation of the black is quickened, and the shade produced is said to be rendered faster and more permanent to atmospheric influences. The material is subsequently washed and dried in the usual manner.—E. F.

Patterns, Designs or other similar markings in fabrics; Production of ——. C. W. Fulton, Paisley. Eng. Pat. 533, Jan. 11, 1905.

See Fr. Pat. 356,188 of 1905; this J., 1906, 17.—T. F. B.

Hydrosulphite preparation; Manufacture of a ——. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst en Maine, Germany. Eng. Pat. 26,173, Dec. 15, 1905. Under Int. Conv., Dec. 28, 1904.

A HYDROSULPHITE compound directly applicable to vat dyeing is obtained by evaporating to dryness *in vacuo* a mixture of an alkali hydrosulphite, a ketone and ammonia. Thus, 1 litre of a 12 per cent. sodium hydrosulphite solution, 100 c.c. of acetone and 200 c.c. of a 25 per cent. ammonia solution may be used; the resulting white product is more stable than sodium hydrosulphite, but is also capable of reducing Indigo sulphonic acid in the cold (compare Eng. Pat. 6216 of 1904; this J., 1905, 194).
—T. F. B.

Fire-Resisting; An improved solution for rendering combustible materials [*Wood, Textile Materials, &c.*] ——. A. W. Baxter. Eng. Pat. 5209, March 13, 1905 IX., page 182.

UNITED STATES PATENTS.

Fibres; Solvent to be used in effecting the incipient subdivision and decomposition of the semi-ligneous cambium layer and epidermis of Bast ——. M. H. Colahan, Chicago. U.S. Pat. 806,954, Dec. 12, 1905.

THE residue in discharge waste waters obtained on washing "sludge oil" after treatment with sulphuric acid is heated with the discharge waste from paraffin oil purification known as "spent soda" to 100° C., and the mixture is used as a solvent for the purpose set forth in the title.
—T. F. B.

Bleaching Fibres. J. Wakefield, Cockermouth. U.S. Pat. 809,869, Jan. 9, 1906.

SEE Eng. Pat. 26,521 of 1903; this J., 1904, 1026.—T. F. B

Steaming Cloth; Machine for ——. G. B. Gerlach, Assignor to Kettling und Braun, Crimmitzschau, Germany. U.S. Pat. 810,271, Jan. 16, 1906.

SEE Eng. Pat. 7005 of 1905; this J., 1905, 671.—T. F. B.

FRENCH PATENTS.

Silk and Textiles; Process of making artificial ——. H. E. A. Vittenet. Fr. Pat. 350,383, Dec. 8, 1904.

SEE Eng. Pat. 1686 of 1905; this J., 1905, 921.—T. F. B.

Silk; Recovery of solvents, especially Alcohol and Ether, from bobbins of artificial ——. J. Donge. First Addition, dated May 17, 1905, to Fr. Pat. 356,835 of April 21, 1905.

THE bobbins or supports on which the artificial silk is wound are provided with longitudinal perforations, in order to facilitate the introduction of the wash water in the process described in the main patent (see this J., 1906, 71).—H. L.

Tissues at full width; Apparatus for scouring, bleaching, dyeing, mercerising, &c. ——. C. L. Rothwell-Jackson and E. W. Hunt. Fr. Pat. 356,712, Aug. 5, 1905.

THIS invention relates to apparatus for bleaching, &c., tissues at full width (see Eng. Pats. 5409 of 1900 and 7872 of 1903; this J., 1901, 120, and 1903, 904), being more especially concerned with the provision of mechanism for automatically reversing the direction in which the tissues are drawn from the one to the other of two rollers, mounted side by side within a closed vessel The construction and manner of operation of the apparatus are as follows:—The tissue 17 (see Figs. 1 and 2) is wound upon one of two draw-rollers 13, a portion of it, long enough to encircle several times the other draw-roller, being unwound, passed round a pressure-drum 19, and wound upon the second draw-roller, while the carriage bearing the framework upon which the rollers are mounted is outside the keir. The carriage is then run on rails into the keir, its position being so adjusted that clutches 10 and 11, at the end of the shafts upon which the draw-rollers are mounted, engage with clutches 12 and 14, fixed upon the ends of driving shafts 15, extending through stuffing-boxes in the back of, and actuated from outside, the kier. The door of the keir is then closed; the scouring, &c., liquor to be applied, is introduced; and steam is admitted until the required pressure has been attained within the apparatus. The draw-roller upon which the tissue is to be wound is then set in motion. The tissue is thus unwound from the roller upon which it was originally placed and wound upon that which is driven. When almost the whole of it has been received upon the latter roller, the mechanism is reversed and the tissue is re-wound upon the first roller. This is accomplished automatically by means of a friction-pulley 20, fixed upon the shaft of the pressure-drum 19, which descends upon a friction pulley 9, loosely mounted upon the shaft which carries the roller from which the tissue is being withdrawn. When the two pulleys come into

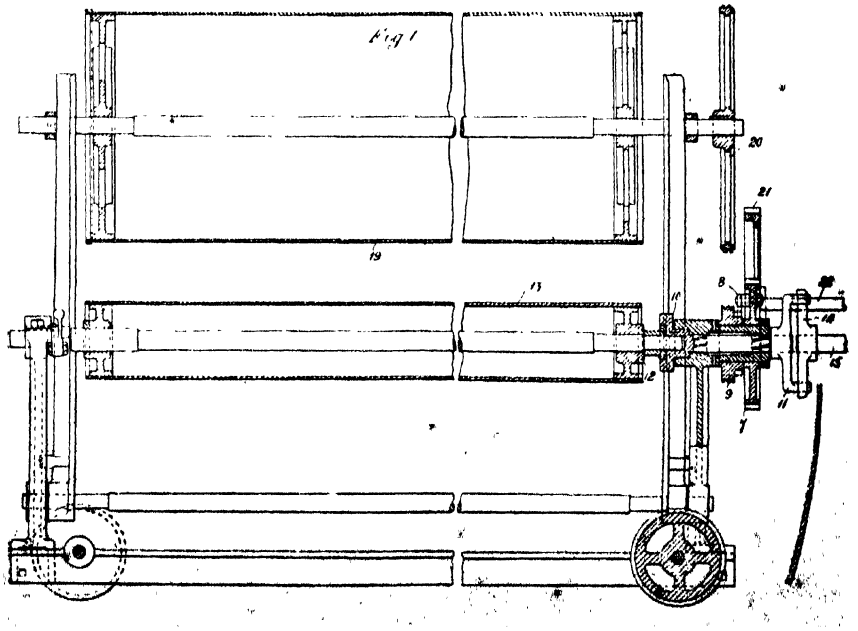


Fig. 2

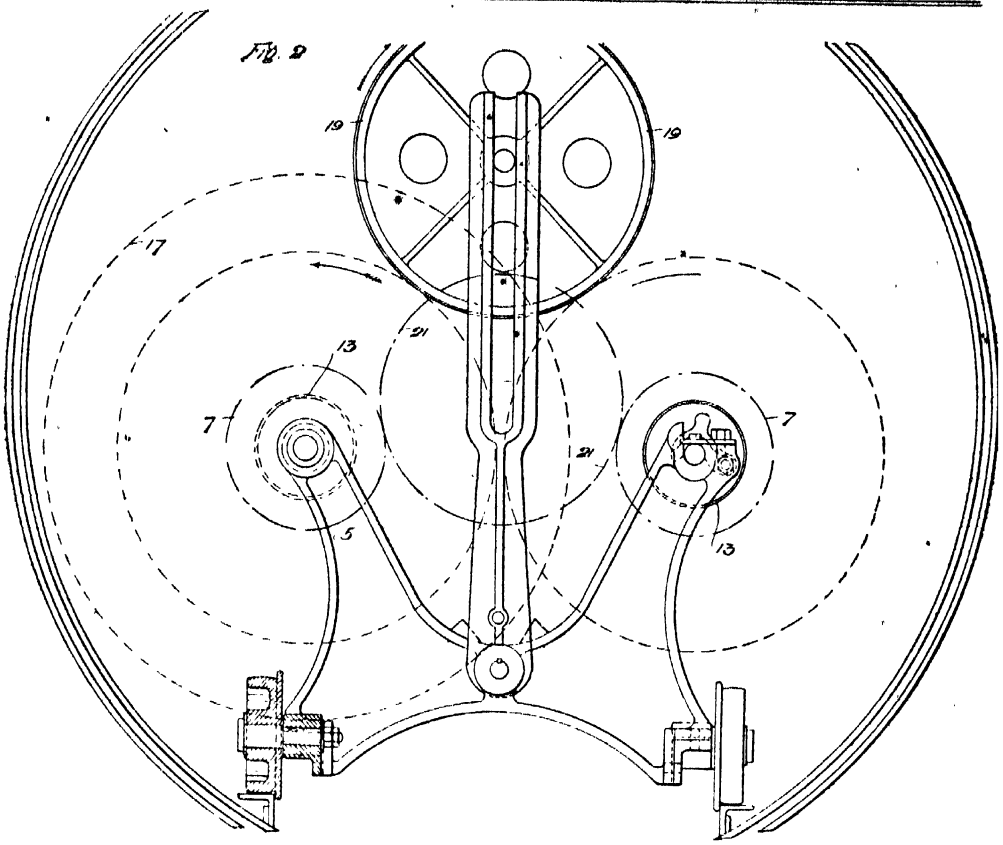
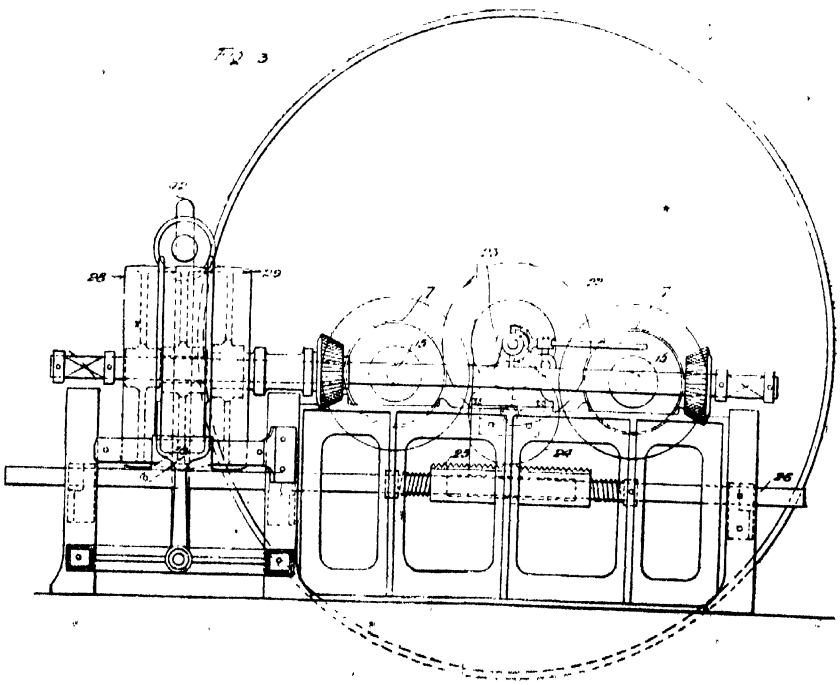


Fig. 3

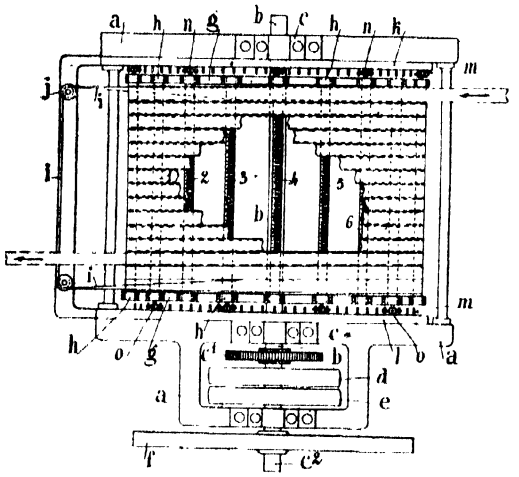


contact, the pulley 9 revolves, and, in doing so, brings a catch, fixed at its side to bear against a piece 8, projecting from a gear-wheel 7, loosely mounted on the shaft 15. The wheel 7, gears with a wheel 21, fixed upon a shaft 22, upon which is keyed a gear-wheel 23, engaging with a gear-wheel 24. The movement communicated to the latter is transferred to a rack 25, upon a rod 26, which is thus moved longitudinally, displacing by its motion a counterpoise 42, which controls the position of the driving strap upon one or other of the two driving pulleys 28 and 29. The draw-rollers are thus actuated in turn, during so long a time as is necessary for the completion of the scouring, &c., of the tissue under treatment.—E. B.

Washing Machine. G. P. Spittal. Fr. Pat. 357,573, Sept. 8, 1905.

A WASHING machine is claimed, which is stated to give the goods a rapid and thorough cleansing, as it almost exactly reproduces the process of washing by hand.—H. L.

Paper, Cloth and other Ribbons; Drum for drying ——. F. Mignot. Fr. Pat. 357,689, Sept. 12, 1905.



THE drum claimed (see figure) is mounted on a frame *a*. Its shaft *b*, resting in the bearings *c*, may be revolved by means of a cog-wheel c^1, and a secondary shaft c^2, to which a fixed and loose pulley *d*, and *e*, and a fly-wheel *f*, are attached. The drum is formed of two lateral plates *g*, on the circumference of which are bearings *h*, in which the smooth ends of screws 1, 2, 3, 4, 5, &c., may work. The threads of these screws run alternately to the right and the left, those of the screws marked with even numbers running to the right. On the drum thus formed by the plates and screws an endless ribbon or band of cloth *i*, is spirally wound passing at both ends on to guide-rollers *j*. Circular bars *k*, and *l*, which are fitted with horizontal pins *m*, are fixed on to the framework *a*, in close proximity to the plates *g*. The bar *k* has a greater diameter than *l*. The screws 1, 2, 3, 4, 5, &c., are furnished alternately on the right and left of the drum with a wheel or four-pointed star *n*, or *o*. The former series is worked by the toothed bar *k*, the latter by the bar *l*. Thus the rotation of the drum causes the screws also to revolve, the series 1, 3, 5, &c., turning in the same, and the series 2, 4, 6, &c., in the opposite direction to that of the drum. The threads of the screws are arranged to correspond with the width of the endless band.

The effect of this arrangement is stated to be (1) to diminish the tension on the endless band; (2) to direct the spirals obliquely yet in parallel lines over the drum, without overlapping. In this way a ribbon of cloth or paper 5 cm. wide is made to traverse a distance of over 125 m., when passing round a drying drum with a diameter of 2 m. and a width of 1, m.

The endless band *i* is required for drying delicate paper ribbons, such as those of cigarette paper, but may be dispensed with for woven ribbons, &c.—H. L.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 71.)

FRENCH PATENTS.

Printing Plates or Casts; Process for preparing a plastic material and for making —— therefrom. L. Collardon. Fr. Pat. 350,376, Dec. 6, 1904.

SEE Eng. Pat. 27,090 of 1904; this J., 1905, 842.—T.F.B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 122.)

Hydriodic acid; Rapid method of preparing ——. F. Bodroux. Comptes rend., 1906, **142**, 279—280.

To 100 c.c. of warm distilled water containing suspended 60 grms. of barium peroxide, 50 grms. of iodine are added, in quantities of 4—5 grms. at a time, each portion being added only when the liquid has become decolorised after addition of the previous portion. The liquid is filtered with the aid of the pump, and the residue washed with about 80 c.c. of water. To the combined filtrates in a tall narrow cylinder, 50 grms. of iodine are added and dissolved, and a rapid stream of sulphur dioxide is then passed through till the liquid is decolorised. The liquid is filtered, and the filtrate concentrated, if necessary, by distillation. The reactions are: $BaO_2+I_2=BaI_2+O_2$; $BaI_2+I_2+SO_2+2H_2O=BaSO_4+4HI$.—J. T. D.

Silicic acid; α- and β-Forms of soluble ——. F. Mylius and E. Groschuff. Ber. 1906, **39**, 116—125.

BY neutralising a weak solution of sodium silicate, $Na_2Si_2O_5$, in the cold with hydrochloric acid, or by neutralising a solution of silicon tetrachloride with sodium hydroxide, a solution of silicic acid is obtained which passes freely through a dialysing membrane, and does not coagulate albumin. It is indifferent whether the acid be added to the silicate or conversely; but immediate complete mixture must be ensured. If there be local supersaturation, some at least of the dissolved silicic acid is in a colloidal form, and coagulates albumin. The authors regard the second, or β-form, as a polymer of the first, or α-form; the change from the α-form occurs slowly and partially in the cold, more rapidly and completely on heating, and is accompanied by a rise in the freezing-point of the solution and a slight increase in the electrical conductivity.—J. T. D.

Barium and Strontium Borates; Compounds of —— with the corresponding Chlorides. L. Ouvrard. Comptes rend., 1906, **142**, 281—283.

By fusing together boric anhydride and strontium chloride, the substance, $5B_2O_3,3SrO,SrCl_2$ is obtained. By adding strontia to the fused mass, no other compound containing chlorine is obtained, but the substances, B_2O_3,SrO and $B_2O_3,2SrO$, which yield respectively with water the compounds, $B_2O_3,SrO,2H_2O$, and $B_2O_3,SrO,4H_2O$. Strontium bromide—but not iodide—behaves similarly to the chloride, and barium furnishes compounds exactly analogous to those of strontium. Neither barium nor strontium borate combines so readily with the corresponding halides as does calcium borate.—J. T. D.

Nitrites and Nitrates; Production of —— by electrolytic oxidation of Ammonia in presence of Cupric Hydroxide. W. Traube and A. Bilts. XI.A., page 185.

Halogens; Use of Hydrogen peroxide for the Quantitative separation of ——. P. Jannasch and P. Zimmermann. XXIII. page 199.

ENGLISH PATENT.

Pyrites of an explosive character; Burning of ——, *and Apparatus therefor.* T. T. Best, S. A. Hollingsworth, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 7915, April 13, 1905.

GREEN pyrites is subjected to a preliminary heating operation on a floor under the same roof as the burners, and preferably arranged with a burner on each side, at a lower level than the floor. The pyrites dust or smalls made in the preheating part of the chamber is raked off the floors to undergo special treatment, and is not allowed to pass into the burners.—E. S.

UNITED STATES PATENTS.

Sulphuric anhydride; Process of making ——. R. Knietsch, Ludwigshafen on Rhine, Assignor to General Chemical Co., New York. U.S. Pat. 809,450, Jan. 9, 1906.

SEE Eng. Pat. 12,781 of 1901; this J., 1902, 772.—T. F. B.

Boric acid, &c.; Process of making —— [*Sulphur Burner*]. H. Blumenberg, jun., Daggett, Cal., Assignor to American Borax Co., Pittsburg, Pa. U.S. Pat. 809,550, Jan. 9, 1906.

A LONG horizontal sulphur-burning chamber, is supplied with air under pressure for continuous working; sulphur is supplied at intervals, the sulphur dioxide being allowed temporarily, during such time of supply, to pass into the outside atmosphere. The gas is led into water containing in suspension the finely-divided ore, whereby boric acid or the like is set free and is dissolved by the water in solution. The product is then separated by evaporation. (Compare U.S. Pat. 734,397 of 1903; this J., 1903, 950). —E. S.

Potash; Apparatus for extracting crude —— [*from Waste Waters of Beet Sugar Factories*]. G. W. Henry and F. W. Beale. U.S. Pat. 803,058, Oct. 31, 1905. XVI., page 191.

Silver Salt; Process of producing solutions containing pure ——. W. Bölsterli, Winterthur, Switzerland. U.S. Pat. 809,278, Jan. 9, 1906.

SEE Fr. Pat. 355,518 of 1905; this J., 1905, 1239.—T. F. B.

Metallic salts and oxides; Method of densifying and eliminating air and gas from masses of pulverulent ——. E. O. Bartlett and W. F. Gordon, Joplin, Mo. U.S. Pat. 809,354, Jan. 9, 1906.

DRY masses of pulverulent metallic salts and oxides are so treated in a revolving receptacle as to cause the component particles to constantly shift their relative positions. —E. S.

Stannic Chloride; Process of making ——. C. E. Acker, Niagara Falls, N.Y., Assignor to Acker Process Co., N.J. U.S. Pat. 810,454, Jan. 23, 1906.

STANNOUS chloride solution, obtained by acting upon tin with a "solvent containing chlorine," is subjected to the action of a gaseous or fluid mixture containing free chlorine, hydrochloric acid, and air or oxygen, the air being in sufficient proportion to prevent undue rise of temperature. The stannic chloride solution thus formed is caused to act on tin to reproduce stannous chlorine, which is again oxidised as before, and the concentrating process is repeated until a solution of stannic chloride is obtained of higher density than 1·800.—E. S.

Stannous Chloride; Process of making ——. C. E. Acker, Niagara Falls, N.Y., Assignor to Acker Process Co., N.J. U.S. Pat. 810,455, Jan. 23, 1906.

METALLIC tin is brought into contact with a solvent containing chlorine, and the stannous chloride thereby produced is subjected to the action of a gaseous or fluid mixture containing free chlorine with or without hydrochloric acid and air. The stannic chloride formed is reduced to stannous chloride by the action of tin, and the process is repeated until a stannic chloride solution exceeding a density of 1·8 is obtained, which is then again reduced and the solution allowed to cool to obtain crystallised stannous chloride.—E. S.

Tin; Process of making Chlorine Compounds of ——. C. E. Acker, Niagara Falls, N.Y., Assignor to Acker Process Co., N.J. U.S. Pat. 810,456, Jan. 23, 1906.

A SOLVENT for tin is subjected to the alternate and repeated action of metallic tin and of a gaseous body containing chlorine (see the two preceding abstracts), and the solution finally obtained is cooled by a medium out of contact with it, whereby, it is stated, "the tendency to produce metastannic compounds is avoided."—E. S.

FRENCH PATENTS.

Lead Chambers [*for Sulphuric Acid*]; *Auxiliary arrangements in* ——. J. Lagache. Fr. Pat. 350,363, Dec. 1, 1904.

PART of the gases are withdrawn from the hottest, or from any desired portion of the lead chamber, by an aspirator, and are conducted to a refrigerator, from which the portion that condenses is withdrawn. The cooled gases are then returned to the chamber. The ventilator or aspirator may be adapted, singly or in series, to any point of the apparatus, within the chambers, or in the connecting passages.—E. S.

Nitrogen; Manufacture of compounds of ——, *from the Air.* Siemens et Halske A.-G. Fr. Pat. 358,171, Sept 30, 1905.

THE constituents of the atmosphere are separated by known processes either chemically or mechanically, and the nitrogen is made to combine with carbides of the alkali metals or similar substances. The oxygen is mixed with a further quantity of air, and the mixture is subjected to the action of electricity for the production of oxides of nitrogen. —R. N.

Perborates; Process of preparing ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler. Fr. Pat. 350,388, Dec. 9, 1904.

SEE Eng. Pat. 26,790 of 1904; this J., 1905, 332.—T.F.B.

Oxygen; Preparation of —— *by the decomposition of oxygenated salts.* G. F. Jaubert. Fr. Pat. 350,377, Dec. 7, 1904.

AN oxygenated salt, such as a perchlorate or nitrate, is mixed with a very small proportion of a combustible substance, and the mixture is agglomerated and moulded into cartridges or the like, which, on being ignited, evolve oxygen with a little carbon dioxide or nitrogen. If desired, an inert substance, such as sand, may be added to the mixture, to moderate the rapidity of the combustion.—E. S.

Air; Process for the Liquefaction of —— *and the production of oxygen with partial recovery of the work expended.* R. Mewes. Fr. Pat. 358,236, Oct. 3, 1905.

AT a certain stage of the ordinary processes of compression and refrigeration of air, with partial recovery of work done, the gas expanded by aspiration, and consisting chiefly of nitrogen (having a vapour tension at —105° C. of 740 mm., that of oxygen being 142 mm.) is not returned in the circuit, but after being utilised in producing liquid air by refrigeration, is discharged, thereby leaving the gaseous mixture richer in oxygen. An aspirating pump is used with special connections for effecting the expansion of the compressed air.—E. S.

Chlorine; Manufacture of —— *by Electrolysis of Hydrochloric Acid.* E. F. Côte and P. R. Pierron. Fr. Pat. 358,245, Oct. 3, 1905. XI.A., page 186.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 122.)

ENGLISH PATENT.

Mica or Muscovy Glass; An improved process for finely comminuting ——. P. Dobler, Munich, Germany. Eng. Pat. 23,149, Nov. 10, 1905. Under Int. Conv., Jan. 23, 1905.

By this process the mica is first heated for several hours in a closed vessel, so that it is opaque on cooling, and is afterwards subjected in a closed vessel to the action of steam or hot water, and then ground.—W. C. H.

UNITED STATES PATENTS.

Glass; Manufacturing Window ——. L. Appert, Paris, France. U.S. Pat. 809,418, Jan. 9, 1906.

A HOLLOW "closed-top blank of glass" is first cast in the shape of a frustrum of a cone, which is then clamped with its open end downward upon a rotary platform. The blank is then transformed into a bulb or ovoid-shaped body by subjecting it to the action of heat in an oven, until it is rendered sufficiently plastic, and, whilst in that condition, imparting to it a rotary movement upon its axis, as well as a vertical up-and-down movement, at the same time that a current of air is being forced into its interior. The glass is now cooled and secured to a second rotary platform with its open end upwards, and then transformed into a plate or disc by reheating in an oven, and imparting to it, when sufficiently plastic, a rotary movement on its axis, after which the glass is annealed. —A. G. L.

Glass-Furnace S. O. Richardson, jun., Toledo, Ohio. U.S. Pat. 809,925, Jan. 9, 1906.

THE furnace comprises a heating-chamber in which a practically closed melting-pot is mounted. The pot is provided with a feed-port opening outside of the heating-chamber, and with an outlet-port discharging into the furnace, which is also provided with a plaining-chamber, and a conduit arranged to transfer metal from the pot into the plaining-chamber. An air-port is interposed between the heating-chamber and the plaining-chamber below the level at which the conduit crosses the port. Means are also provided for passing flame and gases through the heating-chamber and around the pot.—A. G. L.

Vitrified Brick Tile, and various shapes; Method of producing —— *[from slag of Copper-Smelting Furnaces]*. R. Baggaley, Pittsburg, Pa. U.S. Pat. 810,022, Jan. 16, 1906.

THE iron silicate slag from copper-smelting furnaces is run into moulds so as to completely fill them. At the rapidly cooling outer portions of the moulds the slag is confined whilst the hotter central parts are subjected to pressure, after which the article produced is allowed to cool and annealed by heating it in dry sand or slag.—A. G. L.

Ceramic Ware; Process of burning ——. B. E. Eldred, Bronxville, N.Y., assignor to Combustion Utilities Co., New York. U.S. Pat. 810,044, Jan. 16, 1906.

A STATIONARY mass of the ceramic ware is burnt by means of a voluminous slow-burning flame, produced by forcing gases containing oxygen, diluted with products of combustion, through a bed of solid fuel, the air necessary for the combustion of the gas produced being pre-heated in a regenerator. The volume of the flame may be enlarged as the burning of the ware proceeds, or else the amount of burnt gases used as diluent may be varied so as to give alternately a reducing or oxidising flame.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 123.)

Lime-Sand Bricks; Hardening process in the manufacture of ——. R. Seldis. Z. angew. Chem. 1906, 19, 181—183.

FOR the preparation and mixing of the materials three methods are used—the quicklime, the slaked lime, and the heating process. In the first, the moisture of the sand effects the slaking of the lime; in the second, the lime is slaked to the dry hydrated condition, ground to a powder, and mixed with the proper amount of sand; and in the third, weighed amounts of ground quicklime and dry sand are mixed together for 22—25 minutes in a closed vessel to which steam and water are admitted to slake the lime. After any of these processes the materials are taken to the press, and from it the objects are removed to a wagon, which is pushed into the hardening chamber, and exposed to a steam pressure of eight atmospheres for eight to ten hours.

Two hypotheses have been advanced to explain the process of hardening in this chamber. The one assumes that in the production of the pressed ware, each grain of sand must become coated with a thin skin of lime, and that a cementation takes place in the hardening chamber. The second assumes that the hollow spaces between the individual grains of sand are filled with lime, which then effects the cementation. From his own experiments the author considers the following to be the explanation of the process:—At the usual pressure and temperature prevailing in the hardening chamber, a portion of the silicic acid goes over to the gelatinous or colloidal condition. The hydrated lime present in the object reacts with this silicic acid, with a simultaneous union with water, and forms a calcium hydrosilicate, $CaH_2SiO_4 + 2H_2O$, which causes the hardness of the brick.

This theory explans why bricks cannot be made with either a very small or a very large addition of lime, and why the amount of lime required is dependent upon the quantity of soluble silicic acid contained in the sand, and further why the best bricks are obtained when the calcium hydroxide and the free silicic acid are in molecular proportions. The fact that bricks cannot be made from pure quartz-sand and lime, is because the silica in such a form will not combine with the lime at the oven temperature. Felspar sand is used most for the manufacture; it contains 5—7 per cent. of soluble silicic acid, and this, with a lime averaging 85 per cent. of calcium oxide, corresponds with 4—5 cwt. of lime to 2½ cb. m. of sand, a ratio used in practice. The theory also shows that if a hard water containing much lime is used, this will not become chemically combined in the hardening process. It also explains why, when the heating process already referred to is employed, it is necessary to pass the pressed objects at once to the hardening chamber, to avoid interruption of the chemical reaction, which begins in the heating process. Variations in the steam pressure of the hardening chamber should be avoided, and for this purpose a registering pressure-gauge is recommended.—W. C. H.

ENGLISH PATENTS.

Cork Compositions; Manufacture of ——. F. Matas y Rodés, Calella, Spain. Eng. Pat. 248, Jan. 5, 1906.

IN making agglomerates of particles of cork or cork dust, cemented together by a glutinous material, the mixture is forced into moulds fitted into presses in such a manner that the mass is able to receive a mechanical pressure in at least two different directions at right angles to each other. The two pressures may be applied either simultaneously or consecutively (compare Fr. Pat. 349,782; this J., 1905, 734).—J. F. B.

Cork Compositions or agglomerates; Manufacture of ——. F. Matas y Rodés, Calella, Spain. Eng. Pat. 249, Jan. 5, 1905.

THE ground cork is saturated with a solution of resinous

or vegetable glue and subsequently dried. The particles are then separated thoroughly, one from another, and are introduced into moulds which are capable of withstanding high pressures at elevated temperatures. The action of pressure and heat upon the saturated cork softens the glue and causes the particles to adhere together in a solid mass. If desired, a certain proportion of gum-lac or resin may be added to the mass to impart greater rigidity and cohesion.—J. F. B.

Lime Burning and the recovery of Power gas as a by-product; Impts. in and apparatus for ——. The Chalk Power Gas Syndicate, Ltd., and H. S. Stoneham, London. Eng. Pat. 2684, Feb. 9, 1905.

THE apparatus described is intended to reduce the carbon dioxide, derived from limestone by its conversion into quicklime, to carbon monoxide to yield a useful power gas. The apparatus consists of three juxtaposed chambers, one of which acts as a gas producer, the next as the lime-kiln, and the third as a gas-reducer. Carbonaceous fuel (anthracite or coke) is burned in the producer, a blast of air or air and steam being introduced below the grate. The gas produced passes into the kiln and burns there. At a point about two-thirds of its height from the top of the kiln, boshes are arranged to form a constriction of the area, so that, as the lime passes this constriction, it leaves an annular space in which the carbon dioxide and products of combustion collect, and pass through a port into the gas-reducer. This chamber contains carbonaceous material (coke or anthracite) which is raised to incandescence by an air blast, and effects the reduction of the carbon dioxide introduced from the kiln, to carbon monoxide. The reduced gases, containing also hydrogen derived from the decomposition of the steam introduced into the gas producer, are led away from the gas reducer by a pipe controlled by a valve. The kiln chamber is provided with a secondary air supply for the combustion of the gases derived from the producer.—W. C. H.

Fire Resisting; An improved solution for rendering combustible materials [*Wood, Textile Fabrics, &c.*] ——. A. W. Baxter, London. Eng. Pat. 5209, March 13, 1905.

THE impregnating solution is made by dissolving about 12 parts of ammonium phosphate and 1 part of boric acid in 87 parts of water. The claims also include the treatment, by impregnation with this solution, of wood, textile fabrics, and other materials to make them fire-resisting. It is said that materials so treated do not absorb water, prevent metals in contact with them from corroding, and are also preserved.—W. C. H.

Road-making; Impts. in ——. J. C. Butterfield, London. Eng. Pat. 9350, May 3, 1905.

PITCH or asphaltum, or a mixture of the two, is melted in an iron pan, and sufficient fine granite, flint or sharp sand, and limestone or chalk stirred in to give a pasty mixture. After cooling, this is broken up and mixed with more of the mineral ingredients, preferably so as to give a mixture having the composition: Fine granite, 50 per cent.; flint or sharp sand, 25; limestone, 10; and asphaltum or pitch, 15. This mixture may then be powdered so as to pass a 20-mesh sieve. Or, it may be ground only sufficiently to pass through a ¼ in. mesh providing that the fine dust produced in grinding is also used. It is next mixed with from 3 to 10 per cent. by weight of a solution consisting of 90 parts of petroleum or shale oil and 10 parts of commercial nitro-benzol. The whole is thoroughly mixed and wetted, and laid on the roadway to a depth of 2 in., after which the larger "metal" (granite or flint cubes of about 2 in.) are rolled in by means of a steam roller. After hardening for from 48 to 60 hours a waterproof and dustless road is obtained. Or else a mixture of the rubble and binding material may be laid on the roadway. Or, finally, a mixture of rubble and binding material may be moulded into blocks.—A. G. L.

Siloxicon; Process of treating ——. B. Seaboldt, Salt Lake City, U.S.A. Eng. Pat. 17,890, Sept. 4, 1905. Under Int. Conv., Jan. 6, 1905.

SEE U.S. Pat. 796,459 of 1905; this J., 1905, 971.—T. F. B.

FRENCH PATENTS.

Asphalt-compositions for roads, pavements and flagstones, and process of making the same. E. Mathis. Fr. Pat. 358,050, Sept. 26, 1905. Under Int. Conv., Oct. 11, 1904.

CRUSHED or powdered slate, burnt or unburnt, is heated and agitated with a quantity of pitch not exceeding that of the slate. The pitch may be neutralised if necessary by adding lime. Suitable proportions are:—Slate, 2 parts; pitch, containing 5 to 10 per cent. of lime, 1 part. The pitch and slate may also be mixed cold and rammed into position by means of hot irons. Both materials may be replaced by kindred substances, *e.g.*, magnesium silicate and heavy tar fractions.—A. G. L.

[*Cement*] *Kiln; Rotary* ——. W. R. Warren. Fr. Pat. 358,227, Oct. 3, 1905.

THE kiln is divided longitudinally or obliquely into two or more compartments by one or more partitions, so as to ensure better drying and burning of the materials. Fuel and air may be introduced by one or more openings in the lower end of the kiln.—A. G. L.

X.—METALLURGY.

(*Continued from page* 126.)

Gold and Silver Ores; Importance of fine-grinding in the Cyanide treatment of ——. F. C. Brown. Bi-Monthly Bull. Amer. Inst. Min. Eng., 1906 [1], 17—23.

THE author's experience with gold and silver ores in the Ohinemuri district, North Island, New Zealand, points to the importance of fine-grinding in the treatment of comparatively low-grade ores. It was found that with ore crushed to pass screens with from 30 to 40 holes to the linear inch, a considerable quantity of gold and silver in the sands was left undissolved by the cyanide solution, the proportion thus lost increasing with the coarseness of the sands. The process recommended by the author consists in:—(1) Grinding the ore in tube-mills until about 90 per cent. will pass a 200-mesh screen, followed, if necessary, by amalgamation. (2) Agitation of the ore pulp with weak cyanide solution in a tall vat, of comparatively small diameter, with a conical bottom, in the centre of which is fitted an "air-lift" pump for agitating the mixture of ore and cyanide solution. (3) Separation of the solution by settling and passing the supernatant liquid through a filter-press. Except in cases where minerals are present from which the gold cannot be extracted by cyanide solution, mechanical concentration may probably be dispensed with, provided the ore be ground exceedingly fine.—A. S.

[*Gold*] *Ore; Fine grinding of —— by tube-mills, and Cyaniding at El Oro, Mexico.* G. Caetani and E. Burt. Bi-Monthly Bull. Amer. Inst. Min. Eng., 1906 [1], 83—135.

THE authors give an account of an exhaustive investigation as to the economical limit to which the fine grinding of gold ore by tube mills can be carried. The work included also determinations of the influence of various conditions on the efficiency of the tube-mills, and also of the effect of certain substances (lead acetate, mercuric chloride, on the extraction of gold and silver by cyanide solution; lead acetate was found to have a markedly favourable influence on the extraction of both gold and silver. The general conclusion drawn by the authors is that the problem of extracting the gold and silver values from the El Oro ore by cyanide is mainly a mechanical one, the extraction being largely dependent upon the state of division of the ore; and they consider that in the near future the ore will be ground to slime, or to the finest state of division possible economically (see also this J., 1904, 1030).

—A. S.

Fire in Pyritous Mines; Controlling and extinguishing ——. L. T. Wright. Eng. and Mining J., 1906, 81, 171—172.

THE author shows that fires in pyritous mines are probably

due to the action of oxygen on the pyrites in the presence of moisture, the latter acting as an oxygen-carrier. Based on this view, he devised the following method for avoiding such fires or, at least, preventing them from extending to the workings. Powerful fans are fitted up at certain of the entrances to the workings, which are closed by doors and provided with ducts for the air driven along by the fans. In this way, a pressure slightly above that in the outside atmosphere is maintained in the workings, and gases from the interior of blocks of ore or filling material are kept from penetrating into the workings; the gases are thus caused to accumulate in the interior of the blocks, where they ultimately extinguish the fire.—A. S.

Lead Sulphide and Calcium Sulphate; Experiments on the metallurgical behaviour of a mixture of ——. F. O. Doeltz. Eng. and Mining J., 1906, **81**, 175—176.

In Eng. Pat. 17,580 of 1901 (this J., 1902, 349) it is stated that a mixture of lead sulphide and calcium sulphate reacts at a dull red heat, say about 400° C., forming lead sulphate and calcium sulphide. The author describes experiments showing that this reaction does not take place even at temperatures up to 1030° C., if the mixture be heated in a current of carbon dioxide or nitrogen. On the other hand, when lead sulphate and calcium sulphide are brought into contact, the tendency is to form lead sulphide and calcium sulphate. It is probable, therefore, that the lead sulphate obtained together with lead oxide when a mixture of galena and gypsum is heated in presence of air, is due not to a double decomposition of lead sulphide and calcium sulphate, but to the action of sulphuric acid "produced by catalysis" on the lead oxide formed by oxidation of the galena.—A. S.

Thorium and Aluminium; Alloy of ——. O. Hönigschmid. Comptes rend., 1906, **142**, 280—281.

The author has previously shown that by reduction of thoria by silicon in the electric furnace, by direct combination of silicon and thorium in presence of aluminium *in vacuo* at 1000° C., or by reducing a mixture of potassium silicofluoride and thorium potassium fluoride by aluminium, a silicide of thorium is produced, crystallising in quadratic plates resembling graphite, and having the composition $ThSi_2$.

Similarly, the reduction of thoria in the electric furnace by aluminium, the direct combination of thorium and aluminium *in vacuo*, or the reduction of thorium potassium fluoride by aluminium, yields an alloy of thorium and aluminium. This crystallises in long hexagonal prismatic needles, having the colour and metallic lustre of aluminium, and has the formula $ThAl_3$. It is permanent in the air, burns in air or oxygen at a red heat, combines vigorously with halogens, and is attacked by mineral acids. Alkalis in aqueous solution do not affect it, but attack it when fused with it.—J. T. D.

Silver; Determination of —— in large quantities of silver coins. C. Hoitsema. XXIII., page 200.

Tin, Monazite and Xenotime in Tringganu. C. G. Warnford Lock. Bull. (17) of Inst. Min. and Met., 10.

Tringganu is a little known Independent Native State on the East Coast of the Malay Peninsula, between Pahang and Kelantun. The coast is flat and devoid of minerals, and consists of dense jungle, swamps, and rice gardens. The trees are of rapid growth and useless as fuel.

Running parallel with the coast, at about 20 miles distance, is a range of hills, at the foot of which is the seat of the tin-mining industry of Kemaman. The alluvial soils and gravels here rest immediately on the granite bed rock. Everywhere these gravels carry stream tin and, in many cases, the shallowness of the deposit is more than atoned for by the richness of the ground. The extent of the old alluvial workings is great and is due to the Chinese. Not only did they mine, but they smelted upon the spot, as is seen by the accumulation of slags, still containing much tin.

No readily accessible alluvial tin deposits are left; but where there is either no water or too much of it, there is good prospect of success for competent engineers. The most interesting and valuable feature of these alluvial fields is the occurrence of monazite and xenotime. On one concession, worked for tin by Chinese, the writer found that 50 per cent. of the material collected in the sluices was monazite, and in another instance xenotime could be abundantly gathered (with zircons, monazite, cassiterite, ilmenite, &c.) from pot holes in the granite bed of the stream. All these properties are owned by wealthy Singapore merchants. At varying elevations in the foot hills occur lodes of tin stone, but do not exist as profitable ore bodies in the granite itself. But occasionally fine-grained cassiterite is found widely disseminated through the granite. The only profitable ore-bodies hitherto found are in the shales overlying the granite. [T.R.]

Zinc Industry in 1905; *Silesian* ——. Mining World (Chicago), Feb. 3, 1906.

It is estimated by Paul Speier, of Breslau, Prussia, that the spelter production of Upper Silesia in 1905 was 128,000 metric tons. The extraordinary demand from consumers, especially in the second half of the year, resulted in an advance in price to the highest point since 1899, and before that since 1873.

In view of the steadily increasing use of blende by the smelters, which results in an enrichment in the zinc content of the charge for their furnaces, the Silesian smelters are gradually changing their furnaces from the old to the Rhenish type. At the end of 1905 there were in use 316 furnaces, with about 12,500 muffles of the old type, with a single row of muffles, and 162 furnaces, with about 15,000 muffles of the Rhenish type, with several rows of muffles.

Important experiments have been made upon the treatment of low grade calamine ore, with a view to the extraction therefrom of a rich zinc oxide, which can then be passed on to the smelting process. An experimental plant of this character is in operation at the Elizabeth dressing works. The Zinkgewinnungsgesellschaft m.b.H., of Berlin, has purchased a large dump of calamine tailings, containing about 10 per cent. of zinc, for the purpose of recovering the metal.

The production of sheet zinc in Silesia in 1905 was about 54,000 metric tons.

For the roasting of zinc blende there are at present 12 plants, having 128 furnaces, the gases from which are wasted; 144 furnaces, the gases from which are utilised for the manufacture of sulphuric acid; and 10 furnaces, the gases from which are utilised for the manufacture of sulphurous acid.

Some experiments have been made at the Rosamundehütte upon the employment of carborundum in the mixture for muffle manufacture. This gave favourable results. [T. R.]

Spelter Production in 1905. Eng. and Min. J., Feb. 3, 1906.

According to the statistics of Henry R. Merton and Co., Ltd., the production of spelter in Europe and America in 1905 was 647,585 long tons, against 615,290 in 1904, and 562,325 in 1903. This represents practically the total spelter production of the world, the only omissions being the outputs of Sweden and Norway, Saxony and Australia, which in the aggregate are comparatively insignificant. The total zinc production of the world is, however, about 7·5 per cent. larger than the spelter production, because of the important output of zinc oxide produced directly from ore in the United States. The statistics in detail are as follows:—

Country.	1905.	1904.	1903.
Belgium	143,165	137,780	139,000
Rhine district	66,185	64,360	61,215
Holland	13,550	12,895	11,515
Great Britain	50,125	45,490	43,415
France and Spain	49,575	48,310	41,760
Silesia	127,895	128,695	116,885
Austria and Italy	9,210	9,100	9,025
Poland	7,580	10,440	9,745
United States	180,360	168,220	129,995
Total	647,585	615,290	562,325

[T.R.]

ENGLISH PATENTS.

Metalliferous Ores; Apparatus for separation of liquids from solids, especially for use in the treatment of ——. W. H. Lomas, Johannesburg. Eng. Pat. 149, Jan. 3, 1905.

AN endless porous belt is made to pass around a hollow perforated cylinder, or suction-drum, placed within a receptacle containing the mixture of liquids and solids. The cylinder is provided with a stationary curved plate or damper covering those apertures which are not covered by the porous belt. A partial vacuum is created within the suction-drum, whereby the liquid to be removed is drawn into it, the solid being at the same time deposited upon the belt, from which it is subsequently removed by a fluid or gaseous current which is forced through the belt as it passes over a separate pipe or drum.—J. H. C.

Ore Concentration. H. L. Sulman, H. F. K. Picard and J. Ballot, London. Eng. Pat. 7803, April 12, 1905.

SEE Fr. Pat. 354,960 of 1905; this J., 1905, 1177.—T. F. B.

Metalliferous Materials; Methods of purifying and nodulising ——. T. C. King, New York. Eng. Pat. 15,367, July 26, 1905. Under Int. Conv., Nov. 14, 1904.

SEE U.S. Pat. 794,673 of 1905; this J., 1905, 894.—T. F. B.

Ore and Pulp washing and separating machines; Centrifugal ——. S. Fawns and F. E. Davies, London. Eng. Pat 21,755, Oct. 25, 1905.

THE separating chamber is mounted on a hollow shaft, through which the ore or pulp is introduced; it is made in two parts which can be rotated separately. In the peripheries of the two halves of the chamber are ports or outlets which can be opened or closed at will by rotating only the upper portion of the chamber. The ore or pulp passes from the hollow shaft through radial openings into the separating chamber, below a deflecting or distributing plate mounted on the shaft at about the level of the outlets already mentioned. On the inner wall of the separating chamber near these outlets are webs or wings which agitate the ore or pulp and guide the separated solid material through the openings. The liquid rises above the distributing plate and is discharged through openings in the upper half of the separating chamber. Separate collecting channels are provided outside the chamber for the liquid and solid materials respectively. —A. S.

Ores; Smelting ——. J. Savelsberg, Papenburg-on-Emms, Germany. Eng. Pat. 3191, Feb. 15, 1905.

SEE Fr. Pat. 351,535 of 1905; this J., 1905, 894.—T. F. B.

Bronze; Manufacture of ——. G. E. Buttershaw, Barrow-in-Furness. Eng. Pat. 792, Jan. 14, 1905.

AN alloy consisting approximately of copper, 40 parts; zinc, 41; nickel, 10; lead, 3·5; phosphor-tin, 1; and aluminium, 0·15 part, is prepared by melting and combining the components in stages as described in the specification.—J. H. C.

Tin Slags; Smelting of ——. L. Parry, Huddersfield. Eng. Pat. 7154, April 5, 1905.

"FOUL" tin slag, *i.e.*, slag containing 3 per cent. or more of tin, is "cleaned" by smelting it in a furnace, preferably a water-jacketed blast-furnace such as is used for lead smelting, the charge being composed as follows:—(1) Foul tin slag; (2) iron oxide in such quantity as will give a highly basic slag containing more than 40 per cent. of ferrous oxide—"tap cinder" (iron slag) is preferably used for this purpose; (3) lead ashes, slags, drosses or oxidised lead ores in such proportion as to give an alloy containing about 20 per cent. of tin; (4) a source of arsenic or sulphur, such as mispickel, arsenical drosses, spent oxide, or lead sulphate, enough being used to form an easily fusible compound with any metallic iron reduced; (5) a mixture of gas coke and furnace coke in such proportion as to obtain the maximum output, gas coke increasing the reducing action, whilst furnace coke increases the speed of smelting. The slag produced in this way contains only ¾ to 1½ per cent. of tin. The sulpharsenide of iron, lead, tin, copper, cobalt or nickel also produced is crushed, roasted and re-smelted until it becomes rich enough to be worked up for copper, cobalt or nickel. —A. G. L.

Iron Briquettes; Producing ——. L. Weiss, Budapest, Hungary. Eng. Pat. 17,844A, Sept. 4, 1905.

SCRAP-IRON is mixed with fluxes, *e.g.*, lime, ferromanganese, ferrosilicium, and with graphite or charcoal. The mixture is moistened with lime-water, pressed, and allowed to solidify, electrolytic actions generating heat taking place. After cooling, the briquettes form compact waterproof pieces yielding on smelting "94 to 96 per cent. excellent iron."—A. G. L.

UNITED STATES PATENTS.

Iron or Steel; Manufacturing ——. E. Fleischer, Dresden-Strehlen, Assignor to J. E. Goldschmid, Frankfort, Germany. U.S. Pat. 809,291, Jan. 9, 1906.

SEE Fr. Pat. 343,701 of 1904; this J., 1904, 1032.—T.F.B.

Steel; Process of hardening ——. R. A. Hadfield, Sheffield. U.S. Pat. 810,531, Jan. 23, 1906.

SEE Eng. Pat. 25,973 of 1902; this J., 1903, 1296.—T.F.B.

Furnace; Roasting ——. O. Hofmann, Argentine, Kans., Assignor to The United Zinc and Chemical Co., Kansas City, Mo. U.S. Pat. 809,953, Jan. 16, 1906.

THE furnace comprises a number of superposed hearths and a rotating, vertical, central hollow shaft or pipe extending through them. Hollow radial arms project from the central shaft into the hearths. Inside the hollow shaft is a water-supply pipe having branches through which water is sprayed into the hollow arms, which are provided with passages through which steam escapes into the central shaft. The lower end of the shaft communicates with a discharge pipe, below which is a trough, to prevent accumulation of condensed water.—A. S.

Furnace; Duplex Smelting ——. R. Lindemann, Osnabruck, Germany. U.S. Pat. 810,063, Jan. 16, 1906.

SEE Eng. Pat. 26,093 of 1904; this J., 1905, 1238.—T.F.B.

Minerals; [Flotation] Process of separating ——. E. B. Kirby, Rossland, Canada. U.S. Pat. 809,959, Jan. 16, 1906.

THE pulverised mineral is mixed with a considerable quantity of water and with a substance immiscible with, but lighter than water, *e.g.*, a solution of bitumen in light hydrocarbon (kerosene), which, in presence of water, will adhere to some of the mineral particles but not to others. The mass is violently agitated and then allowed to settle, whereby the particles which have become coated with the bitumen solution rise to the surface, this separation being assisted by gentle agitation and by blowing in a current of a gas. The layer of floating matter is removed, and washed, and the mineral particles are separated by filtration and then heated to recover the light hydrocarbon.—A. S.

Ores; Process of treating ——. J. Savelsberg, Papenburg, Germany. U.S. Pat. 810,572, Jan. 23, 1906.

SEE Fr. Pat. 351,535 of 1905; this J., 1905, 894.—T. F. B.

Kilns; Process of preventing the formation of "Scaffolds" in ——. T. C. King, New York, Assignor to National Metallurgic Co., Jersey City, N.J. U.S. Pat. 810,059, Jan. 16, 1906.

THE scaffolds or rings of fused materials are removed from the sides of the kiln by charging calcium fluoride into the kiln against such rings and maintaining them at a high temperature, with the result that they are fluxed or melted down.—W. H. C.

Copper; Refining ——. R. Baggaley, Pittsburg, Pa., C. M. Allen, Lolo, Mont., and E. W. Lindquist, Chicago, Ill. U.S. Pat. 810,249, Jan. 16, 1906.

THE process consists in injecting, by means of an air-blast under pressure, sawdust mixed with "fusible hydrocarbon" into a molten bath of black or blister copper in a converter, before that stage of oxidation has been reached wherein appreciable quantities of copper suboxide are produced.—A. S.

Slag; Saving Metal Values from ——. C. M. Allen, Lolo, Mont. U.S. Pat. 810,364, Jan. 16, 1906.

THE slag and matte are withdrawn from below the surface of the molten bath in the furnace, and overflow through a spout into a fore-hearth or separating chamber. The heat of the matte and slag is conserved by covering them during their passage from the furnace to the separating-chamber with a "practically air-tight conduit" of heat-radiating material.—A. S.

Vitrified Brick, Tile and various shapes; Method of producing —— [*from Slag of Copper Smelting Furnaces*]. R. Baggaley. U.S. Pat. 810,022, Jan. 16, 1905. VIII., page 181.

FRENCH PATENTS.

Steel; Use of Blast-furnace Gas in the working of ——. P. L. Hulin. Fr. Pat. 350,399, Dec. 14th, 1904.

THE gas issuing from the blast-furnace is divided into two streams, one of which, after passing through a purifier, is employed to operate the motor which works up the steel into ingots after fusion; the other stream also passes through a purifier, and, after enrichment with carbonic oxide produced in a separate coke-furnace, is employed for fusing the materials to be converted into steel. For this part of the process a mixture of 85 to 90 parts of blast-furnace gas with 10 to 15 parts of gas from the coke-furnace is recommended.—J. H. C.

Furnace; Crucible ——. E. Hausmann. Fr. Pat. 358,120, Aug. 5, 1905. Under Int. Conv., Aug. 5, 1904.

SEE Eng. Pat. 16,087 of 1905; this J., 1906, 78.—T. F. B.

Zinc Furnace. E. Dor-Delattre. Fr. Pat. 358,150, Sept. 29, 1905.

SEE U.S. Pat. 806,121 of 1905; this J., 1906, 26.—T.F.B.

Aluminium Alloys; Annealing —— by heating to redness and tempering. C. Claessen. Fr. Pat. 358,028, Sept. 25, 1905.

THE alloys are brought to a red heat and gradually cooled down to temperatures varying between 485° C. and 540° C., according to the proportion of copper present, and also according to the purposes for which the alloys are to be used. They are then cooled rapidly by plunging them into fluid baths in the ordinary way.—J. H. C.

Aluminium; Soldering ——. N. Evangelidi. Fr. Pat. 358,166, Sept. 30, 1905.

IN order to make the solder adhere more firmly to the aluminium, it is first of all heated to a point above its melting-point and stirred for some time. The solder, which consists of tin, or an alloy of tin and lead, &c., may be directly applied to the aluminium whilst in the molten state; or else, it may be granulated or powdered after cooling, and sprinkled over the aluminium, which is then heated till the solder melts; or, finally, the two pieces to be joined may be separately covered with the prepared solder, and then joined by means of an ordinary solder.—A. G. L.

Aluminium or Alloys rich in aluminium; Soldering ——. L. Fries. Fr. Pat. 358,184, Sept. 30, 1905. Under Int. Conv., Oct. 5, 1904.

THE process consists in heating the parts to be soldered by means of a previously heated flux capable of dissolving aluminium oxide, *e.g.*, an alkali pyrosulphate. A solder consisting of aluminium or an alloy rich in aluminium, in the form of wire, foil or powder may be used; or else, the parts to be united may themselves serve as solder, being heated to their melting point by the hot flux and, if necessary, a blow-pipe flame.—A. G. L.

Metals; Aluminothermic preparation of ——. T. Goldschmidt. Fr. Pat. 358,071, Sept. 27, 1905.

THE lower oxides, *e.g.*, of chromium or manganese are mixed with 1 to 4 per cent. of chromic acid, or with a higher oxide of manganese before adding the 34 or 35 per cent. of finely granulated metallic aluminium, whereby the production of alloy is increased from 50 or 60 per cent. to 90 per cent.—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

(*Continued from page* 128.)

Nitrates from the Atmosphere; Electric production of ——. Silvanus P. Thompson. The Electrician, Feb. 9, 1906, 56, 666—670.

A DISCOURSE at the Royal Institution, on Feb. 2 (see also this J., 1906, 27).

Nitrites and Nitrates; Production of —— by electrolytic oxidation of Ammonia in presence of Cupric Hydroxide. W. Traube and A. Biltz. Ber. 39, 166—178, 1906.

IN continuation of previous work (this J., 1904, 987; 1905, 280) and in reply to Müller and Spitzer (this J. 1905, 279 and 550) the authors still maintain that cupric hydroxide has a favourable influence upon the oxidation of nitrites to nitrates. The effect is however, much less marked than upon the first stage of the process, the electrolytic production of nitrites from ammonia in solutions containing free alkali.

During the electrolysis a black deposit is observed on the anode which may possibly consist of a higher oxide of copper.—R. S. H.

Ozone; Production of —— by electrolysis of Alkali Fluorides. E. B. R. Prideaux. Faraday Soc. Proc., Jan. 30, 1906. [Advance Proof.]

THE author is unable to confirm the result of Gräfenberg (this J., 1903, 1242), who found that oxygen containing 3·48 per cent. of ozone could be obtained by electrolysis of aqueous hydrofluoric acid. With a current density of 100 ampères per sq. dcm. the percentage was 0·23. With saturated potassium fluoride solutions electrolysed at 0°C. in a glass U-tube coated internally with paraffin, and with a platinum anode, the largest yield was 0·65 per cent. of ozone with a current density of 10 ampères per sq. dcm. This yield is, however, affected by the duration of the experiment, and falls to 0·096 in 4 hours 20 minutes. With increased current density the yield is further reduced. The ozone was estimated by passing the gases through a solution of potassium iodide.—R. S. H.

ENGLISH PATENT.

[*Mercury Lamps*]. *Electrode material for vapour Electric Apparatus.* C. O. Bastian and G. Calvert, both of London. Eng. Pat. 2004A, Feb. 1, 1905.

THE light given by a mercury lamp is modified by adding 10 parts by volume of the liquid alloy of sodium and potassium in the proportion of their atomic weights to 90 parts by volume of mercury. Cadmium, strontium, lithium, &c., may also be added to the alloy.—A. G. L.

UNITED STATES PATENTS.

Cell; Electric ——. K. Tsukamoto, Tokyo, Japan. U.S. Pat. 809,647, Jan. 9, 1906.

IN an electric cell, the combination is claimed of an outer casing having located within it a carbon tube containing graphite, manganese dioxide, potassium chloride, potassium permanganate and ammonium chloride, and surrounded by a fibrous substance, such as blotting paper, which is bound around it. Between the inner surface of the shell and the fibrous coating around the carbon tube, is placed a mixture of ammonium chloride, potassium chloride, gypsum, mercuric chloride and dextrin.—B. N.

[*Electric*] *Cell; Asymmetric* ——. M. Büttner, Wilmersdorf-Berlin, Germany. U.S. Pat. 809,770, Jan. 9, 1906.

AN aluminium anode is used and a cathode of any metal, the electrolyte consisting of a solution of ammonium hydroxide and boric acid.—B. N.

Calcium Carbide; Apparatus [Electric Furnace] for the production of ——. E. F. Price, G. E. Cox and J. G. Marshall. Assignors to Union Carbide Co., all of of Niagara Falls, N.Y. U.S. Pat. 809,842, Jan. 9, 1906.

The electrodes of the electric furnace consist of spaced graphite rods of reduced cross-section, and a high current density is used in the electrodes in order to effect the reduction of the charge. A jacket, of relatively high resistance, surrounds the electrode rods, for the purpose of excluding oxidising gases from the rods and for supporting them against breakage. The furnace is provided with a feed-supply for lime and carbon, and there is also an arrangement for withdrawing heat from the ends of the electrodes remote from the zone of reduction.—B. N.

Hides; Process of [electrically] treating ——. F. B. Hinkson, Assignor to J. M. and J. J. Flannery. U.S. Pat. 810,144, Jan. 16, 1906. XIV., page 190.

French Patents.

Carbide of Silicon; Production of compact agglomerated —— by means of the Electric Furnace. A. J. V. Bouvier. Fr. Pat. 350,369, Dec. 5, 1904.

Agglomerated carbide of silicon is obtained by treating in the electric furnace a mixture of amorphous carbide of silicon, crystallised carbide of silicon, silica, coke-dust and sawdust. The agglomerated carbide is hard, resists the action of acids and high temperatures, and is good for insulating purposes.—B. N.

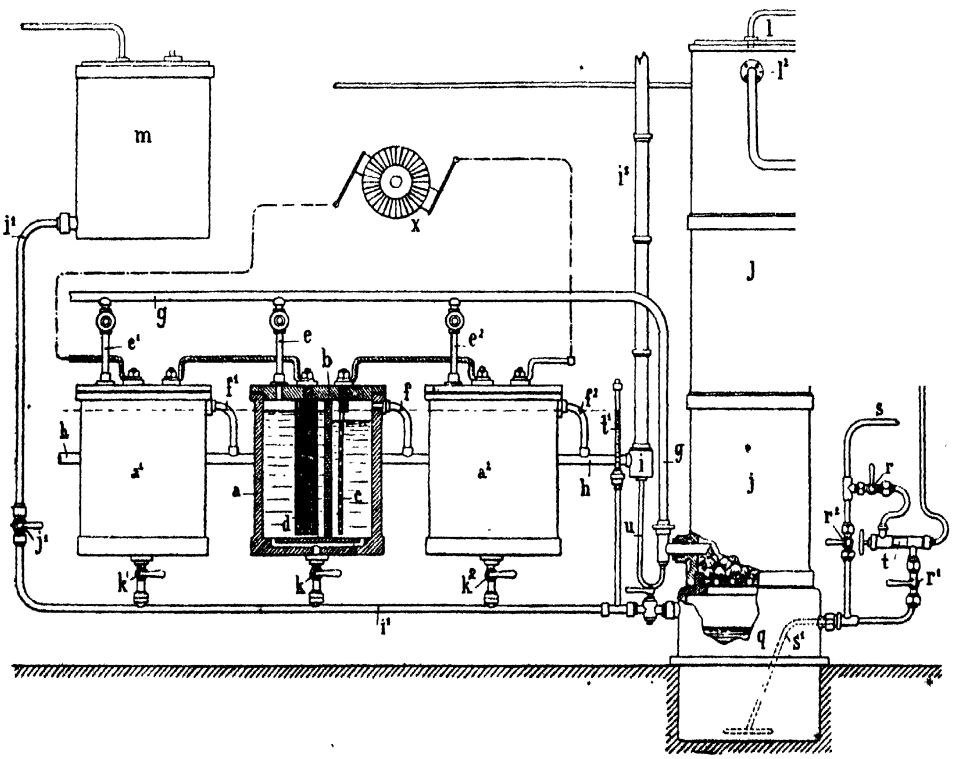
Electric Arcs; Process for effecting reactions between Gaseous substances by means of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 350,392, Dec. 12, 1904.

See Eng. Pat. 26,602 of 1904; this J., 1905, 1178.—T. F.B.

Nitrogen; Manufacture of compounds of —— from the air. Siemens et Halske A.-G. Fr. Pat. 358,171, Sept. 30, 1905. VII., page 180.

Chlorine; Manufacture of —— by electrolysis of Hydrochloric Acid. E. F. Côte and P. R. Pierron. Fr. Pat. 358,245, Oct. 3, 1905.

Pure chlorine is said to be obtain without loss of hydrochloric acid. a, a^1, a^2, are divided by diaphragms partments, metallic cathodes c and c connected to a suitable source solution of hydrochloric acid is which is of the same capacity ap of the electrolytic cells, by ope and one of the valves k, k^1, k^2, the cells may be ascertained by the escapes through f, f^1, f^2 into h, an bottle i into i^2. Some of the entrair gas condenses and collects in the sip runs into q, or it may be collected se The remainder of the acid is separate in absorption towers. The chlorine e, e^1, e^2 into g, and through the sto coke, over which a spray of wate falls. The aspirator l^1 draws off l^2. The water containing dissolved chloric acid collects in q, where it is liquid from the cells when the str diminished to 5 or 6 per cent. Steam r^2 being open and r and r^1 closed, boiling, and the chlorine is thus tower j and collected; r and r^1 are closed, when the steam acting through the weak acid liquid from q, through connection with the absorption tow acid. The acid liquid thus becomes chloric acid, and is delivered into m. about 250 litres capacity, and receiv ampères, do not require more than o



(B.)—ELECTRO-METAL

Iron; Anodic Corrosion of —— by and the passivity of iron. F. H schmidt. Z. Elektrochem., 1906,

The authors have submitted the ir

the electrolytic corrosion of water- and gas-mains to an experimental investigation. In most cases, danger is ascribed to the electric tramways, in which the overhead wires are positive whilst the rails are connected to the negative terminal of the generators at the central power station. This causes a marked anodic polarisation of the iron mains in the district near the power station, which is directly due to return currents leaking through the earth. The corrosion is peculiar, in that the outward appearance of the pipes is not much altered, but the iron is transformed into a soft mass which consists of ferrous phosphates and silicates mixed with particles of iron and carbon. From this appearance, however, one cannot conclude that the corrosion is electrolytic since many cases of ordinary corrosion have been found to give a similar result.

For studying this question, unpolarisable standard electrodes consisting of zinc plates surrounded by a paste of zinc sulphate have been employed. These are sunk in the ground at different points, and potential measurements between these various electrodes or between the electrodes and the rails or iron pipes enable the direction and magnitude of the earth current to be determined. For the more accurate estimation of the magnitude of the current, a special form of coulomb meter is recommended, but it has not been applied directly in the present work.

Before the effect of such currents can be foretold, it is necessary to know if the iron conduits are in the active or passive condition, since it is well known that under different circumstances iron can behave in these two ways. For the elucidation of this problem, the soils must be distinguished according to the constitution of the salt solutions which they have adsorbed. Of the more commonly occurring substances, alkalis and nitrates can be considered as favouring the passive state, chlorides and free carbonic acid as establishing the active condition necessary for corrosion to occur (see Mugdan, this J., 1903, 798). Of special importance is the behaviour of solutions of carbonates; even when these are slightly alkaline to start with, the passage of current increases the content of carbon dioxide in the layers immediately surrounding the anode, and the bicarbonate solution thus obtained is very favourable for corrosion, as it destroys the passive condition of the iron. Chlorides behave similarly. On account of the very dilute nature of the solutions, diffusion is unable to effect any marked diminution in this action.

The experimental work is very wide in its scope. Cases of corrosion under varying conditions of current and with different solutions have been examined in the laboratory. Measurements of the conductivity of soil and of solutions adsorbed by sand have also been carried out, and finally a series of direct measurements have been made in Strassburg in connection with the tramways in that city.

It is frequently found that the corrosion occurs only very locally upon the iron pipes, the difficulty of explaining this is dwelt upon, and the possibility of the attack being due to the abnormally high conductivity of the soil between the rails and mains at these points is put forward as the most likely explanation.

So far as the present investigation is able to throw light on this complicated question, the authors are inclined to believe that, except in such cases where the soil exhibits an abnormally high conductivity, no marked electrolytic corrosion is to be feared when the P.D. between the pipes and rails is below 1 volt. They ascribe this freedom from attack to the fact that under these conditions only minute currents can pass which would take many years to effect marked destruction, rather than to this potential being below a minimum necessary for electrolysis to occur.

—R. S. H.

Calcium; Electrolytic ——. L. Doermer. Ber., 1906, 39, 211—214.

When pieces of commercially prepared calcium, or the powdered metal are struck with a hammer upon an anvil, sharp explosions are noticed. These may perhaps be accounted for by reaction with the layer of rust, since if this is carefully removed, the effect is much less marked. The gas content of the metal is not marked; upon heating 50 c.c. of the powder, about 25 c.c. of hydrogen are obtained below a red heat, but this gas is reabsorbed at higher temperatures. Upon remelting the powdered metal, a more dense product is obtained, which is considerably more stable towards attack by air or water than the rods of the commercial metal.—R. S. H.

Copper silicide and the formation of Silicon soluble in hydrofluoric Acid. P. Lebeau. Comptes rend., 1906, 142, 154—157.

A mixture of equal parts of silicon and copper was fused in the electric furnace, and one portion was cooled suddenly by plunging into water, whilst another portion was allowed to cool very slowly. The products contained 43·5 and 41·9 per cent. of total silicon respectively. Determinations of the silicon existing in the state of combination with copper showed 12·8 per cent. in the case of the rapidly cooled alloy, but only 11·3 per cent. in the case of that cooled slowly. The analysis of copper-silicon alloys by the method previously employed (this J., 1905, 1508, also Comptes rend., 1905, 141, 889) always showed a deficit of 1·5—2·0 per cent. This was due to the presence of a modification of silicon soluble in hydrofluoric acid. The free silicon is extracted by long digestion with 10 per cent. caustic soda lye. The residue is oxidised by nitric acid, yielding a mixture of silica and silicon. Formerly this mixture was resolved by extracting the silica by hydrofluoric acid. Since, however, the silicon was partially soluble in that acid, the method now adopted consists in converting the mixture into potassium silicate and determining the silica in the product. The ratio of copper to combined silicon in these alloys always corresponds approximately to the formula $SiCu_4$. The micrographic examination of polished surfaces of the alloys, consisting of copper silicide and free silicon, after etching with potash, shows the differentiation between the combined and the free silicon. On etching with hot concentrated hydrofluoric acid, the distribution of the soluble variety of silicon can be ascertained. Copper silicide is best prepared by adding the calculated quantity of copper to a cupro-silicon rich in silicon. It melts at about 800° C., is very brittle and has a conchoidal fracture.—J. F. B.

English Patents.

Furnaces; Electric ——. P. Girod, Paris. Eng. Pat. 13,690, July 3, 1905. Under Int. Conv., July 4, 1904.

See Addition of July 4, 1904, to Fr. Pat. 329,822 of 1903; this J., 1904, 1225.—T. F. B.

Furnaces; Electric ——. P. Girod, Paris. Eng. Pat. 23,402, Nov. 14, 1905. Under Int. Conv., Dec. 24, 1904.

See Addition of Dec. 24, 1904, to Fr. Pat. 329,822 of 1903; this J., 1905, 740.—T. F. B.

United States Patents.

Electroplating Apparatus. A. W. L'Hommedieu, Assignor to C. F. L'Hommedieu, both of Chicago, Ill. U.S. Pat. 809,309, Jan. 9, 1906.

A cylinder, mounted in an inclined position and closed at its lower end, is provided with a solution containing the metal to be deposited, and is arranged so that it may be rotated on its central axis. Means are provided for adjusting the inclination of the cylinder. The anodes are arranged around the inner surface of the cylinder, and one or more cathodes near to the axis, the electrodes being separated by a removable perforated cylinder of non-conducting material adapted to contain the material to be plated, the articles being supported by a metallic pan, placed near to the bottom of the outer cylinder and forming a part of the cathode.—B. N.

Metallic Coatings; Process for electrolytic production of lustrous —— upon metals. A. Classen, Aachen, Germany. U.S. Pat. 809,492, Jan. 9, 1906.

See Fr. Pat. 350,964 of 1905; this J., 1905, 806.—T. F. B.

Precious Metals; [Electrolytic] Apparatus for recovering ——. E. J. Garvin, Portland, Oreg., Assignor to Garvin Cyanide Extraction Co., Oregon. U.S. Pat. 809,939, Jan. 16, 1906.

The apparatus consists essentially of a main tank, a separa-

ting tank connected with the upper portion of the main tank, and an amalgamating tank connected with the separating tank and discharging into the main tank. The separating tank and amalgamating tank each have a number of metal partitions serving as anodes, and also a cathode partly immersed in a layer of mercury on the bottom of the tank. The mixture of pulverised ore and solvent in the main tank separates into two layers; the upper layer is conveyed to the separating tank where any ore is allowed to settle out, whilst the dissolved precious metal is recovered by a combined process of electrolysis and amalgamation. The lower layer from the main tank is mixed with the spent solvent from the separating tank, and the mixture is forced into the amalgamating tank; here the dissolved precious metal is separated by electrolysis and amalgamation, and the mixture of ore and solvent is discharged into the main tank.—A. S.

Metals or alloys for Lithographic purposes; Process of electrolytically preparing ——. O. C. Strecker, Darmstadt, Germany. U.S. Pat. 810,889, Jan. 23, 1906.

SEE Eng. Pat. 6701 of 1900; this J., 1901, 727.—T.F.B.

FRENCH PATENT.

Copper; Direct process for preparing pure —— electrolytically from copper matte as anode in an electrolyte containing acid copper sulphate solutions. W. Borchers, R. Franke, and E. Gunther. Fr. Pat. 358,026, Sept. 25, 1905. Under Int. Conv., Oct. 5, 1904.

SEE Ger. Pat. 160,046 of 1904; this J., 1905, 897.—T.F.B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 129.)

Arbutus Unedo Oil. G. Sani. Atti R. Accad. dei Lincei Roma, 1905, **14**, [2], 619—623. Chem. Centr., 1906, **1**, 373.

THE fruit of the *Arbutus Unedo* has been recently used at Perugia for the preparation of alcohol on a commercial scale. The author states that this process would prove still more remunerative if the oil contained in the distillation-residue of the fruits were extracted. The seeds of *Arbutus Unedo* contain 39·03 per cent. of a golden-yellow oil of sweet taste, having the sp. gr. 0·9208 at 15° C., and Zeiss refractometer reading at 25° C., 71 "degrees." The oil becomes turbid at 9° C.; at —23° C. it has the consistence of butter; at —27° C., it is solid. Its constants are:—saponification value, 208; iodine value, 147·86; Reichert-Wollny value, 0·861; Hehner value, 92·48; Maumené value (in Tortelli's apparatus, using olive oil as diluent; this J., 1904, 608), 103·5° C.; neutralisation value of liquid fatty acids, 198·26. The oil consists of the glycerides of palmitic, oleic, linolic and isolenolenic acids, the two latter predominating. Determinations by Hazura's method gave oleic acid, 3·43; linolic acid, 53·75; and isolinolenic acid, 24·33 per cent.—A. S.

Fats; Bacterial Decomposition of ——. O. Rahn. Centralbl. Bakteriol., 1905, **15**, 422. Chem.-Zeit., 1906, **30** [Rep.] 30.

A VIEW frequently expressed is that fats are only decomposed by micro-organisms that require nitrogenous food, but the author concludes that the decomposition must be effected by micro-organisms that require very little nitrogen. He prepared mixtures of mineral nutrient fluid with fat, and observed, under suitable conditions, marked decomposition of the fat. The micro-organisms isolated from the cultures were *Penicillium glaucum*, a *Penicillium* with brownish-yellow spores, a mould-fungus that coloured the fat red, a white and a gray mould fungus, a motile bacillus, *a*, producing a green fluorescent colouring matter, and a smaller non-motile bacillus, *b*. Pure cultivations of each of these were made and their action upon fat studied. It was found that the *penicillia*, had a pronounced action upon fats, attacking the glycerol and lower fatty acids, but not oleic acid. The white mould-fungus had a less energetic action; it oxidised volatile fatty acids, but did not attack oleic acid. The gray mould-fungus had but little action. The bacillus, *a*, had marked hydrolytic and oxidising powers; it decomposed oleic acid, but had no special action upon volatile fatty acids. Bacillus, *b*, had much less effect upon fats.—C. A. M.

ENGLISH PATENTS.

Fatty Substances; Apparatus for extracting —— from products containing them, by means of carbon tetrachloride. P. Bernard, Arras, France. Eng. Pat. 18,667, Sept. 15, 1905. Under Int. Conv., Dec. 24, 1904.

THE dried and powdered material is introduced into an extractor, the charging orifice of which is then hermetically sealed. Carbon tetrachloride is now introduced into the lower part of the vessel, expelling the air, which passes through a cooling coil where any vaporised solvent is condensed and returned to the reservoir. After sufficient extraction of the material a fresh quantity of carbon tetrachloride is introduced from the reservoir, and this drives before it the solvent charged with fat into an evaporating vessel, whence the evaporated tetrachloride is returned through a condenser to the reservoir.—C.A.M.

Soap; Manufacture of insoluble ——. P. Krebitz. Munich, Germany. Eng. Pat. 4092, Feb. 27, 1905.

A MIXTURE of the neutral fat with a metallic hydroxide, such as lime, is boiled and allowed to stand for several (five to ten) hours in a closed vessel. The resulting insoluble soap is ground, and the glycerin extracted by washing the mass with hot water, the final washings, poor in glycerin, being used in place of pure water in subsequent saponifications. The time required for saponification may be reduced to 30 minutes or one hour by the addition of, say, 5 per cent. of fatty acids or rosin.—C. A. M.

Detergents; Manufacture of ——. W. E. Heys, Watford, Herts. Eng. Pat. 17,999, Sept. 6, 1905.

CLAIM is made for the manufacture of detergents by mixing the oil or other saponifiable matter and a vegetable meal with sodium carbonate and treating the mixture with caustic soda lye, preferably containing some sodium bicarbonate. The resulting pulverulent mass is granulated by means of a sieve, and subsequently powdered in a disintegrator.—C. A. M.

FRENCH PATENT.

Washing Powders containing Alkali Peroxides; Process and apparatus for packing and preserving ——. Königswarter und Ebell. Fr. Pat. 358,167, Sept. 30, 1905.

SEE Eng. Pat. 19,809 of 1905; this J., 1906, 32.—T.F.B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 129.)

(*A.*)—PIGMENTS, PAINTS.

Aniline and its homologues; Black lakes from ——. S. Kirpitschnikoff. IV., page 173.

ENGLISH PATENT.

White Lead; Machine for the manufacture of ——, *and for use in similar processes.* J. Scott, Bombay, India. Eng. Pat. 23,915, Nov. 5, 1904.

THE apparatus comprises a revolving cylinder constructed in two parts, lined with tin or lead and provided with a hollow trunnion passage. Gases, air or steam are admitted to the cylinder through a passage in one of the trunnions on which it is mounted, or the gases may be introduced through a valve, used for charging and discharging the contents, and which, when closed, forms a flush face inside the cylinder, so that no material can lodge therein.—D. B.

German Patents.

Lakes [from Azo Dyestuffs]; Process of preparing colour ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 160,172, May 28, 1903.

Lakes are prepared in the usual manner from the dyestuffs obtained by combining a diazonium compound with 1.8-alkyloxynaphthol-3.6-disulphonic acid. They are stated to be similar in shade to Eosin lakes, but faster to light. The lake from 2-naphthylamine-6.8-disulphonic acid is bluish-red, that from *o*-chloraniline yellowish-red, and that from *p*-toluidine-*o*-sulphonic acid red.—T. F. B.

Dyestuff for Lakes; Process for preparing a monoazo ——. Meister, Lucius und Brüning. Ger. Pat. 163,055, Aug. 24, 1904. IV., page 176.

(C.)—INDIA-RUBBER, Etc.

Rubber; Resin-content of some different kinds of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 394—395.

Thin sheets (0·2 mm. thick) of the rubber, prepared by masticating the sample previously dried *in vacuo* over calcium chloride, were extracted with acetone in a Soxhlet apparatus. The following results were obtained:—

Trade name and source of rubber.	Resin.
	Per cent.
Parà fine; *Hevea brasiliensis* (America)	1·44
Ecuador scraps; *Castilloa elastica* (America)	3·12
Santos Mattogrosso Mangabeira; *Hancornia speciosa* (America)	12·18
Guatemala sandy; *Castilloa elastica* (America)	9·6
Red Adeli balls; *Landolphia owariensis* (Africa)	12·23
Mozambique balls; *Landolphia owariensis* (Africa)	8·62
Large ditto	11·23
Fine Mozambique spindles; *Landolphia* (Africa)	6·80
Fine Red Massai balls; *Landolphia* (Africa)	4·40
Gambia balls; *Landolphia senegalensis* (Africa)	3·40
South Cameroon balls; *Landolphia* (Africa)	5·99
Lewa rubber; *Manihot glaziovii* (Africa)	6·81
Madagascar low; *Landolphia* (Africa)	3·39
Madagascar niggers; *Landolphia* (Africa)	3·94
Mozambique unripe; *Landolphia* (Africa)	6·68
Soudan twists (Africa)	7·99
Borneo rubber; *Ficus elastica* (Asia)	4·76
Fine Ceylon Parà; *Hevea brasiliensis* (Asia)	2·26
Fine Parà rubber	0·57

The method of drying the rubber exercises a considerable influence upon the determination of the resin-content by acetone-extraction. Whereas a sample of fine Parà dried *in vacuo* over calcium chloride, yielded to acetone 1·44 per cent., another sample of the same rubber dried at 80° C. in an oven yielded 6·83 per cent. Samples of Ecuador scraps, similarly treated, yielded 3·12 per cent. and 30·2 per cent. respectively. The action of the resin at the elevated temperature appears to be to form a rubber "solution" ("Kautschukharzquellung") soluble in acetone.—E. W. L.

Rubber vulcanised by heat; Influence of sulphur-content on the tensile strength of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 394.

A good commercial Parà rubber, containing (washed and dried) 6·27 per cent. of resins, and 0·27 per cent. of ash, was masticated with quantities of milk of sulphur ranging from 5 to 40 per cent. of sulphur on the weight of the rubber. The mixtures were vulcanised at 145° C. under a pressure of 4—5 atmospheres for 50 minutes, in cylindrical glass moulds, in an autoclave. After three hours the rubber cylinders were broken in a dynamometer. The breaking strains and extensions (of a cylinder 2 cm. long and 17·5 mm. in diameter) are given in the following table, and indicate that under the conditions specified the maximum strength is obtained with a rubber vulcanised with about 20 per cent. of sulphur:—

Sulphur added to raw rubber.	Breaking strain.	Elongation.	Sulphur added to raw rubber.	Breaking strain.	Elongation.
Per cent	kilos.	cm.	Per cent.	kilos.	cm.
5	3·25	5·5	25	14·25	9·6
10	9·5	7·5	30	14·0	9·2
15	13·0	9·7	35	13·9	9·0
20	14·5	9·7	40	13·7	9·0

—E. W. L.

Caoutchouc; Torrey's method of determining pure ——. R. Ditmar. XXIII., page 200.

English Patent.

Rubber; Extraction of pure raw —— *from rubber plants.* K. von Stechow, Wiesbaden, Germany. Eng. Pat. 12,859, June 21, 1905.

See Fr. Pat. 355,611 of 1905; this J., 1905, 1245.—T.F.B.

French Patent.

Caoutchouc; Process of making aqueous Solutions of —— *and of regenerating caoutchouc.* P. Alexander. Fr. Pat. 358,018, Sept. 25, 1905.

See Eng. Pat. 14,681 of 1905; this J., 1905, 1244.—T.F.B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 130.)

Leather Industries; Yearly report (1905) *of the German Research Institute for* ——. J. Paessler.

The results of a large number of analyses of tanning materials, showing the variable percentages of tannins they contained, are given in the following table:—

Tanning material.	Oak-bark.	Pine-bark.	Wattle-bark.	Mangrove-bark.	Mallet-bark.	Valonia.
Number of analyses	82	110	25	32	49	28
Tannins	Per cent. 10·3 [12·6]	Per cent. 12·7 [17·2]	Per cent. 34·4 [42·0]	Per cent. 32·3 [48·6]	Per cent. 44·8 [55·6]	Per cent. 31·4 [36·4]
Sol. non-tannins	[6·4] 6·6	[7·1] 9·6	[16·9] 9·9	[19·6] 11·4	[36·7] 7·8	[24·2] 11·7
Insoluble	72·7	66·6	44·8	43·8	33·7	44·7
Water	10·4	11·1	10·9	12·5	13·7	12·2

Tanning material.	Valonia-beard.	Myrobalans.	Myrobalans (stone freed).	Divi-divi.	Quebracho-wood.	Sumach.
Number of analyses	85	13	4	7	23	50
Tannins	Per cent. 42·1 [51·3]	Per cent. 30·8 [42·6]	Per cent. 52·0 [54·7]	Per cent. 44·6 [49·6]	Per cent. 20·9 [24·1]	Per cent. 26·8 [32·8]
Sol. non-tannins	[32·1] 14·0	[31·8] 14·6	[46·7] 16·2	[40·9] 18·5	[15·0] 1·4	[18·0] 16·2
Insoluble	31·8	38·7	17·8	27·3	63·1	45·0
Water	12·1	9·9	12·0	9·6	13·8	9·0

Note.—The figures given in the above tables relate to the average values, but, in the case of the tannins, the maximum and minimum values also are given in brackets.

—F. K. K.

Chromium Compounds; Poisonous nature of —— and their effect in chrome leather manufacture. H. Becker. Collegium, 1906, 35—36, 37—44.

An exhaustive investigation upon this subject was made and its results were communicated to the German section of the International Assoc. of Leather Trades Chemists (I.A.L.T.C.), at their last meeting in Frankfort on the Maine. The fact that chromic acid and its salts are poisonous is well known, but only a single case of serious blood poisoning in the chrome leather industry could be traced by the author. Now and then, when acting contrary to instructions, inexperienced workmen suffer from sore fingers; frequently little care is taken of these sores to begin with, and, once neglected, they take a long time to heal. The workmen should be supplied with rubber gloves, and their hands should be occasionally examined. They should rub vaseline on to their hands and arms, and every small injury should be properly dressed, a waterproof bandage being used. The workmen should be informed of the poisonous nature of chromic acid and its salts, and respirators should be supplied to those who weigh out the bichromate.

Chromic oxide is non-poisonous, and no danger whatever can, therefore, arise to the public from using chrome-tanned leathers, nor to workmen employed in factories which employ the "one-bath" method for tanning skins or hides.—F. K. K.

English Patents.

Tanning leather and skins; Process of ——. C. Baron, Marseilles, France, and J. Aubert, Genes, Italy. Eng. Pat. 17,551, Aug. 30, 1905. Under Int Conv., Oct. 14, 1904.

See Fr. Pat. 347,097 of 1904; this J., 1905, 284.—T. F. B.

Films, sheets and cords; Producing non-absorbent ——. F. E. Blaisdell, London. Eng. Pat. 1398, Jan. 24, 1905.

Films of gold-beater's skin are coated with a solution of a gelatinous or albuminous solution containing potassium bichromate. The coated film is then exposed to light, and the coating is rendered tough and non-absorbent. If desired, the skin may first be impregnated with chromic acid and then coated with the gelatinous substance. Cords of gut, parchments and similar materials may also be treated with potassium bichromate or chromic acid.—J. F. B.

United States Patent.

Hides; Process of [electrically] treating ——. F. B. Hinkson, Newcastle, Pa., Assignor to J. M. and J. J. Flannery, Pittsburg, Pa. U.S. Pat. 810,144, Jan. 16, 1906.

The hides are suspended in a bath, each hide being disposed between a pair of electrodes through which an electric current is passed. The current passes transversely through the hides, and its direction is reversed at suitable intervals (see U.S. Pat. 807,930 of 1905; this J., 1906, 83).—A. S.

French Patent.

Horn Substitute; Manufacture of a ——. H. Schwarzberg. Fr. Pat. 358,172, Sept. 30, 1905.

Fifty parts of casein are dissolved in an aqueous solution of borax; 50 parts of starch are then added, sufficient water being used to make the whole into a paste. Twenty-five parts of gelatin, 0·25 part of glycerin, and 7 to 10 parts of melted paraffin are now mixed with the paste together with a quantity of α-naphtholsulphonic acid equivalent to from 1 to 5 per cent. of the whole. The product is allowed to dry in the form of thin films, then completely dried by treating with alcohol and finally rendered waterproof by subjecting it to the action of aluminium acetate or hexamethylenetetramine.—W. P. S.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 130.)

Sugar Juices; Preservation of —— by mercuric chloride. L. Ehrmann. Bull. Assoc. Chim. Sucr. Dist., 1905, 23, 634.

Samples of cane juice which cannot be analysed on the spot have often to be sent by post, and it is usual in such cases to add 1 part of mercuric chloride per 1000 of juice to prevent changes due to fermentation. The powdered salt, however, tends to remain undissolved unless the sample is well shaken, and the preparation of the bottles is tedious. A few c.c. of a concentrated alcoholic solution of the mercuric salt are preferably added, the liquids evenly mixed by merely turning the bottle around, and the alcohol finally expelled by exposure to the sun or by heating.—L. J. de W.

Cane and other Molasses; Elimination of the invert sugar in —— by fermentation. H. and L. Pellet and Pairault. Bull. Assoc. Chim. Sucr. Dist., 1905, 23, 639—647.

It is now established in a general way that yeasts (and moulds) which secrete only zymase and no sucrase (invertase) are incapable of inverting sucrose and can act only on invert sugar or reducing sugars.

One of the authors (Pairault) found a yeast which in five days fermented the whole of the reducing sugars in a sample of molasses in Martinique, but left the sucrose practically untouched. The experiments were repeated at the Pasteur Institute, Lille, with molasses and yeast from Martinique, the yeast which had been preserved dormant having been resuscitated in invert sugar agar-agar solution. The results, as a whole, show that a yeast not containing invertase has been isolated. Several well-defined yeasts of the kind are known; but the present organism has not been characterised.—L. J. de W.

Apiose. E. Vongerichten and F. Müller. Ber., 1906, 39, 235—240.

Apiose is a pentose sugar having the constitutional formula $(CH_2OH)_2C.OH.CHOH.CHO$, existing in conjunction with dextrose in the glucoside apiin which is obtained from parsley seed (see this J., 1900, 1139; 1901, 1034, and 1902, 596). It is now found that the green portions of the parsley plant contain, besides apiin, a considerable proportion of another glucoside, hydroxy-apiin methyl ether, which also yields apiose on hydrolysis. Apiose, when oxidised by nitric acid, yields first apionic acid, and finally a dicarboxylic acid which is probably hydroxymethyltartaric acid. Apiose reduces Fehling's solution, the ratio of the cupric-reducing power of apiose to that of dextrose being 1 : 0·74.—J. F. B.

Formaldehyde; Production of Sugar from ——. H. and A. Euler. Ber., 1906, 39, 39—45 (see also this J., 1905, 902).

The authors show that, with a suitable concentration of formaldehyde, the latter can be condensed to sugar by any soluble base; with feebly condensing bases, it is only necessary for the concentration of the formaldehyde to be sufficiently small compared with that of the base. When sodium carbonate is employed as base, the concentration of the formaldehyde when sugar is first formed, depends directly on the initial concentrations of the aldehyde and alkali, as the formation of sugar only occurs after a certain amount of the aldehyde has been converted into formate and methyl alcohol. The concentration of sodium carbonate most suitable for the sugar-condensation is somewhat less than one-half that of the aldehyde; increase of the concentration favours the formation of formate, especially in concentrated solutions. It is found that glycollic aldehyde is formed as an intermediate stage between formaldehyde and sugar. The following figures, all referring to grm.-mols. of formaldehyde, illustrate the course followed by a condensation.

	At first.	After.		
		10 hrs.	13 hrs.	14 hrs.
Formaldehyde	0·67	0·47	0·11	—
Formic acid + methyl alcohol	—	0·04	0·06	0·065
Glycollic aldehyde	—	0·24	0·07	0·07
Higher sugars—pentoses (by diff.)	—	0·136	0·43	0·535

—T. H. P.

i-Arabinoketose from Formaldehyde; Formation of ——. H. and A. Euler. Ber., 1906, **39**, 45—51. (Compare preceding abstract.)

When formaldehyde is condensed by means of calcium carbonate, less formate and better defined sugars are obtained than when an alkaline solution is employed. From the products of such a condensation, the authors have prepared:—(1) *i*-arabinophenylosazone, the corresponding sugar being, not *i*-arabinose, but *i*-arabinoketose, and (2) a small quantity of the phenylosazone of a hexose. If the condensation is interrupted before one-half of the formaldehyde has been attacked, the solution is found to contain glycollic aldehyde.—T. H. P.

Caramelisation of Sugar; Function of formaldehyde in the ——. A. Trillat. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 652—655.

The formation of formic aldehyde during the heating of sugar (this J., 1905, 901) may serve to throw light on the phenomenon of caramelisation. Several caramels examined by the author contained from 0·005 to 0·325 per cent. of formaldehyde. In sugar heated to 125° C. i.e., before caramelisation occurs, the presence of formaldehyde could be detected. The conclusion is that caramel, or sugar which has commenced to caramelise, contains more or less formaldehyde which influences its reducing properties and its fermentability. This formation of aldehyde explains, at least partially, the variations in the reducing power of massecuites, and the destruction of sugar therein by heat. It may also explain the fact that sugar canes, which have taken fire and been partially burnt, never ferment, owing to the antiseptic property of formaldehyde. Besides the free formaldehyde found in sugar caramel, a considerable proportion will have become polymerised, furnishing products similar to methylenitan or to formose, which portion no longer gives the reactions of formaldehyde. It is of interest to note that on heating a solution of formaldehyde to which lime, soda or potash has been added, a brown sticky mass is obtained, having the odour of sugar caramel and the bitter taste of this product.—L. J. de W.

Sugars; Colour reactions of the principal —— N. Schoorl and C. J. van Kalmthont. XXIII., page 200

Sugar; Influence of the Lead Precipitate on the Polarisation of ——. W. D. Horne. XXIII., page 200.

Sugar; Influence of the Lead Precipitate on the Precipitation of ——. H. and L. Pellet. XXIII., page 200.

Sugars [Cupric-Reducing]; Determination of —— by means of Zeiss' Immersion Refractometer. B. Wagner and A. Rinck. XXIII., page 200.

Pentoses; Volumetric Method for Determining ——. A Jolles. XXIII., page 201.

English Patent.

Charcoal; Kilns for making or revivifying animal or other ——, *or for Carbonising other substances.* J. Buchanan. Eng. Pat. 4925, March 9, 1905. III., page 171.

United States Patent.

Potash; Apparatus for extracting crude —— *[from waste waters of Beet Sugar Factories].* G. W. Henry and F. W. Beale, Denver, Colo. U.S. Pat. 803,058, Oct. 31, 1905.

The invention consists essentially in apparatus for evaporating the water from the wash-liquids, which contain most of the potash in the beet, by means of the waste heat from the boiler-grates of the refinery. For this purpose the wash-waters are run into a tank, whence they pass into a shallow metal trough which is built into the whole of the top of a long horizontal flue, through which the waste gases are made to pass on their way from the boiler-grates to the smoke-stack. An outlet from this trough is controlled by a vertically sliding gate, by means of which the amount of liquid in the trough may be suited to the quantity of hot gases passing through the flues. The overflow from the trough passes into a basin from which it may be again returned to the main tank and, finally, to the evaporating trough.—A. G. L.

French Patents.

Separation of Solids (Beetroot Slices) held in suspension in liquids; Apparatus for ——. L. von May, Fr. Pat. 358,082, Sept. 27, 1905.

The liquid carrying the solids in suspension is caused to flow over an inclined perforated plate into a perforated trough. The liquid drains through the perforations, and the solids are removed from the trough by a rotating S-shaped brush, and are swept on to a plate from which they slide into a perforated conveyor trough. The conveyor carries the solids forward, at the same time squeezing out the remainder of the liquid, and delivers them to an elevator.—W. H. C.

Beetroots; Separation of Juice from ——. M. Weinrich. Fr. Pat. 358,156, Sept. 29, 1905.

The fresh beets are fed from a hopper against a rasping-cylinder by means of a reciprocating piston. A stream of dilute milk of lime, or lime dissolved in weak juice, is allowed to fall on the rasping cylinder by which it is thoroughly mixed with the beet pulp. The mixture of pulp and milk of lime then passes through a series of vessels in which it is stirred by paddles, and is heated by means of steam to a temperature of 70°—75° C. The pulp is then passed through pressing machinery which removes the juice. The mares may subsequently be mixed with water and subjected to a second pressing, the dilute juice from which may be used for dissolving the lime.—J. F. B.

Combustible or artificial coal composed of House Refuse and Nightsoil, ground together with Coal or Charcoal Dust and an Agglomerant composed of Water, Molasses and Glucose. J. P. Renenaux and A. Perrier. Fr. Pat. 358,200, Oct. 2, 1905. II., page 170.

Starches; Manufacture of Rice and Maize ——. J. Jean et Cie. Fr. Pat. 350,370, Dec. 5, 1904.

Rice or purified maize is treated with an equal weight of a 2 per cent. solution of phosphoric acid, and the mixture is thoroughly stirred until it becomes homogeneous and the gluten is dissolved. It is then diluted with four times its weight of water, and the dissolved gluten is separated from the starch by washing. The acid solution is neutralised by lime and the phosphoric acid is recovered. Hydrochloric acid may be used instead of phosphoric acid.

—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 132.)

Enzyme Action. II. H. P. Barendrecht. Z. physik. Chem., 1906, **54**, 367—375. (See this J., 1904, 945.)

The author has extended his investigation to the hydrolysis of lactose by the lactase prepared from a pure culture of *Saccharomyces Kefir.* The reaction was similar to that of the inversion of sucrose by invertase; that is, with a given quantity of the enzyme the amount of decomposition was proportional to the concentration of the sugar solution, only when this concentration was very low. As the concentration increased, the amount of inversion relatively diminished, finally becoming constant. The author states that this behaviour appears to represent the fundamental law of enzyme action. The

retarding effect of the reaction products on the decomposition of lactose by lactase is greater than in the inversion of sucrose by invertase. Moreover, of the two hexoses produced, galactose retards the reaction nearly twice as much as dextrose does, whereas in the inversion of sucrose the retarding effects of dextrose and levulose are identical. The author seeks to explain this difference by means of his radiation hypothesis of enzyme action (this J., 1901, 945). The enzyme lactase may be regarded as consisting of galactose and dextrose in a "living radiating condition" combined with albuminoid substances. Both the galactose and dextrose radiations are capable of decomposing lactose. In the lactose molecule, however, the dextrose portion is present in a less altered or modified condition than the galactose portion, and hence the dextrose radiation will be absorbed to a smaller extent (by the galactose portion of the lactose molecule) than the galactose radiation (by the dextrose portion of the molecule). Thus, in the hydrolysis of lactose by lactase, the dextrose radiation is the more active agent, and hence the reaction will be retarded to a greater degree by added galactose than by dextrose, whilst foreign hexoses, which absorb equally both the dextrose and galactose radiations, should have a retarding effect as great as galactose and dextrose together. This latter conclusion was confirmed experimentally.—A. S.

Diastase; Influence of the reaction of the medium on the activity of ——, and the products of saccharification of Starch. L. Maquenne and E. Roux. Comptes rend., 1906, **142**, 124—129.

All starches and malt-infusions have an alkaline reaction towards methyl orange, the degree of alkalinity varying in different samples. As a general rule starch pastes neutralised exactly to methyl orange by the addition of N/10 sulphuric acid are saccharified more rapidly than ordinary pastes. If the addition of acid be extended so as to diminish the alkalinity of the mixed medium, starch paste and malt infusion, the rate of saccharification increases up to a maximum point, and then rapidly decreases as the point of exact neutrality is approached. As soon as the neutral point is passed and the total mixed medium acquires an acid reaction, saccharification ceases. A distinct alkaline reaction to methyl-orange is, therefore, essential to the saccharification of starch by malt. By a series of tests with starches of various origins the authors have found that the most rapid saccharification is obtained by first neutralising the starch paste to methyl orange and then adding to the malt infusion a quantity of acid equal to about 33·66 per cent. of the quantity required to neutralise it completely. The neutralisation of the medium to this extent not only intensifies the activity of the diastase but also increases the proportion of maltose in the products of saccharification. The proportion of the original starch which is converted into maltose is raised from 75—82·5 per cent., in the case of the ordinary media, to 86—92 per cent. in the case of the neutralised media. The conclusions formulated in this J., 1905, 630, must, therefore, be modified slightly in a quantitative sense. It must be admitted that the starches contain, in their ordinary condition as pastes, not 80 per cent. of amylocellulose ["amylose"] but about 90 per cent., in presence of about 10 per cent. of amylopectin, unless this latter body is capable of being resolved by a specially active diastase with the separation of an amylose residue.
—J. F. B.

Diastase; Influence of the reaction of the medium on the activity of ——. A. Fernbach. Comptes rend., 1906, **142**, 285—286.

Referring to the observation of Maquenne and Roux (see preceding abstract) on the influence of the degree of alkalinity of the medium towards methyl orange upon the velocity and the extent of the conversion of starch-paste by malt extract, the author points out that such media contain both primary and secondary phosphates, the latter being very inimical to diastatic activity. The addition of acid to the point of neutrality to methyl orange converts the secondary phosphates into primary phosphates and neutralises the inhibitive influence of the former, thus establishing a condition which is most favourable to diastatic action (see this J., 1900, 260). In the absence of secondary phosphates the addition of the least trace of acid has a retarding effect. The influence of the phosphates is not confined to diastatic actions; the same observation has been made with regard to the proteolytic action of malt enzymes (this J., 1900, 916), and also in the case of the coagulation of starch pastes by malt extract.—J. F. B.

Formic Acid; Inhibitive action of —— on various fungi. W. Henneberg. Z. Spiritusind., 1906, **29**, 34—35.

The author has tested the action of formic acid at various concentrations on distillery yeasts in grain and potato mashes. Observations were made with pure cultures of yeast and other organisms, with cultures under industrial conditions, and with cultures purposely infected by various harmful bacteria and fungi. The proportions of formic acid necessary to prevent the development of the different organisms varied according to the conditions, *e.g.*, the quantity sown and whether present in pure cultures or as mixtures. Under industrial conditions with infected yeasts, proportions of 0·17—0·25 per cent. of formic acid sufficed to prevent the development of all the organisms other than the culture yeast, which proved to be the most resistant. The infecting organisms, however, were not killed, but were capable of developing when transferred to ordinary wort. The resistance of the culture yeasts to the presence of formic acid could certainly be increased by acclimatisation, so that formic acid is quite suitable for use as an antiseptic in distilleries and yeast factories.
—J. F. B.

Sulphurous Acid; Mechanism of the acclimatisation of yeasts to ——. G. Gimel. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 669—672.

It is generally said that the acclimatisation of yeasts to sulphurous acid is illusory, but the author finds that it is quite real in the presence of unstable mineral matter or an easily decomposable salt. The adaptation develops the protoplasmic activity leading to the secretion of an oxidising substance. The chief characteristic of the acclimatised yeast is the greater quantity of sulphates to be found in the ash.—L. J. de W.

Mucor javanicus; Fermentation by ——. C. Wehmer. Centr. Bakt., II., 1905, **15**, 8. Z. ges. Brauw., 1906, **29**, 53.

Mucor javanicus has a much more energetic fermentative action than *Mucor racemosus* and readily attacks strong wort of 15—16 per cent. Balling (21·6—25·6 lb. per barrel). The amount of alcohol produced lies usually between 4 and 5 per cent., rising in some cases to over 6 per cent. In the decomposition of sugar by this mould, small quantities of non-volatile acids are also formed. This alcoholic fermentation is not a consequence of lack of air, and occurs when the latter has free access to the solution, so that it is quite immaterial whether the fungus grows as mycelium or in the yeast form, the latter being obtained more readily and more abundantly than with *Mucor racemosus*. In presence of oxygen, the alcohol formed appears to be scarcely attacked by the mould. Restriction of the access of air to the solution causes the greatest diminution in the mould-growth, the decomposition of sugar being influenced to a less, and the production of alcohol to a still less, extent.—T. H. P.

Sulphured Hops; How much sulphurous acid do —— give up to Beer Wort? Wiegmann. Allgem. Brauer.- u. Hopfenzeitung, 1905, **45**, 115. Z. ges. Brauw., 1906, **29**, 52—53.

The author finds that hops contain from 0·088 to 0·320 per cent. of sulphur dioxide and that 1 litre of hopped wort contains from 2·3 to 5·5 mgrms. of sulphur dioxide, according to the extent of the sulphuring. Hops originally unsulphured also show the presence of as much as 0·088 per cent. of sulphur dioxide, this being formed during the course of the analysis from a sulphur compound in the hops. Assuming that 100 litres of wort produce about 75 litres of finished beer, the quantity of sulphur dioxide in the latter which can be attributed to sulphured hops

will, under the most unfavourable conditions, amount to from 3 to 7·4 mgrms. per litre (0·2—0·5 gr. per gall.). This small proportion may be neglected, since it has been shown that certain yeasts produce much larger amounts of sulphur dioxide than this, especially in presence of sulphates and amides.—T. H. P.

Wort Boiling. M. J. Cannon and W. Fyffe. J. Inst. Brewing, 1906, 12, 39—55.

THE authors discuss the differences between the two systems of boiling the wort, by steam and by direct fire. According to experiments carried out with portions of the same worts boiled by the two systems, it would appear that the chief differences manifest themselves as differences in the stability of the beer, *i.e.*, the permanence of brightness, flavour and character over lengthy periods. It was found that a very fair measure of the stability was obtained by boiling the beer in a flask, making it up to the original volume and observing the amount and character of the albuminous deposit which separated on standing. Those beers which threw a heavy flocculent deposit invariably showed a tendency to haziness and alteration in flavour at an early date, whilst those in which a very slight precipitate was formed remained free from these defects for a considerable period. The experimental parallel boilings were made on the one hand in a gas-heated copper and on the other hand in a jacketed open pan heated by steam at pressures of 16—45 lb., whilst in another series a closed pan, in which the wort was boiled under a pressure of 4 lb. per sq. in. was employed. In practically all cases the worts boiled by direct fire gave beers which cleared earlier and remained bright for longer periods than the beers from the worts boiled by steam, and the inferiority of the latter was greater the lower the steam pressure employed. It is certain that the superiority of the beers boiled over a fire was not due to a higher temperature of the bulk of the wort during ebullition, since the actual temperature of the wort was frequently higher in the case of the steam boiling, particularly in the closed copper. The difference is really attributable to the vastly higher temperature of the heating surfaces in boiling by direct fire, whereby the wort is momentarily superheated whilst in contact with the bottom of the pan, and a "cooking" action takes place, as distinguished from mere ebullition. This difference is illustrated chemically by a series of analyses described in the paper, determinations being made of the "albumins," "peptones" and "amides" in the different worts. It was found that the boiling by direct fire reduced the proportions of "albumins," both coagulable and uncoagulable, whilst increasing the proportions of "peptones" in the wort. Analyses of beers prepared from the worts boiled by fire and steam respectively also showed lower proportions of "albumins" and "peptones" and higher proportions of "amides" in the products boiled by direct fire. Hence the operation known as "cooking," which is produced by boiling over a fire results in an increased coagulation and a degradation of the albuminoids remaining in solution in the wort, with an accumulation of the lower, unprecipitable, and, therefore, stable forms at the expense of the higher colloidal forms, which are liable to form deposits and hazes on storage.—J. F. B.

Cane- and other Molasses; Elimination of the invert sugar in —— by fermentation. H. & L. Pellet and Pairault. XVI., page 190.

Barley; Determination of extract of——. G. Graf. XXIII., page 201.

Arbutus Unedo Oil. G. Sani. XII., page 188.

Alcohol; Manufacturing tax on —— in France. Bd. of Trade J., Feb. 1, 1906.

A FRENCH presidential decree fixes the rate of the manufacturing tax on alcohol, and products with an alcoholic base, from the 1st January, 1906, at 1 fr. 62 cts. per hectol. of pure alcohol. [T.R.]

Spirits and Beer; Production of —— in United Sta
Bd. of Trade J., Feb. 8, 1906.

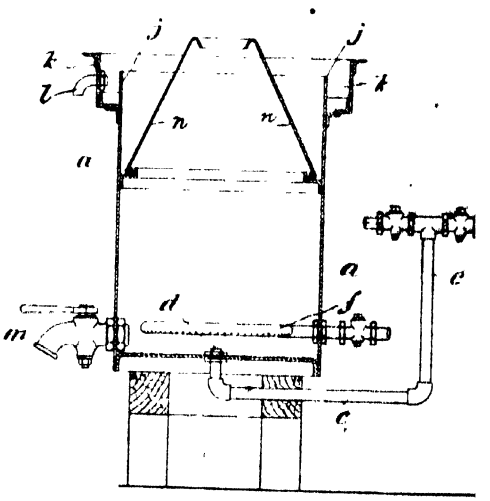
IN the annual report for the year ended 30th June, 19
of the Secretary of the United States Treasury, it
stated that the total production of distilled spirits in
United States, exclusive of fruit brandies, was 147, 810,
taxable galls., against 134,311,952 galls. in 1903—
an increase of 13,498,842 galls. The production
fruit brandies increased by 255,322 galls. During
fiscal year 1904—5, 1772 distilleries of all kinds w
in operation, a decrease of 400 as compared with the p
ceding year. The production of beer was 49,522,0
barrels, an increase of 1,256,861 barrels. [T.R.]

ENGLISH PATENTS.

Worts, Beers, Stout and the like; Apparatus for fermentin maturing and storing ——. T. Crossman, Oldha Lancs., and O. Selg, New York. Eng. Pat. 837 April 19, 1905.

THE apparatus consists of an open or closed tank havi a conical lower portion, at the bottom of which is situat a sludge chamber, connected with the tank by a slui valve. Within the tank is placed a skimming funn supported at the surface of the liquid by floats and co nected with the outside by a flexible tube. An attempe tor is also placed in the tank, having pipes with a diamon shaped section so as to prevent the settling of any sludg on the pipes. The preliminary sludge which rises at th beginning of the fermentation is withdrawn by the skimme the latter is then washed out and the top yeast removec The heavy sludge sinks and is collected in the sludge vesse Finally the sluice valve is closed and the clear beer i withdrawn through a racking cock in the conical part of th tank.—J. F. B.

Pulp [for Beer Filtration], Apparatus for cleansin and sterilising ——. H. J. West and Co., and L. Chew London. Eng. Pat. 12,765, June 20, 1905.



THE pulp is washed in a vessel containing water by submitting it to the combined action of jets of water and of air introduced under pressure at the lower part of the vessel. The fibres are thereby thoroughly subdivided and carried upwards against the inner sloping surface of a perforated cone from which they fall down again for further treatment. In the figure, *a* is the washing vessel containing the pulp; the pipe *c*, and nozzle *d*, serve for the introduction of the water or steam, whilst the compressed air enters through the perforated ring *f*; *n* is the perforated inverted cone against which the pulp is projected, whilst the foul water passes into the trough *k*, over the weir *j*, and flows out through the pipe *l*. The pulp is sterilised by means of steam introduced through the nozzle *d*.—J. F. B.

Beer; Processes for Pasteurising —— and apparatus for use therein. K. H. Loew, Lakewood, U.S.A. Eng. Pat. 25,495, Dec. 7, 1905.

See U.S. Pat. 808,668 of 1906; this J., 1906, 131.—T.F.B.

Acetification; Apparatus for automatic ——. L. Royer, Paris. Eng. Pat. 24,245, Nov. 24, 1905.

The apparatus consists of a high cylinder divided by horizontal partitions into a number of separate compartments of equal volume. Each compartment is filled with beech chips and is provided with a siphon discharging into the next lower compartment. All the compartments are fitted with air-outlet valves leading to a condenser, and with inlet valves for the admission of sterilised air when the siphons act. The liquid is admitted to the apparatus from a tank through a tap regulated to pass in three hours a volume exactly equal to the capacity of the individual compartments. This tap delivers the liquid into a tipping vessel provided with a siphon, so that every three hours a charge of liquid is allowed to pass into the apparatus. The lowest compartment is provided with an overflow through which the acetified liquid flows into barrels, &c. —W. P. S.

United States Patents.

Beer; Method of Pasteurising ——. H. Gronwald, Berlin. U.S. Pat. 810,745, Jan. 23, 1906.

See Eng. Pat. 17,419 of 1905; this J., 1906, 36.—T.F.B.

Vinasse; Treatment of ——. C. Sudre, Paris. U.S. Pat. 810,442, Jan. 23, 1906.

See Fr. Pat. 321,701 of 1902; this J., 1903, 225.—T.F.B.

French Patents.

Beer; Manufacture of —— by Fermentation at relatively high temperatures. J. F. Wittemann. Fr. Pat. 358,228, Oct. 3, 1905.

Fermentation is started at a temperature of about 10° C., and the fermenting wort is not cooled in the usual way during the process of primary fermentation, so that the final temperature may be as high as 20°—25° C. The carbon dioxide and the volatile aromatic principles of the beer, which escape during fermentation at so high a temperature, are collected and compressed in storage vessels, and are subsequently returned to the beer under pressure after clarification. At the high temperature employed, the fermentation of the maltose is practically complete after the stage of primary fermentation, and the beer can be chilled to a temperature of 1° C. for rapid clarification without after-fermentation. The gas employed for saturating the beer may be enriched in aroma by passing it over dry hops.—J. F. B.

Musts, Wines and other Acid Liquids; Process for determining the total acidity of ——. P. P. A. Andrieu. Fr. Pat. 357,957, July 29, 1905. XXIII., page 202.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 132.)

(*A.*)—FOODS.

Wheat Flour; Bleaching of ——. E. Fleurent. Comptes rend., 1906, **142**, 180—182.

In the bleaching of flour only those processes have an industrial value which are based on the utilisation of nitrogen peroxide produced either chemically or by the action of electricity on air. Pure oxygen, when ozonised, has no action on the colour of the flour, and imparts a disagreeable odour to the product. Calculated as nitrogen peroxide, the quantity of bleaching agent required varies according to the nature of the flour, from 15 c.c. to 40 c.c. per kilo. of flour. No difference in chemical composition can be detected between the bleached and the original flour. The action of the nitrogen peroxide is confined to the yellowish oil of the wheat, but this action is not a destruction of the colour by oxidation. The bleaching action coincides with a decrease in the iodine value of the oil, *e.g.*, iodine values before bleaching of 86·44, 81·70 and 86·10 became respectively, after bleaching, 80·79, 65·20 and 56·70. By combination with the nitrogen peroxide the film of oil covering each granule of starch becomes transparent, and enables the whiteness of the starch to show through. Bleaching by ageing alone, on the other hand, involves an oxidation of the oil and the precipitation of white, fixed, fatty acids. The action of ozone results in an increase in the iodine value, the formation of volatile acids and constancy of the total acidity on keeping. The following test for bleached flours is based on the fixation of the nitrogen peroxide by the oil:—50 grms. of flour are extracted with petroleum spirit, the extract is evaporated at a low temperature, and the oil is redissolved in 3 c.c. of amyl alcohol. The solution is treated in a test-tube with 1 c.c. of alcohol containing 10 grms. of caustic potash per litre. With normal flours the yellow coloration of the liquid does not change, but with bleached flours the colour changes to orange-red, proportional in intensity to the quantity of nitrogen fixed. This test will reveal the presence of 5 per cent. of bleached flour in a sample. The decrease of the iodine value of the oil by bleaching is greater the finer the quality of the flour. With the lower grades the action of the gas tends to be confined to the cellulosic residues and such flours do not lend themselves to the bleaching process. Bleaching has no action on the enzymes of the flour, but the oil shows less tendency to become rancid on keeping in proportion to the quantity of nitrogen peroxide fixed; in this sense the keeping properties of the flour are enhanced by bleaching. —J. F. B.

English Patents.

Pepsin; Manufacture of preparations of —— containing Hydrochloric Acid. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,526, June 16, 1905.

See Fr. Pat. 355,560 of 1905; this J., 1905, 1249.—T.F.B.

Coffee Substitute from Grain or Malt; Process of manufacturing a ——. Kathreiner's Malzkaffee Fabr., G.m.b.H., Munich, Germany. Eng. Pat. 17,623, Aug. 31, 1905. Under Int. Conv. Sept. 5, 1904.

The grain or malt is soaked in water or lime-water through which a current of air is blown, and is then placed in a closed vessel containing a solution of "fruit acids" or tannin and subjected to a pressure of about eight atmospheres. The pressure is next reduced to about two atmospheres, and the temperature increased to about 50° C. The mass is then dried at a low temperature under reduced pressure and the treatment repeated until the starch is completely inverted. The product is finally roasted. The solution of "fruit acids" gradually becomes saturated with maltose and may be used for "glazing" the roasted product. The grain may also be treated with chlorine, ozone, or an electric current in the intervals between the above operations, to remove the flavour of the grain oil.—W. P. S.

United States Patents.

Milk Products; Means for making —— and recovering milk fluids. C. M. Taylor, jun., Philadelphia. U.S. Pat. 809,860, Jan. 9, 1906.

See Eng. Pat. 20,292 of 1904; this J., 1905, 101.—T.F.B.

Dairy Products; Suction Apparatus for ——. C. M. Taylor, jun., Philadelphia. U.S. Pat. 809,861, Jan. 9, 1906.

See Eng. Pat. 20,292 of 1904; this J., 1905, 101.—T.F.B.

(*B.*)—SANITATION; WATER PURIFICATION.

Carbon Monoxide in the Air; Determination of —— by means of iodic anhydride. A. Levy and A. Pécoul. XXIII., page 201.

ENGLISH PATENT.

Boiler Water; Apparatus for the chemical examination of —— while the boiler is in operation. W. P. Thompson, London. From A. Schmitz, Aachen, Germany. Eng. Pat. 22,021, Nov. 4, 1905.

THE apparatus consists essentially of two glass cylinders secured to a plate. Water from the boiler is allowed to flow into one of the cylinders and there receives the addition of a few drops of indicator solution. The coloured water is then run into the second cylinder and titrated with an acid solution; the quantity of the latter needed is a measure of the amount of sodium hydroxide required to be added to the feed water for softening purposes. The concentration of the sodium salts in the boiler water may be ascertained by allowing the water to flow into a third cylinder provided with a float.—W. P. S.

FRENCH PATENTS.

Water; Process and Apparatus for purifying and sterilising ——. H. Lavollay. Fr. Pat. 358,105, Sept. 28, 1905.

A REGULATED quantity of a solution of a permanganate, preferably calcium permanganate from a reservoir, is allowed to flow into a pipe through which also the water, to be purified, flows *en route* to a mixing vessel provided with baffle-plates, &c. The pressure in the permanganate vessel is slightly in excess of that of the water in the pipe, and the supply of the permanganate is duly regulated by a tap. After leaving the mixing vessel, the water receives the addition of a mixture of ferrous and ferric hydroxides, and is then allowed to settle, being finally filtered if necessary.
—W. P. S.

Combustible or artificial Coal composed of house refuse and nightsoil ground together with Coal or Charcoal Dust and an agglomerant composed of water, molasses and glucose. J. P. Reneaux and A. Perrier. Fr. Pat. 358,200, Oct. 2, 1905. II., page 170.

(C.)—DISINFECTANTS.

Formaldehyde; Determination of —— in Formaldehyde Pastilles [Trioxymethylene]. E. Rüst. XXIV., page 203.

ENGLISH PATENT.

Aluminium Acetate; Manufacturing insoluble —— [Antiseptic]. R. Reiss, Charlottenburg, Germany. Eng. Pat. 8445, April 20, 1905.

SEE Ger. Pat. 160,348 of 1904; this J., 1905, 1027.—T. F. B.

UNITED STATES PATENT.

Antiseptic Compounds; Making solidified ——. D. Gencse, Assignor to Genese Cereal Manuf. Co., of West Virginia, both of Baltimore, Md. U.S. Pat. 809,795, Jan. 9, 1906.

A SOLIDIFIED antiseptic compound, containing stearoptenes and alcohol, is prepared by heating a mixture of 94 parts of glycerin and 6 parts of sodium stearate to a temperature of about 220° F. for 3—5 hours, then lowering the temperature to about 125° C., and mixing in the volatile ingredients at that temperature.—J. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 132.)

ENGLISH PATENTS.

Paper Pulp; Manufacture of —— [for photographic papers]. M. E. le Normant des Varannes and A. R. de Vains, Cebazat, France. Eng. Pat. 505, Jan. 10, 1905.

RAG pulp, after preparation and refining in engines with steel knives, is passed over sand traps to eliminate the heavier particles of metal, and is then formed into half-stuff on a machine. The pressed half-stuff is made up into rolls which are introduced whilst still moist, into closed vessels in which they are subjected to the action of chlorine gas. This gas converts all the metallic particles present in the pulp into soluble chlorides, which are then eliminated by diluting and washing the pulp in a stone engine provided with several washing drums. The washed pulp is then sized and completely refined in a stone refining engine before making into paper.—J. F. B.

Paper; Manufacture of ——. E. F. Morris, Stockport. Eng. Pat. 8325, April 19, 1905.

A COMPOSITION, made up of 2 parts of boiled linseed oil, 0·5 part of Turkey red oil at 50 per cent. strength, 0·5 part of ammonia, sp. gr. 0·880, and 100 parts of water, is added to paper pulp containing 50 parts of dry paper in 4000 parts of water. The paper made from the treated pulp is said to be more resistant in the wet state, and to withstand friction better than ordinary paper.—J. F. B.

Pulp; Process of compacting liquid-borne fibrous ——. J. H. Rivers, St. Louis, U.S.A. Eng. Pat. 16,466, Aug. 14, 1905.

FIBROUS pulp suspended in water is admitted in known quantities into a closed chamber, having a removable false bottom in which a large number of perforated or reticulated moulds are fixed. These moulds are placed as near together as possible, and are all of the same shape in any one plate. A liquid or air pressure is then allowed to act upon the liquid pulp from above, causing the clear water to flow through the perforated moulds and to deposit the suspended material on the walls of the moulds in such a manner that each fibre is compacted against the other fibres under a constant pressure, proportional to the flow of liquid. The mould-plate is then removed and replaced by an empty one.—J. F. B.

Celluloid, Horn, Ebonite or similar substances; Process of producing substitutes for ——. W. H. Story, London. Eng. Pat. 8875, April 27, 1905.

SEE Fr. Pat. 353,995 of 1905; this J., 1905, 1081.—T. F. B.

UNITED STATES PATENTS.

Adhesive [from Waste Sulphite Lyes] and process of making same. F. H. Patch, Richmond, Va. U.S. Pat. 809,739, Jan. 9, 1906.

AN adhesive is prepared from the evaporated liquors resulting from the boiling of wood pulp by the sulphite process. A mixture of oil and rosin is prepared of approximately the same specific gravity as the concentrated sulphite liquor and the mixture is then incorporated with the liquor.—J. F. B.

Cellulose Acetate. A. Eichengrün and T. Becker, Elberfeld, Germany, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 809,935, Jan. 16, 1906.

SEE Addition of Jan. 30, 1903, to Fr. Pat. 317,007 of 1901; this J., 1903, 1015.—T. F. B.

FRENCH PATENT.

Cellulose Derivatives and process of making same. G. W. Miles. Fr. Pat. 358,079, Sept. 27, 1905.

ESTERS of cellulose of varying degrees of hydration may be prepared by hydrating to the desired degree the ester of anhydrous cellulose with a monobasic fatty acid, and then precipitating with water; 100 grms. of dry cellulose are allowed to stand for some hours with 400 c.c. of glacial acetic acid and 5 c.c. of sulphuric acid; 280 c.c. of acetic anhydride are then added, and, when the solution has become clear, 40 to 50 c.c. of 10 per cent. sulphuric acid to effect partial hydration of the ester; after standing about 12 hours water is added, and the product is washed. It is soluble in acetone, films being obtained by evaporating the solutions, and becomes plastic on treatment with chloroform. The products obtained by further hydration of the cellulose ester are decreasingly soluble in acetone (see U.S. Pat. 733,729 of 1903; this J., 1903, 961).
—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 134.)

Cocaine Formate. F. Vigier. J. Pharm. Chim., 1906, **23**, 97—98.

Cocaine formate, $C_{17}H_{21}NO_4.CH_2O_2$ is obtained in fine, silky, branching needles, m.pt. 42° C., by saturating cocaine with formic acid. The salt is soluble in water 1 : 42 at 20° C., but is dissociated at 90° C. in aqueous solution, the base separating in oily drops. In 95 per cent. alcohol it dissolves to the extent of 1·3 : 10 at 20° C.; it is sparingly soluble in ether and in chloroform, insoluble in oils. The refractive index of the aqueous solution is 1·334, the specific rotatory power, $[\alpha]_D$ = −56° 40′. —J. O. B

Pinus maritima Mill.; Essential oil from the buds of — —. E. Bellom. Estr. aus Annuario della Soc. Chim. di Milano, 1905, **11**; Chem. Centr., 1906, **1**, 360—361.

By the distillation of buds of *Pinus Maritima Mill.*, collected in the South of France, a bright green oil of fresh aromatic taste, and with the characteristic odour of "pine-needle" oil, was obtained; the yield was 0·681 per cent. from the fresh buds, and 0·517 per cent. from dried buds. The constants of the oil are shown in the following table:—

	Oil from fresh buds.	Oil from dried buds.
Sp. gr. at 15° C.	0·8810	0·8963
$[\alpha]_D^{15°}$	−26·518′	−22·355′
Acid value	0	5·43
Ester value	7·90	8·27
Esters	2·77%	2·92%
Uncombined "alcohol"	—	11·00%
Combined "alcohol"	2·13%	2·28%

The oil is soluble in 10 parts of 90 per cent. alcohol, but is insoluble in 80 per cent. alcohol. It is free from aldehydes, but contains 1·396 per cent. of capryhc acid, which forms the main portion of the free acid present; the esters in the oil are probably those of the lower fatty acids. The chief constituent of the oil is *l*-pinene, and limonene also is probably present. The nature of the alcohol present both in the free and in the combined state was not ascertained. —A. S.

Acetone; Action of — *on Alkali Sulphites.* V. Rothmund. Monatsh Chem., 1905, **26**, 1545—1558.

The author confirms, from the results of physico-chemical experiments, the statements of Lumière and Seyewetz (this J., 1896, 920; 1903, 510, 1014) and Kerp (Arbb. Kaiserl. Gesundh., 1901, **21**, 40) that acetone combines with alkali sulphites in aqueous solution. An interesting fact in connection with this action of acetone is that, with neutral solutions of alkali sulphite, alkalinity is produced, whereas on adding acetone to a solution of free sulphurous acid, an increase of acidity is the result. The explanation of this apparently conflicting behaviour is that acetone-sulphurous acid is practically monobasic, but is an appreciably stronger acid than sulphurous acid. The reaction with alkali sulphites may be expressed by the equation: $(CH_3)_2CO + SO_3 + H_2O = (C_3H_6O)HSO_3 + OH$. —A. S

Camphor; Synthetic — —. U.S. Customs Decision. Chem. and Drug., Feb. 3, 1906.

A decision has been given by the Board of United States General Appraisers sustaining the claim of a firm of importers on the classification of artificial camphor. The importers protested against the assessment of duty by the collector at the rate of six cents per pound on merchandise classified as refined camphor under paragraph 12 of the Tariff Act of 1897. They claimed that the merchandise was crude camphor, and accordingly entitled to free entry under paragraph 515, and the Board upheld the claim, stating that the article in question is not produced from the gum of the camphor-tree, but is the synthetic product, the result of a partially secret process covered by letters patent issued by the United States. The decision says: "The official examiner in the Appraisers' office at the port of New York, experienced in appraising camphor, was unable to say whether the official sample was gum camphor or a synthetic product. We are of the opinion, therefore, that the merchandise before us must be considered to be camphor within the meaning of the term used in the Tariff Act. To hold otherwise would be in effect, in innumerable cases, doubtless an abridgment of the opportunity for carrying out new discoveries in manufacturing processes. The claim of the importers for free entry is therefore sustained." [T.R.]

Rare Earth Metals; Sulphates of the — —. C. Matignon. Comptes rend., 1906, **142**, 276—278.

The author has determined the heats of formation of the sulphates of lanthanum, praseodymium and neodymium and samarium. The following table shows the results, with corresponding figures for other metals for comparison. Q_1, is the molecular heat evolved in the formation of solid sulphate and solid water from solid sulphuric acid and solid oxide, Q_2, that evolved when solid sulphuric anhydride is substituted for solid sulphuric acid.

	Q_1.	Q_2.
	cal	cal
Lanthanum	46·1	65·1
Praseodymium	44·9	60·9
Neodymium	44·7	60·7
Samarium	37·9	56·9
Calcium	63·2	82·2
Barium	83·3	102·3
Lead	42·2	61·1
Silver	36·1	55·1

—J. T. D.

Rare Earths; Contributions to the chemistry of the —, *I.* M. Esposito. Chem. Soc. Proc., 1906, **22**. 20—22.

The methods advocated for the separation of cerium, lanthanum, and "old didymium" have been examined comparatively, with the following results:—

Preparation of the Material.—Rather more than half a kilo. of finely-powdered Swedish cerite was mixed into a paste with water, and 375 grms. of concentrated sulphuric acid were gradually added. Considerable evolution of heat took place and the mass swelled up somewhat. The excess of acid was removed by heat, and the cold white or grey mass was thrown in small portions into five litres of ice-cold water. The silica was removed by filtration and a current of hydrogen sulphide was passed through the solution to precipitate any arsenic, molybdenum, bismuth, copper or lead, which might be present. To the filtrate, oxalic acid was added, which precipitated all the ceria, lanthana, and "didymia" along with lime and traces of the metals of the yttrium group which are present in cerite (Brauner, Chem. Soc. Trans., 1883, **43**, 278). The oxalates were thoroughly washed and dried.

Methods of separation.—For ordinary purposes, the process devised by H. Debray (Compt. rend., 1883, **96**, 928), slightly modified as follows, appears to give rapid and satisfactory results. The dried oxalates were boiled with strong nitric acid until completely decomposed, the solution was evaporated to dryness, the last part of the process being conducted on a sand-bath, and the anhydrous nitrates, mixed with twice their weight of sodium nitrate, were fused in a porcelain dish until no more nitrous fumes were evolved. The cold mass was detached from the dish, coarsely powdered, and digested in warm water acidified with nitric acid. The insoluble, pale yellow ceric oxide was collected and washed with ammonium nitrate solution, as recommended by Schützenberger (Compt. rend., 1895, **120**, 663). If pure water is

used, the finely-divided ceric oxide will pass through the filter. The filtrate was again evaporated to dryness and fused so as to eliminate the remainder of the cerium. The lanthanum and "didymium" were subsequently separated by fractional crystallisation of the oxalates from strong nitric acid solution.

Very pure ceria can be obtained by the following method, depending on the use of chromic acid:—The solution of nitrates is precipitated with caustic soda, and the hydroxides are washed several times by decantation with boiling water. A warm aqueous solution of chromic acid is then added and the whole left for several days. A heavy, yellowish-white precipitate remains, which, on ignition at a gentle heat, yields cerium sesquioxide as an almost white powder without the slightest tinge of red or yellow. When thus obtained, the oxide dissolves readily in boiling hydrochloric acid, and the solution, even when viewed through a considerable thickness, does not show a trace of absorption bands.

Strophanthin; Determination of —— in Strophanthus Seeds and in Strophanthus Tincture. Aconite Root; Alkaloidal Valuation of ——. Caesar and Loretz' Report. XXIII., page 201.

Coniine, Nicotine and Sparteine; Differentiation of ——. C. Reichard. XXIII., page 200.

Iodothymol [Aristol]; Determination of Iodine in ——. H. Cormimbeuf. XXIII., page 202.

Chloroform in Air, Blood, and Aqueous Liquids; Determination of Small Quantities of ——. M. Nicloux. XXIII., page 201.

Acetaldehyde; Determination of ——. Seyewetz and Bardin. XXIII., page 202.

Formaldehyde; Determination of —— in Formaldehyde Pastilles [Trioxymethylene]. E. Rüst. XXIII., page 202.

UNITED STATES PATENTS.

Dialkylbarbituric Acids; Process of making ——. M. Engelmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 809,362, Jan. 9, 1906.

SEE Ger. Pat. 162,219 of 1903; this J., 1905, 1189.—T.F.B.

Bismuth Disalicylate and process of making same. B. B. Seifert, Assignor to Chem. Fabr. von Heyden Akt.-Ges., Radebeul, Germany. U.S. Pat. 809,583, Jan. 9, 1906.

SEE Eng. Pat. 19,375 of 1905; this J., 1905, 1323.—T.F.B.

FRENCH PATENTS.

Aldehydes and Ketones; Method of preparing saturated ——. G. Darzens. Fr. Pat. 350,390, Dec. 12, 1904.

UNSATURATED ketones or aldehydes may be converted into the saturated compounds, without reduction of the ketonic or aldehydic group, by catalytic agents, provided these be prepared in such a manner as not to be too energetic in their actions. For example, nickel oxide is mixed with asbestos, and heated to 250°—300° C. in a tube through which a current of hydrogen is passed, until reduction is complete; the temperature is then allowed to fall to 180° or 200° C., and the vapours of the aldehyde or ketone to be hydrogenated are passed over the metal. The temperature at which the metallic oxide is best reduced, and that at which the hydrogenation takes place most effectively are determined in each special case by trial.—T. F. B.

Terpene Alcohols; Process of obtaining ——. A. Haller and C. Martine. Fr. Pat. 350,393, Dec. 12, 1904.

PULEGONE may be reduced by passing it over reduced nickel at about 150° C. (Sabatier and Senderens' method); the product contains no unreduced pulegone, and no pulegol nor menthone; it resembles peppermint oil very closely both in odour and in chemical properties, and appears to consist of a mixture of isomeric menthols. It boils at 107°—110° C. (18 mm.); the fraction boiling at 109°—110° C. at the same pressure, when cooled to 0°C., forms a crystalline mass, from which two crystalline substances were obtained, of m. pts. 43° and 77° C. respectively.—T. F. B.

Dialkylbarbituric Acids; Process of making —— from the products of condensation of Guanylurea, Biuret, Alloxanic Ether, and similar derivatives of Urea and Guanidine, with Dialkylcyanoacetic Esters, Dialkylmalonic Esters, Dialkylmalonyl Halides or Dialkylmalonitriles. E. Merck. Fr. Pat. 357,968, Sept. 6, 1905. Under Int. Conv., Oct. 19, 1904.

COMPOUNDS which are easily converted into urea or guanidine are capable of condensing with dialkylcyanoacetic esters, or with dialkylmalonic esters, halides or nitriles, forming more or less complex imino-compounds, which are easily converted by saponification into the corresponding dialkylbarbituric acids.—T. F. B.

Dialkylmalonic Acid; Process for making Diamides of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 358,085, Sept. 27, 1905.

DIALKYLMALONIC acid diamides are produced by adding the corresponding acid chlorides to about five times their weight of a concentrated aqueous solution of ammonia, the mixture being continuously agitated until the reaction is complete, when the amide is removed by filtration; a further small quantity of the product may be obtained by evaporating the ammoniacal solution, when, moreover, the whole of the ammonia may be recovered.—T. F. B.

Acetylene and Chlorine; Production of compounds of ——. Alby Carbidfabr. Aktieholag. Fr. Pat. 358,146, Sept. 29, 1905. Under Int. Conv., April 28, 1905.

A MIXTURE of chlorine and acetylene gases, diluted with carbon dioxide, is exposed to the action of rays which are capable of inducing reaction, such as radium rays, Röntgen rays, ultra-violet rays and direct sunlight. The presence of the carbon dioxide moderates the violence of the reaction, and the products are ethyl tetrachloride or ethylene dichloride, according to the proportions of the gases in the mixture.—J. F. B.

Oxyhæmoglobin; Preparation of a solution of ——. W. J. J. Hendrikszoon. Fr. Pat. 358,161, Sept. 29, 1905.

FRESH blood is centrifugalised and the serum is decanted off from the clotted globules. The mass of the latter is then mixed with a solution of common salt and again separated by centrifugal action. This operation is preferably repeated three times, in order to remove the whole of the serum. The clotted blood is then treated in an agitating machine with finely chopped asbestos and water. The globules are thus broken up and the oxyhæmoglobin enters into solution. The liquid is filtered, the residues of tissue being retained on the filter by the asbestos, and a clear solution of oxyhæmoglobin is obtained.—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 135.)

Pyridine as a ripening agent for Silver Bromide emulsions. Lüppo-Cramer. Phot Korr., 1905, **42**, 538. Chem.-Zeit., 1906, **30**, Rep., 32.

THE method of preparing silver bromide emulsions described by Witt (Ger. Pat. 151,752; this J., 1904, 836) has been examined by the author, who finds that pyridine offers no advantages over ammonia as a "ripening" agent. The solvent action of pyridine upon silver bromide is so little more than that of ammonia solution, that even after several hours "ripening" the development of the "grain" is hardly more than when pyridine is not present. On the other hand, the degree of sensitiveness is not increased, and can be attained just as readily and certainly by the methods hitherto employed.—C. A. M.

Colour Photography; "Bleaching-out" process of ——. Kümmel. Phot. Runds., 1905, **19**, 328. Chem.-Zeit., 1906, **30**, Rep., 32.

The author having found that a red "fog" invariably occurs with the mixture of dyestuffs used by Neuhauss, has examined the different Erythrosins: tetrachlortetrabromofluorescein, tetraiodofluorescein, and diiodofluorescein, and has found that the first is but little sensitive, whilst the last is extraordinarily sensitive, much more so than the tetraiodofluorescein. The sensitiveness of the red dyestuffs can be increased by the use of the ammonium salts instead of the sodium salts. Very pure dyestuffs are less sensitive than those containing traces of impurities, notably iodine. The red "fog" can be prevented by replacing a fourth part of the tetraiodofluorescein by diiodofluorescein. Iodine appears to have a catalytic action in increasing the sensitiveness of the Erythrosins. In many cases the sensitiveness to light can be considerably increased by the addition of colloidal gold solution. The coloured gelatin can be easily transferred to paper as follows:—It is poured on to a piece of plate glass which has previously been cleaned and polished with a solution of wax and colophony in benzol. When dry, the gelatin is moistened on the surface with a brush, and a piece of paper similarly moistened laid upon it, pressed down, and left to dry. The coloured gelatin film adheres to the paper, and can be removed with it from the plate.

—C. A. M.

Coloured Photographs by Wood's method. R. Neuhauss. Phot. Runds., 1905, **19**, 332. Chem.-Zeit., 1906, **30**, Rep., 32.

In Wood's method three negatives are taken through a red, green and blue light filter respectively, and diapositives made from them and used for making copies on chrome gelatin plates, a diffraction grating being placed between the diapositive and the plate. For the diapositive taken through the red colour filter a screen ruled with about 1000 lines to the square centimetre, is used; for the green diapositive one with 1250 lines; and for the blue diapositive, one with 1500 lines. In the case of the red diapositive, for instance, only those parts which were red in the original are copied, since only those parts are transparent. The colours only appear when viewed through an apparatus specially constructed for the purpose. The ruled screen used for the red copy breaks up the white light into green colours and projects a spectrum at the point where the eye of the observer is applied. It was noticed that, in certain photographs taken by Joly's method, the lines of the ruled screen cut the lines of the Joly ruled plates at right angles, and excellent colour effects were produced.—C. A. M.

Cyanine Dyestuffs; Constitution of ——. W. König. IV. page 173.

Acetone; Action of —— on alkali sulphites. V. Rothmund. XX., page 196.

English Patents.

Paper Pulp; Manufacture of —— [*for photographic papers*]. M. E. le Normant des Varannes and A. R. de Vains. Eng. Pat. 505, Jan. 10, 1905. XIX., page 195

Photographic Paper; Self-toning ——. C. S. Poulsen, Valby, Denmark. Eng. Pat. 19,850, Oct. 2, 1905

A durable self-toning photographic paper is produced by adding a dyestuff such as Fuchsin or Methyl Violet to an emulsion in which part of the silver is present as cyanide or thiocyanate. The dyestuff is said to prevent the reaction between the silver and gold salts previous to toning. For instance, for every kilo. of emulsion may be added 5—15 mgrms. of the dyestuff, 3—6 grms. of an alkali cyanide or thiocyanate, and 2—3 grms. of gold chloride. The tones produced are stated to depend only on the concentration of the salt solution subsequently used, not on duration of immersion; tones from red-brown to blue-black are said to be obtainable on such paper.—T. F. B.

Photographic Images; Manufacture of coloured ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 7557, April 10, 1905.

The specification of Fr. Pat. 337,054 of 1903 (this J., 1904, 455) described the production of coloured images by dyeing a bichromated gelatin "image," and transferring the dyestuff to paper coated with gelatin ("pinatype" process). It is found that many dyestuffs do not give good results by this method, the gelatin paper being uniformly coloured (*e.g.*, with a Safranine or with Tartrazine), or a reversed image may be produced. The present patent claims the employment of the following dyestuffs for this process, all of which are stated to give excellent results:—The "Mikado dyestuffs" from *p*-nitrotoluenesulphonic acid; the soluble azo dyestuffs derived from dehydrothiotoluidine, Primuline, or their substitution products; natural Carmine; the sulphonic acids of Induline and Nigrosine; Naphthazine Blue; certain of the diamine dyestuffs (*e.g.*, Diamine Pure Blue, Dianil Blue, Dianil Yellow, Dianil Garnet); and "arylido-anthraquinonesulphonic acids" or their derivatives.—T. F. B.

United States Patent.

Photographic Prints; Process for producing multi-coloured ——. S. Vathis, Paris. U.S. Pat. 809,651, Jan. 9, 1906.

See Eng. Pat 579 of 1902; this J., 1902, 723.—T.F.B.

French Patent.

Photographic Paper; Self-toning ——. C. S. Poulsen. Fr. Pat. 358,203, Oct. 2, 1905.

See Eng. Pat. 19,850 of 1905; preceding these.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 135.)

Nitrocellulose; Decomposition of —— at temperatures below its ignition point. A. Saposchnikow and W. Jagellowitsch. J. russ. phys.-chem. Ges., 1905, **37**, 822—828. Chem. Centr., 1906, **1**, 339.

The authors examined the rate of decomposition of a specimen of ordinary pyroxylin of the approximate composition, $C_{24}H_{29}(NO_2)_{11}O_9$, at seven different temperatures between 120° and 150° C. The method adopted, consisted in measuring the volume of gas evolved from a weighed quantity of the pyroxylin in a definite interval of time at a given temperature (compare Mittasch, this J., 1903, 1208). Curves constructed by using the volume of gas (v) and the time (t) as ordinates had distinct bends, indicating the autocatalytic character of the reactions. The relation between the temperature and the maximum reaction-velocities $\left(\frac{dv}{dt}\right)$ corresponding to the bends in the curves, may be represented by two lines, corresponding to the equations:

Between 120° and 130° C., $\left(\frac{dv}{dt}\right)$ max. $= -2{\cdot}22 + 0{\cdot}192t$,

Between 135° and 150° C., $\left(\frac{dv}{dt}\right)$ max. $= -64{\cdot}22 + 0{\cdot}48t$;

these lines intersect at the point corresponding to 135° C. The gaseous decomposition products consisted of carbon dioxide, carbon monoxide, nitric oxide and nitrogen; the relative proportions of the different gases were not affected to any considerable extent by the temperature. At temperatures below 135° C., the solid residue contained no hydrogen, whilst at temperatures above 135° C. it contained hardly any nitrogen (see also this J., 1904, 1112).—A. S.

English Patents.

Explosion or Percussion Caps; Process for the manufacture of safety ——. F. Gehre, Munchen, Germany. Eng. Pat. 19,402, Sept. 26, 1905.

Copper caps are used, filled with solid di- or trinitromesitylene, di- or trinitropseudocumene, or di- or trini-

troxylene, the whole covered with a thin coating, amounting to about 0·3 grm., of mercury fulminate. By this means it is claimed that a quicker and more violent explosion is ensured.—B. J. S.

Explosives; Impts. in ——. G. Roschke, Hamburg, Germany. Eng. Pat. 25,780, Dec. 11, 1905.

The invention comprises the use of copper oxalate as a cooling agent in fire-damp explosives not only with dinitrobenzene and turmeric (as in Eng. Pat. 21,189 of 1902; this J., 1902, 1471), but also with such carbon-containing substances as woodmeal or dust, naphthalene, or colophony, with or without the addition of a nitro-compound. —B. J. S.

UNITED STATES PATENTS.

Nitroglycerin; Process of making ——. C. L. Reese, Assignor to the Eastern Dynamite Co., Wilmington, Dela. U.S. Pat. 804,817, Nov. 14, 1905.

The object of the invention is to accelerate the separation of nitroglycerin from the emulsion formed on nitration of glycerin. The author has discovered that the emulsifying effect is caused by the presence of small quantities of colloidal silica. It is therefore proposed to add a small percentage (0·001 per cent.) of sodium fluoride (or other compound of fluorine) to the glycerin before nitration. The silicon is thereby converted into silicon tetrafluoride, and the separation of the nitroglycerin is effected more readily.—B. J. S.

Match. A. Swoboda, Vienna, Assignor to W. Bokmayer, Modling, Austria. U.S. Pat. 810,363, Jan. 16, 1906.

See Fr. Pat. 355,846 of 1905; this J., 1905, 1256.—T.F.B.

FRENCH PATENT.

Explosives; Impts. in ——. C. Girard. Fr. Pat. 350,371, Dec. 5, 1904.

Claim is made for explosives composed of nitrates fused together, either alone or mixed with other explosive or combustible substances. For example, a mixture prepared by fusing together 80 parts of ammonium nitrate and 88 parts of guanidine nitrate is stated to form a powerful explosive.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

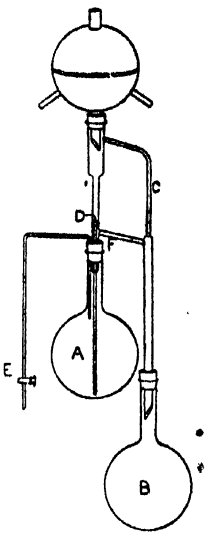
(*Continued from page* 140.)

APPARATUS, ETC.

Extraction of Liquids with ether; Improved apparatus for the continuous ——. R. S. Bowman. Chem. Soc. Proc., 1906, **22**, 24—26.

The apparatus comprises a simple system of tubes, a condenser, and two ordinary flasks, preferably round bottomed. The liquid to be extracted is placed in the flask, A, in sufficient quantity to very nearly fill the flask to the bottom of the neck. This flask may frequently be replaced with advantage by a wide test-tube. From one-eighth to one-fifth of this volume of ether, with which the substance is to be extracted, is placed in the flask B, which is heated on a water-bath or electric heater. The ether passing as vapour up tube, C, is condensed in the condenser and falls back and collects in the inner tube, D. A column presently accumulates in D, long enough to force its way through the liquid in A, and there is then a constant succession of small drops of ether ascending in A, collecting on the surface of the liquid, and finally overflowing at F, and returning to the flask, B.

On completion of the process of extraction, the neck of the flask will be filled with ether. There will also be a column of ether in tube D, reaching a few centimetres above tube F, and hence the neck of the flask may be emptied by opening the stopcock, E, and allowing the ether to run off into some vessel. If necessary, the flask



may now be replaced by a similar one containing a fresh portion of the liquid to be extracted and the process resumed.

ENGLISH PATENT.

Gas; Burner for testing ——. C. C. Carpenter, London. Eng. Pat. 24,828, Nov. 30, 1905 (see this J., 1905, 1085).

For the purpose of testing photometrically coal gas of different composition or quality, a "tri-current" argand burner is so constructed as to allow a simultaneous adjustment of the three currents of air supplied to the burner. The gas is supplied from the socket by means of three narrow tubes to an annular chamber from which it issues through a ring of holes so as to form a hollow flame. The air admitted to the inner and outer surfaces of the flame enters through passages in an adjustable disc, provided with a threaded socket, so that the disc can be raised and lowered, thus diminishing or increasing the air supply as required. The additional supply of air to the chimney, necessary for "tri-current" burners, is admitted partly through a small side channel permanently open, and partly through a vertical ring of ports, or orifices, which may be covered by a flange attached to the adjustable disc. In the case of poor gases, the small channel admits sufficient air, whilst more air is admitted for rich gases by lowering the disc, thus uncovering these ports and simultaneously increasing the two other air supplies.—R. L.

INORGANIC—QUANTITATIVE.

Halogens; Use of hydrogen peroxide for the quantitative separation of the ——. J. Jannasch and F. Zimmermann. Ber., 1906, **39**, 196—197.

The authors find that iodine can be separated quantitatively from bromine and chlorine by means of hydrogen peroxide in acetic acid solution. The mixture containing the three halogens is dissolved in 120—150 c.c. of water, 15 c.c. of pure glacial acetic acid and 3 c.c. of 30 per cent. hydrogen peroxide are added, and the liberated iodine is distilled over in a current of steam. The iodine is collected in three connected receivers of which the first contains 80—100 c.c. of water, 10 grms. of hydrazine sulphate, and 10 c.c. of strong ammonia, whilst the other two each contain 25 c.c. of water, 2 c.c. of ammonia, and 0·5 grm. of hydrazine sulphate. When the distillation is complete, the contents of the receivers are mixed, acidified cold with 30—40 c.c. of concentrated sulphuric acid, and the iodine precipitated as silver iodide.—A. S.

Silver; Determination of —— in large quantities of silver coins. C. Hoitsema. Z. anal. Chem., 1906, **45**, 1—14.

The coins to be assayed, are sampled down to 1000, from each of which, cylinders or sectors are stamped in a way which varies somewhat for each (Dutch) coin. If necessary, the "pitons" so obtained are further sampled down by allowing them to drop through a funnel having a narrow opening, a part only of the heap formed, being taken. The actual determination of the silver is made by Stas's modification of the Gay-Lussac method, except that 20 grms. of the sample are used instead of 1 grm. as heretofore. For the control test on pure silver, 5 grms. of silver are taken. Pipettes holding 2000 c.c. and 500 c.c. are used instead of the usual 100 c.c. Stas pipette. The silver is weighed out to 0·02 mgrm., and by using special precautions as to the cleaning and emptying of the pipettes, keeping the temperature of the solutions constant, &c., the silver value is obtained with an error of only 0·00001 of the total.—A. G. L.

ORGANIC—QUALITATIVE.

Coniine, Nicotine, and Sparteïne; Differentiation of ——. C. Reichard. Pharm. Centralh., 1905, **46**, 309—313; 385—388.

With copper oxychloride.—A small quantity of the oxychloride, reduced to powder, is moistened with a drop of the alkaloid, then with hydrochloric acid. Nicotine gives a persistent violet-blue reaction; coniine a bright green which becomes paler; sparteïne gives no reaction.

With α-nitroso-β-naphthol.—A few drops of a solution of the reagent are evaporated in a small porcelain capsule. A trace of the bases is added to the residue; coniine gives a deep green colour, nicotine a yellowish-brown tint.

With ammonium sulphomolybdate.—Nicotine gives a greenish-yellow colour when spotted out with the reagent; coniine and sparteïne give no reaction. If ammonium persulphate be added to the mixture, nicotine develops a violet-purple colour, coniine and sparteïne a yellow tint.

With potassium sulphovinate and sulphuric acid.—Nicotine gives first a yellow, then a red colour; sparteïne, and coniine, no reacion.

With sodium picrate.—Nicotine gives a reddish-yellow colour, sparteïne and coniine no change. On adding ammonium persulphate and potassium thiocyanate to the mixture, sparteïne gives an orange-red tint; nicotine, no reaction; coniine, a very feeble orange shade.

With ferric chloride and potassium thiocyanate, spotted out on porcelain and dried, sparteïne gives a blue-violet or violet-red shade; nicotine and coniine give a green colour.

With ferric chloride and potassium ferrocyanide, mixed in solution, and the blue liquid spotted out and dried, coniine gives a green-brown reaction; nicotine does not affect the original blue tint for some time, then changes it to green; sparteïne gives a violet colour. On adding potassium thiocyanate to the mixture, the colour changes to pale blue with sparteïne, but no change occurs with nicotine or with coniine.—J. O. B.

Sugars; Colour reactions of the principal ——. N. Schoorl and C. J. van Kalmthout. Ber., 1906, **39**, 280—285.

The authors have subjected the colour reactions prescribed by Pinoff (this J., 1905, 1192), for the detection of the various sugars in mixtures, to a critical examination. They conclude that none of these reactions are capable of distinguishing between levulose and cane sugar, owing to the extreme ease with which the latter is inverted. Neither can levulose be detected in presence of dextrose unless it be present in considerable quantities, *e.g.*, more than 10 per cent. The resorcinol test (reaction 3, *loc. cit.*) is a modification of Seliwanoff's test, which is by no means an improvement. The best modification of this test for the detection of levulose or cane sugar in presence of dextrose and other aldose sugars consists in reducing the concentration of the acid to N/1 and working in aqueous media, dextrose will then show only a slight yellow coloration after heating for 15 minutes. The bichromate test (reaction 4) shows both levulose and cane sugar, and is only available when the proportions of these sugars a above 10 per cent. The molybdate test (reaction 5) is modification of Cotton's test for the presence of cane sug in milk. The modification is no improvement, since onl milk sugar fails to develop the blue coloration under th conditions specified. The only way to detect levulose is t concentrate it in the mixture by extraction with alcoh and ether, or, by precipitation as calcium levulosate. Th authors speak highly of Berg's test (this J., 1904, 1240 as a means for identifying a pure sugar as an aldose or ketose, but it cannot be used, as claimed, for testing the freedom of aldose sugars from ketoses.—J. F. B.

ORGANIC—QUANTITATIVE.

Caoutchouc; Torrey's method of determining pure ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 418.

The author has examined Torrey's method of estimating rubber (this J., 1905, 1193). He finds that the method is quite useless practically, since in attempting to match the alkaline solution of the nitrated product with that of the standard solution, the colour is not perceptibly altered by addition of quantities of water ranging, with different specimens of rubber, from 50 to 100 c.c.—E. W. L.

Sugar; Influence of the lead precipitate on the polarisation of ——. W. D. Horne. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 635—637.

In reply to the criticisms of H. and L. Pellet on the author's method of defecating raw sugars with dry basic lead acetate (this J., 1904, 340), it is pointed out that the quantity of sugar retained by the precipitate after separation of the portion freely soluble in cold water, is less than the errors of observation in the polariscope, and one-tenth only of the augmentation due to the volume of the precipitate. The increase observed in the specific gravity of the lead precipitate after removing the lead with sulphuretted hydrogen, concentrating on the water-bath and re-precipitating, is to be attributed to a considerable modification of the organic matter of the original precipitate by the treatment with hydrogen sulphide, and by evaporating at the high temperature for the sake of concentration. Whether the process is novel or not, it is only since the production, within the last two years, of a dry basic lead acetate of fixed composition that the method became practicable. The amount of moisture in samples examined, varied from 0·14 to 2 per cent., and where only 0·35 grm. of the lead salt is used can have no appreciable effect on the polarisation. Excess is easily avoided, since each particle of the powder added, produces a precipitation, and no more is added as soon as the lead salt begins to give only a slight precipitate. There is no salt left in solution as the filtrate is free from lead.—L. J. de W.

Sugar; Influence of the lead precipitate on the precipitation of ——. H. and L. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1905, **23**, 638—639. (See preceding abstract.)

The quantity of sugar retained by a lead precipitate in a sugar solution varies with the quantity of the precipitate, and the concentration of the sugar solution. This quantity does not correspond to that which may be determined in the washed precipitate, since on washing, the precipitate gives up a certain quantity of sugar, as has been observed in the case of animal charcoal. It does not appear evident why a precipitate decomposed by sulphuretted hydrogen should yield a very different substance from that which was precipitated, for this is the general method of separating many substances without alteration. In the first precipitation, however, taking place in a solution rich in sugar, more sugar is retained than in the second case, when the solution is poor in sugar. This is the method adopted of freeing a precipitate from impurities carried down with it. It is not astonishing, therefore, that a different specific gravity was found in the two precipitates.—L. J. de W.

Sugars [Cupric-Reducing]; Determination of —— by means of Zeiss' Immersion Refractometer. B. Wagner and A. Rinck. Chem.-Zeit. 1906, **30**, 38-39.

The authors propose to determine the quantity of cuprous oxide, precipitated from Fehling's solution by reducing

sugars, by means of the refractometer instead of by weighing or titration; 30 c.c. of alkaline tartrate solution, containing 346 grms. of Rochelle salt and 250 grms. of caustic potash per litre, 30 c.c. of Fehling's copper sulphate solution, and 60 c.c. of water, are boiled in a beaker, and 25 c.c. of the sugar solution, of a concentration not exceeding 1·04 per cent., are added. The mixture is boiled; the precipitate is collected in a filter-tube containing asbestos, and is dissolved after washing, in not more than 5 c.c. of 25—30 per cent. nitric acid. The filter is washed three or four times and the solution is evaporated to dryness on the water-bath. It is important to remove the product from the water-bath as soon as the crystalline cupric nitrate is formed, otherwise some basic salt may be produced. The cupric nitrate is dissolved in exactly 5 c.c. of nitric acid, the refractometer value of which is known, the solution is diluted to 10 c.c. at 17·5° C. with water, and is examined in the refractometer. The results are not exactly proportional to the values of the readings, which are converted into terms of dextrose by the following table:—

Dextrose.	Scale divisions	Difference for 0·04 per cent. dextrose.
Per cent.		
0·04	20·8	
		2·4
0·08	23·2	
		2·2
0·25	32·9	
		2·2
0·29	35·1	
		2·0
0·80	62·4	
		2·0
0·84	64·4	
		1·9
0·96	70·4	
		1·9
1·00	72·3	

The method is claimed as more accurate, more rapid, and more economical than the usual methods.—J. F. B.

Pentoses; Volumetric method for determining ——. A. Jolles. Ber., 1905, **39**, 96—97.

0·2—1·0 grm. of a pentose or pentose-yielding material is mixed with 200 c.c. of hydrochloric acid of sp. gr. 1·06, and steam is passed into the mixture until the formation of furfural is shown by Bial's reagent, to be complete, 100 c.c. of hydrochloric acid being added during the distillation. An aliquot portion of the distillate is neutralised and mixed with a known volume, in excess, of standard potassium bisulphite solution, which reacts with the furfural according to the equation:—

$$C_4H_3O.CHO + KHSO_3 = C_4H_3O.CH(OH).SO_3K.$$

After about two hours' standing, the excess of bisulphite is measured by titration with iodine solution; 1 c.c. of N/1 bisulphite solution corresponds to 0·07505 grm. of pentose.—T. H. P.

Barley; Determination of extract of ——. G. Graf. Z. ges. Brauw., 1906, **29**, 25—26.

The author has devised the following modification of the method for determining extracts of barleys in use in the "Wissenschaftliche Station für Brauerei in Munich." The barley is ground so as to give, when tested by Vogel's grading sieve, 86·2 per cent. of fine, and 13·8 per cent. of coarse grist, together with 0·2 per cent. of husks. 25 grms. of this grist are soaked for 15 hours with 25 c.c. of malt-extract, and 50 c.c. of water. The mash is then slowly heated, with stirring and replacement of the evaporated water, to boiling on a sand-bath and the boiling maintained for 5—10 minutes; after gelatinisation occurs, it is advisable to add a few c.c. of hot water. After cooling to 50° C., 75 c.c. of malt extract are added and the whole heated in 25 minutes, to 75° C., at which temperature it is kept until saccharification is complete. When cold, the mash is made up to a weight of 225 grms., the remaining procedure being as in the determination of the extract of malt as described below. The malt-extract is best prepared by mixing coarsely ground pale malt with water in the ratio of 1 : 5 and allowing to stand for two hours, with occasional stirring. To determine the extract contained in the malt extract employed, about 80 grms. of the latter are boiled and then made up to the original weight by the addition of water. The specific gravity of the filtered liquid is then measured and the corresponding extract-content read off from Balling's tables. The author's method gives results in good agreement with those obtained by Reichard and Purucker's method (Z. ges. Brauw., 1904, **27**, 345 and 366; 1905, **28**, 37; this J., 1905, 1120). —T. H. P.

Carbon Monoxide in the air; Determination of —— by means of iodic anhydride. A. Levy and A. Pécoul. Comptes rend., 1906, **142**, 162.

Gautier has shown that carbon monoxide when mixed with air, reduces iodic anhydride, and that the reaction is perfectly quantitative even when the carbon monoxide is extremely dilute. Acetylene also reduces the anhydride but the reaction is not complete, and is only slight when the acetylene is highly diluted. The authors have designed a method for the detection and determination of carbon monoxide in air, based on this reaction, the iodine liberated being absorbed in chloroform and determined colorimetrically. In studying the possible error due to the presence of acetylene, they have found that 4 parts of acetylene per 10,000 produce only the very faintest tint, and 1 part per 10,000 produces none at all, whereas the presence of 1 part of carbon monoxide per 10,000 produces an intense coloration. It is concluded, therefore, that in testing normal air the possible presence of acetylene may be neglected, but that in testing industrial gases arrangements must be made for the previous absorption of the acetylene, as well as of sulphuretted hydrogen, nitrous fumes and other disturbing gases. When extreme accuracy is required, the iodine liberated is to be absorbed in a solution of potash.—J. F. B.

Acetylene; Combustion of —— by oxygen. P. M. Beaupré. II., page 168.

Chloroform in air, blood and aqueous liquids; Determination of small quantities of ——. M. Nicloux. Comptes rend., 1906, **142**, 163—165.

Small quantities of chloroform, not exceeding 0·1 grm., in alcoholic solutions, are determined by making up the volume of the solution to 60 c.c. with alcohol, and boiling the liquid under a reflux condenser with 10 c.c. of 10 per cent. pure alcoholic potash for about 1 hour. The flask is cooled, 15 c.c. of water are added, and the liquid is made exactly neutral to phenolphthalein. Potassium chromate is added and the chlorine is titrated with a solution of silver nitrate containing 8·535 grms. of the salt per litre, 1 c.c. of which corresponds to 2 mgrms. of chloroform.

For the determination of chloroform in air, the air is passed at the rate of 1 litre in 30 minutes through two absorption tubes containing 95 per cent. alcohol, which absorbs the chloroform. For the determination of chloroform in blood or other aqueous liquids, the liquid is diluted with five times its volume of 80—95 per cent. alcohol, acidified with 0·25 grm. of tartaric acid. The mixture is distilled in a Schloesing's fractionating flask and the distillate is collected in 10 c.c. of 95 per cent. alcohol, until one-third of the total liquid has been distilled. The determination of the chloroform in the alcoholic solution is then conducted as above. There appears to be a systematic error inherent in the method whereby the results come out 1·5—2 per cent. too low.—J. F. B.

Strophanthin, Determination of —— in strophanthus seeds and in strophanthus tincture. Caesar and Loretz' Report, September, 1905; Pharm. Centralh., 1905, **46**, 859.

Seven grms. of moderately finely crushed strophanthus seeds are introduced into a flask with 70 grms. of absolute alcohol, and the gross weight is noted. The mixture is then digested on the water-bath, under a reflux condenser for one hour. After cooling, the original weight is made up by the addition of absolute alcohol and the liquid is filtered; 50·5 grms of the filtrate, equivalent to 5 grms. of the seeds, are then evaporated in a porcelain capsule on the water-bath. When the alcohol has been driven

off, the residue is treated with light petroleum spirit, and the solution of fat thus obtained, is filtered through a small plain filter. After washing with more light petroleum spirit, the insoluble residue on the filter is washed back into the capsule with 5 to 8 grms. of boiling water. The whole is then heated to boiling and treated with 5 drops of basic lead acetate solution. The lead precipitate is collected on a filter, and washed with boiling water until the filtrate is free from bitter taste. The filtrate containing the glucoside is then heated to boiling, and freed from lead by means of hydrogen sulphide. After heating to expel the gas, the lead sulphide is filtered off, and washed until free from bitterness. If only the crude strophanthin is to be determined, an aliquot part of this filtrate may be evaporated to dryness in a tared capsule and weighed. If the amount of pure strophanthin be required, the glucoside in the above filtrate is hydrolysed into strophanthidin, by boiling gently for two hours with 5 drops of hydrochloric acid. When the volume of the liquid is reduced to 10 c.c., it is made up to about 20 c.c. by the addition of distilled water. The cold solution is then twice shaken out with two successive washings, each of 10 c.c. of chloroform, and the chloroform extracts collected in a small tared flask. The aqueous portion is again boiled for half an hour, then again shaken out thrice with 10 c.c. of chloroform, these chloroform extracts being added to those previously obtained. The aqueous solution is again boiled, and if any bitter taste is evident, again shaken out with chloroform, the process being repeated until no more bitterness is evident. The bulked chloroform extracts are then distilled to dryness, the residue dried till of constant weight, and weighed as strophanthidin, 1 part of which = 2·182 parts of strophanthin.

In the case of strophanthus tincture, 51 grms. are evaporated to drive off the alcohol, the residue treated with 15 drops of basic lead acetate and the process continued as above.—J. O. B.

Aconite Root; Alkaloidal valuation of ——. Cæsar and Loretz' Report, September, 1905; Pharm. Centralh., 1905, **46**, 860.

Seven grms. of moderately finely powdered aconite root are macerated for half an hour in a closed flask with 70 grms. of ether and 5 grms. of 15 per cent. caustic soda solution, with frequent agitation. The ethereal layer is then run through a pad of absorbent cotton wool, and set aside until clear. Fifty grms., or an aliquot part of the clear ether extract, 10 grms. of which = 1 grm. of root, are then weighed off, and shaken out with 15, 10, and 10 c.c. in succession, of a 1 per cent. solution of hydrochloric acid. The acid extract is filtered into a separator, rendered alkaline with ammonia, and shaken out with 15, 10 and 10 c.c. of chloroform. The chloroform extracts are filtered into a small tared flask, the solvent is distilled off, and the residue moistened twice with 5 c.c. of ether, each lot of ether being driven off separately, and then dried to constant weight in the exsiccator. To determine the amount of alkaloid in this residue volumetrically, it is dissolved in a few c.c. of absolute alcohol, treated with 20 c.c. of water and a few drops of hæmatoxylin indicator, then titrated with N/10 hydrochloric acid, each c.c. of which is equivalent to 0·0645 grm. of aconitine.—J. O. B.

Iodothymol ["*Aristol*"]*; Determination of iodine in* ——. H. Cormimbœuf. Ann. Chim. anal. appl., 1905, **10**, 453—454.

Half a grm. of the iodothymol is intimately mixed with 3 grms. of pure anhydrous sodium carbonate, and the mixture is fused in a small crucible until all the organic matter has been burnt off. The cooled residue is then dissolved in warm water, the solution filtered, and treated with half its volume of solution of ammonia. The iodine is then precipitated in the usual manner with silver nitrate, and weighed as silver iodide. The amount of chloride present as impurity is found by acidifying the filtrate from the silver iodide precipitate with nitric acid, when silver chloride is precipitated, which is collected and weighed.—J. O. B.

Acetaldehyde; Determination of ——. Seyewetz and Bardin. Bull. Soc. Chim., 1905, 1000—1002.

The aldehyde solution is diluted so that it contains not more than approximately 7 to 8 per cent. Ten c.c. of this solution are added to 40 c.c. of 10 per cent. solution of anhydrous sodium sulphite, containing one or two drops of phenolphthalein indicator. In order to avoid loss, the solutions and mixture should be kept at 4° to 5° C. The solution is then titrated in the usual manner with N/1 sulphuric acid. The amount of aldehyde present is deduced from the quantity of acid used, according to the equation

$$2Na_2SO_3 + 2CH_3CHO + H_2SO_4 = (SO_3HNa,CH_3CHO)_2 + Na_2SO_4.$$

The presence of paraldehyde and acetal is without influence on the reaction; if acetic acid be present it must be determined separately.—J. O. B.

Formaldehyde; Determination of —— in Formaldehyde Pastilles (*Trioxymethylene*). E. Rüst. Z. angew. Chem. 1906, **19**, 138—139.

The author has modified the hydrogen peroxide method in such a way as to permit of operating on a large amount of substance, and of using normal acid and alkali with phenolphthaleïn as an indicator. A funnel is placed in the mouth of a 250 c.c. conical flask, and 1·9—2·0 grms. of the powdered substance weighed into it from a tube. The substance is washed down into the flask by about 70 c.c. of N/1 sodium hydroxide solution delivered from a burette, and dissolved. Then 9—10 grms of neutral 30 per cent. hydrogen peroxide are added, at first in small portions and cautiously, so as to avoid heating and frothing, then more rapidly. After two hours the contents of the flask are heated cautiously to boiling, and boiled to destroy the excess of peroxide. The funnel is now rinsed into the flask, a drop or two of phenolphthaleïn added, the liquid titrated with N/1 acid to very slight excess, and taken back with the N/1 sodium hydroxide. Any original acidity or alkalinity in the substance must be tested for, and if found, titrated and allowed for.—J. T. D.

French Patent.

Musts, Wines, and other Acid Liquids; Process for determining the total acidity of ——. P. P. A. Andrieu. Fr. Pat. 357,957, July 29, 1905.

The apparatus consists of an ordinary gas-burette fitted on a wooden stand and connected with a reservoir of water. A side tube at the top is connected with a gas evolution flask. Into this flask, 20 c.c. of a solution containing 5 grms. of sulphuric acid per litre are introduced, and 4 c.c. of a saturated solution of sodium bicarbonate are placed in a small tube which is supported in the flask. The apparatus having been connected up, the gas is evolved and the level of the water in the burette is read off. The reading so obtained is adjusted on a calibrated slide rule opposite the figure 5 on the fixed sulphuric acid scale of the rule. The operation is then repeated with the liquid under examination, and the new volume of gas evolved, corresponds on the slide rule with the acidity of the liquid in grms. of sulphuric acid per litre.—J. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 140.)

Gold; Double Acetates of ——. *Crystallised barium auryl hydroxide.* F. Weigand. Z. angew. Chem., 1906, **19**, 139—140.

If the compounds of alkaline earth and gold oxide formed by precipitating auric chloride with baryta-water (strontia, lime, magnesia, lead or zinc hydroxide) be heated, while still moist, with acetic acid, crystallisable salts are formed, shown by analysis to be $M(C_2H_3O_2)_2.2Au(C_2H_3O_2)_3$. They are very stable in the dry state, but their aqueous solutions slowly decompose.

From the filtrate, after precipitating auric chloride with baryta-water, small yellow-green crystals slowly separate, which have the composition $BaO_2(AuO)_2.5H_2O$. —J. T. D.

Titanium Tetrachloride and Stannic Chloride; Preparation of ——. Ber., 1905, **39**, 249—250.

TITANIUM dioxide is heated in a tube of hard glass, and chloroform vapour is passed over it. The reaction, $TiO_2 + 2CHCl_3 = TiCl_4 + 2CO + 2HCl$ occurs, and the tetrachloride is condensed in a cooled receiver. By-reactions occur, a colourless gas decomposed by water with formation of titanium dioxide, and which is, therefore, probably titanium hydride, being formed, besides carbonyl chloride and carbon dioxide. If the reaction be carried on at a high temperature, white needles condense in the receiver, which have the characters of hexachlorobenzene. Stannic oxide behaves similarly, but silica is unaffected.—J. T. D.

Amines; Action of Oxygen on aliphatic —— in presence of Copper. W. Traube and Schönewald. Ber., 1906, **39**, 178—184.

SCHÖNBEIN (Ber. Akad. Wissensch., Berlin, 1856, 580) and Tuttle (Annalen, **51**, 283) showed that by the action of oxygen on ammonia solution in presence of metallic copper, part of the ammonia is oxidised to nitrous acid. The authors have examined the action of oxygen on ethylamine and methylamine in presence of copper. They find that the metal is oxidised, but no nitrous acid is produced; the amine is oxidised to the corresponding aldehyde (formaldehyde from methylamine, and acetaldehyde from ethylamine) and ammonia is split off. With glycocoll, ammonia and glyoxalic acid are formed, but in this case nitrous acid is also produced.—A. S.

Glucosides and Albuminoids; Alterations of the Refractive Indices of the — — under the action of Enzymes, Acids, and Bacteria. F. Obermeyer and E. Pick. Beitr. chem. Physiol u. Path., 1905, **7**, 331—381. Woch. f. Brau., 1906, **23**, 45—47.

THE authors have employed the refractive index as a physical measure for the study of the internal constitutional changes which accompany the splitting of complex bodies into simpler ones under the action of enzymes and acids. In all the cases in which the splitting of glucosides and polysaccharides by enzymes was studied, no change was observed in the refractive indices of the mixtures. Many of these reactions have been proved to be reversible equilbria, and, since the sum of the refractive indices of the products is equal to the refractive index of the original substance, it is concluded that no fundamental alteration in the structural relations of the atoms takes place. Similarly, the splitting of the bodies of this class, by means of acids, is not accompanied by any change in their refractive indices until the reactions have proceeded so far that secondary changes have occurred. The proteolytic action of pepsin also takes place without alteration of the refractive index, and is, therefore, of a simple nature. Trypsin, on the other hand, in its action on all albumins and albuminoid derivatives susceptible to tryptic digestion, causes an increase in the refractive index, and a more profound constitutional change is, therefore, indicated. This difference is regarded as being absolutely characteristic for the two typical proteolytic ferments. Digestion by papayotin is not accompanied by an increase in the refractive index. The splitting of albumin by the action of hydrochloric acid at a moderate temperature takes place without change of the refractive index, but the more profound change effected at the boiling temperature is accompanied by an increase in the refractive index. Lastly, it is found that the digestion or fermentation of meat bouillon and Witte's peptone by cultures of bacteria, such as the powerfully proteolytic species of Proteus, cholera vibrio and *B. coli comm.* is accompanied by a decrease in the refractive index, indicating that the processes of bacterial digestion differ in some essential particulars from those effected by pepsin, trypsin and acids.—J. F. B.

Carbon Dioxide; Action of ultra-violet light on moist and dry ——. S. Chadwick, J. E. Ramsbottom, and D. L. Chapman. Chem. Soc. Proc., 1906, **22**, 23.

BY the action of ultra-violet light on dry carbon dioxide, the authors have succeeded in partially decomposing it into carbon monoxide and oxygen. The conditions of the experiment made it impossible to decide what percentage of the oxygen was present in the form of ozone. If the carbon dioxide be moist there is no decomposition.

Departmental Committee on Royal School of Mines. Final Report, Feb., 1906. (Wyman and Sons, Fetter Lane, E.C.) Price 4d.

THE report of the Departmental Committee is signed by all the existing members—namely:—Mr. R. B. Haldane, K.C., M.P., Sir Francis Mowatt, Sir W. de W. Abney, F.R.S., Sir William S. Church, Mr. A. H. Leech, Sir Philip Magnus, M.P., Mr. Walter McDermott, Mr. F. G. Ogilvie, Lord Reay, Sir Arthur W. Rücker, F.R.S., Mr. Sidney Webb, Sir Julius C. Wernher, Sir William H. White, F.R.S., Mr. J. C. G. Sykes (secretary), and Mr. F. E. Douglas (assistant secretary).

The terms of reference, and the text of the conclusions and recommendations are given below:—

Terms of Reference.

To inquire into the present working of the Royal College of Science, including the School of Mines; to consider in what manner the staff, together with the buildings and appliances now in occupation or in course of construction, may be utilised to the fullest extent for the promotion of higher scientific studies in connection with the work of existing or projected institutions for instruction of the same character in the Metropolis or elsewhere; and to report on any changes which may be desirable in order to carry out such recommendations as they may make.

Conclusions and Recommendations.

76. The conclusions at which we have arrived are:—

(1) That the position of this country makes further provision for advanced technological education essential.

(2) That the students, by whose advanced technological education the nation would profit, are not actually obtaining it to the extent which is desirable, and that this is due to:—

(*a*) The lack of facilities for instruction in certain important subjects;

(*b*) The absence of such co-ordination among existing institutions of technological education as would permit the concentration of the more advanced courses in a limited number of institutions;

(*c*) An insufficient appreciation, especially on the part of employers, of the value of such education.

(3) That the opportunities for research in our technological institutions are inadequate to the industrial needs of the Empire, owing not to any want of ability on the part of the professors, but to the fact that much of their time is frequently absorbed in the giving of comparatively elementary instruction in Pure and Applied Science.

(4) That in any institution in which the highest technological education is given, the equipment should be adequate for the purpose, and the staff should include, at the head of the several specialised branches of the work, men of the first rank in their profession.

77. From this point of view the recommendations which we have the honour to submit in reply to our Terms of Reference may be summed up as follows:—

That the present combination of conditions at South Kensington points to the desirability of so utilising the resources there available, and of making additions to these, as to form on that site an institution of the highest standing, an institution which, with the staff, equipment, and students that it will command, would go far towards remedying the above-mentioned defects.

78. The remainder of our Report will show the manner in which we propose that effect should be given to the view thus summarised, and will take up the threads of

the scheme at the point at which our Parliamentary Report (Cd. 2610), of the 20th February last, left them.

79. It will be remembered that in that Report we inquired whether the Board of Education were in a position to inform us (1) that, if it were found possible to establish a scheme such as we had sketched in outline, they would be willing to allow the Royal College of Science (including the Royal School of Mines) to be brought into it under a common government and administration; and (2) that the existing Government contribution to the support of these institutions would be continued under the new conditions on the scale already made necessary by the provision of the new laboratories of the Royal College of Science.

80. We print in Appendix I. the answers which we have received from the Board of Education to these inquiries. It will be seen therefrom that the Board have replied to the first of these questions in the affirmative, and that, in reply to the second, the Government have intimated that they will be prepared to bring the Royal College of Science and Royal School of Mines, including the new laboratories, into a scheme framed on lines approved by the Board of Education, in accordance with this Report, and to make a grant of £20,000 per annum in respect of the cost of staff and of the laboratory expenses, with provision in addition for certain other minor expenses.

81. The favourable disposition of the Government has greatly strengthened our position, and enabled us to obtain the support and co-operation which we consider necessary to ensure the success of the scheme described generally in our Preliminary Report.

82. The gift of a capital sum in excess of the *minimum* referred to in Section III. of that Report has been secured.

83. The Commissioners of the 1851 Exhibition are prepared, if satisfied with the scope and constitution of the new institution, to place at the disposal of its governing body the unoccupied portion of their estate at South Kensington.

84. The Council of the City and Guilds of London Institute have indicated their willingness to bring the Central Technical College into a scheme to be framed to their satisfaction on the general lines we are able to recommend in this Report.

85. We attach the highest importance to the co-operation of the London County Council, as the local education authority, and with regard thereto the most cordial assurances were given at an early stage of the movement. The Council, on the 27th July, 1903, received a report from its General Purposes Committee upon the proposal contained in the letter which Lord Rosebery had a short time previously addressed to the Chairman of the Council—a proposal, the essential features of which are incorporated in our scheme and passed a resolution expressing "its high appreciation of the important proposal," and its welcome of "the establishment of further provision in London for advanced technological teaching and research." It further resolved to place on record its opinion that, subject to certain conditions being fulfilled (about which we may say we do not anticipate any difficulty), the Council would be well advised, when the time came, to contribute a sum not exceeding £20,000 per annum towards the maintenance of the institution.

86. In our opinion a sufficient maintenance fund is assured, at any rate, to justify a commencement, if not to carry out the scheme we have in view as fully as we hope may be possible hereafter.

87. As stated in our Preliminary Report, we have inquired into the working of the Royal College of Science and the Royal School of Mines, but we have done so with a definite end in view. We think it appears from the answers we have received from the Board of Education to the questions we ventured to ask in that Report, taken in conjunction with the terms of reference, that it is the desire of His Majesty's Government that the staff of the Royal College of Science, including the Royal School of Mines, together with the buildings and appliances now in occupation or in course of construction at South Kensington, should be utilised to the fullest extent for the promotion of higher scientific studies in connection with the larger scheme which we endeavoured to sketch in outline in our Preliminary Report. We have now to make, so far as appears to us possible, recommendations with regard to the essential features in the constitution and purposes of the new institution which we propose should be created, and with regard to the position of the several bodies brought with it under a common government and administration.

88. The main object is the establishment, at South Kensington, of an institution or group of associated Colleges, of Science and Technology, where the highest specialised instruction should be given, and where the fullest equipment for the most advanced training and research should be provided, in various branches of science, especially in its application to industry, for which no sufficient provision already exists elsewhere. The number of the departments will be limited by the resources available, and at first a selection will have to be made among them, but they may be increased almost indefinitely as additional means are provided, and new applications of science to the arts and industries are discovered. The scale on which the departments are established should be capable of gradual expansion with the increase in the number of students, fitted by preliminary education, to take advantage of the teaching and training contemplated.

89. The scheme should, in the first instance, and subject to necessary adjustments, include the work of the Royal College of Science, the Royal School of Mines, the Central Technical College, and departments to be established on the additional site at South Kensington.

90. Such being the scope of the new institution, it is necessary that we should make recommendations with regard to the composition and functions of its governing body, and the question at once arises what should be the relation of the new institution to the University of London. On this question it is necessary to premise that we are agreed that it is desirable that the new institution should be established immediately, and that its organisation should proceed without delay, and there is substantial agreement among us that for this purpose a governing body of the character sketched in a subsequent paragraph should be at once appointed with power to take immediate action. We wish, however, to put in the forefront of our recommendations under this head a proviso that they should not be regarded as in any way intended to prejudice the future settlement of the question of the relation between the new institution and the University. This is a question on which divergent views are held. It is contended, on the one hand, that the constitution we recommend for the immediate future should not be a merely temporary one, but that the new institution should be permanently independent of University control; and, on the other hand, that the new institution should pass, as soon as may be, under the control of the University, the character of the University, and the composition of its Senate, being changed to such extent as may be found necessary for this purpose.

91. We append a brief statement of arguments which have been put forward in support of these two views.

92. For the first view it is said:

"It is assumed that, whatever may be the subsidiary purposes of the new institution, its principal purpose must be to afford a two years' course of advanced study, linking science with investigation, production and manufacture, to students of, say, nineteen years of age and upwards, who have received elsewhere a good general education, and have passed in addition through the equivalent of a two years' systematic training in science, whether at the new institution itself or elsewhere. Such an institution, while it will make for the general intellectual development of its students, will have their preparation for the work of life as its dominant aim. It must therefore maintain close contact with current practice in the industries of the Empire, and, although it will not overlap these, the transition from the school to the world of work must be easy and natural. Industrial and commercial conditions are constantly altering, the character and relative importance of manufacturing processes, and even of entire sections of national activity are subject to unforeseen variation. An institution which is to keep touch with these interests, must be correspondingly elastic. Its organisation must be free from

all impeding trammels founded upon experience of the well-tried and comparatively little-changing track of an education regulated, and rightly regulated, by other aims. It must be free to adapt itself, its staff arrangements, and its methods of teaching to the conditions of the time. Its constitution must place the responsible control in the hands of men with a continuing knowledge of affairs and of the great producing activities of the Empire, and its governors must be in a position to govern with a single eye to the fitness of the institution for its proper function.

"These conditions of success appear to exclude the proposition that the control of the institution should be vested in a University. It has been suggested that some modification might be made for the purpose in the composition of the Senate of the University of London; but changes introducing such control and organisation as are here indicated would be so radical as to be inconsistent with the prevailing British conception of a University, and if applied to London University might endanger its usefulness in many of its existing functions which are of vital importance to the successful accomplishment of its essential objects. A system of control and organisation common to the new institution and the University could not be formulated without such compromises as would seriously impair the efficiency of both.

"Moreover, students for advanced courses of study in the new institution should be drawn from all parts of the Empire. It should, in fact, be an Imperial College of Technology, admission to which should be sought by men trained in the Universities and Technical Colleges at home and in the Dominions beyond the sea. Freedom from subordination to any existing University would enhance its attraction for the ablest students whose preliminary training had been obtained elsewhere, and would indicate its distinctive character as an Imperial College. Students would be free to take degrees at London University or other Universities, in addition to the College Diplomas.

"London University has special obligations laid upon it in connection with the London district, and must continue to fulfil them. It cannot claim any peculiar right to provide for Imperial needs. On all these grounds it is undesirable to attempt amalgamation of the new institution with London University."

93. For the second view it is said:—

"(1) Modern opinion, at home and abroad, is in accord that degrees should be given for advanced technological education.

"In this country, if it is possible to infer a settled policy from recent and numerous precedents, it appears that such degrees should be given by Universities. Not to mention recent developments at the older Universities, the power of conferring degrees for advanced instruction in technology has been given by each of the five University Charters granted within the last five years, as well as to the University of London, when it started on its new career.

"Since it is recommended that the new institution shall be (as each of its existing component parts already is) a School of the University of London, the Report contemplates no change in the degree-giving power of the University. There would, however, evidently be danger of friction between the University and a powerful School if each were regarded by the other as external to itself.

"Nor is it desirable that the great engineering societies should have a large share in the management of the chief Engineering College in the Metropolis, without having a corresponding share in settling the conditions under which degrees are given, and without being also associated with the management of other London Schools of Engineering of University rank.

"These objects could be attained if all these institutions were under a common control (which could hardly be other than that of a modified Senate of the University), and if the bodies, which on the alternative scheme would be interested only in the new College, were given such representation on the Senate as would enable them to exert a powerful influence in deciding the terms on which the degrees in Engineering were given, and in controlling all Engineering education of University rank in London, whether established at South Kensington or elsewhere.

"(2) The University has already prepared the way for such a solution of the problem. The Senate in a letter addressed to the committee has expressed its willingness that its numbers should be increased if the new College were administered by, or under the control of, the University. On that condition, too, University College appears willing to consider either the proposal that its Engineering Department should be moved to South Kensington, or that it should have special relations to the new College. Difficulties due to the existence of separate interests have been and are being diminished. Firstly, the University College London (Transfer) Act, 1905, will make the College and its resources the property of the Senate in September next; and secondly, King's College has approached the University with the expression of a desire for the establishment of closer relations between them, and the negotiations are proceeding satisfactorily.

"It would be a very serious step to check a spontaneous movement, which is thus healing the divisions and rivalries that have hindered the progress of University education in London for three quarters of a century, by reverting to the principle of dual or multiple control which, as experience has shown, tends neither to economy nor efficiency.

"(3) As to the question whether a University is the proper body to exercise control over an Imperial Technical College it must be observed:—

"Firstly, that one of the 'purposes' of the University of London approved by Parliament is to 'hold forth to all classes and denominations both in the United Kingdom and elsewhere without any distinction whatsoever an encouragement for pursuing a regular and liberal course of education' (Statutes, Section 3). The University is not, therefore, a local body only. Its energies were not intended to be confined, and are, in fact, not confined, to the United Kingdom or to London.

"Secondly, that the proposal to give ultimate control to the University is bound up with that for the appointment of a Royal Commission, which would probably give to the representatives of Engineering on the Senate, adequate powers to deal with the conditions on which degrees in that subject are conferred, and to secure the requisite flexibility in the conduct not only of the new College but of the whole faculty of Engineering.

"Thirdly, that an Imperial institution which throws its doors open to all must be largely local in character. Nay, it should be so, if the mingling of British and Colonial students, which it is one of the main objects of Imperial Education to secure, is to be attained. Further, a successful local institution of the first rank must become in part National, Imperial, and even International. It is, in fact, impossible to draw a clear line of demarcation between Imperial and Local Education. An Imperial institution must have a strong local basis, and the effect of its creation on local education is a matter of primary importance. An attempt to establish side by side two systems, one Imperial and the other local, would only lead to confusion."

94. We do not consider that the establishment of the new institution should be delayed pending a decision between these two views, or that the general lines of its organisation (except, possibly, as respects the Governing Body) should be regarded as other than permanent. If changes can be made in the character and constitution of the University which will make it desirable to amalgamate the two institutions, we should wish to see such modifications made, and an amalgamation effected accordingly, and we venture to suggest that a Royal Commission should be appointed to consider what these changes should be.

95. Meanwhile, for the reasons we have already given, and subject to the proviso we have already made, we recommend that a Governing Body should be established consisting of forty members appointed as follows:—

Six by the Crown;

Four by the Board of Education;

Five each by the University of London, the London County Council, and the Council of the City and Guilds of London Institute;

Four by the teaching staff of the new institution;
Two by the Commissioners of the Exhibition of 1851;
One each by the Royal Society, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Iron and Steel Institute, the Institution of Naval Architects, the Society of Chemical Industry, the Federated Institution of Mining Engineers, and the Institution of Mining and Metallurgy.

96. The Governing Body should have the general management, direction and administration of the new institution, which should be established in the first instance as a School of the University of London.

97. For the purposes of the new institution the Governing Body should have the entire disposal of the accommodation provided by the Royal College of Science, including the buildings in course of construction at South Kensington, the Central Technical College, and all buildings which may be erected on the additional site at South Kensington.

98. The site and buildings of the Royal College of Science including the buildings in course of construction should either remain the property of His Majesty's Government or be transferred to the Governing body of the new institution, as His Majesty's Government may determine.

99. The site and buildings of the Central Technical College should, if and so long as they desire it, remain the property of the City and Guilds of London Institute, who should provide for their maintenance and repair.

100. The Governing Body should be incorporated, and subject to such special provisions as may be made by their instrument of incorporation they should receive and expend fees and other funds which may be assigned to the purposes of the new institution, they should appoint the professors and the other members of the staff, they should determine the departments and subjects of instruction, they should control the arrangement of the courses of instruction, and the award of diplomas, and they should make provision for the protection of students now in the constituent institutions and of the existing diplomas. Further, in each of the departments of the new institution the Governing Body should appoint a Board, not necessarily consisting of members of their own body, and including members of the teaching staff and persons with practical experience of industrial requirements, to give expert advice with regard to such particulars connected with that department as the Governing Body may refer to them.

101. We recommend that it be an instruction to the Governing Body to enter into negotiations with the University of London, with King's College, and pending its actual incorporation, with University College, with regard to the co-ordination of the engineering work of these Colleges with that of the new institution. If, for the purpose of carrying out such co-ordination, funds are needed, either for transferring the Engineering Departments of one or both of these Colleges to South Kensington, or for carrying on at these Colleges work of an advanced type which would otherwise be done at South Kensington, or in aid of any other arrangement for that purpose to which the Governing Body may agree, we recommend that the Governing Body be authorised to incur such reasonable expenditure as may in their opinion be necessary. Subject to such arrangements, we recommend that instruction in the higher branches of technology should, as far as possible, be concentrated at South Kensington. In the establishment of new departments we do not think it will be possible at present to go much beyond the various branches of engineering, with mining and metallurgy, though we hope provision may be made later for other subjects. We think the principal technical and engineering societies should be consulted as to the departments most requiring development and expansion, and as to the number of students for whom it is desirable to make provision in each department. In view of the character of the subjects which will, it may be expected, predominate on the South Kensington site, it must, we think, before long become a question whether the Biological Department of the Royal College of Science shall be retained there. As soon as this question becomes ripe for settlement the provision to be made for that department will be a matter for negotiation.

102. In our Preliminary Report we indicated the principal subjects which should, in our opinion, either at once or in the early future, be within the purview of the institution, and gave illustrations of the kind of higher or more specialised applications of these subjects, some of which we suggested should be dealt with. We do not think we can usefully offer more precise recommendations than are made in that Report as to the priority in which the different branches of study should be undertaken, believing that this is a matter which will be best left to the Governing Body.

103. We think, however, that it may be found possible, even in the immediate future, to make arrangements for the establishment of departments dealing adequately with the greater number of the special sections of applied science named. Thus it would seem that certain of these departments might be accommodated in the buildings of existing London institutions, while, for others, special accommodation would fall to be provided at once in the first additions to the buildings already available on the South Kensington site. For example, in view of the character and standard of the work now carried out by the Central Technical College, we think prominence should be given in the new institution to certain specialised developments of mechanical and electrical engineering.

104. We have already reported that we think a fully-equipped Central School of Mines should be maintained, providing a full course of instruction in mining and metallurgy, especially in the mining and metallurgy of metals produced in India and the Colonies, but not found in workable quantities in the United Kingdom. This would constitute one department of the new institution. In this, as in the other departments, care should be taken that the specialised and advanced instruction is organied with due regard to provision already made elsewhere—for example, it would probably be undesirable to include provision for advanced treatment of the metallurgy of iron and steel.

105. It should be borne in mind that the traditions and prestige of the Royal School of Mines and the Associateship of that school are valuable assets, and we think care should be taken to preserve those traditions and that diploma.

106. We think the specialised course of mining should be of two years' duration, in which the teaching should be restricted to technical and advanced instruction. Special courses of mining and metallurgy should be provided for those students who are subsequently to be engaged in mining and metallurgy respectively, but all such students should receive, as far as possible, concurrent instruction in both mining and metallurgy.

107. In our opinion accommodation should be provided in this department for 100 to 120 fully-qualified students, *i.e.*, fifty or sixty entries in each of the two years contemplated, so that forty to fifty students might be expected to pass out each year after successfully completing the course.

108. Vacation work under the guidance of school authorities, in districts where practical work is conducted, is a great and valuable feature of American and Canadian Schools of Mines. We think it would be advantageous for students of the Royal School of Mines to have one short period of practical mine surveying and of mining work generally in a metalliferous mine, and another similar period of experience of the work of a coal mine. For while we do not recommend that the Royal School of Mines should specialise in coal mining as in metalliferous mining, we believe that such experience, in a department of mining in which Great Britain is pre-eminent, would afford most valuable educational opportunities, even for mining students whose future work was to be metalliferous mining. From the evidence before us we think that it might be of advantage that the arrangements for these courses of vacation work should be made through such institutions as the Camborne Mining School and the Wigan Mining College respectively.

109. One of the Sub-committees which we have had occasion to appoint from time to time in the course of our deliberations was charged with the consideration of the curriculum, accommodation, and appliances suitable for the Royal School of Mines, and we submit in Appendix

VIII. the report which was made to us by that Sub-committee.

110. At first, at any rate, we think preliminary training should be given in the new institution. But while, on the one hand, we do not recommend that admission to the higher technical courses should be limited to students who obtain their preliminary training there, on the other hand we think that, both as regards the general education of the students admitted and the character of the teaching provided, this preliminary branch of the new institution should be organised with the definite intention of preparing thoroughly suitable candidates for admission to the advantages of the higher instruction which it is the principal object of the new institution to afford.

111. No student should be admitted to any specialised technical department who has not received, either in the new institution itself or elsewhere, an adequate training of a technical and scientific character such as should be common to every branch of engineering. He should have spent two years on a course of instruction in science such as he could obtain in a well-organised college or technical institution, after having reached the standard of general education usually marked by University matriculation. An examination test should be imposed on all candidates for admission to the higher departments, except in the case of students who show, by some recognised qualification, that they have received the necessary preliminary training, and when there are more candidates for admission to a particular department than can be received the best should be selected on a competitive basis.

112. The preliminary training to be given in the new institution should be of the kind which has just been referred to. It should consist of a course of two years' instruction in science, technology, and engineering, of such a character as the Governing Body consider the most suitable preparation for the specialised courses, and it should be, in the main, common to all students proceeding to advanced instruction in any department. We have already indicated our opinion that students who have not attained a certain standard of general education are not fitted to obtain the fullest advantage from the specialised instruction of the higher departments. We, therefore, think that evidence of this should be required before admission to the preliminary department.

113. With regard to educational arrangements we recommend that, subject to reservations made by any constituent institution or co-operating body which may stipulate for the right to enter students under prescribed conditions, students should enter not for any one of the constituent institutions but for the new institution as a whole, with a view to following out courses to be arranged by the Governing Body.

114. The professors of the constituent institutions should be regarded as professors of the new institution.

115. There should be a principal officer of the new institution, who should be responsible to the Governing Body for the supervision of education and discipline in all the constituent institutions.

116. It must, in our opinion, be left to the Governing Body to work out the scheme in detail and to make statutes and regulations for the new institution in general accordance with our proposals.

117. We desire, in bringing this Report to a close, to record our deep indebtedness to Mr. Sykes, our Secretary, for the devotion and knowledge which he has brought to bear on our task. Alike in his work here throughout the two years during which the Committee has been sitting, and in the investigation which he has conducted for us abroad, he has displayed the utmost zeal and discretion.

118. To Mr. Douglas, also, our Assistant Secretary, we are under much obligation for the qualities he has shown, for the large mass of material which he has collected for us, and for the amount of work which he has put into the discharge of his duties.

The signatures of Mr. Walter McDermott and Sir William H. White are subject to a statement defining the position of the proposed Royal Commission to consider what changes should be made in the character and constitution of the University of London in order that the new institution may be amalgamated therewith. The signatories of this statement express the opinion that it is vital to the success of the new institution that its organisation and equipment for the part it is to play in technical education should be entrusted, for a *minimum* period of five years, to a special governing body, such as is recommended in the report; that the uninterrupted action of that body should be assured during this period; and that inquiry by Royal Commission or otherwise should be deferred until experience has been gained in actual working.

Lord Reay and Sir Arthur Rücker add a memorandum in which they record their opinion that it is desirable in the interests of higher education and of the new institution that steps should be taken as soon as possible to incorporate it in the University of London.

Trade Report.

BRITISH INDIA; SCHEDULE IV.—IMPORT TARIFF.

Bd. of Trade J., Feb. 8th, 1906, 271—273.

No.	Names of Articles.	Per	Tariff valuation.	Duty.
	CHEMICALS, DRUGS, MEDICINES, NARCOTICS, AND DYEING AND TANNING MATERIALS.		R. a.	Per cent.
10	Chemical products and preparations—			
	Acid, sulphuric	lb.	0 1½	5
	Alkali, Indian (sajji-khar)	cwt.	2 0	,,
	Alum	,,	4 8	,,
	Arsenic (other than European)	,,	23 0	,,
	,, (China mansil)	,,	19 0	,,
	,, other sorts	—	*ad val.*	,,
	Bicarbonate of soda	cwt.	6 0	,,
	Copperas, green	—	*ad val.*	2½
	Explosives, namely, blasting gelatin, dynamite, roburite, tonite, and all other descriptions, including detonators and blasting fuse.			
	Sal ammoniac	cwt.	30 0	,,
	Sulphate of copper	,,	17 8	,,
	Sulphur, (brimstone), flour	,,	5 8	,,
	,, ,, roll	,,	5 4	,,
	,, ,, rough	,,	5 0	,,
	All other sorts of chemical products and preparations, including saltpetre, borax, grape sugar and glucose, but excluding nitrate of soda, chloride of potassium, sulphate of ammonia, sulphate of potash and kainit salts, which are free.	—	*ad val.*	,,
11	Drugs, medicines, and narcotics—			
	Banslochan (bamboo camphor)	lb.	0 4	,,
	Brimstone (amalsâra)	cwt.	16 0	,,
	Camphor, refined, cake	lb.	2 0	,,
	,, partially refined, cake, in blocks of about 13 lb.	,,	1 10	,,
	Camphor, crude, in powder	,,	1 8	,,
	China root (chobchini), rough	,,	9 0	,,
	Cocaine	—	*ad val.*	,,
	Quinine and other alkaloids of cinchona	—	—	free
	All other sorts of drugs, medicines, and narcotics, except opium	—	*ad val.*	5

No.	Names of Articles.	Per.	Tariff valuation.	Duty.
12	Dyeing and tanning materials—		R. a	Per cent.
	Alizarin dry, 40 per cent.	lb.	1 4½	8
	" " 50 "	"	1 8½	"
	" " 60 "	"	1 12	"
	" " 70 "	"	2 0½	"
	" " 80 "	"	2 4½	"
	" " 100 "	"	2 12	"
	" moist, 10 "	"	0 4½	"
	" " 16 "	"	0 7	"
	" " 20 "	"	0 8	"
	Aniline dye, moist (indigo blue)	"	0 6½	"
	" dry	"	0 14	"
	" salts	—	*ad val.*	"
	Cochineal	lb	1 8	"
	Gallnuts (myrabolams)	—	*ad val.*	"
	" Persian	cwt	40 0	"
	Madder or munjit	"	8 8	"
	Orchilla weed	"	3 8	"
	Sappan wood and roof	—	*ad val.*	"
	Turmeric	—	"	"
	All other sorts of dyeing and tanning materials	—	"	"

New Books.

La Céramique Industrielle. Par Albert Granger, D. ès. Sc., Professeur de Chimie et de Technologie Céramique à l'Ecole d'Application de la Manufacture Nationale de Sévres. Gauthier-Villars, Imprimeur-Libraire. Quai des Grands-Augustins, 55, Paris, 1905. Price 17 Fr.

8vo volume, containing 627 pages of subject matter, and an alphabetical index. There is also a glossary of terms used in the industry with their meanings, also a table of contents. In the text are 179 illustrations. The subject matter is sub-divided and classified as follows:—I. Plastic Substances. II. Nonplastic Substances. III. Tests of Raw Materials, and Analysis of Pastes, Colours, &c. IV. Preparation of Raw Materials. V. Preparation of Pastes. VI. Moulding. VII. Drying and Furnacing. VIII. Baking the Wares. IX. Glazes, Enamels. X. Terra-cotta. XI. Refractory Products. XII. Crockery and Earthenware. XIII. Stone-ware. XIV. Porcelain. XV. Decoration. XVI. Importance of the Ceramic Industry.

Conversations on Chemistry. First Steps in Chemistry. By W. Ostwald, Professor of Chemistry in the University of Leipsic. Translated by Stuart K. Turnbull. Part II.—The Chemistry of the most Important Elements and Compounds. First Edition. John Wiley and Sons, New York, 1905. Price 8s. 6d. nett. Chapman and Hall, Ltd., London.

Small 12mo volume, containing 373 pages of subject matter with 32 illustrations. There are 45 chapters of subjects taken from inorganic chemistry, and chiefly relating to the principal elements and compounds. The treatment of the matter is by way of question and answer.

The Production of Aluminium and its Industrial Use. By Adolphe Minet. Translated, with additions, by Leonard Waldo, S.D. (Harv.). First Edition. John Wiley and Sons, New York, 1905. Price 10s. 6d. nett.

12mo volume, containing 256 pages of subject matter with 57 illustrations, and alphabetical indexes of subjects and authors' names. The subject matter is classified as follows:—Part I.—Processes for the Production of Aluminium. A. Chemical Methods of Producing Aluminium. B. Electrochemical Methods of Producing Aluminium. Part II.—Aluminium and its Alloys, Methods of Working and Uses. A. The Aluminium Industry. B. Aluminium and its Alloys. C. Working of Aluminium. D. Uses of Aluminium. Appendix—Supplementary Notes.

Le Blanchissage et l'Apprêt du Linge. Louis Vérefel. Aux Bureaux de la Revue., 64, Chaussée d'Antin, 1906. Price 3 frcs.

12mo volume, containing 173 pages of subject matter with 73 illustrations, and a table of contents. The subject matter is classified thus:—Part I. Bleaching. 1. Nature of Articles Bleached. 2. Theory of Bleaching. 3. Chemical Products used in Bleaching. Bleaching by Cleansing Agents. II. Industrial Bleaching. Part II. Finishing.

Electric Power. What it is, and what it can do. By Alfred W. Marshall, M.I.Mech.E., &c. Perceval Marshall and Co., 26-29, Poppin's Court, Fleet Street, E.C., 1906. Price 3d.

Pamphlet, 12mo size, containing 41 pages of subject matter, including a glossary of "Every-day Electrical Terms Simply Explained."

JOURNAL OF THE

Society of Chemical Industry.

No. 5.—Vol. XXV. SUPPLEMENT. March 15, 1906.

HON. TREASURER:—
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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

INDEX FOR 1905.

The Index for 1905 is in the press and will be ready for issue with the March 31st number to those members entitled to receive it.

LONDON SECTION.

The next meeting of the London Section will be held at the Chemical Society's Rooms, Burlington House, Piccadilly, on Monday, April 2nd, when Mr. E. J. Watkins will read a paper on "The Ropiness in Flour and Bread, and its detection and prevention."

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

IMPORTANT NOTICE.

Arrangements have been made with Messrs. Thos. Cook & Son for an inclusive charge of £17 per person for the journey. This will include first-class return tickets to Rome, leaving London on the 23rd April by the 2.20 p.m. service, *via* Boulogne and St. Gothard route, and arriving at Como at about 2 p.m. on the 24th; a steamer trip from Como to Bellaggio and back, departure from Como on Wednesday morning, the 25th, arriving in Rome at 11 p.m. the same day. The charges further include dinner *en route* on April 23rd, breakfast on arrival at Bâle and luncheon *en route* on the 24th, steamer trip, dinner and hotel at Como, breakfast, luncheon, and dinner on the 25th, first-class hotel accommodation, including breakfast, at Rome during seven days' stay; also transfers between station and hotel at Rome on arrival, the necessary fees to railway and hotel servants, and the services of a competent courier on the outward journey up to the arrival at the hotel in Rome. The tickets are available for return at any time within 25 days, and members are at liberty to return by the Mont Cenis route, provided that they notify this intention when applying for the tickets. Sleeping car accommodation from Boulogne to Bâle will be provided at an extra cost of 15*s.* 10*d.* for each person. For those who desire full board and lodging in Rome, the inclusive charge will be £18 15*s.*

Since at the time of the Congress all railways and hotels will be full, it is necessary to give Messrs. Cook ample notice, and therefore applications for tickets should be made at once, but not later than the 22nd

March, to the General Secretary, Charles G. Cresswell, Palace Chambers, Westminster, S.W. Should the requisite minimum number of 30 applications be received, each applicant will be required to deposit the sum of £8, which he will forfeit should he abandon the journey.

Changes of Address.

Alston, R. A., l/o Knights; c/o Glencairn Main Reef G. M. Co., P.O. Box 191, Germiston, Transvaal.
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Oberländer, Dr. Otto, l/o Victoria Park; 21, Portland Crescent, Plymouth Grove, Manchester.
Peffer, Harry C.; all communications to c/o Pittsburgh Reduction Co., East St. Louis, Ill., U.S.A.
Queiroz, L. M. Pinto de; all communications to Caixa 255, Sao Paulo, Brazil.
Rust, Robt. R., l/o Depue; 1315, Fourth Street, Peru, Ill., U.S.A.
Saxe, Sigmund; all communications to 107, Manhattan Avenue, New York City, U.S.A.
Shields, Dr. John; Journals to Minas de Rio Tinto, Prov. de Huelva, Spain.
Shoffstall, A. S.; Journals to 307, Morris Street, Woodbury, N.J., U.S.A.
Short, Andrew; Journals to 24, Simpson Street, Newcastle-on-Tyne.
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Smith, Edgar B., l/o Silvertown; Box 599, Sydney, Cape Breton, Canada.
Smith, R. W.; all communications to P.O. Box 85, Knights, Transvaal.
Southerden, F., l/o 56; 49, West Grove Road, Exeter.
Spayd, C. H., l/o Philadelphia; Fernwood P.O., East Lansdowne, Delaware Co., Pa., U.S.A.
Steiger, Geo., l/o Geological Survey; Cosmos Club, Washington, D.C., U.S.A.
Thomas, Jas. E., l/o Germiston; P.O. Box 53, Krugersdorp, Transvaal.
Wainwright, Dr. J. H., l/o Front Street; 60, Wall Street, New York City, U.S.A.
Wakefield, Wm. C.; Journals to c/o Savile Town Chemical Co., Ltd., Mill Street East, Dewsbury.
Woodside, T. F., l/o Carteret; The Warner Chemical Co., 141, Broadway, New York City, U.S.A.
Wildman, A. J., l/o Stroatfield Avenue; 133, Central Park Road, East Ham, E.

Member Omitted from List.

1904. Stevens, Edgar B., 688, Seventh Street, Buffalo, N.Y., U.S.A., Chemist (Wood Products Co.).

Deaths.

Donald, Jas., 96, Anerley Park, Anerley, S.E.
Littlewood, Dr. Jas. B., Chief Examiner in Chemistry, Patent Office, Washington, D.C., U.S.A.
Lyte, F. Maxwell, 17, Mentone Mansions, Fulham Road, London, S.W. March 4.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 3432. Passburg. Apparatus for drying pulverised, granular, and like material *in vacuo*.* Feb. 12.
,, 3443. Lee. Apparatus for boiling liquids. Feb. 12.
,, 3458. Mower and Bassett. Drying kilns. Feb. 12.
,, 3542. Hoddinott. Centrifugal separators. Feb. 13.
,, 3809. Clapham and Clapham. *See under* II.
,, 3954. Adams and Cannon. Kilns. Feb. 17.
,, 4245. Grossmann. Preventing corrosion of metallic vessels in the evaporation and storing of liquids. Feb. 21.
,, 4419. Lehmann. Drying substances containing volatile matters. Feb. 23.
,, 4473. Mills (Hendricks). Process of separating materials containing an admixture of moisture.* Feb. 23.
,, 4547. Cartwright. Surface apparatus for condensing, evaporating, or the like. Feb. 24.
[C.S.] 4271 (1905). Binder. Centrifugal extractors. Feb. 28.
,, 5663 (1905). Hinze. *See under* XVI.
,, 6185 (1905). Mower. Treating fumes escaping from furnaces for the recovery of valuable constituents. Feb. 21.
,, 6916 (1905). Brown. Distilling and condensing apparatus. Feb. 21.
,, 8814 (1905). Johnson (Matcham). Coolers for powdered or granular material. Feb. 28.
,, 10,617 (1905). Rudge-Whitworth, Ltd., Pugh and Heathcote. Method of ascertaining the temperature of heated articles. Feb. 21.
,, 10,875 (1905). Aktiebolaget Separator. Centrifugal separating apparatus. Feb. 28.
,, 13,492 (1905). Brewtnall. Apparatus for cooling and heating. Feb. 21.

[C.S.] 17,457 (1905). Warren. Rotary kilns. Feb. 28.
,, 19,209 (1905). Lake (Aktiebolaget Separator). Centrifugal separators. Feb. 21.
,, 24,186 (1905). Ray. Evaporating apparatus. Feb. 21.
,, 25,871 (1905). Messinger and Popper. Drying process and apparatus therefor. Feb. 21.

II.—FUEL, GAS, AND LIGHT.

[A.] 20,445A (1905). Wesselsky. Gas generator. Feb. 21.
,, 3417. Schatz. *See under* XXIII.
,, 3456. British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Filaments for incandescent electric lamps. Feb. 12.
,, 3509. Iseki. Filament for incandescent lamps.* Feb. 13.
,, 3570. Winand. Elimination of carbon dioxide from the combustion products of internal combustion engines. [Ger. Appl., Feb. 18, 1905.]* Feb. 13.
,, 3637. Seymour. Coke ovens. Feb. 14.
,, 3684. Just, Hanaman, Landesberger, Salzmann, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Feb. 14.
,, 3695. Forbes. Preparation of calcium carbide. Feb. 14.
,, 3730. Parker. Manufacture of coal gas and apparatus therefor. Feb. 15.
,, 3809. Clapham and Clapham. Apparatus for extracting tarry or like substances from gases. Feb. 16.
,, 3816. Lynde. Apparatus for generating gas. Feb. 16.
,, 3870. Pistorius. Manufacture of lighting gas and dense coke from coal dust.* Feb. 16.
,, 3998. Prout. Manufacture of peat fuel. Feb. 17.
,, 4077. Müller. Power gas producers.* Feb. 19.
,, 4081. Just, Hanaman, Landesberger, Salzmann, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Feb. 19.
,, 4119. Ingrey, Bartlett and Maclure. Production of acetylene. Feb. 19.
,, 4230. Holmes, Holmes and Cameron. Apparatus for extracting tar from illuminating gas.* Feb. 20.
[C.S.] 24,242 (1904). Arzt and Baron. Gas for illuminating and heating purposes. Feb. 21.
,, 27,397 (1904). Central Torfkohlen Ges. Manufacture of peat fuel. Feb. 28.
,, 4917 (1905). Whitfield. Suction gas producer plant. Feb. 21.
,, 4921 (1905). Buchanan. Gas furnaces for charcoal and like kilns. Feb. 28.
,, 11,949 (1905). Just, Hanaman, and Verein. Elektricitäts A.-G. Manufacture of filaments for electric incandescent lamps. Feb. 21.
,, 21,447 (1905). Woodall and Duckham. Vertical retorts for the destructive distillation of coal. Feb. 28.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 3892. Thompson (Soc. d'Eclairage et de Chauffage par les procédés A. Guy). Apparatus for the vaporisation of petrol and other oils for the production of carburetted air.* Feb. 16.
,, 4427. Coulson. Process of solidifying tar.* Feb. 23.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 3449. Arnold, Fox, Scott and Roberts. Manufacture of nitro compounds. Feb. 12.
,, 3506. Hirschberger, Hoffa, and Levinstein, Ltd. New colouring matter and the production thereof. Feb. 13.
,, 4097. Ransford (Cassella und Co.). New sulphur colours and process for making same. Feb. 19.
[C.S.] 5449 (1905). Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of a yellow sulphur dye. Feb. 21.
,, 11,066 (1905). Meyenberg, Allpass, and Clayton Aniline Co., Ltd. Manufacture of sulphur colouring matters. Feb. 28.
,, 13,804 (1905). Ransford (Cassella und Co.). Manufacture of polyazo colours. Feb. 21.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 3549. Lake (Linkmeyer). Manufacture of artificial silk.* Feb. 13.
,, 3566. Linkmeyer. Recovery of oxide of copper in the manufacture of artificial silk. [Belg. Appl., April 5, 1905.]* Feb. 13.
,, 3709. Kay and McGregor. Printing textile fabrics. Feb. 15.
,, 4073. Meister, Lucius und Brüning. Manufacture of ketone sulphoxylates. [Ger. Appl., Sept. 30, 1905.]* Feb. 19.
,, 4121. Keffel and Meinel. Manufacture of a waterproof washable material of velvety appearance.* Feb. 19.
,, 4461. Innes-Baillie. Process of degumming ramie and other grasses or fibres. Feb. 23.
,, 4569. Feder. Manufacture of moisture-proof fabrics.* Feb. 24.
,, 4595. Zürcher. Method for painting fabrics.* Feb. 24.
,, 4597. Lilienfeld. Producing glossy or silky effects on fabrics or other materials. Feb. 24.
[C.S.] 4211 (1905). Burdick. Colouring or decorating fabrics, paper, or other materials. Feb. 28.
,, 4644 (1905). Lemaire and Lemaire. Utilisation of waste fibres in the manufacture of linen thread. Feb. 28.
,, 7231 (1905). Riep and Bauer. Manufacture of a wool lubricant soluble in and readily washed out by water. Feb. 28.
,, 15,532 (1905). Venter. Apparatus for dyeing, mordanting, or bleaching loose materials, spun threads, cops, knitted goods and the like. Feb. 28.
,, 21,937 (1905). Lake (Leontieff). Dyeing vats. Feb. 28.

VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

[C.S.] 4211 (1905). Burdick. *See under* V.
,, 13,507 (1905). Wood. Wallpaper printing machines. Feb. 28.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 3536. Ponthus. Manufacture of a double acetate of copper and lime. [Fr. Appl., Aug. 31, 1905.]* Feb. 13.
,, 3583. Moscicki. *See under* XI.
,, 3680. Det Norske Aktieselskab f. Elektrokemisk Ind., and Halvorsen. Production of concentrated nitric and sulphuric acids from nitrosulphonic acid and nitrous sulphuric acid. [Appl. in Norway, Feb. 15, 1905.]* Feb. 14.

[A.] 3905. Applegarth and Quain. Production of ozone. Feb. 16.

„ 3994. Lance and Elworthy. Recovery of sulphurous acid and carbonic acid in the treatment of sulphurous ores or compounds or sulphates, and method of producing nitrogen. [Fr. Appl., Feb. 18, 1905.]* Feb. 17.

„ 4063. Krell. Tubes for concentrating acid.* Feb. 19.

„ 4199. Brunet. *See under* XIIIA.

„ 4219. Johnson (Badische Anilin und Soda Fabrik) Production of nitrites.* Feb. 20.

„ 4409. Lance and Elworthy. Synthetic production of ammonia, cyanogen, and nitrogen compounds generally. [Fr. Appl., Feb. 22, 1905.]* Feb. 22.

„ 4502. Clemm. Manufacture of alkali thiosulphate and alumina from alkali sulphate and bauxite or similar aluminiferous material. Feb. 23.

[C.S.] 2463 (1905). Piva. Process for treating leucite and substances containing the same. Feb. 21.

„ 26,435 (1905). Soc. l'Air Liquide. Liquefying atmospheric air in several portions differing in composition. Feb. 21.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 4399. Thame and Cornell. Process for treating china clay. Feb. 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 3655. Jeroch, and Deutsche Ferrit-Cement Ges. Manufacture of cement. [Ger. Appl., Sept. 28, 1905.]* Feb. 14.

„ 3755. Jacobs. Production of a preservative for wood, metal and the like.* Feb. 15.

„ 3897. Zimmermann. Manufacture of artificial wood. Feb. 16.

„ 4486. Salomon. Production of weather-proof and non-inflammable timber.* Feb. 23.

„ 4503. Johnson (Koepp und Co.). Manufacture of stucco. Feb. 23.

[C.S.] 3617 (1905). Colloseus. Manufacture of cement from furnace slag. Feb. 28.

„ 14,329 (1905). Colloseus. *See under* X.

X.—METALLURGY.

[A.] 3528. Day. Process and apparatus for smelting ores and converting mattes.* Feb. 13.

„ 3575. Mills (Seigle). Extraction of gold, platinum, silver, nickel, copper and other metals. Feb. 13.

„ 3743. Woods and Schmidt. Recovery and separation of refuse metals and machinery therefor. Feb. 15.

„ 3901. Brinton. Process of treating manganese steel.* Feb. 16.

„ 3906. Steinhart and Vogel. Treatment of tin ores. Feb. 16.

„ 3978. Cook. Metallurgical processes. Feb. 17.

„ 4008. Isherwood. Extraction of zinc from zinc ores. Feb. 17.

[C.S.] 25,116 (1904) Moore. Apparatus for separating particles of gold and other metals from the gangue with which they are associated. Feb. 28.

„ 2532 (1905). Rumbold, Patchin and Hughes. Treatment of complex sulphide and oxidised ores for the recovery of zinc, nickel, cobalt, and manganese oxides, and of copper, arsenic, lead, bismuth, cadmium and tin. Feb. 21.

„ 2619 (1905). Gutensohn. Extraction of metals from ores and waste material. Feb. 21.

[C.S.] 3619 (1905). Colloseus. *See under* IX.

„ 6290 (1905). Wagner. Alloy. Feb. 21.

„ 13,141 (1905). Hoffmann. Manufacture of a substance for improving steel. Feb. 28.

„ 14,329 (1905.) Colloseus. Apparatus for pulverising blast furnace slag. Feb. 28.

„ 21,839 (1905). Saunders, and S. O. S. Synd., Ltd. Separation of metals from their ores. Feb. 28.

„ 23,592 (1905). Henning. Manufacture of foundry pig iron. Feb. 28.

„ 26,263 (1905). Frodingham Iron and Steel Co. Ltd., and Mannaberg. Blast furnaces. Feb. 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 3455. British Thomson-Houston Co., Ltd. (General Electric Co.). Magnetic material for electrical purposes. Feb. 12.

„ 3583. Moscicki. Apparatus for producing nitric oxides by electricity.* Feb. 13.

„ 3990. McCarty. Process for decomposing water by electrolysis. Feb. 17.

„ 4335. Bingham. Electric furnaces. Feb. 22.

„ 4336. Bingham. Electric furnaces. Feb. 22.

„ 4405. Weill. Apparatus for electroplating. Feb. 22.

„ 4519. Dolphin. Electrolytic deposition of copper. Feb. 24.

[C.S.] 778 (1905). Bloxam (Polzeniusz). Manufacture of accumulator plates. Feb. 28.

„ 5984 (1905). Price, Cox and Marshall. Electric furnaces and electrodes for use therein. Feb. 21.

„ 6790A (1905). Potthoff. Electroplating apparatus. Feb. 28.

„ 13,427 (1905). Kitsee. Secondary batteries. Feb. 21.

„ 13,689 (1905). Gardner (Thoresen and Tharaldsen). Deviating or drawing out electric arcs or discharges applicable to apparatus for the treatment of gases. Feb. 28.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 3521. Middleton, Iveson and Wilson. Cooling melted fats or fatty substances or the like. Feb. 13.

„ 4116. Wallbaum. Preparation of easily and durably emulsifiable fatty substances.* Feb. 19.

„ 4290. Harris. Process for purifying tallows. Feb. 21.

„ 4462. Innes-Baillie. Manufacture of soap. Feb. 23.

„ 4481. Lanza and Lanza. Process and apparatus for extracting olein and stearine from fatty acids. [Ital. Appl., Feb. 23, 1905.]* Feb. 23.

[C.S.] 3602 (1905). James (Roth). Apparatus for the rapid cooling of fluid soaps. Feb. 28.

„ 12,784 (1905). Perez y Garcia. Apparatus for heating oils and fats. Feb. 21.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A.)—PIGMENTS, PAINTS.

[A.] 3446. Lance and de Joannis. Manufacture of paint material. [Fr. Appl., Feb. 16, 1905.]* Feb. 12.

„ 4199. Brunet. Obtaining lithopone from complex ores and other substances.* Feb. 20.

„ 4533. Leishman. Waterproofing composition applicable as a vehicle for pigments.* Feb. 24.

[C.S.] 12,998 (1905). Van der Schuijt, Kuntze and Overman. Process for preparing white paint. Feb. 21.

„ 16,787 (1905). Ruch. Manufacture of paints, varnishes and the like. Feb. 21.

(*B.*)—RESINS, VARNISHES.

[A.] 3563. Seeser. Manufacture of coverings for floors, walls, ceilings and the like.* Feb. 13.

„ 3788. Baringer. Process for rendering manilos copal, sandarach and like resinous substances insoluble in oil. [Ger. Appl., Feb. 25, 1905.]* Feb. 15.

[C.S.] 16,787 (1905). Ruch. *See under* XIIIA.

(*C.*)—INDIA-RUBBER.

[A.] 3416. Hood. Method and machine for purifying crude and reclaimed rubber and the like.* Feb. 12.

„ 3889. Grätz. Preparation of rubber for vulcanisation.* Feb. 16.

„ 4002. Penther. Process and apparatus for separating caoutchouc from fibrous materials.* Feb. 17.

„ 4307. Spencer and von Romocki. Treatment of india rubber. Feb. 21.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 3450. Arnold, Fox, Scott and Roberts. Manufacture of a colloidal material. Feb. 12.

„ 3516. Oakes. Process of treating hides. [U.S. Appl., March 31, 1905.]* Feb. 13.

„ 4122. Ohr and Schlegel. Method of protecting gelatin from the influence of moisture and heat.* Feb. 19.

„ 4561. Jensen. Composition for preserving leather.* Feb. 24.

„ 4570. Sadikoff. Manufacture of glue.* Feb. 24.

[C.S.] 21,443 (1905). Schowalter. Preparation for preserving and waterproofing leather. Feb. 21.

XV.—MANURES, ETC.

[A.] 3344. Harper. *See under* XVIIIB.

[C.S.] 10,023 (1905). Van Haeften. Apparatus for treating peat, particularly for making manures. Feb. 21.

XVI.—SUGAR, STARCH, GUM, ETC.

[C.S.] 5663 (1905). Hinze. Apparatus for lixiviating and washing sugar and other substances. Feb. 28.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 3786. Reul and Grund. Preparation of yeast. Feb. 15.

„ 3885. Reid, Le May, Christian and Adlam. Process of treating stout, beer, cider and other fermented liquids. Feb. 16.

„ 4274. Whitehouse and Beetlestone. Alcohol separation process. Feb. 21.

„ 4552. Hellwig. Preparing and filtering beer wash. Feb. 24.

[C.S.] 5845 (1905). Fränkel. Production of pure diastase. Feb. 21.

„ 13,834 (1905). Gothard. Treatment of yeast to render it suitable for commercial purposes. Feb. 28.

„ 21,754 (1905). Schrottky. Manufacture from grain of a material for use in brewing and for other purposes. Feb. 21.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

[A.] 3938. Loring. Fixation or addition of nitrogen to alimentary substances. Feb. 17.

„ 4365. Makin. Preparation of foods from yeast. Feb. 22.

„ 4403. Risberg. Manufacture of butter in centrifugal apparatus.* Feb. 22.

[C.S.] 4351 (1905). Hatmaker. Preservation of animal tissues. Feb. 21.

„ 12,112 (1905). Hudson. Manufacture of flour and apparatus therefor. Feb. 28.

„ 12,956 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of silk fibroin peptone. Feb. 21.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 3444. Harper. Economic disposal of effluent from septic tanks for soil fertilisation.* Feb. 12.

„ 4537. Broadbent and Broadbent. Means for treating trade effluents. Feb. 24.

[C.S.] 7521 (1905). Brodie. Treatment of the clinker from refuse destructor furnaces. Feb. 21.

„ 12,797 (1905). Ramsden. Sludge separating tanks for sewage and like liquids. Feb. 28.

„ 24,435 (1903). Krüger. Water purifying apparatus. Feb. 21.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 4304. Dobler. Apparatus for impregnating paper and card in a paper making machine during its manufacture.* Feb. 21.

„ 4541. Sanguinetti. Oscillating cylindrical pulp strainers. Feb. 24.

„ 4577. Annison and Oliver. *See under* XXII.

[C.S.] 4211 (1905). Burdick. *See under* V.

„ 5766 (1905). Topham. Apparatus for filtering or pumping and regulating the flow of solutions of cellulose and the like. Feb. 28.

„ 10,880 (1905). Boult (Moritz and Moritz). Paper making apparatus. Feb. 21.

„ 14,385 (1905). Gagedois. Production of white pulps from natural vegetable matter or from coloured or dyed waste material for use in paper making. Feb. 21.

„ 1182 (1906). Soc. Franç. de la Viscose. Cellulose product and process of manufacturing same. Feb. 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 3367. Ewan and Young. Manufacture of guanidine salts. Feb. 12.

„ 4029. Seipermann and Fairweather. Manufacture of saccharin. Feb. 19.

„ 4050. Seipermann and Fairweather. Manufacture of saccharin and its salts. Feb. 19.

[C.S.] 2304 (1905). Oberländer, and Alliance Chemical Co. Manufacture of *o*-toluenesulphochloride. Feb. 21.

„ 11,058 (1905). Sommer. Production of anhydrides of organic acids. Feb. 21.

„ 12,843 (1905). Cooper (Bayer und Co.). Manufacture of new esters of aminoalcohols, and of salts thereof. Feb. 28.

„ 16,723 (1905). Ellis (Chem. Fabr. von Heyden, A.-G.). Manufacture of guaiacol sulphonic acids and of salts thereof. Feb. 21.

[A.] 3905. Applegarth and Quain. Production of ozone. Feb. 16.

„ 3994. Lance and Elworthy. Recovery of sulphurous acid and carbonic acid in the treatment of sulphurous ores or compounds or sulphates, and method of producing nitrogen. [Fr. Appl., Feb. 18, 1905.]* Feb. 17.

„ 4063. Krell. Tubes for concentrating acid.* Feb. 19.

„ 4199. Brunet. *See under* XIIIA.

„ 4219. Johnson (Badische Anilin und Soda Fabrik) Production of nitrites.* Feb. 20.

„ 4409. Lance and Elworthy. Synthetic production of ammonia, cyanogen, and nitrogen compounds generally. [Fr. Appl., Feb. 22, 1905.]* Feb. 22.

„ 4502. Clemm. Manufacture of alkali thiosulphate and alumina from alkali sulphate and bauxite or similar aluminiferous material. Feb. 23.

[C.S.] 2463 (1905). Piva. Process for treating leucite and substances containing the same. Feb. 21.

„ 26,435 (1905). Soc. l'Air Liquide. Liquefying atmospheric air in several portions differing in composition. Feb. 21.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 4399. Thame and Cornell. Process for treating china clay. Feb. 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 3655. Jeroch, and Deutsche Ferrit-Cement Ges. Manufacture of cement. [Ger. Appl., Sept. 28, 1905.]* Feb. 14.

„ 3755. Jacobs. Production of a preservative for wood, metal and the like.* Feb. 15.

„ 3897. Zimmermann. Manufacture of artificial wood. Feb. 16.

„ 4486. Salomon. Production of weather-proof and non-inflammable timber.* Feb. 23.

„ 4503. Johnson (Koepp und Co.). Manufacture of stucco. Feb. 23.

[C.S.] 3617 (1905). Colloseus. Manufacture of cement from furnace slag. Feb. 28.

„ 14,329 (1905). Colloseus. *See under* X.

X.—METALLURGY.

[A.] 3528. Day. Process and apparatus for smelting ores and converting mattes.* Feb. 13.

„ 3575. Mills (Seigle). Extraction of gold, platinum, silver, nickel, copper and other metals. Feb. 13.

„ 3743. Woods and Schmidt. Recovery and separation of refuse metals and machinery therefor. Feb. 15.

„ 3901. Brinton. Process of treating manganese steel.* Feb. 16.

„ 3906. Steinhart and Vogel. Treatment of tin ores. Feb. 16.

„ 3978. Cook. Metallurgical processes. Feb. 17.

„ 4008. Isherwood. Extraction of zinc from zinc ores. Feb. 17.

[C.S.] 25,116 (1904) Moore. Apparatus for separating particles of gold and other metals from the gangue with which they are associated. Feb. 28.

„ 2532 (1905). Rumbold, Patchin and Hughes. Treatment of complex sulphide and oxidised ores for the recovery of zinc, nickel, cobalt, and manganese oxides, and of copper, arsenic, lead, bismuth, cadmium and tin. Feb. 21.

„ 2619 (1905). Gutensohn. Extraction of metals from ores and waste material. Feb. 21.

[C.S.] 3619 (1905). Colloseus. *See under* IX.

„ 6290 (1905). Wagner. Alloy. Feb. 21.

„ 13,141 (1905). Hoffmann. Manufacture of a substance for improving steel. Feb. 28.

„ 14,329 (1905.) Colloseus. Apparatus for pulverising blast furnace slag. Feb. 28.

„ 21,839 (1905). Saunders, and S. O. S. Synd., Ltd. Separation of metals from their ores. Feb. 28.

„ 23,592 (1905). Henning. Manufacture of foundry pig iron. Feb. 28.

„ 26,263 (1905). Frodingham Iron and Steel Co. Ltd., and Mannaberg. Blast furnaces. Feb. 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

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„ 4533. Leishman. Waterproofing composition applicable as a vehicle for pigments.* Feb. 24.

Official Notices.

EXTRAORDINARY GENERAL MEETING OF THE SOCIETY.

Notice is hereby given that an Extraordinary General Meeting of the Society will be held at 3.30 o'clock, precisely, in the afternoon of Tuesday, the twenty-seventh day of March, 1906, at the House of the Society of Arts, John Street, Adelphi, W.C., by kind permission of the Council of that Society, with the object of considering and adopting the resolution mentioned in the Requisition hereinafter set forth:—

"To the President and Council of the Society of Chemical Industry."

We, the undersigned Members of the Society of Chemical Industry, hereby request that, in accordance with Bye-Law 40, you will convene an Extraordinary General Meeting of the Society with the object of considering, and if approved by the said Extraordinary Meeting, of adopting the following resolution (that is to say):—

Resolution.

"That it is desirable that the Society of Chemical Industry as now existing should be incorporated under and subject to the grant of a Royal Charter and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation."

Dated this twenty-second day of December, 1905.

Here follow signatures of the following:—

George Beilby.	Henry de Mosenthal.
V. G. Bloede.	Prof. Chas. E. Munroe.
Jas. H. Bowman.	Jas. P. Murray.
Eugene A. Byrnes.	Robert W. Neff.
Eustace Carey.	A. L. Norton.
Prof. Frank Clowes.	D. H. T Peploe.
Frederick P. Dewey.	Dr. W. H. Perkin.
Dr. Edward Divers.	Dr. Frederick B. Power.
Dr. A. R. L. Dohme.	Sir William Ramsay.
Thos. Fairley.	Sir Boverton Redwood.
Dr. Fred. W. Frerichs.	Walter F. Reid.
Oscar Guttmann.	President Ira Remsen.
Samuel Hall.	Sir Henry E. Roscoe.
Jas. Otis Handy.	George D. Rosengarten.
Dr. B. J. Harrington.	Dr. Samuel P. Sadtler.
Dr. Edward Hart.	Alfred Gordon Salamon.
Otto Hehner.	Dr. Karl F. Stahl.
E. Grant Hooper.	H. E. Stuart.
David Howard.	Sir Joseph W. Swan.
H. Aug. Hunicke.	H. P. Talbot.
C. C. Hutchinson.	M. J. Taylor.
Prof. Edward H. Keiser.	E. C. Thompson.
Prof. W. R. Lang.	Dr. T. E. Thorpe.
Ivan Levinstein.	Prof. W. A. Tilden.
Arthur R. Ling.	Thos. Tyrer.
Anthony McGill.	John H. Usmar.
Edward Mallinckrodt.	W. H. Van Winckel.
N. H. Martin.	S. S. Voorhees.
Prof. R. Meldola.	Dr. W. H. Walker.
Dr. Rudolph Messel.	R. A. Wallace.
Dr. W. Lash Miller.	Charles Wightman.
Dr. Ludwig Mond.	Dr. H. W. Wiley.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906.

The attention of Members is drawn to the Notice which accompanied the February 15th issue of the Journal.

The General Secretary will be obliged if those members, who have made arrangements directly with the Congress Committee in Rome, will forward their names to the Society, in order that arrangements may be made for a headquarters in Rome and for combined travelling. It would also be of service if they would indicate their contemplated date of departure and proposed route, and also whether they have a preference for any particular hotel in Rome.

Deaths.

Donald, Jas., 96, Anerley Park, Anerley, S.E.

Littlewood, Dr. Jas. B., Chief Examiner in Chemistry, Patent Office, Washington, D.C., U.S.A.

Lyte, F. Maxwell, 17, Mentone Mansions, Fulham Road, London, S.W. March 4.

Nottingham Section.

Meeting held at Derby on Wednesday, January 24th, 1906.

Mr. J. M. C. Paton in the Chair.

NOTES ON FOAMING GLUE.

By H. J. Watson.

The paper on this subject by Trotman and Hackford at the last meeting of this Section having given rise to some interesting discussion, it was thought that some notes, the results of some experiments, performed quite independently and without knowledge of their work, would prove an interesting adjunct to their paper.

The evils of foaming glues are well known to those connected with the trade, for, although a glue may in every other respect be excellent, it will be immediately condemned for many purposes if it foams. Among the various causes to which foaming in glue is attributed are the following:—(1) The presence of free alkali or alkaline earth; (2) Free acidity; (3) The addition of zinc compounds; (4) Prolonged heating either in open pans or under pressure; (5) the presence of mucin pointed out by Rideal. It was with the object of throwing further light on the cause of foaming that a series of experiments were commenced. A difficulty experienced at the outset was the absence of a reliable comparative test, by which the amount of foam produced by a glue could be measured with any degree of accuracy.

The following is the method usually described in text books:—"A 10 to 20 per cent. solution of glue is stirred with an egg-beater or glass rod for a few seconds; the height of the foam is measured in inches." No test could be more vaguely described, and more useless. This being so, the method communicated to the discussion on Trotman and Hackford's paper was devised (see this J., Feb. 15, pages 108—9), and has been used in the experiments described in these notes.

(1) *The effect of free alkali.*—For this experiment a sample of British-made bone glue was used. When broken up, two quantities of 5 grms. each were weighed out; to one 5 c.c. and to the other 10 c.c. of N/5 sodium hydroxide solution were added, and both were then subjected to the foam test with the following result:—

Table I.

Weight of glue taken in grms.	c.c. of N/5 sodium hydroxide added.	Made up to c.c.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
5	—	50	73	45	28
5	5	50	78	45	33
5	10	50	80	45	35

It does not appear from the result of this experiment that the presence of free alkali materially increases the amount of foam, the amount present being considerably more than would be found in an ordinary sample of glue, but it is believed that it would tend to produce foam in two ways if present in the material from which the glue was made, or if added in the course of extraction. First, it would combine with any grease to form a soap, and,

secondly, it would assist in the formation of gelatone, the effect of which is dealt with later on.

(2) *The effect of free acidity.*—Using the same sample of glue to test the effect of free acid in glue, the results, which will be given in Table II., were obtained :—

TABLE II.

Weight of glue taken in grms.	Substance added.	Made up to c.c.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
5	5 c.c. N/5 H_2SO_4	50	75	45	30
5	10 c.c. N/5 H_2SO_4	50	90	45	45
5	5 c.c. H_2SO_3 ·75% SO_2.	50	86	45	41

As in the case of free alkali, the acidity is higher than would be expected in an ordinary sample of glue, so that free acidity can hardly be considered as tending to produce foaming in glue. It has been found, however, as will be seen from the following experiments, that sulphurous acid, sometimes used as a preservative and bleaching agent, does, as one would expect, tend to increase the foam, though not considerably. Four sample cakes of glue were obtained as follows :—(1) Bleached with sulphurous acid (boric acid present); (2) Unbleached (boric acid present); (3) Bleached (boric acid absent); (4) Without bleaching or boric acid. 5 grms. of each subjected to the foam test gave the following results :—

TABLE III.

No.	Weight of glue taken in grms.	Made up to c.c	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
1	5	50	82	45	37
2	5	50	77	45	32
3	5	50	80	45	35
4	5	50	76	45	31

Boric acid appears to have little or no influence on the amount of foam produced.

(3) *The effect of zinc compounds.*—Zinc sulphate appears to lengthen the time required for the foam to die away.

(4) *The effect of heat.*—500 c.c. of a 10 per cent. solution of glue, 50 c.c. of which gave 28 c.c. of foam, was kept at a temperature of 180° F. for seven hours. At the end of the first hour 50 c.c. taken out gave 30 c.c. of foam; after three hours 33 c.c. of foam, and after seven hours 37 c.c. of foam. A gradual increase in the amount of foam is produced as the period under heat is lengthened. 500 c.c. of a 10 per cent. solution of glue having a foam test of 22 c.c. was made. This was also kept at a temperature of 180° F. for seven hours with similar results. After the first hour there were 24 c.c. of foam, after the second 27 c.c. of foam, at the end of seven hours 32 c.c. of foam.

From these results it appears that heat must be a very important factor in producing foam, and further experiments confirm this.

A sample of glue-size was taken at a stage in the process of manufacture where the period under heat had only been short. A portion was made into a 10 per cent. solution, no preservative being present. 50 c.c. of this solution subjected to the foam test gave only 20 c.c. of foam which rapidly died away. After further treatment with boric acid and bleaching 50 c.c. of a 10 per cent. solution gave 25 c.c. of foam. The glue-size then underwent a further period of heating for concentration, and, when a sample was diluted to a 10 per cent. solution, it registered as much as 45 c.c. of foam. Other sample cakes of glue made from glue-size, taken at the early stage of the process of manufacture as in the last experiment, were then tested in the usual way; 5 grms., made up to 50 c.c., gave 20 c.c. of foam which soon disappeared. Sample cakes obtained from the final stage of the process tested in the same way, gave 42 c.c. of foam.

Heat, then, appears to be the all-important factor in producing foaming glue; the prolongation of the time under heat in the process of manufacture only tends to produce foaming glue, and the manufacturer who succeeds in reducing the period under heat to the shortest possible will, in all probability, produce the least foaming glue. It would be a rather difficult problem to manufacture glue without heat, but I am convinced that by careful attention and improved methods of manufacture the amount of foam in glue could be reduced to a minimum.

The next question to consider was, in what way does heat tend to bring about foaming? The only theory which seems to suggest itself as a probable explanation is that, under the continued influence of heat, hydrolysis of the gelatin (first formed from the collagen of the material operated upon) to gelatone must take place. Trotman and Hackford have shown that, under the influence of heat, the nitrogen precipitated by zinc sulphate decreases, and what they term peptone, or gelatone, nitrogen increases; and it has been shown in this paper that the foam also increases, so that it would appear reasonable to conclude that gelatone is the principal foam-producing substance in glue.

Gelatone not being obtainable, the analogous substance, peptone, was used in some experiments.

Five grms. of dry peptone, treated like a sample of glue in the foam test, gave so much foam that it was impossible to measure it.

Experiments were then made by adding to glue varying quantities of dry peptone and estimating the amount of foam produced with the following results :—

TABLE IV.

The effect of peptone.

Weight of glue taken in grms	Peptone added in grms.	Made up to c.c.	c.c. to top of foam.	c.c to top of solution.	c.c. foam.
5	0·02	50	78	45	33
5	0·05	50	85	45	40
5	0·10	50	93	45	48
5	0·50	50	above 100	45	above 55

Peptone and gelatone being analagous substances it appears reasonable that gelatone would act in a similar manner to peptone in producing foam.

(5) *The presence of Mucins.*—If gelatones were the only foam-producing substance in gelatin or glue, one would expect to find a proportional relation between the gelatone nitrogen of glue and the amount of foam produced; generally speaking, this is so, but exceptions have been found, as will be seen on reference to the following table :—

TABLE V.

No.	Total nitrogen as gelatin.	Gelatin by $ZnSO_4$	Gelatone N by difference as gelatin.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
1	78·26	58·53	19·73	95	45	50
2	79·56	72·19	7·37	73	45	28
3	78·26	72·19	6·87	78	45	25
4	74·36	61·89	12·47	83	45	38

Nos. 1 and 4 were known to be prepared from material which underwent little or no preparation prior to boiling, while Nos. 2 and 3, though going through the same boiling process, were made from prepared material—No. 3 receiving rather better cleansing than No. 2. The presence of mucins would explain this difference, and confirmation has been obtained on this point by adding to solutions of glue, varying quantities of wash waters from the cleansing operations, and estimating the foam produced; with increasing quantities of wash water there was a corresponding increase in the amount of foam.

Grease as a foam-producing factor has not been experimented with, because, with the improved methods of degreasing material, it is very rarely that one comes across grease in glue in these days.

Conclusions.—By the selection of good material and

subjecting it to thorough degreasing and cleansing operations, and then reducing the period under heat to the shortest possible, it is thought that a glue would be obtained that would be practically foam free; but even if the material be well prepared and the boiling operations neglected one must be prepared to find foaming glue resulting.

Over a large range of samples from various sources, British and foreign, no sample of glue has been found to be foam free by my test.

Journal and Patent Literature.

I.—PLANT, APPARATUS & MACHINERY.

(*Continued from page* 168.)

English Patent.

Separators for liquids; Centrifugal ——. Aktiebolaget Separator and E. A. Forsberg, Stockholm. Eng. Pat. 21,190, Oct. 18, 1905.

The claim is for a separator in which the relative proportions of the separated liquids can be regulated by resistances which are adjustable from the outside of the bowl. The resistances consist of strips, wings, &c., placed between the inner wall of the bowl and the liner, between the bowl and the upper plate, or in the space between the bowl and the top disc.—W. H. C.

United States Patents.

Drying-machine. J. H. Lorimer, Philadelphia, Pa. U.S. Pat. 811,306, Jan. 30, 1906.

The material to be dried is carried between a pair of endless bands or aprons of open-work through a chamber through which air circulates. The bands have sprocket chains at their edges which pass over guide-wheels at either end of the chamber, where they are slightly separated to allow of the supply or discharge of the material being treated. The bands travel backwards and forwards within the chamber, and the upper band is prevented by guides fixed to the walls of the chamber from pressing too heavily upon the lower one which carries the material. —W. H. C.

Drying and Conditioning machine. J. H. Lorimer, Philadelphia, Pa. U.S. Pat. 811,307, Jan. 30, 1906.

A drying and a conditioning chamber are placed end to end and the materials to be treated are passed through them in succession, being carried on an endless band in a manner similar to that described in the preceding abstract. The drying and the conditioning mediums are circulated in each chamber independently.—W. H. C.

Furnace. T. Suzuki, Sunamura, Japan. U.S. Pat. 812,380, Feb. 13, 1906.

See Eng. Pat. 3015 of 1905; this J., 1905, 1054.—T. F. B.

Furnaces; Method of preserving the inner walls of ——. F. C. W. Timm, Hamburg. U.S. Pat. 812,619, Feb. 13, 1906.

See Fr. Pat. 353,566 of 1905; this J., 1905, 1020.—T. F. B.

French Patent.

Gaseous mixtures, especially the oxygen and nitrogen of the air; Apparatus for mechanically separating ——. E. F. M. Farcot. Fr. Pat. 358,397, Oct. 10, 1905.

The gaseous mixture is led into a box or chamber made in the form of a sector of a circle, the inlet being at the centre of the circle. This box is rapidly rotated, whereby, it is claimed, the lighter gas is carried round with it, whilst the heavier gas tends to collect in that portion rearmost to the direction of rotation.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 170.)

Power production; Modern —— and its relation to the coal resources of Great Britain. G. T. Beilby. Address to the Glasgow University Eng. Soc., Jan. 11, 1906.

At a moderate estimate there are in Great Britain steam engines and boilers with a yearly output of 5,000,000 h.p. which consume not less than 5 lb. of coal per i.h.p. hour or, roughly, 50,000,000 tons per annum (see this J., 1899, 643). The author advocates the use of gas engines and steam turbines whereby the coal consumption might be reduced to 1·5 lb. per i.h.p. hour, or a total of 12,000,000 tons. This would imply an annual saving of £9,800,000, whilst the cost of making the change in plant need not exceed £50,000,000, or, if the power is to be delivered as electricity, £60,000,000. The use of producer gas, such as Mond gas, in efficient internal combustion engines or the employment of steam turbines, gives a means of producing power in bulk as cheaply as at certain of the more important water-power stations in America and Europe. Apart from the gains to the individual manufacturer who consumes, and the engineer who supplies this power, the nation derives a great economic advantage by the conservation of its coal resources, more especially in view of the steadily increasing demand for power per head of the population, which, if it had to be met by the old wasteful system, would still further tax the coal resources. —R. L.

Bunsen flame; Study of the ——. W. Allner. J. Gasbeleucht., 1905, **48**, 1035-1041, 1057—1066, 1081—1086, 1107—1112.

Haber and Richardt (this J., 1904, 976) have shown that the temperature of the inner cone of a Bunsen flame (see this J., 1891, 992, 993) supplied with coal gas, may be calculated from the chemical composition of the products of combustion, by making use of the alteration of the constant k of the equilibrium $\frac{H_2O.CO}{CO_2.H_2}$ with the temperature. The author has extended this investigation to the cases of flames supplied with mixtures of: carbon dioxide and hydrogen, carbon monoxide and hydrogen, methane and hydrogen, methane, hydrogen and carbon dioxide, benzene and hydrogen, benzene, hydrogen and carbon dioxide, and pure benzene. In all these cases, except with the two first-mentioned mixtures, the temperature could be calculated from the composition of the products of combustion, but in the case of the benzene flame, it was found necessary to withdraw the combustion gases from the lower portion of the flame, since with such a hot flame (about 2000° C.) the equilibrium is displaced during the withdrawal of the gases through the cooling zone at the upper part of the inner flame. In the case of the mixtures of hydrogen with carbon dioxide and carbon monoxide respectively, it is probable that the temperatures produced are not sufficiently high for equilibrium to be attained in a short time.—A. S.

Auer burner; Radiation of the ——. H. Rubens. J. Gasbeleucht., 1906, **49**, 25—30.

The author examined the total emission spectra of the incandescent Auer mantle, the spectral region studied ranging from $\lambda = 0{\cdot}45\mu$ to $\lambda = 18\mu$. Measurements were made with an incandescent Auer mantle, the Bunsen flame,

secondly, it would assist in the formation of gelatone, the effect of which is dealt with later on.

(2) *The effect of free acidity.*—Using the same sample of glue to test the effect of free acid in glue, the results, which will be given in Table II., were obtained :—

TABLE II.

Weight of glue taken in grms.	Substance added.	Made up to c.c.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
5	5 c.c. N/5 H_2SO_4	50	75	45	30
5	10 c.c. N/5 H_2SO_4	50	90	45	45
5	5 c.c. H_2SO_3 ·75% SO_2.	50	86	45	41

As in the case of free alkali, the acidity is higher than would be expected in an ordinary sample of glue, so that free acidity can hardly be considered as tending to produce foaming in glue. It has been found, however, as will be seen from the following experiments, that sulphurous acid, sometimes used as a preservative and bleaching agent, does, as one would expect, tend to increase the foam, though not considerably. Four sample cakes of glue were obtained as follows :—(1) Bleached with sulphurous acid (boric acid present); (2) Unbleached (boric acid present); (3) Bleached (boric acid absent); (4) Without bleaching or boric acid. 5 grms. of each subjected to the foam test gave the following results :—

TABLE III.

No.	Weight of glue taken in grms.	Made up to c.c	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
1	5	50	82	45	37
2	5	50	77	45	32
3	5	50	80	45	35
4	5	50	76	45	31

Boric acid appears to have little or no influence on the amount of foam produced.

(3) *The effect of zinc compounds.*—Zinc sulphate appears to lengthen the time required for the foam to die away.

(4) *The effect of heat.*—500 c.c. of a 10 per cent. solution of glue, 50 c.c. of which gave 28 c.c. of foam, was kept at a temperature of 180° F. for seven hours. At the end of the first hour 50 c.c. taken out gave 30 c.c. of foam; after three hours 33 c.c. of foam, and after seven hours 37 c.c. of foam. A gradual increase in the amount of foam is produced as the period under heat is lengthened. 500 c.c. of a 10 per cent. solution of glue having a foam test of 22 c.c. was made. This was also kept at a temperature of 180° F. for seven hours with similar results. After the first hour there were 24 c.c. of foam, after the second 27 c.c. of foam, at the end of seven hours 32 c.c. of foam.

From these results it appears that heat must be a very important factor in producing foam, and further experiments confirm this.

A sample of glue-size was taken at a stage in the process of manufacture where the period under heat had only been short. A portion was made into a 10 per cent. solution, no preservative being present. 50 c.c. of this solution subjected to the foam test gave only 20 c.c. of foam which rapidly died away. After further treatment with boric acid and bleaching 50 c.c. of a 10 per cent. solution gave 25 c.c. of foam. The glue-size then underwent a further period of heating for concentration, and, when a sample was diluted to a 10 per cent. solution, it registered as much as 45 c.c. of foam. Other sample cakes of glue made from glue-size, taken at the early stage of the process of manufacture as in the last experiment, were then tested in the usual way; 5 grms., made up to 50 c.c., gave 20 c.c. of foam which soon disappeared. Sample cakes obtained from the final stage of the process tested in the same way, gave 42 c.c. of foam.

Heat, then, appears to be the all-important factor in producing foaming glue; the prolongation of the time under heat in the process of manufacture only tends to produce foaming glue, and the manufacturer who succeeds in reducing the period under heat to the shortest possible will, in all probability, produce the least foaming glue. It would be a rather difficult problem to manufacture glue without heat, but I am convinced that by careful attention and improved methods of manufacture the amount of foam in glue could be reduced to a minimum.

The next question to consider was, in what way does heat tend to bring about foaming? The only theory which seems to suggest itself as a probable explanation is that, under the continued influence of heat, hydrolysis of the gelatin (first formed from the collagen of the material operated upon) to gelatone must take place. Trotman and Hackford have shown that, under the influence of heat, the nitrogen precipitated by zinc sulphate decreases, and what they term peptone, or gelatone, nitrogen increases; and it has been shown in this paper that the foam also increases, so that it would appear reasonable to conclude that gelatone is the principal foam-producing substance in glue.

Gelatone not being obtainable, the analogous substance, peptone, was used in some experiments.

Five grms. of dry peptone, treated like a sample of glue in the foam test, gave so much foam that it was impossible to measure it.

Experiments were then made by adding to glue varying quantities of dry peptone and estimating the amount of foam produced with the following results :—

TABLE IV.

The effect of peptone.

Weight of glue taken in grms	Peptone added in grms.	Made up to c.c.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
5	0·02	50	78	45	33
5	0·05	50	85	45	40
5	0·10	50	93	45	48
5	0·50	50	above 100	45	above 55

Peptone and gelatone being analagous substances it appears reasonable that gelatone would act in a similar manner to peptone in producing foam.

(5) *The presence of Mucins.*—If gelatones were the only foam-producing substance in gelatin or glue, one would expect to find a proportional relation between the gelatone nitrogen of glue and the amount of foam produced; generally speaking, this is so, but exceptions have been found, as will be seen on reference to the following table :—

TABLE V.

No.	Total nitrogen as gelatin.	Gelatin by $ZnSO_4$	Gelatone N by difference as gelatin.	c.c. to top of foam.	c.c. to top of solution.	c.c. foam.
1	78·26	58·53	19·73	95	45	50
2	79·56	72·19	7·37	73	45	28
3	78·26	72·19	6·87	78	45	25
4	74·36	61·89	12·47	83	45	38

Nos. 1 and 4 were known to be prepared from material which underwent little or no preparation prior to boiling, while Nos. 2 and 3, though going through the same boiling process, were made from prepared material—No. 3 receiving rather better cleansing than No. 2. The presence of mucins would explain this difference, and confirmation has been obtained on this point by adding to solutions of glue, varying quantities of wash waters from the cleansing operations, and estimating the foam produced; with increasing quantities of wash water there was a corresponding increase in the amount of foam.

Grease as a foam-producing factor has not been experimented with, because, with the improved methods of degreasing material, it is very rarely that one comes across grease in glue in these days.

Conclusions.—By the selection of good material and

vided with a similar valve, 17, and 16. If it be desired that the gas should be permeated by the liquid in the form of a spray, spraying nozzles, 24, may be provided. —R. L.

Gases; Portable storage vessels for liquified ——. P. Heylandt, Erfurt, Germany. Eng. Pat. 17,884, Sept. 4, 1905.

Two concentric vessels which are connected together only at the neck are used, the liquefied gas being contained in the inner one and as perfect a vacuum as possible being maintained in the space between them. The inner vessel is made of porcelain or of some similar non-conducting material which is "air-tight, solid, and highly unsusceptible of very considerable change of temperature," while the outer vessel may be of the same or a similar material or of metal. The vessel is suspended, within an outer protecting case, by an elastic frame carried on trunnions by another frame similarly attached to the outer case, the whole suspending arrangement being similar to that used for suspending the mariners' compass, and known as a gimbal. The inner double vessel is consequently maintained in an upright position when the outer case is inclined. The neck of the inner vessel is bent outwardly and downwardly, in order to remove the joint between the two concentric vessels as far as possible from the influence of the cold, and it is covered by a metal cap with a central tubular opening closed by a plug of porous material. —W. H. C.

Mantles for gas burners; Incandescent — —. J. E. T. Woods, West Norwood. Eng. Pat. 8162, April 17, 1905.

A THIN wire, composed of an alloy of nickel, cobalt, tungsten, tin and copper, is covered with asbestos; the covered filament is woven into mantles, impregnated with glucinum chloride and a cerium salt, and baked a tover 600° F. to convert the salts into oxides.—H. B.

Tantalum wire; Incandescence bodies of — — *for electrical glow lamps.* Siemens und Halske Akt. Ges., Berlin. Eng. Pat. 18,403, Sept. 12, 1905. Under Int. Conv., Oct. 13, 1904.

SEE Addition to Fr. Pat. 321,412 of 1902; following these.—T. F. B.

UNITED STATES PATENTS.

Gas producers. C. Ellis. Assignor to Combustion Utilities Co., New York. U.S. Pat. 811,208, Jan. 30, 1906.

THE producer is constructed of a shell with a closed lower end forming the ash chamber; a partition across the chamber divides it into compartments, each containing a screw conveyor for removing the ash; an upwardly tapering baffle-wall extends across the shell above the partition and at an angle thereto; and blast tuyères, projecting through the sides of the shell, are directed against the baffle-wall.—H. B.

Gas; Apparatus for generating ——. B. E. Eldred and C. Ellis. Assignors to Combustion Utilities Co. New York. U.S. Pat. 811,706, Feb. 6, 1906.

THE claim is for the combination of a gas-producer with a water-gas generator. A regulated proportion of carbon dioxide from the flues of a steam boiler is mixed with the air supplied to the producer, and the products from the two generators can be mixed in any desired proportions by regulating valves fixed on the mains leading from the generators to the distributing main.—W. H. C.

FRENCH PATENTS.

Mantles [jute fabrics]; Incandescence ——. T. Schiefner. Fr. Pat. 358,252, Oct. 4, 1905.

JUTE is employed for the manufacture of mantle fabrics in the usual way.—H. B.

Incandescence electric lamps; Manufacture of ——. Siemens und Halske A.-G. First Addition, dated Sept. 14, 1905, to Fr. Pat. 321,412, May 26, 1902 (this J., 1903, 206).

IN order to harden a filament composed of tantalum, the metal is fused beforehand with the addition of a minute proportion of oxygen, hydrogen, carbon, silicon, aluminium, tin or titanium. For example, an addition of about 0·05 per cent. of carbon hardens the product considerably.—H. B.

Incandescence electric lamps; Manufacture of metallic conducting bodies [tungsten and molybdenum] for ——. A. Just, F. Hanaman, Ver. Elektrizitäts A.-G., H. Landesberger and I. Salzmann. Fr. Pat. 358,272, Oct. 4, 1905.

IN manufacturing filaments of tungsten or molybdenum, if the fused metal, which always contains some carbide, be used as starting material, it is first drawn into wires and these are then heated *in vacuo* by means of a progressively increasing current, so as to distil off the carbon and thus raise the fusing point of the filament. If the starting material be a reducible compound, such as the oxide or sulphide, it is made into a plastic mass by means of water or other volatile non-carbonaceous agglutinant, moulded into the desired form, and heated intensely in an atmosphere of hydrogen. If the pulverulent metal be used, it is first rendered plastic by mixing it with sulphur and a sufficiency of carbon bisulphide, or by heating it with sulphur till the latter becomes plastic; the plastic mass is moulded to the desired form, and heated in hydrogen, so that the sulphide first formed is reduced to the metallic state.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 172.)

Coal; Decomposition of —— *at relatively low temperatures.* E. Boernstein. Verh. d. Ges. Deutsch. Ntf. u. Aerzte, 1904, II. Theil., I. Hälfte, 141—142. Chem. Centr., 1906, 1, 497.

EXPERIMENTS were carried out with eight different Westphalian coals; from 3 to 5 kilos. of each were subjected to a kind of fractional distillation, the temperature being kept constant at certain points until the decomposition at such temperature was complete; the highest temperature attained in the experiments was 450° C. The distillation residues, although showing essential differences, were more nearly alike in composition than the original coals. The amounts of the aqueous distillates from the coals were in the same order as the "oxygen-numbers" of the raw materials; they contained small quantities of ammonia and hydrogen sulphide, and also catechol (except in the case of Shamrock bituminous coal—"Fettkohle"); phenol, on the other hand, was only present in one case, and then only in traces. The gaseous products of distillation did not exhibit differences corresponding with those shown by the different coals; compared with ordinary coal-gas, they were characterised by a higher content of heavy hydrocarbons (5—14 per cent.) and of methane and its homologues (55—76 per cent.), and a lower content of hydrogen (5—16 per cent.). Of the tars, seven had a specific gravity between 0·95 and 0·98, whilst the eighth had the sp. gr., 1·03. Their "hydrogen- and oxygen-numbers" corresponded roughly with those of the coals from which they were derived, and there was some relation between the "oxygen-numbers" and the content of higher phenols. The tars from the bituminous, gas, and flaming coals began to distil at about 70°—80° C., but the tar from a forge-coal only at 115° C.; they did not contain any aniline, thiophene, naphthalene or anthracene. The seven light tars contained quantities of paraffins (m. pt. 55°—60° C.) ranging from 0·3 to 2 per cent.; the eighth higher-boiling tar was free from paraffin, but from the fraction distilling at 375°—435° C. obtained from it, a small quantity of greenish-yellow crystals, probably isomethylanthracene was separated.—A. S.

Petroleum; Boryslaw crude ——. M. Wielezynski. Chem.-Zeit., 1906, **30**, 106—109.

THE analysis of 21 samples gave the following range of values:—Sp. gr. at 17·5° C., 0·8368—0·9634; yield of crude "benzine" (sp. gr. 0·750), 5·2—19 per cent.; petroleum distillate (sp. gr. 0·750—0·850), 37—51 per cent.; paraffin, 0·58—13·8 per cent. (though only three samples gave less than 6·5 per cent.). These figures, however, do not represent the commercial oil, which is warmed to facilitate the separation of dirt and water, and often also before piping, so that a considerable quantity of the light constituents is dissipated. The author concludes that though there are no great fluctuations in the composition of Boryslaw oil, which is, in the main, poor in light fractions ("benzine") and rich in paraffin, it cannot be regarded as homogeneous. Changes are even noticeable in the oil from one and the same well when the latter has been worked for some considerable time. Wells at lower levels produce oil richer in paraffin than those at higher levels, though in the latter the oil appears in association with ozokerite.—C. S.

Pseudocumene in Roumanian petroleum; Presence of ——. P. Poni. Ann. Scient. de l'Univ. de Jassy, **3**, 217—218. Chem. Centr., 1906, **1**, 459.

THE author has succeeded in identifying pseudocumene in Roumanian petroleum. It has previously been detected in the petroleums from Rangoon, Baku, Pennsylvania, Ohio, Caucasus, Pechelbronn (Alsace), Tarnow (Galicia), and Terro de Lavoro (Italy).—A. S.

Petroleum; Bleaching the distillation residues of ——. K. Charitschkow. Westnik shirow. weschtsch., 1905, **6**, 135. Chem.-Zeit., 1906, **30**, Rep., 35.

RECENTLY, in the manufacture of lubricating oils, the purification of the products has been effected, not by distillation, but by means of chemical reagents; these products, which constitute the so-called "viscosine," have a high viscosity. The residues are freed from resinous substances, and bleached to a certain extent by treatment with sulphuric acid; the residues from Grosny petroleum are more easily bleached in this way than the residues of Baku petroleum. The residue from Baku lubricating oil ("goudron") is very difficult to bleach; even when dissolved in benzine and treated with sulphuric acid, it remains black and opaque. For those products which are not readily acted upon by sulphuric acid alone, an addition of 4 per cent. of potassium bichromate on the weight of the acid, is advantageous. By treatment with this reagent a solution of "goudron" in benzine or ligroin, becomes dark brown in colour, and clear. The action of the sulphuric acid and potassium bichromate reagent on 10 samples of Baku "goudron" was examined. After the treatment, the oil was washed with caustic soda. The sum of the percentages of treated oil and resinous matter removed was invariably greater than 100. In many cases the specific gravity of the solution of the "goudron" in benzine was higher after the acid treatment than before.—A. S.

Petroleum Production of the United States. Oil, Paint and Drug Reporter. Through Chem. Trade J., Feb. 24, 1906.

THE production of petroleum in the United States during the year 1905 has shown considerable increase over that of the year preceding, due to the active prosecution of the search for oil in the newer producing sections, notably in the State of Kansas, in Oklahoma and Indian Territories, and in California, while the older producing States, Pennsylvania, West Virginia, New York, Ohio, and Indiana, show a marked decrease. In Texas and Louisiana the increase has been considerable, while in California the increase has been steady. It may well be doubted if Texas can maintain the present rate of production, as there has been a steady decrease during the past few months. The total production in the United States during 1905 was fully 137,000,000 barrels, of which California is credited with 35,000,000 barrels, Texas 30,000,000 barrels, Louisiana 10,000,000 barrels, Kansas and the Territories 12,000,000 barrels, the Pennsylvania fields (including West Virginia, New York, and South-East Ohio) 28,000,000 barrels, and the Ohio and Indiana fields, producing what is known as the Lima grades of oil, 19,000,000 barrels.

The export movement in the various petroleum products, while showing an increase of 179,710,000 galls., did not meet the expectations that had been entertained. It was the general belief that owing to the war in the Far East, and later to the almost total destruction of the Russian oil producing and refining plants, the demand for American oil would be increased to an extent which would tax the capacity of the refineries. It appeared, however, that the producers in Roumania, Galicia, Sumatra and Borneo entered the field, and competition followed to secure the trade the Russians had enjoyed, the result being that only a part of this trade fell to the American refiners. All the products, however, showed an increase in the amounts exported. The exports of crude oil during the past year showed an increase of 6,290,000 galls., the increase being entirely in the shipments of Texas fuel oil. The export movement has been very irregular, the amounts being, in gallons:—1903, 121,984,693; 1904, 95,974,645; 1905, 102,264,117.

The exports of illuminating oil showed an increase of 113,097,000 galls., an increase which was considerably smaller than had been expected as a result of the conditions affecting the markets abroad. The shipments increased largely following the destruction of the Russian refineries, but during the last three months showed a considerable decrease. American oil, however, generally receives preference in the European markets by reason of its superior quality, but as the oil from other countries is sold at a lower price, these have shared largely in the increased requirements. The exports were:—1903, 672,298,439 galls.; 1904, 745,742,071 galls.; 1905, 858,839,713 galls. [T.R.]

ENGLISH PATENT.

Benzine or petroleum spirit and other liquid hydrocarbon mixtures; Instrument for testing ——. C. Roth. Eng. Pat. 21,518, Oct. 23, 1905. XXIII., page 236.

UNITED STATES PATENT.

Lacquer or varnish [from oil-gas tar]. J. P. Hart. U.S. Pat. 811,563, Feb. 6, 1906. XIII*B*., page 224.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 176.)

Diphenylmethane series; Studies of reduction in the ——. H. Duval. Comptes rend., 1906, **142**, 341—342.

THE author has studied the action of reducing agents upon azodiaminodiphenylmethane. Stannous chloride in acid solution reduces this body and converts it into a tetramine of the benzidine type with rupture of the -N : N- linkage. The product, tetraminodiphenylmethane, $(NH_2)_2C_6H_3.CH_2.C_6H_3(NH_2)_2$, forms a tetrabenzoyl derivative, m. pt. 275° C. The reduction by zinc dust in alkaline media follows another course. The azo-group is reduced to the hydrazo state, and when the reduced solution is heated with hydrochloric acid, ammonium chloride is split off and *p*-diamino-acridine, m. pt. 284° C. is obtained. —J. F. B.

Diazonium salts; Replacement of negative radicals by hydroxyl radicals in ——. E. Noelting and M. Battegay. Ber., 1906, **39**, 79—86.

IN certain diazonium compounds containing electronegative radicals, halogen, nitro, or sulphonic groups can be replaced by hydroxyl groups at the ordinary temperature under the influence of sodium bicarbonate or acetate, or sometimes even in acid solution. The behaviour of the diazo compounds from 2.5.6-trichloroaniline-3-sulphonic acid, *o*-nitroaniline-*p*-sulphonic acid, 2.5-dichloroaniline-4-sulphonic acid and 2-chloroaniline-4-sulphonic acid in this direction was investigated by the authors. 2.5.6-Trichloroaniline-3-sulphonic acid was prepared by nitrating and reducing 1.2.4-trichlorobenzene-

5-sulphonic acid, according to the method described in Ger. Pat. 139,327. It forms white needles, readily soluble in hot water, but only slightly in cold water. Its sodium salt is readily soluble, the barium salt soluble with difficulty. On diazotisation at 20°—25° C. in the usual manner this acid forms the corresponding diazoniumsulphonic anhydride, $C_6HCl_3<^{N_2}_{SO_2}$, which yields azo dyestuffs not differing much in shade from those from *m*-aminobenzenesulphonic acid. The dyestuff formed with β-naphthol dyes wool in fine orange shades. With a hydrochloric acid solution of cuprous chloride the diazo compound readily forms 2.3.4.5-tetrachlorobenzene-sulphonic acid, which is readily soluble in water. If the trichlorodiazoniumsulphonic anhydride is introduced into a cold aqueous solution of 2 mols. of sodium bicarbonate or acetate the solution turns yellow and the dichlorodiazophenolsulphonic acid is formed. This is converted by a hydrochloric acid solution of cuprous chloride into trichlorophenolsulphonic acid and combines with β-naphthol to form the corresponding azo dyestuff, which yields on reduction 3.6-dichloro-2-aminophenol-4-sulphonic acid. The azo dyestuff dyes wool in red shades with a brownish tint, which are turned to violet-brown by the action of alkalis, and to violet, fast to alkalis, by treatment with bichromate and sulphuric acid. If the dyeings on wool are treated with copper sulphate fine crimson shades are obtained. 2.4.6-Tribromoaniline-4-sulphonic acid was obtained according to the method of Berndsen (Annalen, **177**, 86), by the action of excess of bromine on metanilic acid. It is diazotised in the same manner as the trichloro-acid. The dyestuff formed with β-naphthol yields very similar shades to those from the trichloro compound and from metanilic acid. The dyeings are not sensitive to alkalis. By the action of sodium bicarbonate on the diazo compound, 1 mol. of bromine is replaced by hydroxyl. The product was not isolated, but was combined with β-naphthol. By analogy with the chloro-derivative it is probable that the bromine atom in position 6 is replaced, 2.4-dibromo-6-hydroxydiazobenzene-3-sulphonic acid being formed. The β-naphthol dyestuff yields red shades on wool, unstable to alkalis, which are converted into dark violet shades, fast to alkalis, by chroming. 2.5-Dichloroaniline-4-sulphonic acid was prepared by Noelting and Kopp (Ber., 1905, **38**, 3513). Its diazo-anhydride is prepared in the usual manner and combines with β-naphthol to form a dyestuff yielding very similar shades to Orange II., the corresponding derivative of sulphanilic acid. If the diazo-anhydride is treated with sodium bicarbonate and then combined with β-naphthol a red dyestuff is obtained, showing the typical reactions of an *o*-hydroxyazo compound. On chroming, the shades produced by it are changed to dark violet. In a sodium bicarbonate solution of the diazo compound, which was allowed to stand until it no longer combined with azo-components, only 40 per cent. of the chlorine was found to have been converted into chloride, showing that in this case the reaction is very incomplete. *o*-Chloroaniline-*p*-sulphonic acid is readily obtained by heating the acid sulphate of *o*-chloroaniline to 160° C. for some hours at 20—30 mm. pressure. It is rather insoluble in water and forms a readily soluble sodium salt. On diazotising and combining with β-naphthol it forms a dyestuff very similar to Orange II. If the diazo-anhydride is treated with sodium carbonate for some time and then combined with β-naphthol, a dyestuff is obtained which yields impure orange shades only slightly altered by chroming, and which does not show the properties of an *o*-aminophenol derivative. In spite of this about 25 per cent. of the chlorine is split off. If the chlorine is replaced by a nitro group this latter is readily displaced. *o*-Nitraniline-*p*-sulphonic acid forms a diazonium anhydride which combines with β-naphthol to form a dyestuff yielding redder shades on wool than Orange II., which shades are stable to alkalis. If 1 mol. of the diazonium anhydride is added to a solution of 2·5 mols. of sodium bicarbonate, carbon dioxide is evolved and the liquid turns brown, *o*-hydroxydiazobenzene-*p*-sulphonic acid (sodium salt) being formed. This compound combines with β-naphthol to form a dyestuff which yields bright red shades on wool, which are sensitive to alkali, but are changed to fast dark violet shades on chroming.—E. F.

2.2′.4′-*Trihydroxyflavonol*; *Synthesis of* ——. E. Bonifazi, St. v. Kostanecki and J. Tambor. Ber., 1906, **39**, 86—91.

By the action of aromatic aldehydes on *o*-hydroxyacetophenones in presence of strong caustic soda solution, compounds containing the group $X<^{OH}_{CO.CH_2.CH(R)(OH)}$ are first obtained. These split off water immediately, forming either a chalkone, containing the group $X<^{OH}_{CO.CH:CHR}$ or a flavanone, containing the group $X<^{O—CH.R}_{CO—CH_2}$.

The direction in which condensation takes place was formerly considered by the authors to depend on the nature of the *o*-hydroxyacetophenone which was used. They now find that it also depends on the nature of the aldehyde. By the action of quinacetophenonemonomethylether on aldehydes, flavanones have always been previously obtained by the authors, but by the action of this ether on 1.3-dimethoxybenzaldehyde they obtain mainly 2′-hydroxy-5′.2.4-trimethoxychalkone. On treatment with acetic anhydride and dehydrated sodium acetate this forms a mixture of 2′-acetoxy-5′.2.4-trimethoxychalkone and 2-2′.4′-trimethoxyflavanone. The transformation into the trimethoxyflavanone may also be effected by boiling with alcohol and hydrochloric acid. On treatment with amyl nitrite and hydrochloric acid the trimethoxyflavanone forms *a*-isonitroso-2.2′.4′-trimethoxyflavanone, which dyes in orange shades on cobalt-mordant, in brown shades on copper-, and in yellow shades on uranium-, cadmium- and lead-mordants. When boiled with a mixture of glacial acetic acid and 10 per cent sulphuric acid this yields 2.2′.4′-trimethoxyflavonol, which dyes in yellow shades on alumina mordant. This compound forms 2.2′.4′-trihydroxyflavonol,

$$(OH)C_6H_3<^{O.C——C_6H_3(OH)_2}_{CO.C(OH)},$$

on boiling with strong hydriodic acid. This substance is a strong mordant dyestuff. On alumina mordant it dyes in yellow shades and on iron in olive-brown to black shades. This shows that the chromogenic group $—C:O \atop =C.OH$ is much more active in presence of hydroxyl groups in positions 2′ and 4′, and is of importance as it helps to explain the tinctorial properties of Morin, which, according to the authors is 1.3.2′.4′-tetrahydroxyflavonol.—E. F.

English Patents.

Phenylnaphthimidazole; Manufacture of new amino-hydroxylated derivatives of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 11,759, June 5, 1905.

One or both of the sulphonic acid groups of phenylnaphthimidazoledisulphonic acids, which are in the naphthalene nucleus, may be replaced by hydroxyl groups by heating with alkali hydroxides to about 170° C., preferably in presence of water. The initial material, which has the general formula

$$(HO_3S)_2C_{10}H_4<^{N}_{NH}>C.C_6H_4.NH_2,$$

is obtained either by the reduction and condensation of a nitrobenzal derivative of a 1.2-diaminonaphthalenedisulphonic acid, or by treating with acids the nitrobenzal derivative of a nitrobenzeneazo-2-aminonaphthalenedisulphonic acid. In particular, the aminohydroxysulphonic acid of phenyl-1.2-naphthimidazole is claimed.—T. F. B.

Lakes (from azo dyestuffs); Production of red colour ——. J. Y. Johnson. From Badische Anilin und Soda Fabr. Eng. Pat. 82, Jan. 1, 1906. XIII*A*., page 224.

United States Patents.

Dyestuff and process of making same; Anthracene ——. O. Bally, Mannheim, and H. Wolff. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 811,471, Jan. 30, 1906.

See Sixth Addition of June 22, 1905, to Fr. Pat. 349,531 of 1904; this J., 1906, 14.—T. F. B.

Indigo; Process of chlorinating —— . A. Schmidt and E. Kronholz. Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/Main, Germany. U.S. Pat. 812,598, Feb. 13, 1906.

See Eng. Pat. 3182 of 1905; this J., 1905, 964.—T. F. B.

Dye [Anthracene dyestuff]; Yellow-green Anthraquinone ——. R. E. Schmidt and K. Thun, Elberfeld, Germany. Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 812,599, Feb. 13, 1906.

See Fr. Pat 354,076 of 1905; this J., 1905, 1061.—T. F. B.

Dye [Anthracene dyestuffs]. Green Anthraquinone ——. R. E. Schmidt, Elberfeld, Germany. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 812,684, Feb. 13, 1906.

See Fr. Pat. 353,549 of 1905; this J., 1905, 1010.—T. F. B.

German Patents.

Aminobenzoylthiazol compounds; Process of preparing sulphonic acids of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 163,040, March 6, 1904.

Sulphonic acids of aminobenzoylthiazol derivatives may be produced either by reducing the condensation products of nitrobenzoylhalides and thiazolsulphonic acids, or by condensing a nitrobenzoylhalide with a thiazol base, and subsequently sulphonating and reducing. The resulting amino compounds are of value for the production of dyestuffs; for instance, by diazotising on the fibre, and "developing" with β-naphthol, clear, fast orange shades are produced.—T. F. B.

Hydroxyanthraquinone aryl ethers; Process for preparing sulphonic acids of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 164,129, March 13, 1904.

The aryl ethers of the hydroxyanthraquinones (Ger. Pat. 158,531; this J., 1905, 885) are sulphonated in the usual manner. Generally the sulphonic groups first enter the aryl nucleus, and then the anthracene nucleus. The sulphonation of the following ethers is described:—Anthrarufindiphenyl ether, chrysazindiphenyl ether, 1-amino-5-hydroxyanthraquinonephenyl ether (the sulphonic acid of this dyes wool orange shades), anthrarufindi-*o*-cresyl ether, and 1-phenylamino-5-phenoxyanthraquinone (the sulphonic acid of which gives red shades on wool).—T. F. B.

Anthracene series; Process for preparing hydrazine derivatives of the —— *[Anthracene dyestuffs].* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 163,447, Aug. 18, 1904.

The diazo derivatives of aminoanthraquinones are converted by means of sulphites or bisulphites into the diazo sulphonic acids. These may be obtained in the solid form as sulphates, by dilution of their solutions in concentrated sulphuric acid. These diazosulphonic acids are reduced to the corresponding hydrazine derivatives by reduction; this may be effected by stannous chloride, zinc dust, hydrosulphites, &c., or by sulphurous acid or a sulphite, in which case the hydrazine-disulphonic acid, $C_6H_3(SO_3H)N(SO_3H)NH.SO_3H$, is obtained. Such hydrazine sulphonic acids are of value as dyestuffs, dyeing unmordanted wool in shades varying from yellowish-red to blue. The sulphonic acid group or groups may be eliminated by heating with dilute acids.—T. F. B.

Dyestuff; Process for preparing an [Azo] —— *especially suited for the manufacture of lakes.* Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 163,644, March 31, 1904.

Azo dyestuffs, from which very fast, bluish-red lakes are obtainable, may be prepared by combining diazotised 2-amino-1-naphthylmethanesulphonic acids with 2.3-hydroxynaphthoic acid. Similar dyestuffs are obtained from aniline, *m*-xylidine and *p*-nitraniline-*o*-sulphonic acid, but their lakes are fugitive in light.—T. F. B.

Hæmatoxylin; Process for preparing a solid dyestuff from ——. R. Haack. Ger. Pat. 162,726, Jan. 4, 1905. Addition to Ger. Pat. 162,010, July 1, 1904 (see this J., 1905, 1062).

In the process described in the principal patent, viz., of adding alkali nitrite to a concentrated solution of hæmatoxylin or logwood extract (*e.g.*, 30° B.), nitrous fumes are evolved, and hæmatein is produced. This is avoided by working with dilute solutions, *e.g.*, about 2° B., no nitrous fumes nor hæmatein being produced even if the solution is heated.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 179.)

3.2′.4′-Trihydroxyflavonol; Dyeing properties of ——. St. v. Kostanecki, V. Lampe and S. Triulzi. Ber., 1906, **39**, 92—96.

3.2′.4′-Trihydroxyflavonol, called by the authors Resomorin, stands in the same relationship to Morin (1.3.2′.4′-tetrahydroxyflavonol) as Fisetin (3.3′.4′-trihydroxyflavonol) does to Quercetin (1.3.3′.4′-tetrahydroxyflavonol.) The synthesis of Resomorin proved to be difficult, and the dyestuff could not be obtained in a chemically pure condition, but its dyeing properties were investigated and an acetyl derivative was purified and analysed. By the action of 1.3-dimethoxybenzaldehyde on resacetophenone-mono-methyl-ether (pæonol) in presence of sodium hydroxide, 2′-hydroxy-4′.2.4-trimethoxychalkone,

$$C_6H_3(OCH_3)(OH).CO.CH:CH.C_6H_3(OCH_3)_2,$$

is obtained. On boiling with a mixture of alcohol and 10 per cent. hydrochloric acid this is converted into 3.2′.4′-trimethoxyflavanone,

$$(CH_3O)-C_6H_3<\begin{matrix}O-CH-C_6H_3(OCH_3)_2.\\ CO.CH_2\end{matrix}$$

This is converted in the usual manner into an *a*-isonitroso-derivative, which dyes in yellow shades on cobalt mordant. This compound, on boiling for a short time with a mixture of glacial acetic acid and 10 per cent. sulphuric acid, yields 3.2′.4′-trimethoxyflavonol,

$$(CH_3O)C_6H_3<\begin{matrix}O\cdot C-C_6H_3(OCH_3)_2,\\ CO.C(OH\end{matrix}$$

which dyes on alumina mordant in yellow shades. On boiling with strong hydriodic acid this trimethoxyflavonol yields Resomorin, 3.2′.4′-trihydroxyflavonol,

$$(HO)C_6H_3<\begin{matrix}O-C.C_6H_3(OH)_2,\\ CO.C(OH)\end{matrix}$$

the dyeing properties of which closely resemble those of 2.2′.4′-trihydroxyflavonol and Morin; on alumina mordant fine yellow shades, and on iron mordant intense olive-brown shades are obtained. These results show that the dyeing properties of Morin are mainly due to the group —CO.C(OH)=, and not to the hydroxyl group in *peri*-position to the ketonic oxygen atom, which is not present in Resomorin.—E. F.

Cotton fabrics and yarns dyed with sulphide blacks; Investigation into the causes of the tendering of ——, *and some means for preventing it.* J. E. Pilling. J. Soc. Dyers and Col., 1906, **22**, 54—65.

Hanks of cotton yarn were dyed with seven different

sulphide dyestuffs, under the same conditions, and then treated for "fixing" purposes in six different ways. The hanks were next subjected to heating to 100° C. for 24 hours, and to 110°, 120°, and 130° C. for 12 hours. Subsequently their tensile strength was tested and the quantity of sulphuric acid formed, if any, determined. In most cases, but particularly in the case of the higher temperatures, the fibre was found to be greatly weakened and in all cases an appreciable quantity of sulphuric acid was formed. The hanks on which the dye had been "fixed" by means of copper salts were the weakest. In a second series of experiments the yarns were stored at the ordinary temperatures for different periods, varying from one to seven months. In these experiments, it is stated, the hanks fixed by exposure to the air or by chroming, gave better results than those fixed in other ways, showing either no, or very slight, weakening, and producing either no, or very small, quantities of sulphuric acid. The methods of after-treatment adopted were briefly: (1) exposing the wet washed-off yarn to the atmosphere for 24 hours; treating for 15 minutes at 60° C. in (2) a bath containing 3 per cent. of potassium bichromate and 6 per cent. of 20 per cent. acetic acid; (3) 3 per cent. copper sulphate solution; (4) 3 per cent. of potassium bichromate, 3 per cent. of copper sulphate, and 6 per cent. of 20 per cent. acetic acid; (5) 3 per cent. ferrous sulphate solution; (6) 3 per cent. chrome alum solution. The author concludes that the tendering observed was produced by the formation of sulphuric acid. A third series of experiments was undertaken to show that the sulphuric acid was formed solely from the dyestuff. Skeins were impregnated with a 1 per cent. solution of sodium sulphide and then treated by each of the six "fixing" processes without previous washing off. They were then heated to 100° C. and 130° C. for 12 and 24 hours respectively, but no sulphuric acid could be found, or only an infinitesimal amount. The formation of sulphuric acid it is, therefore, concluded, is due to oxidation of the dye-stuff molecule. In a further series of experiments the dyed yarns were subjected to the action of sulphurous acid for two hours (1) in the wet state, (2) dry. The author finds that sulphurous acid rots the dyed yarns under the conditions of his experiments, if they have been after-treated with copper or iron salts, especially in the moist state. The results obtained from each series of experiments are shown in tabular form. They show according to the author that no hard and fast rules can be laid down for the sulphide blacks; that they should not be treated alike, but each individual in the manner best suited to its properties, but that the use of copper salts for after-treatment must be avoided. Special attention is drawn to the fact that yarns treated with bichromate and acetic acid, or subjected to atmospheric influence after dyeing, kept practically in normal condition after many months' exposure. In general, to prevent tendering of goods dyed with sulphide blacks, the author recommends that the dyed goods should be impregnated with a carbonate or acetate; if this be impracticable, in the case of after-treatment with chrome is advantageous in the case of most dyestuffs.—H. L.

English Patents.

Cotton-seed hulls or other waste products containing fibrous materials; Processes and apparatus for treating ——. C. Knopf and Bremer Baumwoll-Werke, C. Knopf und Co. Hemelingen, Germany. Eng. Pat. 12,650, June 19, 1905.

THE waste materials are treated in suitable digesters, autoclaves or similar vessels, with solutions of reagents, which are capable of dissolving both the impurities of the fibres and the hull-residues, without however, noticeably attacking the fibres themselves. Suitable reagents are alkalis, alkaline earths, dilute acids, alkali sulphites and sulphates, and calcium, magnesium, potassium and sodium bisulphite. The treatment is effected under a pressure of about four to six atmospheres, and after the hulls have been sufficiently macerated or softened, the fibres to be recovered are mechanically separated therefrom by washing, beating, and sifting operations.—D. B.

Silk; Manufacture of artificial ——. G. Dietl, Berlin. Eng. Pat. 15,029, July 21, 1905.

SEE Fr. Pat. 356,323 of 1905; this J., 1906, 16.—T.F.B.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer. A. B. Lennox and T. Mackenzie. Eng. Pat. 8342, April 19, 1905. XVIII*B*., page 231.

Dye-water and similar effluents; Apparatus for purifying ——. W. McD. Mackey. Eng. Pat. 11,410, May 31, 1905. XVIII*B*., page 231.

United States Patent.

Formaldehyde-hydrosulphite and process of making same. E. A. Fourneaux, Assignor to H. A. Metz, New York. U.S. Pat. 812,124, Feb. 6, 1906.

A BASIC zinc formaldehyde-hydrosulphite, which is crystalline and can be dried in the air at 100° C. without decomposition, is prepared by the action of a "suitable alkali compound" on a solution of zinc hydrosulphite and formaldehyde. The corresponding sodium formaldehyde hydrosulphite is obtained by the action of sodium carbonate on the zinc compound. One part of the latter is capable of reducing about 1·5 parts of Indigo in the form of its sulphonic acid.—T. F. B.

German Patents.

Cotton and silk mixture; Process for preparing a —— which can be uniformly dyed. J. P. Bemberg, A.-G. Ger. Pat. 165,218, June 9, 1903.

ORDINARY cotton and silk "mixtures" cannot be uniformly dyed, the silk always taking a deeper shade than the cotton. It is proposed to weave together silk and mercerised cotton, the mercerisation being carried to such an extent, previously determined by experiment, that the cotton is dyed to the same depth as the silk by the particular dyestuff which is to be employed.
—T. F. B.

Aniline Black dyeings on wool; Process for increasing the fastness of ——. G. Bethmann. Ger. Pat. 161,263, Nov. 14, 1902. Addition to Ger. Pat. 130,309, Nov. 18, 1900.

THE Aniline Black dyeings on wool, produced by the process described in the principal patent (Eng. Pat. 21,236 of 1900; this J., 1901, 577), are rendered much faster by treatment with a 5 per cent. solution of an alkali carbonate; this neutralises the acid set free during the process, which is not the case when soaping is resorted to, as previously directed.—T. F. B.

Formaldehyde; Process of preparing a compound of —— containing sulphur. L. Cassella und Co. Ger. Pat. 164,506, March 25, 1904.

A SULPHUR derivative of formaldehyde, different from trithioformaldehyde and thiometaformaldehyde, is obtained by the addition of formaldehyde to an aqueous solution of an alkali sulphide. It is stable towards oxidising agents, and is inactive in the cold, but at higher temperatures, especially in presence of alkalis, it is decomposed, alkali sulphide being regenerated. It can be used in printing with sulphide dyestuffs, the finely divided dyestuff being mixed with the formaldehyde derivative, and printed on the fabric, which is then steamed.—T. F. B.

Cotton; Process for producing fast brown shades on ——. Badische Anilin und Soda Fabrik. Ger. Pat. 164,123, March 6, 1904.

ALTHOUGH fur, feathers, &c., can be dyed fast brown shades by impregnation with 1.5-dihydroxynaphthalene and exposure to air, cotton does not give good results by the process. Brown shades fast to light, washing and chlorine can, however, be obtained on cotton by impregnation with 1.5-dihydroxynaphthalene and subsequent steaming.—T. F. B.

Dyestuff ; Process for producing a fast, Bordeaux Red, Azo —— on the fibre. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 162,627, Aug. 11, 1904.

Fast, bordeaux-red shades are produced on the fibre by developing diazotised *m*-aminobenzeneazo-*m*-toluidine with β-naphthol. The dyestuff is formed much more readily than that from *p*-nitrobenzeneazo-*o*-toluidine (Ger. Pat. 155,396 of 1903 ; this J., 1905, 544). White discharges may be produced on the dyeings by means of formaldehyde-hydrosulphite compounds.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 180.)

Sodium tetrathionate and dithionate ; Action of potassium cyanide on ——. A. Gutmann. Ber., 1906, **39**, 509—513.

By the action of potassium cyanide on sodium tetrathionate in presence of alkali, potassium thiocyanate and sodium sulphate and sulphite are formed, according to the equation :

$$Na_2S_4O_6 + 2KCN + 2NaOH = 2KCNS + Na_2SO_4 + Na_2SO_3 + H_2O.$$

In this reaction, therefore, the tetrathionate apparently splits up according to the equation : $S_4O_6 = SO_2 + SO_3 + S_2$, whereas, by the action of sodium arsenite, it decomposes according to the scheme : $S_4O_6 = 2SO_2 + S_2 + O$, sodium sulphite, monosulphoxyarsenate and arsenate being formed (this J., 1905, 618). The explanation of this difference is probably that, in both cases, the tetrathionate gives up two atoms of sulphur to form thiocyanate and monosulphoxyarsenate respectively, but that in the reaction with cyanide the oxygen also given up oxidises the sulphite rather than the cyanide, since cyanates can only be obtained from cyanides in aqueous solutions by the use of very strong oxidising agents.

Sodium dithionate is not acted upon by potassium cyanide alone or in presence of sodium hydroxide, even on boiling.—A. S.

Potassium mercuric ferrocyanide. G. Ferneker. J. Amer Chem. Soc., 1906, **28**, 87—90.

Potassium mercuric ferrocyanide may be obtained as follows :—Fifteen to 20 grms. of mercuric chloride are dissolved in about 100 c.c. of a mixture of equal volumes of absolute alcohol and ether. Eight to 10 grms. of potassium ferrocyanide, dissolved in the least possible quantity of water, are then added, and the precipitate formed allowed to settle. The supernatant liquid is decanted, the precipitate is washed twice with the alcohol-ether mixture, then with cold water, and finally brought on to a filter, where it is washed with about one litre of water cooled to 0° C. The precipitate is once more washed with alcohol and ether and dried at a temperature of 100° C. When thus prepared the compound is a fine powder having only a very faint blue tinge. It has the formula $K_2HgFe(CN)_6$, is insoluble in water, but soluble to a considerable extent in potassium ferrocyanide solution, probably with the formation of a more complex compound.—W. P. S.

Arseniuretted hydrogen ; Reactions and methods of determining ——. H. Reckleben and G. Lockemann. XXIII., page 236.

Iodine ; Japanese ——. Chem. and Drug., Feb. 17, 1906.

The following figures show the increase in the exports of iodine and its compounds in Japan :—

	Quantity.	Values.
	lb	yen.
1905 (11 months)	57,214	250,819
1904	69,715	268,800
1903	29,753	101,174
1902	4,058	14,828

The chief kelp-producing districts in Japan are the province of Shima and the island of Hokkaido, but nearly all fishing districts produce a little. The industry is therefore more or less scattered along the coast of Japan, and is in the hands of many small producers, from whom the three largest firms procure their supplies. The annual production of iodine in Japan at present is estimated at about 200,000 lb., of which about 70,000 lb. is consumed there. [T.R.]

English Patent.

Ammonia ; Process of producing ——. K. Kaiser, Berlin. Eng. Pat. 26,803, Dec. 22, 1905. Under Int. Conv., Dec. 24, 1904.

Calcium turnings are heated in a clay or metal tube to about 500° C., and nitrogen and hydrogen are alternately passed through the tube, whereby calcium nitride is first formed, and then calcium hydride, the displaced nitrogen combining with the hydrogen passed through to form ammonia, which is collected from the effluent gases. The process may be started with calcium nitride or with calcium hydride, instead of with metallic calcium. (See also Fr. Pat. 350,966 of 1905 ; 1905, 801.)—E. S.

United States Patents.

Hydrochloric acid ; Manufacture of ——. I. L. Roberts, Brooklyn, N.Y. Assignor to Roberts Chemical Co., N.J. U.S. Pat. 807,640, Dec. 19, 1905.

Hydrogen and chlorine, in the proportion in which they combine to produce hydrochloric acid, and, preferably, as set free in the electrolysis of sodium chloride in a vessel provided with separate anode and cathode compartments, are conducted, each by its separate tube, to a mixing tube or chamber. This chamber is connected by tubing to the first of a series of receptacles containing water for absorption of the acid, provision for the continuous renewal and removal of which water is provided. The mixture of the gases is ignited, preferably at a point beyond the mixing chamber, into which the flame at once runs back, and in which the combustion goes on quietly and continuously, with the production of hydrochloric acid.—E. S.

Alumina ; Calcination of hydrated ——. A. R. Pechiney, Salindres. Assignor to Cie. des Prod. Chim. d'Alais et de la Camargue, Lyons, France. U.S. Pat. 811,433, Jan. 30, 1906.

See Fr. Pat. 349,707 of 1904 ; this J., 1905, 732.—T. F. B.

Tin ; Apparatus for producing compounds of ——. C. E. Acker, Niagara Falls, N.Y. Assignor to Acker Process Co., N.J. U.S. Pat. 810,897, Jan. 30, 1906.

The apparatus comprises a dissolving vessel for effecting the solution of tin in a solvent containing chlorine, a reaction tower, means for circulating the solution through the dissolving vessel and reaction tower, an electrolytic cell for the production of chlorine, with means for diluting the chlorine by steam, and for delivering it to the reaction tower. (See also U.S. Pats. 810,454—6 of 1906 ; this J., 1906, 180.)—E. S.

Efflorescence ; Apparatus for producing ——. K. Tsuji, Takaoka, Japan. U.S. Pat. 811,002, Jan. 30, 1906.

See Eng. Pat. 2346 of 1905 ; this J., 1905, 1108.—T. F. B.

French Patents.

Nitric acid ; Concentration of dilute ——. Chem. Fabrik Griesheim-Elektron. Fr. Pat. 358,373, Oct. 9, 1905.

Sodium polysulphate, $H_3Na(SO_4)_2$, is heated to about 110°—130° C., and a certain proportion of dilute nitric acid is incorporated with it, by aid of injection of air. From the mixture, concentrated nitric acid is distilled off and collected. The mass is then further heated to 250°—300°C. to expel the water taken up, after which the polysulphate is allowed to cool, the cooling process being aided by the injection of air, until the former temperature of 110°—130° is reached. A further addition of the dilute nitric acid is then made, and the process is renewed. The nitric acid may be distilled under a partial vacuum.—E. S.

Lime; Process for obtaining hydrated ——. J. Reaney, jun. Fr. Pat. 358,396, Oct. 10, 1905.

See U.S. Pat. 803,506 of 1905; this J., 1905, 1230.—T.F.B.

Gaseous mixtures, especially the oxygen and nitrogen of the air; Apparatus for mechanically separating ——. E. F. M. Farcot. Fr. Pat. 358,397, Oct. 10, 1905. I., page 211.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 181.)

Glass Industry of Bavaria. For. Off. Ann. Ser., No. 3526.

The manufacture of glass was impeded in 1904 by dry weather and lack of water power, especially in the Fürth district, the centre of the industry. The United States market, once all-important to the Bavarian glass industry, is being spoilt by inland competition and high duties, whilst the Canadian market has been lost entirely by the tariff war: the duty on Bavarian blown glass was formerly 20 per cent. *ad valorem*, Belgian crystal glass paying 25 per cent., but now the duty on German glass has been raised to 26⅔ per cent., whilst the duty on Belgian glass has been reduced to 10 per cent. If this state of affairs continues the Bavarian glass industry will soon be a thing of the past, having besides to fight against the keen competition of the Rhine provinces, Silesia, Saxony, Belgium and Bohemia. Fürth (Nuremberg) exported in 1890 to the United States glass to the value of 470,000*l.*, which sum fell to 118,533*l.* in 1903, and to 62,834*l.* in 1904. That district exported, up to 1904, mirrors to the value of about 12,500*l.* per annum to Canada, but since the new tariff and surtax amount to 26⅔ per cent. of the total value, the export trade to Canada is almost killed. Some works have ceased to manufacture mirrors, having turned to plate glass instead, whilst other works have stopped manufacturing entirely. The raw materials necessary to the glass industry have also increased considerably in price—acids and arsenic from 15 to 20 per cent., shellac even 300 per cent., &c., whilst the increase of the sale price was only from 5 to 12 per cent. This increase was partially rendered possible by the strike in Belgium. [T.R.]

United States Patent.

Silica glass; Manufacture of — —. J. F. Bottomley, Wallsend, R. S. Hutton, Manchester, and A. Paget, North Cray. U.S. Pat. 812,399, Feb. 13, 1906.

See Eng. Pat. 10,670 of 1904; this J., 1905, 670.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 182.)

Cement: Relation of the volume weight of raw material to the output of a rotary kiln. W. H. Hess. J. Amer. Chem. Soc., 1906, **28**, 91—94.

The output of a rotary kiln in clinker is nearly twice as much when working on cement rock or limestone and clay, as when using a mixture of dry marl and clay, other conditions being the same. This difference is due to the varying volume weights of the materials. Results obtained by the author gave for marl alone a weight of 48·7 lb. per cubic foot; for chemically pure precipitated chalk, 32·7 lb.; and for natural commercial chalk, 70 lb. Using a small experimental kiln, it was found that a marl and clay mixture consuming 1125 lb. of coal per hour and producing 1600 lb. of cement, consumed 2760 lb. of cement mixture having a volume of 53 cubic feet. A kiln of the same construction, working on a cement rock mixture and consuming 1125 lb. of coal per hour and producing 3200 lb. of cement per hour, burned 52 cb. ft. of raw cement mixture per hour. The greater the weight of the ground raw cement mixture per cubic foot, the greater is the output of a kiln. The term "marl," used above, designates the lake deposits of Michigan, Canada, &c., which consist of about 90 per cent. of chalk, 5 per cent. of shell lime, and 5 per cent. of organic matter. As marl and chalk are too bulky, it is probable that in the future they will be replaced, for reasons of economy, by limestone and cement rock.—W. P. S.

English Patents.

Clay, or similar materials; Drying of various substances such as ——. T. M. Stocker, St. Austell, Cornwall. Eng. Pat. 2097, Feb. 2, 1905.

By means of suitably placed partitions, the hot gases in the flues beneath the drying chamber are forced to follow a zigzag or sinuous course, thereby ensuring a more even drying of the clay above.—A. G. L.

[*Pavements, blocks, tiles, &c.*] *Composition of matter.* S. G. Wightman, Washington, D.C., U.S.A. Eng. Pat. 19,622, Sept. 28, 1905.

From 6 to 10 lb. of iron oxide, preferably the "peroxide," is stirred into 100 lb. of melted resin, and the mixture added to 1000 lb. of powdered clay, sand, gravel, loam, &c., previously heated to 200° or 250° F. After thoroughly mixing it, the plastic mixture obtained is moulded and allowed to cool. The blocks obtained show a crushing strain of 2½ tons per sq. in., and remain rigid up to 160° F. When sand is used alone, 15 per cent. of the resin mixture should be used; clay or sand mixed with loam gives good results with 10 per cent. of resin.—A. G. L.

Cementing material and the manufacture of the same. R. Zellenka, Vienna. Eng. Pat. 5513, March 16, 1905.

The cementing material is made by melting sulphur, adding lampblack or other colouring matter, and ferruginous sand from iron foundries, or sand from iron or steel fettling, further heating the mixture until it becomes thick, and then allowing it to cool, with stirring, until it becomes thin enough to be poured into moulds. Before use the material must be heated to about 120° C., when it becomes a thin liquid, in which condition it is used for filling in joints between bricks, stone and iron or steel, &c.—A. G. L.

Cement kilns; Rotary ——. E. Newell and W. Fennell, Misterton, Notts. Eng. Pat. 9108, May 1, 1905.

The kiln is constructed of lengths of welded tube joined together by angle irons secured at the ends of the tubes, the angle irons being faced in a lathe and riveted or bolted together. The kiln has an increased external diameter at the firing end, the internal diameter being kept the same throughout, thus giving a greater thickness of refractory lining at the hottest parts.—A. G. L.

Bituminous substances, resins, oils, waxes and the like; Treating ——. E. Braschler-Kurtz, Zurich, Switzerland. Eng. Pat. 11,191, May 29, 1905. Under Int. Conv., June 2, 1904.

A solution of 90 parts of asphaltum in 200 to 300 parts of benzol is gradually introduced into a boiling solution of 3 parts of sodium soap and 2 parts of crude starch in 10 parts of water, the volatilised benzol being condensed and collected. The mixture is well stirred and allowed to cool with constant agitation, when a homogeneous mass is obtained which forms an even emulsion on diluting with water, and may be used for impregnating paper, bricks, &c., and for rendering roads dust-free. Other substances, *e.g.*, pitch, ozokerite, fats, oils, and balsams, dissolved in solvents such as carbon tetrachloride, &c., may be substituted for the benzol solution of asphaltum; gums, albumins, pectins, soluble silicates, &c., may replace the starch; and alkalis, alkaline earths, or borax may be substituted for the soap. The method of mixing may also be modified somewhat.—A. G. L.

United States Patents.

Roads; Process for tarring ——. L. Prósubert and G. A. Thubé, Nantes, France. U.S. Pat. 812,593, Feb. 13, 1906.

See Fr. Pat. 342,898 of 1904; this J., 1904, 1029.—T.F.B.

Cement; Hydraulic —— and process of making the same. C. D. Clark, Clifton, Ariz. U.S. Pat. 811,902, Feb. 6, 1906.

Ores with an aluminous silicious gangue are treated in concentrating or other mills, and the tailings from these are classified by hydraulic means. The tailings are pulverised and mixed with a calcareous substance, such as limestone, the mass being afterwards reduced to a powder, the mixture burnt to a clinker and the latter pulverised.—B. N.

French Patents.

Pavements, tiles and other building materials; Composition for ——. S. G. Wightman. Fr. Pat. 358 362, Oct. 9, 1905.

See Eng. Pat. 19,622 of 1905; preceding these.—T. F. B.

[*Hydraulic cement*]; *Silico-calcareous agglomerate.* C. de La Roche. First Addition of Feb. 22, 1905, to Fr. Pat. 350,340, Nov. 23, 1904.

In the present addition the agglomerate described in the original patent (see Eng. Pat. 25,884 of 1904; this J., 1905, 1233) is claimed as a hydraulic cement. Other substances, *e.g.*, magnesia, baryta, alumina, may also be added to the mixture.—A. G. L.

German Patent.

Slag; Process for the disintegration of molten blast-furnace ——. W. Lessing. Ger. Pat. 162 614, May 4, 1902. X., page 222.

X.—METALLURGY.

(*Continued from page* 185.)

Nickel and Cobalt Industry in 1905. Mining World, Jan. 27, 1906.

The world's production of nickel amounts annually to between 12,000 and 15,000 tons, Canada and the United States together contributing about two-thirds. The exports from New Caledonia in the 10 months ending with October, 1905, were 110,560 metric tons of nickel ore, and 7286 tons of cobalt ore. On this basis the year's exports may be estimated at about 122,000 tons of nickel ore and 8000 tons of cobalt ore.

Canada's output has been added to materially during the past year by reason of the energetic development of the mines in northern Ontario. There have also been interesting developments in the new district of Cobalt, near Lake Temiskaming, where cobalt-nickel arsenides occur in quantity in the rich silver ore. The average contents of some large shipments of this unique ore to New York showed 3·6 per cent. nickel, 7·3 per cent. cobalt, 31 per cent. arsenic, and 1257 oz. silver. The Ontario Government on Aug. 28 withdrew all lands in the townships of Coleman, Bucke, Lorrain and Hudson, comprising the silver-cobalt area, from sale or lease under the Mines Act, for the purpose of legislating so that a larger revenue may be realised from the mines. Existing rights of applicants, however, will not be interfered with. The Government has also granted to the Temiskaming and Northern Ontario Railway Commission full control over the silver cobalt locations on the right of way, as well as those on the townsite of Cobalt.

The production in Ontario, as reported by the Government for the six months ending with June, 1905, was 4671 tons of nickel, valued at 1,038,040 dols., and 65 tons of cobalt, valued at 80,560 dols. The year's output is estimated at fully 9250 tons of nickel and 125 tons of cobalt. A visit was made to the Sudbury nickel mines by the director of the India mint, for the purpose of securing a supply of nickel to be used in coining the new anna, valued at about 3 cents. The United States mines a small quantity of both nickel and cobalt, and in 1905 there was little change from 1904, when the nickel output of Madison county, Mo., was valued at 25,382 dols., and of cobalt at 89,708 dols.

The imports of nickel ore and matte into the United States in 1905 approximated 13,464 tons, free of duty, which is substantially more than was reported in 1904. Exports of nickel, nickel oxide and matte amounted to 9,698,000 pounds in 1905, which compares with 7,519,200 pounds in 1904, showing an increase of 29 per cent. [T.R.]

Tin Industry in 1905. Mining World, Jan. 27, 1906.

It is 18 years since tin sold at a higher level than in 1905. In 1888, when the world's consumption was 53,389 long tons, the top price in London was 170*l.* per ton; but the collapse of the French syndicate which had "rigged" the market brought the quotation down to 75*l.* per ton. In 1905 the world consumed 93,754 long tons, or 40,365 tons more than in 1888, reducing the visible supply to 13,451 tons on Dec. 31, 1905—a point which initiated a rise in price from 120*l.* 7*s.* 6*d.* to 165*l.* 12*s.* 6*d.* per ton. What share the United States took in establishing extraordinary prices for a metal which is produced at a comparatively low cost, by reason of cheap labour, will be understood when it is said that that country's consumption increased from 14,400 tons in 1888 to 40,144 tons in 1905.

Tin production of the World (long tons).

Countries	1904.	1905.*
Malay States	58,657	57,000
Banka and Billiton	14,638	12,250
Bolivia	9,200	11,900
Cornwall, England	4,282	4,500
Australia	5,082	4,900
Miscellaneous	384	500
Total	92,243	91,050

* Shipments.

[T.R.]

Mineral production of Tasmania. Bd. of Trade J., Feb. 22, 1906.

The following particulars of the mineral production of Tasmania during the years 1903 and 1904 are extracted from the Report of the Mining Department: —

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Gold, fine ozs.	31,795	135,072	65,921	280,015
Silver ore tons	7,169	77,270	—	—
Silver lead ore "	—	—	51,138	203,702
" bullion "	3,197	103,861	—	—
Copper, native "	—	—	212	14,416
" (exported) "	150	11,288	—	—
" blister "	3,508	230,190	8,371	582,540
Tin (exported) "	1,263	154,271	2,071	255,228
Auriferous quartz and pyrites exported "	311	9,410	—	—
Coal "	23,961	20,739	61,109	51,942
All other minerals	—	16,139	—	23,349
Total value £	—	767,240	—	1,411,192

[T.R.]

Carbon in steel; Determination of —— by direct ignition with red lead. C. M. Johnson. XXIII., page 236.

English Patents.

Iron ores; Process for agglomerating pulverulent ——. W. Schumacher, Osnabrück, Germany. Eng. Pat. 28,019, Dec. 21, 1904.

The ores are incorporated with finely-divided silica mixed with lime or calcium hydroxide, subjected to the action of steam and briquetted under pressure.—J. H. C.

Minerals; Wet separation of ——. H. L. Sulman and H. F. K. Picard, London. Eng. Pat. 1821, Jan. 30, 1905.

Small proportions of caustic or carbonated alkali, alkali sulphide or polysulphide, soluble soap, saponin or the like are mixed with the water employed, whereby its surface tension is diminished so as to cause permanent

frothing on agitation. The pulp prepared with the treated water is passed over a shaking table or vanner. —J. H. C.

Lead and like ores; Treatment of ——. A. J. Boult, London. From Soc. Anon. des Mines de Bormettes, and A. Lotti, Marseilles, France. Eng. Pat. 2861, Feb. 11, 1905.

SEE Fr. Pat. 346,527 of 1904; this J., 1905, 200.—T. F. B.

Alloys; Impts. in ——. Soc. Anon. "la Neo-Metallurgie," Paris. Eng. Pat. 3179, Feb. 15, 1905. Under Int. Conv., March 18, 1904.

SEE Fr. Pat. 341,639 of 1904; this J., 1904, 871.—T. F. B.

UNITED STATES PATENTS.

Converter. G. T. Walker, Washington, D.C. U.S. Pat. 811,006, Jan. 30, 1906.

THE converter communicates through an opening with a slag receptacle in close contact with it, air being as far as possible excluded from the slag-receptacle. The metal in the converter is agitated, and the slag and other impurities are driven to the top by means of a current of air or other gas, introduced below the surface of the metal through a double series of tuyères. Through another double series of tuyères air is forced against the surface of the metal in the converter, and drives the slag and other impurities into the slag-receptacle.—A. S.

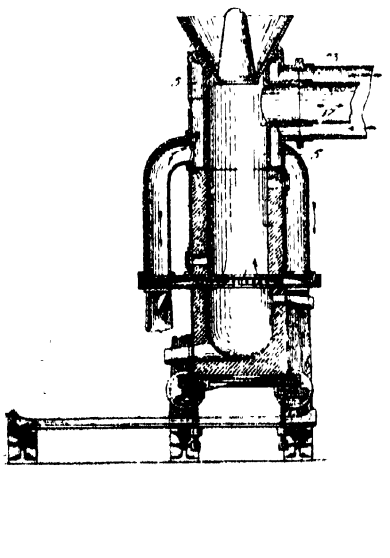
Crucible furnace. E. Hausmann, Cologne, Germany. U.S. Pat. 811,219, Jan. 30, 1906.

SEE Eng. Pat. 16,087 of 1905; this J., 1906, 78.—T. F. B

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 811,643, Feb. 6, 1906.

THE furnace consists of a number of superposed hearths through which passes a rotating hollow shaft having hollow arms extending into the hearths. The shaft is divided by a longitudinal partition into two conduits communicating with each other at the top of the shaft. These conduits are divided into compartments by transverse partitions, and pipes lead from the compartments into the hollow arms. A cooling medium is caused to circulate through the whole apparatus, entering at the bottom of one conduit, and passing in succession up through each compartment and hollow arm on one side of the central partition, and then down in like manner through the compartments and hollow arms on the other side of the partition, finally escaping at the bottom of the second conduit.—A. S.

Furnace; Smelting ——. A. R. Partridge, San Francisco, Cal. Assignor to The Vencedora Mine Equipment Co., California. U.S. Pat. 812,083, Feb. 6, 1906.



THE upper part of the furnace is constructed with double walls, a hot-air space, 5, being thus formed. The air-inlet pipe, 23, surrounds the outlet pipe, 17, leading to the stack, and communicates with the hot-air space. An exhaust fan is placed in the outlet-pipe, and a fan-blower in the inlet-pipe.—A. S.

Ore or flue-dust; Sintering comminuted ——. G. L. Davison. Assignor to American Sintering Co., Chicago, Ill. U.S. Pat. 811,040, Jan. 30, 1906.

THE dry ore or flue-dust is mixed with about 1 per cent. of dry comminuted "fluor," and the mixture is passed gradually through a rotary furnace, wherein it is heated to a temperature which causes the mixture to partially fuse.—A. S.

Ores; Process of recovering values from sulphide ——. F. C. Pohlé, Reno, Nev. U.S. Pat. 811,085, Jan. 30, 1906.

SULPHIDE ores containing gold, silver and base metals are mixed with a chloride and roasted in an oxidising atmosphere, the vapours produced being forced together with the products of combustion, through condensing and cooling arrangements, where any metallic vapours are recovered. The roasted ore is cooled, leached with water to remove soluble substances, and then leached with a solution of an alkali cyanide to dissolve the gold and silver.—A. S.

Nickel-copper alloys; Manufacture of ——. A. Monell, New York. U.S. Pat. 811,239, Jan. 30, 1906.

AN ore containing the sulphides of nickel and copper is smelted, the resulting matte is bessemerised, the product is roasted to convert the metals into oxides, and the latter are reduced in order to obtain directly a malleable nickel-copper alloy.—A. S.

Aluminium; Means for soldering ——. A. W. King. Assignor to C. Rogers, London. U.S. Pat. 811,725, Feb. 6, 1905.

SEE Eng. Pat. 3589 of 1905; this J., 1905, 804.—T. F. B.

Iron sponge; Method of manufacturing ——. G. Gröndal, Djursholm, Sweden. U.S. Pat. 812,174, Feb. 6, 1906.

SEE Fr. Pat. 330,763 of 1903; this J., 1903, 1091.—T.F.B.

Steel; Melt or bath for hardening ——. S. N. Brayshaw, Hulme. Assignor to G. Nash, New York. U.S. Pat. 812,178, Feb. 13, 1906.

SEE Eng. Pat. 12,816 of 1904; this J., 1905, 803.—T. F. B.

GERMAN PATENTS.

Steel in hearth furnaces; Production of slags poor in metallic oxides in the manufacture of mild ——. Elektrostahl G.m.b.H. Ger. Pat. 163,519, July 23, 1904.

CLAIM is made for the addition to the slag, as it forms, of suitable quantities of calcium carbide or silicon carbide, or a mixture of the two substances. The metallic oxides are reduced, the metals re-dissolving in the molten metal in the furnace, and a calcium silicate slag is produced, which, it is stated, has little action on the furnace lining. —A. S.

Ores and metallurgical products of all kinds; "Sulphatisation" of —— by fusion with sulphates. E. Enke. Ger. Pat. 163,410, Nov. 18, 1904.

THE ore is fused with an alkali bisulphate, preferably sodium bisulphate, or with ferrous sulphate, or a mixture of the two substances. The air is excluded and the temperature is maintained at a point at which only the ferrous sulphate added or formed in the process, is decomposed. —A. S.

Alloys of metals of different specific gravity; Manufacture of ——. A. Mahlke. Ger. Pat. 163,411, Nov. 22, 1904.

PIECES of the lighter metal are placed on the bottom of a crucible without touching the walls, and are packed around and above with pieces of the heavier metal. A quantity of the fused heavier metal is then poured into the crucible

so that the light metal is completely protected from the atmosphere. After adding a further quantity of the heavier metal, if required, the mixture is fused.

It is stated that by this process alloys containing relatively high percentages of magnesium can be produced, and also hard lead containing more antimony than that obtained by the usual methods.—A. S.

Slag; Process for the disintegration of molten blast-furnace ——. W. Lessing. Ger. Pat. 162,614, May 4, 1902.

The molten slag is fed on to the corrugated surface of a long, horizontal rotating drum. Lime or other substances may be added to the slag before it reaches the drum, or may be fed on to the drum with it.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 188.)

(*A.*)—ELECTRO-CHEMISTRY.

Electrolytic reduction; Cathodic potential and —— *in sulphuric acid solution.* J. Tafel. Z. Elektrochem., 1906, **12**, 112—122. (See also this J., 1901, 48.)

The present communication gives the general conclusions which the author has arrived at as a result of his extended studies on the reducibility of difficultly reducible organic compounds with lead cathodes in sulphuric acid solution. As special cases the conversion of strychnine into tetrahydrostrychnine and of caffeine into deoxycaffeine have been considered. The progress of the reduction and the current efficiency of the process were followed by gas measurements. It was found first with caffeine, and confirmed later with a whole series of substances, that lead, mercury or cadmium electrodes are essential for the reaction. Direct measurements prove the close connection between the high "over-voltage" which these metals exhibit in sulphuric acid and their power of allowing the reduction to occur. In the course of the work various disturbing influences have been detected, and in many cases could be ascribed to minute quantities of metallic impurity. The lowering of the cathodic potential and the diminution or cessation of the process of reduction are closely connected with a chemical alteration of the surface of the cathode. In this respect mere traces of platinum are exceedingly deleterious. The author favours the view that the surface of the cathode in the active condition consists of a metallic hydride which is destroyed by oxidising agents or by platinum, leaving the less active metallic surface. In both cases, after a shorter or longer time, under the action of the current, the active condition is restored.

In the case of caffeine, below a cathodic potential of 1·6 to 1·7 volts, with current densities varying from 0·04 to 0·125 ampère per sq. cm., reduction does not occur.

Succinimide is reduced to pyrrolidone, but upon spongy lead cathodes the current efficiency attained 67—68 per cent., whilst on polished lead under otherwise similar conditions only 8·6 per cent. was reached. Here definite evidence of the catalytic influence of the metal in increasing the reducing power of the discharged hydrogen ions was obtained.

When the effect is considered of the substance undergoing reduction and its products, upon the cathodic potential, the matter becomes complicated. Both the depolarisation, tending to diminish the potential, as also the specific action of some of these substances in raising the potential, have to be dealt with.—R. S. H.

English Patent.

Furnaces; Electric resistance ——. J. F. Bottomley, Wallsend-on-Tyne, and A. Paget, North Cray, Kent. Eng. Pat. 9522, May 5, 1905.

An electric current is passed through carbon or graphite plates forming an inner lining to the cover of the furnace. The material to be treated is supported on a movable hearth immediately below these plates and is thus heated by radiation. The object is to offer an extended heating surface, the temperature of which can be limited to any desired extent. Means are provided for excluding air and for the admission of material to the hearth.—R. S. H.

Water; Apparatus for the [electrical] purification of ——. J. S. Zerbe. Eng. Pat. 9216, May 2, 1905. XVIII*B.*, page 231.

Flour, grain, rice and other substances; Electric purifier for use in purifying ——. J. L. Lawson. Eng. Pat. 13,907, July 6, 1905. XVIII*A.*, page 231.

United States Patents.

Hydrochloric acid; [Electrical] Manufacture of ——. L. L. Roberts, Assignor to Roberts Chem. Co. U.S. Pat. 807,640, Dec. 19, 1905. VII., page 218.

Lead oxide; Process of making hydrated —— *[electrolytically].* J. H. Bridge, New York, and C. Ellis, Boston, Mass. U.S. Pat. 811,552, Feb. 6, 1906.

A hot concentrated aqueous solution of purified sodium chloride is electrolysed, using lead anodes, and the products of the electrolysis are allowed to mix, so as to form a precipitate of hydrated lead oxide and re-form the original electrolyte. The insoluble lead oxide is removed and the electrolyte again returned to the electrolytic cell.—B. N.

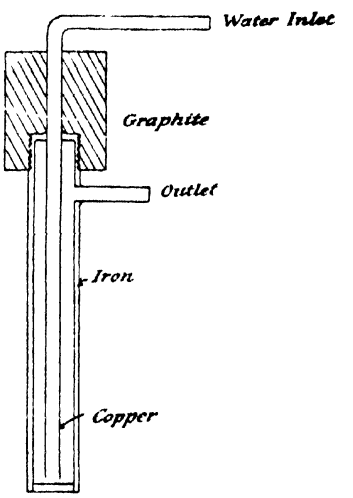
French Patents.

Incandescence electric lamps; Manufacture of ——. Siemens und Halske A.-G. First Addition, dated Sept. 14, 1905, to Fr. Pat. 321,412, May 26, 1902. II., page 213.

Incandescence electric lamps; Manufacture of metallic conducting bodies [tungsten and molybdenum] for ——. A. Jusk, F. Hanaman, Ver. Elektrizitäts A.-G., H. Landesberger and J. Salzmann. Fr. Pat. 358,272, Oct. 4, 1905. II., page 213.

(*B.*)—ELECTRO-METALLURGY.

Calcium; Preparation of metallic —— *by electrolysis.* S. A. Tucker and J. B. Whitney. J. Amer. Chem. Soc., 1906, **28**, 84—87.



The apparatus employed consists of a graphite crucible turned from an Acheson electrode. This crucible forms the anode and the cavity for the electrolyte is 10 cm. in diameter by 10 cm. deep. The bottom of the crucible is about 3 mm. thick and is cooled by a coil of copper tube through which water is circulated. A layer of fluorspar is placed on the bottom, and on this is poured fused calcium chloride until the crucible is nearly full; the

water-cooled cathode shown in the illustration is then immediately lowered into the crucible and the current turned on. Preliminary experiments showed that the temperature of the apparatus must be kept constant just below the point at which the metallic calcium begins to oxidise, namely, 720° C. The yield of metal is most satisfactory if the temperature be kept at 715° C. The current should be kept between 125 and 150 ampères. As the metal forms, the cathode is gradually raised by means of a wheel arrangement, and, when the rod of calcium becomes so long that the cooling effect of the water circulation is lost, the metal is removed and the process resumed by bringing the cooled iron in contact with the electrolyte. —W. P. S.

Metals; Some electrical measurements on ——. C. E. Fawsitt. Roy. Soc. Edin., Proc., 1906, **26**, 1—6.

If two rods of the same metal be inserted in a solution of a salt of that metal, and if one of the rods be in the soft or annealed condition, whilst the other is in the hardened condition, then the hardened rod is the negative and the soft the positive element of the cell. With other electrolytes the results are similar, but the measurements less definite. (Compare G. T. Beilby, this J., 1904, 788.) —R. S. H.

English Patent.

Electroplating tubes or other hollow articles; Apparatus for ——. L. Potthoff, Brooklyn, U.S.A. Eng. Pat. 6790, March 30, 1905.

See U.S. Pat. 786,776 of 1905; this J., 1905, 504.—T.F.B.

United States Patents.

Electrodeposition. W. C. Arsem, Schenectady. Assignor to General Electric Co., New York. U.S. Pat. 811,759, Feb. 6, 1906.

See Eng. Pat. 18,840 of 1904; this J., 1905, 896.—T.F.B.

Iron ore; Magnetic separation of —— and apparatus therefor. G. Gröndal, Djursholm, Sweden. U.S. Pats. 812,170 and 812,172, Feb. 6, 1906.

The separator comprises a stationary electro-magnet, "having a pole-piece formed with an elongated edge," which pole-piece is surrounded by a rotating drum constructed of magnetically indifferent material, but with iron lamellæ on its outer surface. Below, but near the drum, is a tank or chamber divided into two compartments by a partition reaching nearly to the top. A liquid containing the ore in suspension is fed in at the bottom of one compartment, and flows over the partition into the second compartment, thus passing near to the surface of the rotating drum. The non-magnetic particles, which are drawn to the surface, but not out of the liquid, escape through an overflow channel, whilst the magnetic particles of ore are drawn out of the liquid and discharged into another channel.—A. S.

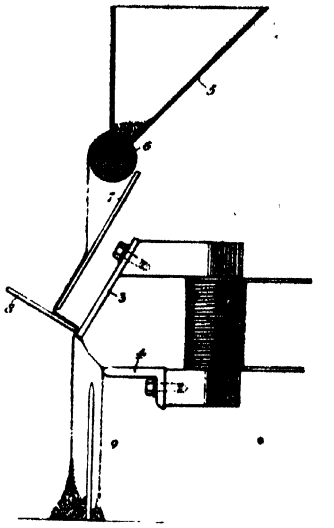
Ore separator; Magnetic ——. G. Gröndal, Djursholm, Sweden. U.S. Pats. 812,171 and 812,173, Feb. 6, 1906.

See Fr. Pat. 348,535 of 1904; this J., 1905, 505.—T.F.B.

French Patent.

Separator for [ores]; Magnetic —— and an electro-magnet for the same. The Edison Ore Milling Syndicate, Ltd. Fr. Pat. 358,262, Oct. 4, 1905.

The electro-magnet, a side view of which is shown in the diagram, is characterised by the pole pieces, 3, 4, being much longer than the diameter of the magnet. The ore is fed from the hopper, 5, over the distributing roller, 6, on to the inclined table, 7. Its descent is arrested by the inclined plate, 8, so that when it comes under the influence of the magnet it is moving very slowly. The magnetic particles are attracted by the lower polar piece, 4, and collect on one side of the division wall, 9, whilst the gangue falls by gravity on the other side. In practice a number



of separators are arranged one above the other, the tailings from one being conveyed to the next lower one, and so on.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 188.)

Olive Oil; Export of —— from South Italy. For. Off. Ann. Ser., No. 3530.

The export of olive oil in the past year is the lowest recorded in the last quinquennial period, the cause being the very poor crop of 1904—5. In the United Kingdom, to which a large portion of the yield was exported, great competition arose from the Spanish and other oils in the British markets. Spain was, however, the chief competitor. Russia, usually an important customer, only took a very small amount.

The following table shows the exports of olive oil from Gallipoli from Jan. 1 to Dec. 31, 1905, as compared with the years 1901—4:—

To—	Quantity.				
	1901.	1902.	1903.	1904.	1905.
	Tuns.*	Tuns.*	Tuns.*	Tuns.*	Tuns.*
United Kingdom	1,279	521	516	560	414
Russia	699	119	97	293	96
France	3	14	11	10	5
New York	4	—	—	—	—
Shanghai	—	—	—	77	82
Italian ports	666	456	960	1,633	980
Total	2,651	1,110	1,584	2,573	1577
Stock at Gallipoli on December 31	1,625	2,081	2,151	2,178	540
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Price f.o.b. on Dec. 31	33 10 0	35 5 0	30 10 0	37 0 0	32 15 0

* Imperial.

[T.R.]

Mercury and iodine; Determination of —— in antiseptic soaps. A. Seidell. XXIII., page 236.

English Patent.

Detergent; Manufacture of a ——. W. E. Heys, Watford, Herts. Eng. Pat. 17,777, Sept. 2, 1905.

Nine lb. of commercial oleine are emulsified with a solution of 1 lb. of ammonium chloride in 20 lb. of water,

in a suitable mixing apparatus. 8 lb. of soda lye (90·6° T.) and 6 lb. of water are then added and the whole well mixed for a few minutes, when 40 lb. of sodium carbonate and 9 lb. of sodium bicarbonate are successively added. Less water and sodium carbonate may be employed, and the bicarbonate may be omitted. Instead of ammonium chloride, ammonium carbonate may be used, in which case 5 lb. of common salt are finally added to the mixture. When the doughy mass at first formed begins to break up, it is removed from the mixer, granulated, dried and passed through a disintegrator, or compressed in suitable moulds. —W. P. S.

FRENCH PATENT.

Unsaturated compounds; Process for transforming —— into saturated compounds. C. Dreymann. Fr. Pat. 358,212, Oct. 2, 1905.

UNSATURATED compounds may be converted, by heating with a condensing agent, preferably sulphuric acid, into saturated compounds, the condensation product being distilled either dry, or by means of superheated steam, or in the vapour of some indifferent substance; the product may also be saponified previous to distillation. For example, 5 parts of olein are heated with 1 part of concentrated sulphuric acid for three hours, at about 50° C.; the product is washed with water, heated in an autoclave with 2 per cent. of its weight of lime, superheated steam being also introduced, and finally distilled by means of superheated steam. A solid, saturated fatty acid is stated to be produced. Turpentine, fatty esters, resins, and the acids contained in petroleum may also be converted into saturated compounds by similar means.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc

(*Continued from page* 189.)

(A.)—PIGMENTS, PAINTS.

White lead; Prohibition of the employment of ——. M. Alfassa. Bull. Soc. d'Encourg., 1906, **108**, 71—85.

ENGLISH PATENTS.

Lakes [from Azo dyestuffs]; Manufacture of red colour ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Bruning, Hoechst a/Main, Germany. Eng. Pat. 4046, March 6, 1905.

SEE Ger. Pat. 161,424 of 1904; this J., 1905, 1244.—T. F. B.

Lakes [from Azo dyestuffs]; Production of red colour ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 82, Jan. 1, 1906.

LITHOL Red (1-naphthalenesulphonic acid -2-azo-β-naphthol) or a similar dyestuff, is ground for one or two hours with a suitable metallic salt or hydroxide, and also, preferably, with a substratum, only such small quantity of water being added that the resulting product is dry. For instance, 100 parts of barium sulphate and 5 parts of the dyestuff are ground together, and a solution of 2·6 parts of barium chloride in 7 parts of water is added gradually, the grinding being continued until the lake formation is complete. (Compare Eng. Pats. 25,511 of 1899 and 2784 of 1900; this J., 1901, 55 and 240.) —T. F. B.

GERMAN PATENTS.

Dyestuff; Process for preparing an [azo] ——especially suited for the manufacture of lakes. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 163,644, March 31, 1904. IV., page 216.

Pigment; Preparation of a white ——. Van der Schnijt and Kuntze, and W. Overman. Ger. Pat. 163,524, May 12, 1904.

ZINC oxide is partially converted into zinc oxychloride by treatment with zinc chloride, and the product is subjected to the action of an alkali carbonate.—A. S.

(B.)—RESINS, VARNISHES.

UNITED STATES PATENT.

Lacquer or varnish. J. P. Ihart, New York, N.Y. U.S. Pat. 811,563, Feb. 6, 1906.

THE fraction of the distillate from oil-gas tar, passing over below 200° C. is mixed with one of the chlorides of tin, bismuth, antimony or aluminium.—B. N.

GERMAN PATENTS.

Lacquer; Matt ——. F. Goldscheider. Ger. Pat. 165,141, Feb. 26, 1904. Under Int. Conv., March 13, 1903.

STARCH is added to an ordinary spirit varnish.—A. S.

Linseed oil for the preparation of varnish; Purification of ——. C. Niegemann. Ger. Pat. 163,056, March 8, 1904.

AFTER cooling the oil to its solidifying point, the temperature is allowed to rise again until the oil becomes capable of being filtered. At this temperature (below 0° C.) the separated albuminous impurities are removed by filtration.—A. S.

(C.)—INDIA-RUBBER, Etc.

Rubber; Action of atmospheric oxygen on Para ——. E. Herbst. Ber., 1906, **39**, 523—525.

PARA rubber (6·004 grms.), purified by the method given by Harries (Ber., 1905, **38**, 1198), was dissolved in benzene (600 c.c., b. pt. 80°—85° C.) and the solution heated for 140 hours under a reflux condenser, while a current of dry air, free from dust, was passed through it. The benzene lost by evaporation was renewed from time to time. The solution gradually became yellow, and a small quantity of a yellowish-grey resinous substance, practically insoluble in alcohol, petroleum ether, glacial acetic acid and carbon bisulphide, separated from it. The rubber had become completely oxidised, and on distilling off the benzene, a syrupy mixture of resinous bodies (6·735 grms.) was obtained. From this residue the following substances were separated: (1) A clear, light-brown syrup (5·818 grms.), soluble in petroleum ether (b. pt. 60°—70° C.), possessing a characteristic aromatic odour, and having the composition $C_{10}H_{16}O$. (2) An amorphous, pale yellow, friable mass (0·115 grm.), with a faint aromatic odour, having the composition $C_{10}H_{16}O_3$, precipitated from the benzene solution by petroleum ether. (3) A dirty yellow viscous mass, solidifying *in vacuo* to a hard, brittle, vitreous mass (0·15 grm.), resembling shellac. This substance was obtained by concentrating the mother liquors from substance (2) and precipitating with a large excess of petroleum ether; it also had the composition $C_{10}H_{16}O_3$. Substances (2) and (3) are similar in composition to Spiller's resin (J. Chem. Soc., **3**, [2], 44).—E. W. L.

Rubber; Solubility of vulcanised —— in pyridine. R. Ditmar. Gummi-Zeit., 1906, **20**, 441.

THE author confirms the statement of W. Esch (Gummi-Zeit., 1906, **20**, 324) that pyridine dissolves notable quantities of vulcanised rubber, on prolonged action at an elevated temperature. Pyridine, therefore, cannot be used as a solvent for the extraction of tar, pitch, and asphaltum, in the analysis of rubber goods.—E. W. L.

Rubber-resins; Ethyl acetate as a solvent for ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 441.

EXTRACTION with ethyl acetate removes a further small

quantity of resin from acetone-extracted, raw Pará rubber. In using ethyl acetate as a solvent for resins in rubber analysis, however, account must be taken of the fact that small quantities of the rubber itself are also dissolved by it, and carried into the extract, from which they must be precipitated by means of alcohol (and their weight deducted from the total loss in weight of the rubber on extraction).

The action of ethyl acetate on the rubber is to render it very plastic; in this condition it can be readily shaped into various objects, which retain their form after the evaporation of the solvent, the rubber losing its plasticity and recovering its original properties.—F. W. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 190.)

ENGLISH PATENT.

Tanning substances; Process of and apparatus for the uninterrupted extraction of ——. G. F. Bögel, Altona-Ottensen, Germany. Eng. Pat. 18,338, Sept. 11, 1905.

SEE Fr. Pat. 357,547 of 1905; this J., 1906, 130.—T.F.B.

FRENCH PATENT.

Leather, Process of preparing ——. P. Magnus and T. J. Davis. Fr. Pat. 358,346, Oct. 7, 1905.

SEE Eng. Pat. 19,443 of 1905; this J., 1906, 130.—T.F.B.

XVI.—SUGAR, STARCH, GUM, Etc.

Lichens; The carbohydrates of the ——. A. Ulander and B. Tollens. Ber., 1906, **39**, 401—409.

As a result of these investigations, the lichens may be divided into two main groups according to the behaviour of their constituent carbohydrates towards boiling water and acid hydrolysis.

(1) *Iceland moss group.*—This group includes the lichens *Cetraria islandica* (Iceland moss), *Evernia prunastri*, *Usnea barbata* and *Cornicularia aculeata* and the fungus *Bulgaria inquinans*. From the members of this group, after purification with potassium carbonate, boiling water extracts amorphous, gelatinous carbohydrates similar to lichenin. The lichenin from Iceland moss is not identical with the evernin from *Evernia*, since the former is optically inactive, whilst the latter is strongly dextrorotatory. All these soluble carbohydrates readily yield dextrose on hydrolysis. The residues from the aqueous extraction are easily hydrolysed by boiling with dilute sulphuric acid, and yield principally dextrose, together with small quantities of mannose and galactose.

(2) *Reindeer moss group.*—This group comprises *Cladonia rangiferina* (reindeer moss), *Stereocaulon pascale* and *Peltigera aphtosa*. These lichens yield no appreciable quantities of carbohydrates soluble in boiling water. The carbohydrates of this group are hydrolysed by acids with far greater difficulty than those of the first group. The products of hydrolysis consist principally of mannose and galactose, with only small quantities of dextrose. The quantitative relations of the sugars obtained by the hydrolysis of the carbohydrates of both groups vary considerably in the different members. Small quantities of furfural and methylfurfural were obtained from both groups of lichens. The residue resisting hydrolysis appears to consist of cellulose.—J. F. B.

Starch factories; Industrial control of the yield of starch in potato ——. E. Parow. Z. Spiritusind, 1906, **29**, 51—52.

THE author describes the method to be followed for checking the yield of starch in the factory, and for tracing the sources of loss, if any. Samples of 60 kilos. each are taken five times in the course of the day from the crude potatoes as they enter the system. These are thoroughly washed, allowed to dry over-night and weighed the next morning. The average weight enables the correct weight of clean, raw material taken into work to be calculated. Similarly five samples of potatoes are taken during the day and the average percentage of starch is determined in them by means of the potato balance. After the potatoes have been rasped and pulped, the starch is separated and collected in the settling tank. After washing in the mechanical washer, the starch is collected in bags and drained. The starch suspended in the wash waters is passed through sieves and settled on tables, and the starch deposited, is drained and weighed with the main yield. The pulps are pumped into a reservoir and measured out in a tared box; five weighings of this when full give the average weight of pulps produced. Determinations are made in the laboratory of the percentage of water in the moist starch; and the percentage of starch in the pulps: (*a*) the starch which might have been recovered by further washing, and (*b*) the starch enclosed in the pulps. Finally, all the effluent waters are gauged at the point of exit from the factory and the quantity of starch suspended in an average aliquot sample of them is determined. The following figures show the results actually found in the case of a starch factory working satisfactorily:—Weight of cleaned potatoes, 191 cwts., containing 1850·8 kilos. of dry starch as determined by the balance. Dry starch obtained, 1404·3 kilos.; in the pulps: (*a*) capable of extraction, 22 kilos.; (*b*) enclosed, 324·5 kilos.; in the effluent waters, 14·6 kilos.; total 1765·5 kilos.; errors and unaccountable losses, 83·3 kilos. = 4·61 per cent. of the total starch.—J. F. B.

Sugars, Specific gravities of solutions of the principal ——. O. Mohr. Z. Spiritusind., 1906, **29**, 25—26.

THE existing data relating to the specific gravities of solutions of the different sugars at different concentrations are of the most diverse nature so far as the temperatures of observation and the units of volume are concerned. The observations have been made indiscriminately at 15°, 17·5° and 20° C., and the units are referred to water either at the same temperatures or at 4° C. Some of the tables show the contents of the solutions in percentages by weight, others show the number of grms. of sugar per 100 c.c. The author has re-calculated and co-ordinated the most reliable tables for the principal sugars, *viz.*, dextrose, levulose, invert sugar and maltose, comparing them with the German official normal tables for cane sugar. He shows the percentage by weight and the concentration in grms. per 100 c.c. for each of the sugars, with the corresponding specific gravities (either at 17·5°/17·5° or at 20°/4°), of cane sugar solutions of the same concentrations at the same temperature and the percentage by weight of cane sugar in solutions of the same specific gravities.

Anhydrous Dextrose (*Salomon, Ber.* 1881, **14**, 2711).

Contents of solution. Grms. per 100 c.c.	Contents of solution. Per cent. by weight.	Sp. gr. of dextrose solution at 17·5°/17·5°	Sp. gr. of cane sugar solution of same concentration at 17·5°/17·5°	Contents of cane sugar solution of same sp. gr. as dextrose. Per cent. by weight.
1·00	0·998	1·00375	1·00387	0·967
2·00	1·988	1·0075	1·00774	1·928
3·00	2·970	1·0115	1·01160	2·906
4·00	3·945	1·0153	1·01547	3·903
5·00	4·912	1·0192	1·01933	4·880
6·00	5·872	1·0230	1·02319	5·825
7·00	6·827	1·0267	1·02705	6·749
8·00	7·773	1·0305	1·03089	7·677
9·00	8·714	1·0342	1·03475	8·581
10·00	9·645	1·0381	1·03858	9·527
11·00	10·570	1·0420	1·04243	10·467
12·00	11·490	1·0457	1·04628	11·352
13·00	12·402	1·0495	1·05011	12·257
14·00	13·309	1·0533	1·05396	13·155
15·00	14·209	1·0571	1·05780	14·047
16·00	15·100	1·0610	1·06161	14·958
17·00	15·984	1·0649	1·06542	15·863
18·00	16·864	1·0687	1·06924	16·740

Levulose (*Ost, Lippmann's "Chem. der Zuckerarten," 3rd Edition*, **1**, 819).

Contents of solution Grms. per 100 c.c.	Contents of solution. Per cent. by weight.	Sp. gr. of levulose solution at 20° 4°	Sp. gr. of cane sugar solution of same concentration at 20° 4°	Contents of cane sugar solution of same sp. gr. as levulose. Per cent. by weight.
	*	*		
1·01	1·0100	1·0021	1·00216	0·995
1·03	1·0324	1·0022	1·00224	1·002
2·01	1·9949	1·0062	1·00600	2·047
2·04	2·0263	1·0063	1·00612	2·073
5·03	4·9395	1·0177	1·01761	4·981
5·04	4·9575	1·0178	1·01768	4·986
5·06	4·9710	1·0178	1·01773	4·986
8·04	7·8051	1·0295	1·02915	7·891
9·28	8·9724	1·0341	1·03392	9·018
10·19	9·8195	1·0379	1·03740	9·941
10·95	10·5199	1·0405	1·04029	10·570
19·90	18·5161	1·0748	1·07441	18·605
21·93	20·2638	1·0821	1·08213	20·257
33·56	29·7995	1·1263	1·12603	29·857
33·97	30·1457	1·1279	1·12754	30·192

Invert Sugar (*Herzfeld, Z. Ver. deut. Zuckerind.*, **37**, 912).

Contents of solution. Grms. per 100 c.c.	Contents of solution Per cent. by weight.	Sp. of invert sugar solution. at 17·5° 4°	at 17·5° 17·5°	Sp. gr. of cane sugar solution of same concentration at 17·5° 17·5°	Contents of cane sugar solution of same sp. gr. as invert sugar Per cent. by weight.
	*	*			
10·39	10·0	1·03901	1·04034	1·04005	10·07
10·93	10·5	1·04109	1·04243	1·04214	10·57
11·47	11·0	1·04316	1·04450	1·04422	11·07
12·02	11·5	1·04527	1·04661	1·04632	11·57
12·57	12·0	1·04737	1·04871	1·04841	12·07
13·12	12·5	1·04949	1·05083	1·05053	12·57
13·67	13·0	1·05160	1·05295	1·05264	13·07
14·78	14·0	1·05588	1·05723	1·05690	14·08
15·90	15·0	1·06018	1·06154	1·06118	15·08
17·03	16·0	1·06453	1·06590	1·06549	16·09
18·17	17·0	1·06889	1·07026	1·06983	17·10
19·32	18·0	1·07330	1·07468	1·07421	18·11
20·48	19·0	1·07772	1·07912	1·07862	19·11
21·64	20·0	1·08218	1·08357	1·08306	20·11
22·82	21·0	1·08665	1·08804	1·08753	21·11
24·00	22·0	1·09114	1·09254	1·09203	22·11
25·20	23·0	1·09566	1·09707	1·09658	23·11
26·40	24·0	1·10019	1·10160	1·10115	24·10
27·62	25·0	1·10474	1·10616	1·10575	25·09
28·84	26·0	1·10930	1·11072	1·11039	26·07
30·09	27·0	1·11433	1·11576	1·11506	27·15

Anhydrous Maltose (*Salomon, J. prakt. Chem., II.*, **28**, 82).

Contents of solution. Grms. per 100 c.c.	Contents of solution. Per cent. by weight	Sp. gr. of maltose solution at 17·5° 17·5°	Sp. gr. of cane sugar solution of same concentration at 17·5° 17·5°	Contents of cane sugar solution of same sp. gr. as maltose. Per cent by weight.
*		*		
1·0	0·997	1·00393	1·00387	1·013
2·0	1·987	1·00785	1·00774	2·015
3·0	2·969	1·01177	1·01160	3·013
4·0	3·943	1·01568	1·01546	3·998
5·0	4·911	1·01953	1·01932	4·963
6·0	5·870	1·02340	1·02318	5·925
7·0	6·823	1·02733	1·02703	6·895
8·0	7·768	1·03122	1·03087	7·855
9·0	8·706	1·03515	1·03471	8·812
10·0	9·637	1·03900	1·03855	9·746
15·0	14·192	1·05827	1·05773	14·321
20·0	18·587	1·07740	1·07680	18·723
25·0	22·829	1·09650	1·09580	22·982
30·0	26·928	1·11550	1·11472	27·096

Anhydrous Maltose (*Ost, Chem.-Zeit.* **19**, 1728).

Contents of solution. Grms. per 100 c.c.	Contents of solution. Per cent. by weight.	Sp. gr. of maltose solution at 20° 4°	Sp. gr. of cane sugar solution of same concentration at 20° 4°	Contents of cane sugar solution of same sp. gr. as maltose. Per cent. by weight.
	*	*		
1·78	1·77	1·005	1·00512	1·74
3·08	3·05	1·010	1·01013	3·02
4·37	4·31	1·015	1·01511	4·28
5·65	5·54	1·020	1·02001	5·54
6·92	6·75	1·025	1·02488	6·78
8·19	7·95	1·030	1·02974	8·01
9·47	9·15	1·035	1·03464	9·24
10·76	10·35	1·040	1·03959	10·45
12·10	11·58	1·045	1·04470	11·75
13·39	12·75	1·050	1·04961	12·84
14·65	13·89	1·055	1·05443	14·02
15·95	15·05	1·060	1·05938	15·19
17·25	16·20	1·065	1·06432	16·36
18·55	17·34	1·070	1·06927	17·51
19·83	18·45	1·075	1·07412	18·65
21·14	19·57	1·080	1·07904	19·78

The columns marked * represent original observations, the others are calculated.

The tables show that the specific gravities of the solutions of the various sugars are not identical with those of cane sugar of the same concentrations. Levulose, invert sugar and maltose solutions have higher specific gravities than the corresponding solutions of cane sugar, whilst those of dextrose have lower specific gravities. The differences at medium concentrations are not very great, and amount only to a few units in the fourth place of decimals, so that the use of the cane sugar tables for the determination of other sugars involves an error of only 0·1 per cent. and is very convenient. The comparison of the tables indicates that the hydrolysis of cane sugar to invert sugar and of maltose to dextrose is accompanied by a considerable contraction in volume.—J. F. B.

Gum; Export of —— from Senegal. Bd. of Trade J., Feb. 15, 1906.

THE total export of gum from Senegal in 1904, the last year for which statistics have appeared, was 2,370,031 kilos., valued at 44,835*l*. This was divided as follows:—Hard gum, 1,842,610 kilos., from the region north of the River Senegal, and 484,095 kilos., from the Soudan and Senegal proper; friable gum, 37,396 kilos., from all parts; dust and damaged gum, 5,930 kilos., from all parts. An export duty of 1 franc 50 centimes per kilo. was formerly levied, but was removed in May, 1905, so that there are now no royalties or export duties on gum. At least three-fourths of the gum is brought by caravans to the various posts on the River Senegal, from which they are taken to St. Louis by river transport of various kinds, and thence embarked for Europe. Since the re-opening of the Egyptian Soudan, the Senegal gum trade has been dwindling away, and is now looked upon as of quite secondary importance.

[T.R.]

Dextrose; Determination of ——. B. Glassmann. XXIII., page 236.

UNITED STATES PATENT.

Sugar; Method of making maize ——. F. L. Stewart, Murraysville, Pa. Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 811,523, Jan. 30, 1906.

THE ears are separated from the growing maize whilst they are still immature, and are at the stage of growth when the "ear is in the milk and the protruding silk is dead." The growth of the plant is then continued, when an increase of the sugar content of the stalk takes place. Finally the juice is extracted, clarified and converted into sugar or syrup.—J. F. B.

FRENCH PATENTS.

Sugar juices; Clarification of —— by means of hydrosulphurous acid or its salts. F. Schiller and K. Herbst. Fr. Pat. 358,296, Oct. 5, 1905.

HYDROSULPHUROUS acid or one of its salts, such as the

aluminium or calcium salt, is added to the crude sugar cane or beet roots during or after the extraction of the juice, whilst the latter is still in the undefecated, acid condition. The base of the hydrosulphite combines with the organic acids of the juice, precipitating them together with a considerable proportion of the albuminoids, and other non-sugar constituents. At the same time the hydrosulphurous acid, which is said to have no inverting action on the sugar, reduces the colouring matters of the juice.—J. F. B.

Starch and dextrin; Manufacture of phonograph records from ——. Comp. gen. de Phonographes, Cinematographes et Appareils de Precision. Fr. Pat. 358,366, Oct. 9, 1905.

For moulding records in the form of discs or cylinders, potato, farina or other starch, or commercial dextrin, is introduced into the mould in a dry, pulverulent condition. The mass is then subjected in the mould to a pressure of about 200 kilos. per sq. cm. During the action of this pressure the temperature of the mass is raised by means of steam to 110°—120° C. Under the combined action of heat and pressure, the starch is modified and becomes fused to a hard, horny mass, which retains the impression of the mould.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 194.)

Fermentation; Studies in ——. 1. *Chemical dynamics of alcoholic fermentation by yeast.* A. Slator. Chem. Soc. Trans. 1906, **89**, 128—142.

The author describes a new method for measuring the velocity of fermentation, over very small ranges of the reaction, by observing the increase of pressure developed in short intervals of time by the carbon dioxide evolved. A bottle of about 150 c.c. capacity is connected with a manometer by a piece of thick rubber tubing. 50 c.c. of the solution of sugar, yeast and nutrient salts are introduced into the bottle and the latter is placed in the thermostat, the apparatus is evacuated through a side tube provided on the short arm of the manometer, and the level of the mercury is read off. The change of pressure caused by the evolution of carbon dioxide is registered on the scale of the manometer, and serves as a very sensitive measure of the relative progress of the fermentation. Experiments made in this manner at 30° C. showed conclusively that when the quantity of yeast was increased, other conditions being constant, the velocity of fermentation was proportional to the concentration of the yeast. In a second series of experiments, the quantity of yeast was maintained constant whilst the concentration of the sugar (dextrose) was varied between 0·20 and 20·0 grms. per 100 c.c. It was found that, between the limits of 0·50 and 10·0 grms. of dextrose per 100 c.c., the velocity of fermentation was very nearly independent of the concentration of the sugar, a maximum point being, however, just discernible at about 5 per cent. of sugar. Below 0·5 per cent. of sugar the velocity of fermentation was influenced by the concentration of the sugar, but was never really proportional to it, whilst above 10 per cent. the excess of sugar exerted a distinct retarding influence. The above observations are most simply explained by the formation of a compound between the enzyme and the sugar by diffusion of the latter into the cell, and the velocity which is measured experimentally is the rate of decomposition of this compound. The temperature-coefficient of the reaction of fermentation is large and varies with the temperature; from the tables given in the paper, the ratios of $V_{15}°/V_{5}° = 5·6$ and $V_{40}°/V_{30}° = 1·6$ may be cited as illustrations. The temperature quotients for every 5° from 5° to 40° C. form a series of numbers which seem to be characteristic of the enzyme zymase, being independent of the concentration of yeast and dextrose, the type of yeast, the presence or absence of nutrient salts and of inhibiting agents.

The initial rates of fermentation of dextrose, levulose, sucrose and maltose are in the ratios of 1:0·92:1·05:0·9. Sucrose and maltose show constant values for the velocity of fermentation within a few minutes of the start, indicating that sufficient of the disaccharide is hydrolysed almost instantaneously for the fermentation to attain its maximum velocity. The addition of lactic acid produced no change in the velocity of fermentation, and the author concludes that it is very unlikely that any but small quantities of sugar go through the intermediate step of lactic acid during fermentation.—J. F. B.

Sarcina [*in brewery yeast*]. Bettges and Heller. Woch. f. Brau. 1906, **23**, 69—74.

In brewery practice, sarcina often occurs in the single coccus form, and cannot be identified by the microscopic examination of yeast in the ordinary way. In order to induce the sarcina to grow in the characteristic packet form, the authors have tried the following methods:—Will's method, by cultivation in ammoniacal yeast-water, gave no growth of sarcina at all. Claussen's method, by digestion with acid ammonium fluoride, failed to separate the sarcina from the culture yeast, both being equally resistant to the antiseptic. Lindner's method, by cultivation on an object glass with exclusion of air by a vaseline ring, gave results, but only after five to eight days. The authors have devised a modification of this last method, accelerating the result by selecting a medium favourable to the sarcina and inimical to the yeast. This improved medium consists of a beer fermented in the laboratory from an unhopped wort, and attenuated as far as possible. Such beer is mixed with a barley or malt decoction, in order that free starch may be present. It is then neutralised by ammonia and an excess of ammonia equal to the quantity required to neutralise, is added, together with sufficient alcohol to bring the final alcohol content of the medium to 2—4 per cent., attention being paid to the fact that volatilisation of both alcohol and ammonia takes place during sterilisation. Vaseline is painted on the object glass to form three sides of a square, some of the yeast is mixed with the culture liquid, and a drop is carefully mounted on the glass, the fourth side of the square being closed by vaseline when the preparation is complete. Sarcina packets are generally visible after two days, but with very slight infections it may be necessary to keep the slide under observation for four days. The same medium may be employed for flask cultivations, the deposit being subjected to microscopic examination in the ordinary way, but in such cultures it is necessary to wait two or three days longer before a result is obtained. By the above method the authors have traced the nidus of a sarcina infection in their beer which, without causing the characteristic sarcina sickness, brought about an acidification and turbidity when the beer was kept for 15—18 days; the source of infection was found in places where the lacquer of the wooden fermentation tuns had worn away, and growths of sarcina had developed in the porous wood.—J. F. B.

Yeast; Production of sulphuretted hydrogen by ——. H. Will and H. Wanderscheck. Z. ges. Brauw., 1906, **29**, 73—78 and 89—96.

The authors have proved that many species of brewery yeasts, both culture yeasts and wild yeasts, are capable of producing sulphuretted hydrogen when fermenting in hopped worts. The culture yeasts are generally more active in this respect than the wild yeasts, and the evolution of sulphuretted hydrogen is generally observed towards the end of the primary fermentation. Of the culture yeasts, Frohberg yeast showed a very feeble reaction, whilst Logos yeast showed a strong one. The sources of sulphuretted hydrogen in normal worts must be either the albuminoids or the sulphates, but the exact source has not yet been ascertained. The addition of gypsum or magnesium sulphate to the wort produced no marked increase in the amount of sulphuretted hydrogen evolved, neither did the use of sulphured malt and hops cause any appreciable increase. On the other hand the addition of peptones, although they contained sulphur, actually decreased the tendency to formation of sulphuretted

Levulose (*Ost, Lippmann's "Chem. der Zuckerarten," 3rd Edition*, **1**, 819).

Contents of solution Grms. per 100 c.c.	Contents of solution. Per cent. by weight.	Sp. gr. of levulose solution at 20° 4°	Sp. gr. of cane sugar solution of same concentration at 20° 4°	Contents of cane sugar solution of same sp. gr. as levulose. Per cent. by weight.
	*	*		
1·01	1·0100	1·0021	1·00216	0·995
1·03	1·0324	1·0022	1·00224	1·002
2·01	1·9949	1·0062	1·00600	2·047
2·04	2·0263	1·0063	1·00612	2·073
5·03	4·9395	1·0177	1·01761	4·981
5·04	4·9575	1·0178	1·01768	4·986
5·06	4·9710	1·0178	1·01773	4·986
8·04	7·8051	1·0295	1·02915	7·891
9·28	8·9724	1·0341	1·03392	9·018
10·19	9·8195	1·0379	1·03740	9·941
10·95	10·5199	1·0405	1·04029	10·570
19·90	18·5161	1·0748	1·07441	18·605
21·93	20·2638	1·0821	1·08213	20·257
33·56	29·7995	1·1263	1·12603	29·857
33·97	30·1457	1·1279	1·12754	30·192

Invert Sugar (*Herzfeld, Z. Ver. deut. Zuckerind.*, **37**, 912).

Contents of solution. Grms. per 100 c.c.	Contents of solution Per cent. by weight.	Sp. of invert sugar solution. at 17·5° 4°	at 17·5° 17·5°	Sp. gr. of cane sugar solution of same concentration at 17·5° 17·5°	Contents of cane sugar solution of same sp. gr. as invert sugar Per cent. by weight.
	*	*			
10·39	10·0	1·03901	1·04034	1·04005	10·07
10·93	10·5	1·04109	1·04243	1·04214	10·57
11·47	11·0	1·04316	1·04450	1·04422	11·07
12·02	11·5	1·04527	1·04661	1·04632	11·57
12·57	12·0	1·04737	1·04871	1·04841	12·07
13·12	12·5	1·04949	1·05083	1·05053	12·57
13·67	13·0	1·05160	1·05295	1·05264	13·07
14·78	14·0	1·05588	1·05723	1·05690	14·08
15·90	15·0	1·06018	1·06154	1·06118	15·08
17·03	16·0	1·06453	1·06590	1·06549	16·09
18·17	17·0	1·06889	1·07026	1·06983	17·10
19·32	18·0	1·07330	1·07468	1·07421	18·11
20·48	19·0	1·07772	1·07912	1·07862	19·11
21·64	20·0	1·08218	1·08357	1·08306	20·11
22·82	21·0	1·08665	1·08804	1·08753	21·11
24·00	22·0	1·09114	1·09254	1·09203	22·11
25·20	23·0	1·09566	1·09707	1·09658	23·11
26·40	24·0	1·10019	1·10160	1·10115	24·10
27·62	25·0	1·10474	1·10616	1·10575	25·09
28·84	26·0	1·10930	1·11072	1·11039	26·07
30·09	27·0	1·11433	1·11576	1·11506	27·15

Anhydrous Maltose (*Salomon, J. prakt. Chem., II.*, **28**, 82).

Contents of solution. Grms. per 100 c.c.	Contents of solution. Per cent. by weight	Sp. gr. of maltose solution at 17·5° 17·5°	Sp. gr. of cane sugar solution of same concentration at 17·5° 17·5°	Contents of cane sugar solution of same sp. gr. as maltose. Per cent by weight.
*		*		
1·0	0·997	1·00393	1·00387	1·013
2·0	1·987	1·00785	1·00774	2·015
3·0	2·969	1·01177	1·01160	3·013
4·0	3·943	1·01568	1·01546	3·998
5·0	4·911	1·01953	1·01932	4·963
6·0	5·870	1·02340	1·02318	5·925
7·0	6·823	1·02733	1·02703	6·895
8·0	7·768	1·03122	1·03087	7·855
9·0	8·706	1·03515	1·03471	8·812
10·0	9·637	1·03900	1·03855	9·746
15·0	14·192	1·05827	1·05773	14·321
20·0	18·587	1·07740	1·07680	18·723
25·0	22·829	1·09650	1·09580	22·982
30·0	26·928	1·11550	1·11472	27·096

Anhydrous Maltose (*Ost, Chem.-Zeit.* **19**, 1728).

Contents of solution. Grms. per 100 c.c.	Contents of solution. Per cent. by weight.	Sp. gr. of maltose solution at 20° 4°	Sp. gr. of cane sugar solution of same concentration at 20° 4°	Contents of cane sugar solution of same sp. gr. as maltose. Per cent. by weight.
	*	*		
1·78	1·77	1·005	1·00512	1·74
3·08	3·05	1·010	1·01013	3·02
4·37	4·31	1·015	1·01511	4·28
5·65	5·54	1·020	1·02001	5·54
6·92	6·75	1·025	1·02488	6·78
8·19	7·95	1·030	1·02974	8·01
9·47	9·15	1·035	1·03464	9·24
10·76	10·35	1·040	1·03959	10·45
12·10	11·58	1·045	1·04470	11·75
13·39	12·75	1·050	1·04961	12·84
14·65	13·89	1·055	1·05443	14·02
15·95	15·05	1·060	1·05938	15·19
17·25	16·20	1·065	1·06432	16·36
18·55	17·34	1·070	1·06927	17·51
19·83	18·45	1·075	1·07412	18·65
21·14	19·57	1·080	1·07904	19·78

The columns marked * represent original observations, the others are calculated.

The tables show that the specific gravities of the solutions of the various sugars are not identical with those of cane sugar of the same concentrations. Levulose, invert sugar and maltose solutions have higher specific gravities than the corresponding solutions of cane sugar, whilst those of dextrose have lower specific gravities. The differences at medium concentrations are not very great, and amount only to a few units in the fourth place of decimals, so that the use of the cane sugar tables for the determination of other sugars involves an error of only 0·1 per cent. and is very convenient. The comparison of the tables indicates that the hydrolysis of cane sugar to invert sugar and of maltose to dextrose is accompanied by a considerable contraction in volume.—J. F. B.

Gum; Export of —— from Senegal. Bd. of Trade J., Feb. 15, 1906.

THE total export of gum from Senegal in 1904, the last year for which statistics have appeared, was 2,370,031 kilos., valued at 44,835*l*. This was divided as follows:—Hard gum, 1,842,610 kilos., from the region north of the River Senegal, and 484,095 kilos., from the Soudan and Senegal proper; friable gum, 37,396 kilos., from all parts; dust and damaged gum, 5,930 kilos., from all parts. An export duty of 1 franc 50 centimes per kilo. was formerly levied, but was removed in May, 1905, so that there are now no royalties or export duties on gum. At least three-fourths of the gum is brought by caravans to the various posts on the River Senegal, from which they are taken to St. Louis by river transport of various kinds, and thence embarked for Europe. Since the re-opening of the Egyptian Soudan, the Senegal gum trade has been dwindling away, and is now looked upon as of quite secondary importance.

[T.R.]

Dextrose; Determination of ——. B. Glassmann. XXIII., page 236.

UNITED STATES PATENT.

Sugar; Method of making maize ——. F. L. Stewart, Murraysville, Pa. Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 811,523, Jan. 30, 1906.

THE ears are separated from the growing maize whilst they are still immature, and are at the stage of growth when the "ear is in the milk and the protruding silk is dead." The growth of the plant is then continued, when an increase of the sugar content of the stalk takes place. Finally the juice is extracted, clarified and converted into sugar or syrup.—J. F. B.

FRENCH PATENTS.

Sugar juices; Clarification of —— by means of hydrosulphurous acid or its salts. F. Schiller and K. Herbst. Fr. Pat. 358,296, Oct. 5, 1905.

HYDROSULPHUROUS acid or one of its salts, such as the

aluminium or calcium salt, is added to the crude sugar cane or beet roots during or after the extraction of the juice, whilst the latter is still in the undefecated, acid condition. The base of the hydrosulphite combines with the organic acids of the juice, precipitating them together with a considerable proportion of the albuminoids, and other non-sugar constituents. At the same time the hydrosulphurous acid, which is said to have no inverting action on the sugar, reduces the colouring matters of the juice.—J. F. B.

Starch and dextrin; Manufacture of phonograph records from ——. Comp. gen. de Phonographes, Cinematographes et Appareils de Precision. Fr. Pat. 358,366, Oct. 9, 1905.

For moulding records in the form of discs or cylinders, potato, farina or other starch, or commercial dextrin, is introduced into the mould in a dry, pulverulent condition. The mass is then subjected in the mould to a pressure of about 200 kilos. per sq. cm. During the action of this pressure the temperature of the mass is raised by means of steam to 110°—120° C. Under the combined action of heat and pressure, the starch is modified and becomes fused to a hard, horny mass, which retains the impression of the mould.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 194.)

Fermentation; Studies in ——. 1. *Chemical dynamics of alcoholic fermentation by yeast.* A. Slator. Chem. Soc. Trans. 1906, **89**, 128—142.

The author describes a new method for measuring the velocity of fermentation, over very small ranges of the reaction, by observing the increase of pressure developed in short intervals of time by the carbon dioxide evolved. A bottle of about 150 c.c. capacity is connected with a manometer by a piece of thick rubber tubing. 50 c.c. of the solution of sugar, yeast and nutrient salts are introduced into the bottle and the latter is placed in the thermostat, the apparatus is evacuated through a side tube provided on the short arm of the manometer, and the level of the mercury is read off. The change of pressure caused by the evolution of carbon dioxide is registered on the scale of the manometer, and serves as a very sensitive measure of the relative progress of the fermentation. Experiments made in this manner at 30° C. showed conclusively that when the quantity of yeast was increased, other conditions being constant, the velocity of fermentation was proportional to the concentration of the yeast. In a second series of experiments, the quantity of yeast was maintained constant whilst the concentration of the sugar (dextrose) was varied between 0·20 and 20·0 grms. per 100 c.c. It was found that, between the limits of 0·50 and 10·0 grms. of dextrose per 100 c.c., the velocity of fermentation was very nearly independent of the concentration of the sugar, a maximum point being, however, just discernible at about 5 per cent. of sugar. Below 0·5 per cent. of sugar the velocity of fermentation was influenced by the concentration of the sugar, but was never really proportional to it, whilst above 10 per cent. the excess of sugar exerted a distinct retarding influence. The above observations are most simply explained by the formation of a compound between the enzyme and the sugar by diffusion of the latter into the cell, and the velocity which is measured experimentally is the rate of decomposition of this compound. The temperature-coefficient of the reaction of fermentation is large and varies with the temperature; from the tables given in the paper, the ratios of $V_{15}°/V_{5}° = 5·6$ and $V_{40}°/V_{30}° = 1·6$ may be cited as illustrations. The temperature quotients for every 5° from 5° to 40° C. form a series of numbers which seem to be characteristic of the enzyme zymase, being independent of the concentration of yeast and dextrose, the type of yeast, the presence or absence of nutrient salts and of inhibiting agents.

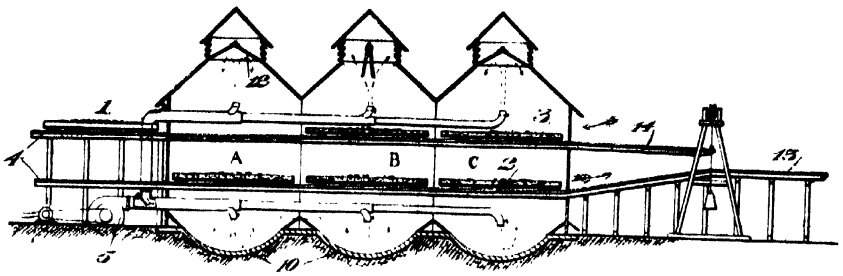
The initial rates of fermentation of dextrose, levulose, sucrose and maltose are in the ratios of 1:0·92:1·05:0·9. Sucrose and maltose show constant values for the velocity of fermentation within a few minutes of the start, indicating that sufficient of the disaccharide is hydrolysed almost instantaneously for the fermentation to attain its maximum velocity. The addition of lactic acid produced no change in the velocity of fermentation, and the author concludes that it is very unlikely that any but small quantities of sugar go through the intermediate step of lactic acid during fermentation.—J. F. B.

Sarcina [*in brewery yeast*]. Bettges and Heller. Woch. f. Brau. 1906, **23**, 69—74.

In brewery practice, sarcina often occurs in the single coccus form, and cannot be identified by the microscopic examination of yeast in the ordinary way. In order to induce the sarcina to grow in the characteristic packet form, the authors have tried the following methods:—Will's method, by cultivation in ammoniacal yeast-water, gave no growth of sarcina at all. Claussen's method, by digestion with acid ammonium fluoride, failed to separate the sarcina from the culture yeast, both being equally resistant to the antiseptic. Lindner's method, by cultivation on an object glass with exclusion of air by a vaseline ring, gave results, but only after five to eight days. The authors have devised a modification of this last method, accelerating the result by selecting a medium favourable to the sarcina and inimical to the yeast. This improved medium consists of a beer fermented in the laboratory from an unhopped wort, and attenuated as far as possible. Such beer is mixed with a barley or malt decoction, in order that free starch may be present. It is then neutralised by ammonia and an excess of ammonia equal to the quantity required to neutralise, is added, together with sufficient alcohol to bring the final alcohol content of the medium to 2—4 per cent., attention being paid to the fact that volatilisation of both alcohol and ammonia takes place during sterilisation. Vaseline is painted on the object glass to form three sides of a square, some of the yeast is mixed with the culture liquid, and a drop is carefully mounted on the glass, the fourth side of the square being closed by vaseline when the preparation is complete. Sarcina packets are generally visible after two days, but with very slight infections it may be necessary to keep the slide under observation for four days. The same medium may be employed for flask cultivations, the deposit being subjected to microscopic examination in the ordinary way, but in such cultures it is necessary to wait two or three days longer before a result is obtained. By the above method the authors have traced the nidus of a sarcina infection in their beer which, without causing the characteristic sarcina sickness, brought about an acidification and turbidity when the beer was kept for 15—18 days; the source of infection was found in places where the lacquer of the wooden fermentation tuns had worn away, and growths of sarcina had developed in the porous wood.—J. F. B.

Yeast; Production of sulphuretted hydrogen by ——. H. Will and H. Wanderscheck. Z. ges. Brauw., 1906, **29**, 73—78 and 89—96.

The authors have proved that many species of brewery yeasts, both culture yeasts and wild yeasts, are capable of producing sulphuretted hydrogen when fermenting in hopped worts. The culture yeasts are generally more active in this respect than the wild yeasts, and the evolution of sulphuretted hydrogen is generally observed towards the end of the primary fermentation. Of the culture yeasts, Frohberg yeast showed a very feeble reaction, whilst Logos yeast showed a strong one. The sources of sulphuretted hydrogen in normal worts must be either the albuminoids or the sulphates, but the exact source has not yet been ascertained. The addition of gypsum or magnesium sulphate to the wort produced no marked increase in the amount of sulphuretted hydrogen evolved, neither did the use of sulphured malt and hops cause any appreciable increase. On the other hand the addition of peptones, although they contained sulphur, actually decreased the tendency to formation of sulphuretted



by the dotted arrows. The cars may be replaced by a travelling floor of gauze.—W. H. C.

Alcoholic liquors; Maturing and mixing ——. J. and T. Spencer Handsworth, and J. A. Spencer, West Bromwich. Eng. Pat. 4174, Feb. 28, 1905.

The liquor is placed in a vessel, such as a barrel, provided with a number of cross partitions arranged along its length. The partitions are perforated with a number of holes arranged so that the holes of one partition are opposite the bars of the next one. The barrel is mounted on trunnions, and is revolved or oscillated in any desired manner for a prolonged period. The liquid, occupying only a portion of the space in the barrel, is forced into intimate contact with the air. The air may be renewed periodically, and any undesirable gases may be removed by suction. In certain cases a stationary vat, provided with movable perforated partitions or blades, may be employed.—J. F. B.

Distillation and rectification [of spirits]; Combined separation of head and tail products in continuous and periodic ——. O. Pampe, Halle on the Saale, Germany. Eng. Pat. 8476, April 20, 1905. Under Int Conv, April 21, 1904.

In a rectifying or distilling column a zone exists separating the part at which the fusel oils are insoluble in the alcoholic vapours from that at which they are soluble and volatile. At this boundary zone pure water vapours are introduced, which, if they are finely divided and well distributed, lower the percentage of alcohol at that point and absorb all the fusel oil and other tail products. The vapours thus saturated with fusel oil are then conducted to the heating pipes of a portion of the apparatus called the "after-vaporiser of the head-products separator," which serves for the final separation of the head products from the pure alcohol. The abstraction of heat from the aqueous-fusel oil vapours, used in the heating pipes, dephlegmates these vapours, decomposing them into a liquid poor in fusel oil, which is returned to the still, and into vapours rich in fusel oil which are subsequently condensed. A better dephlegmation is obtained by giving these heating pipes an inclination towards the inlet, so that the movement of the vapours and the liquid which separates from them, takes place in contrary directions, and the repeated vaporisation and liquefaction causes an increase in the fusel oil contents of the vapours. Thus, the head products separator with its "after-vaporiser" forms a combined system which separates both head and tail products simultaneously.—J. F. B.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer. A. B. Lennox and T. Mackenzie. Eng. Pat. 8342, April 19, 1905. XVIIIB., see next page.

French Patent.

Wines; Process of rapidly clarifying, ageing and maturing ——. E. Monti. Fr. Pat. 358,287, Oct. 5, 1905.

The excess of oxidisable acids in the wine, *e.g.*, the malic and succinic acids, are converted into tartaric acid by cooling the wine to a temperature near its freezing point and passing a current of air through the liquid. At the same time the albuminoids of the wine are precipitated The wine is then warmed again to a temperature of 20°—30° C., in order to allow the air dissolved at the low tem perature to expand. These operations are repeatec several times in the course of about six months, and each time the wine is cooled, a further deposit of tartrates separates out. If the wine does not contain sufficient potash to fix the tartaric acid produced by oxidation, the calculated quantity of base may be added. If the action of the air be undesirable, the current of air may be replaced by one of carbon dioxide.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 195.)

(*A.*)—FOODS.

Gluten; Crude ——. F. A. Norton. J. Amer. Chem. Soc., 1906, **28**, 8—25.

The insoluble proteids of wheat obtained by kneading a dough of flour in a stream of water consist of about 75 per cent. of true gluten (gliadin and glutenin) together with small percentages of non-gluten proteids, mineral matter, fat, starch, fibre and other non-nitrogenous matter. Crude gluten represents, in addition to the true gluten content of a flour, the balance between the loss of non-gluten proteids and gain from the retention of non-nitrogenous matters. The relation of the percentage of the crude gluten to the total proteid can be thus explained by the varying composition of different flours in respect to nitrogenous and non-nitrogenous compounds. Crude gluten is a very rough expression of the gluten content of a flour or wheat, and the determination has but little worth in the valuation of flours. The relation of crude gluten to total proteid ($N \times 5{\cdot}7$) varies with the character of the flour, the percentage of crude gluten being greater than that of total proteid in bakers' and low grade flours, nearly the same in patent flours, and less in whole wheat meal. The determination of the total nitrogen and gliadin-nitrogen together with the ratio of gliadin to total proteid ($N \times 5{\cdot}7$) seems to be the best method for ascertaining the gluten content and character of the gluten in the valuation of flours.—W. P. S.

Flesh; The phosphorus content of ——. A. D. Emmett and H. S. Grindley. J. Amer. Chem. Soc., 1906, **28**, 25—63.

The authors have investigated the distribution, the quantity, and the nature of the inorganic and organic phosphorus compounds occurring in animals, the flesh of which is used as food for man. The Hart-Andrews method (this J., 1904, 33) of separating and determining the inorganic and organic phosphorus was found to give good results in aqueous extracts of flesh after the coagulable proteids had been removed. The results obtained show that there is a difference in the quantities of phosphorus present in beef and veal. Of the total phosphorus in beef, 75 per cent., and in veal, 64 per cent., is soluble in cold water, whilst of the organic phosphorus, one-fourth is soluble in the case of beef and one-sixth in that of veal. The soluble organic phosphorus in beef constitutes one-third of the total soluble phosphorus, and in

veal one-fourth. The ratio of the soluble organic to the soluble inorganic phosphorus is 3 : 5 in beef, and 3 : 9 in veal. The phosphorus forms 23·4 per cent. of the ash of beef and 20·2 per cent. of the ash of veal, whilst the soluble phosphorus compounds in beef constitute 17·8 per cent., and in veal 12·8 per cent. of the ash. The percentage of fat in the different cuts of veal has little influence on the total phosphorus content, but the cuts which are nearest the bony structure apparently contain more insoluble phosphorus than the other cuts. Different methods of cooking flesh give products which differ decidedly as to the quantities and the nature of the phosphorus contents. The soluble organic phosphorus is not in combination with the coagulated proteid, with the albumoses or with the peptones.—W. P. S.

English Patents.

Milk preparation or preserve for medicinal or nutritive purposes. L. Sarason, Berlin. Eng. Pat. 4304, March 1, 1905.

See U.S. Pat. 809,138 of 1906; this J., 1906, 132.—T.F.B.

Flour, grain, rice and other substances; Electric purifier for use in purifying ——. J. L. Lawson, Leith. Eng. Pat. 13,909, July 6, 1905.

"High tension electricity other than frictional" is used to separate bran, chaff, fibrous matter, and other impurities from flour, grain, rice, &c.

An apparatus is described consisting of insulated conducting plates charged with high tension electricity and working transversely over a tray which consists of alternate channels and spaces and has a rapid reciprocating movement. The impurities are attracted out of the channels and being deflected by the transverse movement of the plates and repelled on touching the plates, are dropped through the intermediate spaces into discharge spouts.

—R. S. H.

United States Patent.

Milk preparations; Process of making ——. S. Székely and E. Kovács, Budapest, Austria-Hungary. U.S. Pat. 811,971, Feb. 6, 1906.

See Eng. Pat. 25,624 of 1904; this J., 1905, 207.—T.F.B.

French Patent.

Milk sugar and casein; Process of extracting —— from milk. J. R. Hatmaker. Fr. Pat. 358,375, Oct. 9, 1905. Under Int. Conv., Oct. 11, 1904.

See Eng. Pat. 21,865 of 1904; this J., 1905, 1077.—T.F.B.

German Patent.

Milk; Manufacture of a substitute for skimmed —— from oil-cakes. E. Josing. Ger. Pat. 162,480, Feb. 13, 1904.

Pulverised oil-cake is treated with quicklime and extracted with lukewarm water, and after addition of sugar, the solution is separated by settling. According to one claim, instead of adding sugar, the latter is produced from the oil-cake itself by treatment with diastase.

—A. S.

(B.)—SANITATION; WATER PURIFICATION.

English Patents.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer. A. B. Lennox, Newcastle-on-Tyne, and T. Mackenzie, Glasgow. Eng. Pat. 8342, April 19, 1905.

The claim is for improvements in evaporators described in Eng. Pats. 13,227 and 18,488 of 1904 (this J., 1905, 811, 982), and consists in the provision of horizontal baffle plates, to divide the evaporator into a series of compartments. The baffle plates, which have openings on alternate sides, or alternately in the centre and at the sides, in order to impart a zigzag course to the vapour or gas, are constructed as dampers which can be withdrawn from the frames in which they slide, to enable any deposit formed on them to be removed.—W. H. C.

Dye-water and similar effluent; Apparatus for purifying ——. W. McD. Mackey, Leeds. Eng. Pat. 11,410 May 31, 1905.

The effluent is collected in a tank from which it is pumped up into a large cylindrical vessel inclined to the horizontal, the inlet pipe entering at the lowermost part of the vessel. Immediately before entering the pipe leading to the pump, the effluent receives the addition of certain chemicals, such as milk of lime, &c., which are contained in tanks situated above the collecting tank. A small pipe furnished with taps provides a regulated supply of water from the pump to the reagent tanks. The inclined vessel acts as a settling tank from which the clear effluent leaves through a pipe fixed at the uppermost angle and leading to a filter. The sediment falls towards the inlet end of the vessel and a part of it is continually stirred up by the inflowing stream, causing the freshly formed precipitate to settle more rapidly. Portions of the sediment may be withdrawn from time to time by means of a sludge cock.—W. P. S.

Sewage and other foul waters; Composition or agent for purifying —•—. J. Swallow, J. W. Swallow, and J. Filburn, Leeds. Eng. Pat. 12,092, June 9, 1905.

The composition consists of alum, 1 part; copperas (ferrous sulphate), 1 part; and Epsom salts (magnesium sulphate), 1/4 part, to which may be added chloride of lime, 1/80 part, and clay, 1 part. The first three ingredients are dissolved in water, then mixed with the others, and the whole formed into blocks of convenient size for use.—W. P. S.

Sewage; Clearing vats [settling tanks] for ——. B. Schmidt, Dresden, Germany. Eng. Pat. 24,402, Nov. 25, 1905.

A series of superposed deflecting plates are placed in front of the inlet to the tank, and extend across the width of the latter. The number of plates varies according to the velocity of the inrushing sewage; the higher the velocity, the greater the number of plates used. The plates are curved downwards, and the lower edge of each plate extends a little lower than that of the next higher one, forming between them curved sluice-ways, which break up the sewage into wide, thin bands. The velocity of the stream is thus effectively reduced, and the precipitation of the suspended matters facilitated. The clear liquid passes over the edges of troughs, provided at the top of the tank, and flows away to an exit pipe.

—W. P. S.

Sewage and other such waste products; Apparatus [settling tank] for the treatment of ——. D. Cameron and F. J. Commin, London. Eng. Pat. 27,240, Dec. 30, 1905.

A long sinuous weir is placed in the settling tank, and by being folded backwards and forwards on itself presents a great length of surface, over which the sewage trickles in a thin film. A baffle-plate is provided across the entrance to the chamber, and all sewage entering the tank has to pass under this plate. The sewage is thus rapidly freed from suspended solids, and may be delivered in a fresh condition to the filter-beds, &c. Means are provided for the removal of mud from the tank.—W. P. S.

Water; Apparatus for the [electrical] purification of ——. J. S. Zerbe, New York. Eng. Pat. 9216, May 2, 1905. Under Int. Conv., May 2, 1904.

The water enters the bottom of a vertical cylinder, the lower half of which contains a number of aluminium electrodes connected with an electric supply of low voltage. The upper part of the cylinder serves for the mixing of the water with the liberated gases. A pipe then conducts the water from the top of the cylinder to the bottom of a filter chamber. This part of the apparatus is also cylindrical in shape, and the filter is arranged axially

so that the water is forced from the space between the outer wall and the filter through the latter into the central space. A central perforated pipe reaching to the bottom of the filter chamber is provided for drawing off the water, and during the time the water is in the central space it is subjected to the further action of the gases generated in the electrical cylinder, a portion of the gases being collected for this purpose and conducted into the filter chamber.—W. P. S.

(C.)—DISINFECTANTS.

Potassium permanganate; Germicidal action of ——. J. B. Garner and W. E. King. Amer. Chem. J., 1906, **35**, 144—147.

POTASSIUM permanganate is antiseptic to *B. typhosus* in concentrations greater than N/500.—E. F. A.

UNITED STATES PATENT.

Formic aldehyde compound [*Disinfectant*]; *Process of making a* ——. A. Stephan, Gross Lichterfelde, Germany. U.S. Pat. 812,608, Feb. 13, 1906.

SEE Fr. Pat. 345,598 of 1904; this J., 1904, 1233.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 195.)

ENGLISH PATENTS.

Paper; Calendering, glazing or removal of wire marks from printing ——. W. T. Haydon, London. Eng. Pat. 4414, March 3, 1905.

IN order to break up the wire marks and to give the paper a similar texture on both sides, the paper is passed between calender rolls, one (or both) of which is engraved similarly to fine linen or else has a felt or blanket of linen fabric between the metal roll and the paper. The obliteration of the wire mark by this means should be performed when the paper is slightly damp, either by artificial damping before calendering or by treating the paper before it has been fully dried on the paper machine.—J. F. B.

Cellulose or paper; Stuff purifier and screen for the manufacture of ——. L. Krause, Zell, Germany. Eng. Pat. 21,415, Oct. 21, 1905.

SEE Fr. Pat. 357,891 of 1905; this J., 1906, 132.—T. F. B.

Paper pulp; Machines for forming and combining webs of ——. H. Parker, Nashua, U.S.A. Eng. Pat. 22,718, Nov. 6, 1905. Under Int. Conv., April 17, 1905.

SEE U.S. Pat. 808,614 of 1905; this J., 1906, 88.—T. F. B.

UNITED STATES PATENTS.

Pulp treating machine. H. Parker, Nashua, N.H. Assignor to Improved Paper Machinery Co., Castine, Me. and Nashua, N.H. U.S. Pat. 811,660, Feb. 6, 1906.

THIS invention relates to a pulp-forming cylinder rotating in a vat. The interior of the cylinder is divided by radial partitions forming compartments, to each of which suction can be applied separately, so that the pulp is first subjected to suction of low intensity and considerable volume, and subsequently to suctions of increasing intensities.—J. F. B.

Cellulose compound and process of making the same. R. W. Strehlenert, Djursholm, Sweden, and F. Reubold, Ludwigshafen. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 812,098, Feb. 6, 1906.

SEE Fr. Pat. 347,900 of 1904; this J., 1905, 454.—T. F. B.

FRENCH PATENT.

Paper coloured on one side; Process and apparatus for making ——. Leykam-Josefsthal Act.-Ges. f. Papier- und Druck-Ind. First Addition, dated Sept. 13, 1905, to Fr. Pat. 343,186, May 16, 1904.

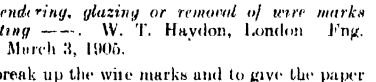
SEE Eng. Pat. 17,163 of 1905; this J., 1906, 87.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 197.)

Caffeine; Conversion of —— *into paraxanthine, theophylline and xanthine.* F. Fischer and F. Ach. Ber., 1906, **39**, 423—435.

CAFFEINE when subjected to the action of phosphorus pentachloride or of chlorine above 160° C., is converted into a dichlorocaffeine, containing one chlorine in the 3-methyl group, *i.e.*, 3-chloromethyl-8-chloroparaxanthine



This, on heating with water forms formaldehyde and 8-chloroparaxanthine, which is easily reduced to paraxanthine. When chlorine, dissolved in a suitable solvent, is used at about 90°—100° C. the isomeride 7′ 8-dichlorocaffeine is formed, which, on boiling with water, is converted into 8-chlorotheophylline. By the action of chlorine dissolved in phosphorus oxychloride, a tetrachlorocaffeine is formed in which all three methyl groups of caffeine have taken up chlorine. Boiling with acetic acid converts this into chloroxanthine.—E. F. A.

Bromoform; Decomposition of —— *under the influence of light and air.* N. Schoorl and L. M. Van den Berg., Pharm. Weekblad, 1906, **43**, 2—8. Chem. Centr., 1906, **1**, 441—442.

ON passing a current of air through boiling bromoform exposed to sunlight, there is formed, besides bromine and hydrobromic acid, also carbon tetrabromide, probably owing to a secondary reaction: $Br_2 + CHBr_3 = CBr_4 + HBr$. The oxidation products formed, are water, carbon monoxide, carbon dioxide, hydrobromic acid and bromine; the proportions of carbon monoxide and hydrobromic acid and of carbon dioxide and bromine differ according to the amount of oxygen used. The following equations represent the ultimate results when bromoform in sealed tubes is exposed to sunlight in the presence of a small and a large proportion of oxygen, respectively:—

$$CHBr_3 + O \rightarrow CO + Br_2 + HBr,$$
$$2CHBr_3 + 5O \rightarrow 2CO_2 + H_2O + 6Br.$$

—A. S.

Chloroform, bromoform and iodoform; Decomposition of —— *under the influence of light.* N. Schoorl and L. M. Van den Berg. Pharm. Weekblad, 1906, **43**, 8—10. Chem. Centr., 1906, **1**, 442.

IN the absence of air or oxygen, chloroform is not affected by exposure to light, but bromoform is decomposed, probably into hydrobromic acid and the hypothetical compound CBr_2. Iodoform was also partially decomposed by exposure to light, but in this case, traces of air were present. On exposure to air, in the absence of light, iodoform shows a violet colour after a quarter of an hour, whilst, after one hour, the separation of iodine is distinctly perceptible; bromoform after one hour is faintly yellow, has an acid reaction, and gives a precipitate with silver nitrate; chloroform gives no precipitate with silver nitrate even after four hours.—A. S.

Iodoform dissolved in chloroform; Decomposition of —— *by diffused daylight and by radium rays.* W. P. Jorissen and W. E. Ringer. Chem. Weekblad, 1905, **2**, 799—802. Chem. Centr., 1906, **1**, 442.

IODOFORM dissolved in chloroform appears to be completely decomposed on exposure to diffused daylight if

oxygen be present. The influence of the oxygen is shown by the fact that if a solution of iodoform in carbon bisulphide be covered with water and then exposed to diffused daylight, the decomposition proceeds only very slowly. A solution of iodoform in chloroform, solidified by means of liquid air, is apparently unaffected by exposure to bright daylight, so long as it is kept in the solid state.

By exposure to the rays from 5 mgrms. of radium bromide, 75·2 per cent. of the iodine was liberated at 25° C., from 50 c.c. of a solution of 1 grm. of iodoform in 100 grms. of chloroform, whereas under similar conditions, but without exposure to radium rays, only 18·8 per cent. of the iodine was set free.—A. S.

Arsenic; Presence of —— in so-called "pure" glycerol. J. Galimard and E. Verdier. J. Pharm. Chim., 1906, **23**, 183—184.

It is found that although the so-called "pure" glycerols of commerce fail to give any indication of arsenic by the Marsh test when introduced direct into the testing apparatus, the same samples, after being boiled for 10 hours under a reflux condenser, with an equal volume of water acidified with 1 per cent. of pure sulphuric acid, invariably give a distinct arsenical ring when so tested. It is evident, therefore, that glycerol may contain an arsenical impurity which is not reduced by the ordinary procedure of Marsh's test. Probably the arsenic is present as an ester, which requires the treatment indicated to render its presence evident. All the samples of "pure" glycerol examined as above, gave indications of arsenical contamination.—J. O. B.

Earths; Chemistry of the rare ——. G. Wyroubow and A. Verneuil. Ann. Chim. Phys., 1905, **6**, [8], 441—507. Chem. Centr., 1906. **1**, 321—324.

Electrolytic reduction; Cathodic potential and —— in sulphuric acid solution. J. Tafel. XI.A., page 222.

ENGLISH PATENTS.

Santalol esters from sandal-wood oil; Manufacture of ——. A. Knoll, M. Daege and H. Knoll (Knoll und Co.). Ludwigshafen on Rhine, Germany. Eng. Pat. 17,511, Aug. 30, 1905. Under Int. Conv., Feb. 10, 1905.

The esters of santalol with monobasic aromatic acids, and also with carbonic acid, do not possess the disagreeable taste, or exhibit the irritant effects of santalol, or of its acetyl derivative or phthalic ester. They are prepared by the ordinary methods of acidylation, *viz.*, by the action of the acid anhydrides, chlorides, or esters. The preparation of the benzoyl, salicyl and normal carbonic esters and of the ethylcarbonic esters is described in detail. —T. F. B.

Salicylic acid menthol ether; Production of ——. B. Bibus and R. Scheuble, Vienna. Eng. Pat. 8544, April 20, 1905.

Menthol is mixed with an excess of salicylic acid, and the mixture is heated for several hours at a temperature of 140°—220° C., a current of gas such as hydrogen, carbon dioxide or hydrogen chloride being passed through the mixture during the operation. The product is freed from the excess of acid by washing with a solution of an alkali carbonate, and the ether is purified by fractional distillation. The unesterified residue, consisting mainly of menthol, menthene and menthyl chloride, is converted into menthyl chloride by treatment with hydrogen chloride under pressure, and this is then converted into the salicylate by double decomposition with a metallic salicylate.—J. F. B.

Oxyhæmoglobin; Manufacture of a solution of ——. W. Jansen, The Hague, Holland. Eng. Pat. 21,172, Oct. 18, 1905.

See Fr. Pat. 358,161 of 1905; this J., 1906, 197.—T.F.B.

Dialkylmalonyl ureas; Manufacture of ——. Farbw. vorm. Meister, Lucius und Brüning, Hoechst a/Main. Germany. Eng. Pat. 26,275, Dec. 16, 1905. Under Int. Conv. Jan. 9, 1905.

Diethylmalonylthioureas are converted into dialkylmalonyl ureas by boiling them for a long time with a solution of a salt of a heavy metal, such as lead or copper, which is capable of removing the sulphur as an insoluble sulphide.—J. F. B.

UNITED STATES PATENTS.

Mercury salts of cholic acid, and process of making same. E. Wörner. Assignor to J. D. Riedel, Akt.-Ges., Berlin. U.S. Pat. 811,193, Jan. 30, 1906.

See Eng. Pat. 11,180 of 1905; this J., 1905, 930.—T.F.B.

4-Imino-2.6-dioxypyrimidine; Process of making ——. M. Conrad, Aschaffenburg, and W. Beckh, Darmstadt, Germany. U.S. Pat. 811,826, Feb. 6, 1906.

See Fr. Pat. 349,353, and Eng. Pat. 22,128 of 1904; this J., 1905, 689.—T. F. B.

Pyrimidine derivatives; Process of making ——. M. Conrad, Aschaffenburg, and W. Beckh, Darmstadt, Germany. U.S. Pats. 811,827, 811,828 and 811,829, Feb. 6, 1906.

See Eng. Pats. 22,126, 22,127 and 22,128 of 1904; this J., 1905, 689.—T. F. B.

Salicylic acid methylene acetate, and process of making same. F. W. S. Valentiner, Leipsic, Germany. U.S. Pat. 811,884, Feb. 6, 1906.

See Fr. Pat. 350,623 of 1905; this J., 1905, 750.—T.F.B.

FRENCH PATENTS.

Dialkylbarbituric acids; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Sept. 12, 1905, to Fr. Pat. 343,976, June 14, 1904. Under Int. Conv., May 12, 1905.

The present Addition to the principal patent (Ger. Pat. 162,219 of 1903; this J., 1905, 1189) relates to the preparation of dialkylbarbituric acids by heating with mineral acids the 2-thio-4-imino-5-dialkyl-6-oxypyrimidines, produced by the condensation of dialkylcyanoacetic esters with thiourea in presence of an alkali alcoholate.—T. F. B.

Unsaturated compounds; Process of transforming —— into saturated compounds. C. Dreymann. Fr. Pat. 358,212, Oct. 2, 1905. XII., page 224.

"Norgine" [Ammonium tangate from seaweed]; Preparation of —— soluble after drying, and neutral. Soc. Française la Norgine. Fr. Pat. 358,398, Oct. 10, 1905.

Tang acid, prepared from seaweed by processes previously described (see Eng. Pats. 12,275 and 12,277 of 1898; this J., 1898, 794) and containing about 35 per cent. of dry substance, is treated with a slight excess of ammonia either in the form of a concentrated solution or of gas. The ammonium tangate is then rolled into thin sheets and dried in a current of air at about 70° C., whereby the excess of ammonia is removed together with the water, and a perfectly neutral, dry product is obtained which is entirely soluble in water.—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 198.)

Photographic prints toned with metallic ferrocyanides; Decomposition in ——. L. Lemaire. Bull. Soc. Ind. Nord., 1905, **33**, 25.

Silver prints which have been toned with uranium ferrocyanide always exhibit deterioration after some time. Insufficient washing, and traces of hydrogen sulphide do not cause this decomposition. It is greatly retarded if the prints be washed in a dilute solution of sodium carbonate, and entirely prevented if they are then bathed in dilute nitric acid and washed. Light appears to have no detrimental effect, but exposure to the atmosphere hastens the decomposition. It would thus appear to be

due to the silver ferrocyanide formed during toning, becoming decomposed by the air; this view is confirmed by the fact that prints from which the silver ferrocyanide had been removed by means of potassium thiocyanate were perfectly stable, as were those in which the ferrocyanide was decomposed by alkali, and the resulting silver salt removed by nitric acid.—T. F. B.

ENGLISH PATENT.

Photographic developer; Manufacture of a ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9537, May 5, 1905.

SOLUTIONS of *p*-hydroxyphenylglycinamide with alkali carbonates are energetic photographic developers The alkaline solutions are stated to be very stable. One part of the reducing agent may be dissolved in 200 parts of water with 3 parts of potassium metasulphite and 6 parts of "dry" potassium carbonate.—T. F. B.

UNITED STATES PATENTS.

Flash-light composition. A. Eichengrün, Elberfeld, Germany. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 812,028, Feb. 6, 1906.

SEE Eng. Pat. 24,987 of 1904; this J., 1905, 1031.—T. F. B.

Photographic papers; Process of manufacturing ——. I. Hoffsümmer, Düren, Germany. U.S. Pat. 812,204, Feb. 13, 1906.

SEE Eng. Pat. 17,303 of 1905; this J., 1905, 1189.—T. F.B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 199.)

Nitroglycerin and nitrocellulose; Supposed instability of —— in presence of traces of acid. A. Leroux. Congrès de Chimie et Pharm., Liége, July, 1905. Bull. Soc. Chim. Belg., 1905, **19**, 243—244.

THE author discusses the influence of nitric and sulphuric acids on nitroglycerin and nitrocellulose explosives, and states that the supposed dangerous effect of free acid on these explosives is a fallacy, being based entirely upon assumption without any experimental evidence.—A. S.

Acids [sulphuric and nitric acids]; Fatal explosion of waste —— at Stratford. Chem. Trade J., 1906, **38**, 182—183.

THE following is a short abstract of the evidence given by Capt. Thomson, Chief Inspector of Explosives, at an inquest held with reference to the death of a man at the Abbey Mills Chemical Works, Stratford, caused by the explosion of four iron drums, each containing about 10 cwt. of waste acid (mixed nitric and sulphuric acids) from the manufacture of nitroglycerin. At the time of the explosion the deceased was loosening the bungs of the drums by means of a hammer and chisel. Capt. Thomson stated that two of the drums which exploded had jagged rents from end to end, but in the other two, the ends had been blown out and the sides forced in. The waste acid evidently contained nitroglycerin which, in the cold weather, had become frozen round the screw plug or bung. In the frozen condition, nitroglycerin was much more sensitive than when liquid, and a blow with a hammer and chisel on the bung or even a turn of the screw plug would cause an explosion. It was probable that one drum exploded first and caused another to burst in like manner, but with respect to the two drums with the ends blown out, Capt. Thomson was of the opinion that this was more a case of shock than a real explosion, and could have been caused by fluid pressure. The important question in connection with the accident was the reason for the presence of nitroglycerin in the waste acid. The acid came from the Explosives and Chem. Products Co., of Great Oakley, Essex, and at this works, as at the Government factory at Waltham Abbey, after the separation of the nitroglycerin from the waste acid by the usual method, about 2 per cent. of water was added to the acid, and until this explosion occurred, it had been thought that this water had "decomposed all after-charge of nitroglycerin." Capt. Thomson stated that an inquiry would be held by the Home Office, and he recommended that in future any waste acids supplied from a factory manufacturing nitroglycerin should be sent out in glass carboys.—A. S.

ENGLISH PATENT.

Nitroglycerine; Process of making ——. C. L. Reese, Wilmington, U.S.A. Eng. Pat. 20,310, Oct. 7, 1905.

SEE U.S. Pat. 804,817 of 1905; this J., 1906, 199.—T.F.B.

UNITED STATES PATENT.

Chlorate-powder. C. E. Mathews, Rio, Wis. U.S. Pat. 811,941, Feb. 6, 1906.

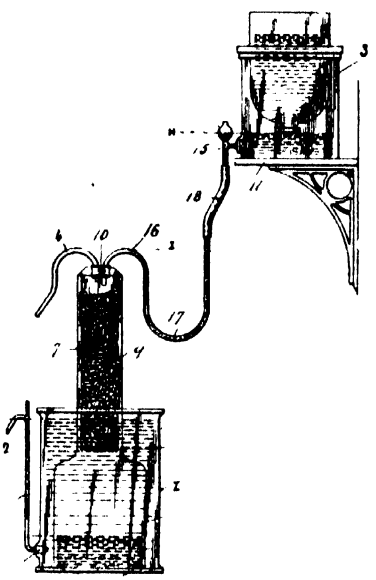
THE powder is composed of a mixture of granulated sugar (1 part) and potassium chlorate (1½ parts), together with a sufficient quantity of a liquid consisting of gasolene (1 part), spirits of turpentine (1 part), alcohol (1 part) and water (2 parts) "to moisten the mixture."—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 202.)

APPARATUS, ETC.

Gas-generator. C. L. Parsons, Durham, N.H. U.S. Pat. 811,737, Feb. 6, 1906.



THE solid, 7, from which the gas is to be generated, is contained in the vessel, 9, which is open at the bottom, is provided with a grid to support the solid, and stands in the tank, 1, which has an overflow, 2. The liquid to react upon the solid, 7, is fed from the vessel, 3, through the pipe, 15, 18, the liquid seal, 17, and the bend, 16, into the vessel, 9, at the point, 10; the gas generated escapes through 4. In the vessel, 3, a constant level, H, is maintained by a Mariotte's bottle at such a height above the level, I, in the tube, 16, that the liquid enters the vessel, 9, under a pressure equal to that in the vessel, 9, which is governed by the height of the overflow from the vessel, 1.—W. H. C.

Gas calorimeter. C. V. Boys. Roy. Soc. Proc., 1906, **77A**, 122—131.

THE author, as one of the London Gas Referees, has

designed the instrument here described, for use in determining the calorific value of gas. As compared with the Junkers and other forms of calorimeter, it offers the following advantages:—the thermometers for the water inlet and outlet are on the same level; the temperature of the outflowing water is thoroughly equalised, so that fluctuations in the thermometer readings are avoided; the instrument is easily taken to pieces and fitted up again, so that all the parts can be examined to see if they are made according to the regulations; its height is such that the thermometers can be comfortably read when the instrument stands on an ordinary table; the various water and gas connections, and condensed-water drip, can be turned round independently to any position convenient for observation; and the volume of cooling water, and hence the time required to change it, is comparatively small, thus ensuring that simultaneous readings of the inlet and outlet thermometers give the true rise of temperature.

A circular base, A, carrying the gas-pipe fitted with two No. 3 union-jet burners, B, is protected from radiation on the top by a disc of bright metal fastened beneath the three centering blocks, C. On these blocks rests a vessel, D, of sheet brass, with a central chimney of thick sheet copper, E; the drip-pipe, F, for condensation water is fixed 1 in. from the bottom; and the vessel may

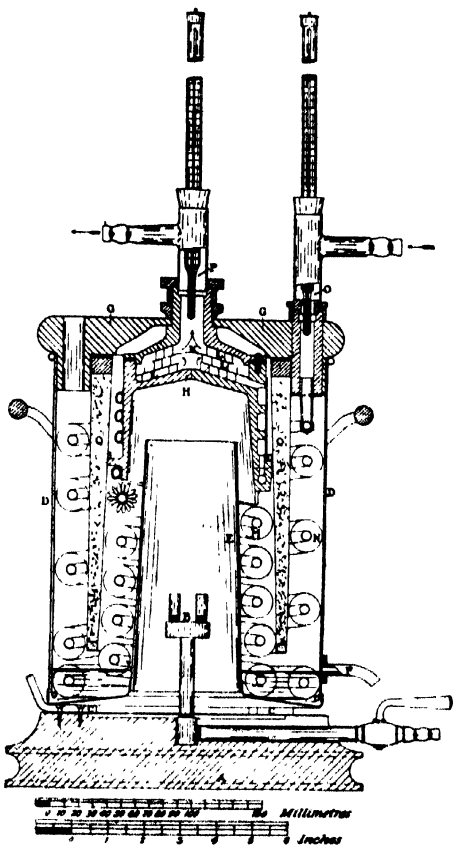


FIG 1.

be turned round to any convenient position. Attached to the lid, G, at the centre, is a brass temperature-equalising chamber for the outflowing water; two dished plates of thin brass, K, K, are held in place by three scrolls of thin brass (strips bent round like clock springs) L, L, L, a little leakage from each scroll to the one above, and from each coil to the next, being permissible, as encouraging the temperature equalisation. The pendant portion of this box is kept cool by water flowing through

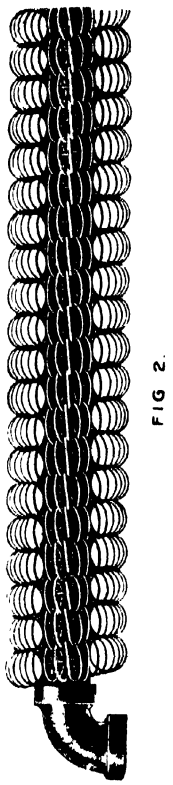


FIG 2.

a channel made in the solid metal, as shown on the right side, or formed of a tube, sweated on, as shown on the left. Connected to the water channel at the lowest point are six turns of copper pipe, M, such as is used in a motor-car radiator. The radiating surface extension may consist of coils of copper wire wound round the tube, as shown in Fig. 2, or copper strips or the like may be used. A second helix of similar pipe, N, surrounding the first, is fastened to it at the lower end and terminates at the other end in the water-inlet box, provided with the thermometer, O. The water-outlet box, P, is similar to the latter. The lowest turns of the coils, M, N, are immersed in water which, in the first instance, is put into the vessel, B. The insulating brattice, Q, between the two coils is of thin sheet brass and is filled with cork dust; it is carried by an internal flange resting on the lower edge of the casting, H. A cylindrical wall of thin sheet brass, slightly smaller than D, is secured to the lid, so that when the instrument is lifted out of the vessel, D, and placed upon the table, the coils are protected from injury; the annular space between D, and this wall, serves to prevent loss of heat to the outer air. Owing to the absence of water-cooling from all but the lower end of the chimney, E, it remains so hot that condensation does not occur upon its inner surface, and another advantage is that its extra æromotive power enables the instrument to be made much shorter than usual. To prevent corrosion by the gaseous products of combustion, the whole coil system can be lifted out when not in use, and immersed in very dilute sodium carbonate solution; and any deposit of calcium salts in the pipe system can be removed by very dilute hydrochloric acid, followed by water.—H. B.

ENGLISH PATENT.

Benzine or petroleum spirit and other liquid hydrocarbon mixtures; Instrument for testing ——. C. Roth, Frankfort-on-Maine, Germany. Eng. Pat. 21,518, Oct. 23, 1905. Under Int. Conv., Nov. 24, 1904.

THE apparatus has been devised for the purpose of determining the value of petrol or similar oils by means of their boiling points. It comprises in construction a spirit evaporator, preferably in the form of a glass tube having graduations throughout its length, or only in its lower part, or being provided in its interior with a separate scale, so that during the evaporation of the oil the diminution of its volume may be noted at any time. It is provided with a thermometer and has, in its upper part, a lateral opening for the escape of vapour. The lower part of the tube is immersed in a heating receptacle surrounded with felt and charged with lime, to which water is added by means of a dropping funnel inserted in the cover.—D. B.

INORGANIC—QUANTITATIVE.

Arseniuretted hydrogen; Reactions and methods of determining ——. H. Reckleben and G. Lockemann. Z. angew. Chem., 1906, **19**, 275—283.

ARSENIURETTED hydrogen in gaseous mixtures cannot be accurately determined by passing the gas through silver nitrate solution and afterwards weighing the separated silver. The latter persistently retains arsenic and too persistent washing causes a part of the silver to assume the colloidal form, rendering filtration impossible. Nor can the arsenious acid in the solution be conveniently titrated, owing to the fact that a portion of it is oxidised by the nitric acid, the resulting nitrous acid also interfering. Trustworthy results may, however, be obtained by shaking a measured volume of the gas with solutions of either silver nitrate, iodine in potassium iodide, iodic acid or hypochlorites, and measuring the decrease in volume. Commercial "Eau de Javelle" is the most suitable solution to use, as it absorbs arseniuretted hydrogen very rapidly. The presence of arseniuretted hydrogen in a mixture of gases may be detected by passing the latter through a small capilliary tube (so as to form minute bubbles) into an ammoniacal solution of silver nitrate. A gas containing less than 0·01 part per million of arseniuretted hydrogen gives a grey turbidity in less than two minutes. If no turbidity is produced, the absence of arseniuretted hydrogen may be regarded as proved, but, if a reaction is given, tests for the presence of stibine, hydrogen sulphide and phosphine must be made, as these substances also produce a turbidity with the silver solution.—W. P. S.

Carbon in steel; Determination of —— by direct ignition with red lead. C. M. Johnson. Proc. Eng. Soc. W. Pennsylvania, 1906, **21**, 586—602.

THE author finds that the combustion process with preliminary decomposition of the steel by potassio-cupric chloride is very untrustworthy in the case of steels containing large percentages of chromium, tungsten, or molybdenum. These steels, and indeed all steels which the author has tried, give accurate results by the direct combustion process; and, provided the temperature be kept high, drillings almost 1 mm. thick can be completely burnt. A porcelain boat is used, and the mixture of drillings and red lead is covered with a lid of asbestos, to prevent "creeping." The general arrangements are as usual, save that the carbon dioxide is absorbed in baryta water, and the barium carbonate formed weighed.—J. T. D.

ORGANIC—QUANTITATIVE.

Mercury and iodine; Determination of —— in antiseptic soaps. A. Seidell. J. Amer. Chem. Soc., 1906, **28**, 73—76.

A WEIGHED quantity of the soap is treated in an Erlenmeyer flask with about 150 c.c. of 95 per cent. alcohol, and from 3 to 5 c.c. of concentrated hydrochloric acid. The mixture is warmed and successive small quantities of water added until a perfectly clear solution is obtained on shaking. If suspended particles of impurities be present, the solution must, of course, be filtered. A slow current of hydrogen sulphide is then passed through the solution for about one hour. The precipitated mercury sulphide is collected on a filter and washed with 95 per cent. alcohol. The weight of mercury sulphide obtained multiplied by 1·955 gives the amount of mercuric iodide in the portion of the sample taken. The filtrate from the mercury sulphide may be evaporated on the water-bath to about one-third the original volume, water added to replace the alcohol, and the solution filtered after cooling, to remove the separated fats. The iodine is then liberated with nitrous acid, shaken out with chloroform and titrated as usual.—W. P. S.

Dextrose; Determination of ——. B. Glassmann. Ber. 1906, **39**, 503—508.

THE determination of dextrose by the reduction of alkaline solutions of mercuric salts may be carried out either with the Liebig-Knapp alkaline mercuric cyanide solution, or with Sachse's alkaline mercuric-potassium iodide solution. The former is made by dissolving 10 grms. of mercuric cyanide in water, adding 100 c.c. of caustic soda lye of 1·145 sp. gr. and diluting to 1 litre. Sachse's solution consists of 1·8 grms. of mercuric iodide and 2·5 grms. of potassium iodide dissolved in a little water, with the subsequent addition of 8 grms. of caustic potash, and dilution to 100 c.c. The reaction proceeds quantitatively in both cases in strictly stochiometrical ratios of 1 mol. of dextrose to three atoms of mercury. The dextrose solution is added to an excess of the boiling solution of mercury salt, the reduced mercury is filtered off, and dissolved in a sufficient quantity of hot concentrated nitric acid. The mercury in this solution is titrated with N/100 ammonium thiocyanate solution by Volhard's method. A gasometric method is also described, based on the decomposition of hydrazine sulphate by mercuric salts with evolution of nitrogen in the ratio N_2 : 2Hg. For this purpose the dextrose solution is boiled with a known quantity of mercuric solution previously standardised gasometrically by hydrazine sulphate. The excess of mercuric salt remaining unreduced is then determined in the same manner. A Hempel's gas evolution flask is employed. The results, according to determinations cited in the paper, agree well in both methods with the quantities of dextrose actually employed.—J. F. B.

Malt analysis committee; Report of the —— to the Council of the Institute of Brewing. L. Briant, A. J. Brown, A. C. Chapman, J. Heron, A. R. Ling, E. R. Moritz, A. Gordon Salamon, and L. T. Thorne. J. Inst. Brewing, 1906, **12**, 1—10.

ON April 7th, 1905, the Council appointed the above-mentioned chemists for the purpose of reporting methods for determining the extract, moisture, diastatic power, colour and percentage of ready-formed sugars in malt; and requested them to invite the opinions and views of other representative chemists upon the suggested methods.

Commercial methods of malt analysis.—The Seck mill, set at 25, is to be used throughout. In order to allow for loss in the mill, a quantity of malt, slightly in excess of that required for each determination, is to be separately weighed out and ground. Finally, the exact amounts of grist, subsequently required for the various determinations, are weighed out. It is not permissible to grind at the outset sufficient malt for all the determinations, and to weigh out the various quantities from this grist.

Extract and tint.—Extract.—Fifty grms. of ground malt are to be weighed out and mashed in a copper or glass beaker of about 500 c.c. capacity with 360 c.c. of distilled water previously heated to 154°—155° F. The beaker is covered with a clock glass, and placed in a water-bath, so that its contents are kept at 150° F. for 55 minutes. The mash is stirred at intervals of about ten minutes during this time. The temperature is then raised to 158° F. in five minutes, and the whole mash washed into a flask graduated to 515 c.c., cooled to 60° F., made up to the mark with distilled water at the same temperature, well shaken, and filtered through a large ribbed paper. The specific gravity of the filtrate is then determined at

once at 60° F., compared with water at the same temperature. The excess specific gravity over water (=1000) multiplied by 3·36 gives the extract in brewers' lb. per standard quarter of malt.

If preferred, the mashing can be carried out directly in the 515 c.c. measuring flask. In this case the mash should be shaken at intervals of about 10 minutes.

Tint.—For this determination the Lovibond tintometer is to be employed. The above wort, filtered perfectly bright, is to be placed at once in a 1 in. cell, and its tint recorded in colour units of the series "52" glasses. The experiment should not be carried out in direct sunlight, and the light must fall equally on both halves of the white plate, so that both fields—*viz.*, the malt extract field and the standard field are equally illuminated. To test this, the glasses and the cell should be reversed, and all results rejected when the figures do not agree, whichever side the cell is placed.

Moisture.—About 5 grms. of ground malt are to be accurately weighed out in a small shallow vessel, about 2 ins. in diameter and 1 in. in depth, heated for five hours in a boiling-water oven, allowed to cool in a desiccator, and re-weighed, the loss in weight being taken as the moisture content and calculated as a percentage on the malt.

Diastatic Activity (Lintner value).—Twenty-five grms. of ground malt are to be extracted with 500 c.c. of distilled water (*see* Appendix) for three hours at 70° F., and filtered bright, stirring well every half-hour. A portion of the filtrate (3 c.c.) is allowed to act on 100 c.c. of a 2 per cent solution of soluble starch (*see* Appendix) at 70° F. for an hour in a 200 c.c. flask. N/10 caustic alkali (10 c.c.) is then added in order to stop further diastatic action. The liquid cooled to 60° F., made up to 200 c.c. with distilled water at the same temperature, well shaken, and titrated against 5 c.c. portions of Fehling's solution, using ferrous thiocyanate as indicator.

The titration is carried out as follows:—

Five c.c. of Fehling's solution (*see* Appendix) are accurately measured into a 150 c.c. boiling flask, and raised to boiling over a small naked Bunsen flame. The converted starch solution is added from a burette, in small quantities, at first of about 5 c.c., the mixture being kept rotated and boiled after each addition until reduction of the copper is complete, which is ascertained by rapidly withdrawing a drop of the liquid by a glass rod, and bringing it at once in contact with a drop of the indicator on a porcelain or opal glass slab.

The preparation of Fehling's solution and of the indicator are dealt with in the Appendix.

The results are calculated by the following formula:—

$$A = \frac{1000}{XY},$$

in which A equals the diastatic activity, X equals the number of cubic centimetres of malt extract contained in 100 cc., of the fully diluted starch conversion liquid, and Y equals the number of cubic centimetres of the same liquid required for the reduction of 5 c.c. of Fehling's solution.

The above method (using 3 c.c. of malt extract to 100 c.c. of 2 per cent. soluble starch solution) is not accurate for malts having a diastatic capacity exceeding 50 Lintner; in the case of such malts the relative volume of malt extract must be less, say 2 c.c., or, for malts of the highest diastatic capacity, such as are frequently used by distillers and vinegar makers (*i.e.*, malts of over 80 Lintner), an even smaller volume of extract must be taken.

Cold water extract per cent.—Twenty-five grms. of ground malt are to be digested with 250 c.c. of distilled water containing 20 c.c. of N/10 ammonia (*i.e.* 20 c.c. of N/10 ammonia made up to 250 c.c. with distilled water) for three hours at 70° F., stirring about three or four times during this period. After filtering, the specific gravity of the bright filtrate is taken at 60° F., compared with water at the same temperature. The excess specific gravity over water (=1000) divided by 3·86 and multiplied by 10 gives the cold water extract per cent.

The percentage of ready-formed soluble carbohydrates may be approximately arrived at by subtracting 4 from the value obtained for the cold water extract per cent.

Statements of results.—The results, expressed to the nearest first decimal place only, except in the case of diastatic activity, which should be recorded only to the nearest integer, are to be stated according to the following scheme:—

Extract per standard quarter, brewers' lb.
Moisture, per cent.
Diastatic activity (Lintner value).
Tint (10 per cent. wort, 1 in. cell, "52" series Lovibond).
Cold water extract, per cent.
Equivalent approximately to ready-formed soluble carbohydrates.

Appendix.

Preparation of soluble starch.—Purified potato starch is to be digested with dilute hydrochloric acid of sp. gr. 1037·0, at the room temperature (60°—65° F.) for seven days, stirring the mixture daily. The operation is conveniently carried out in Winchester quart bottles, 1 lb. of starch and 1000 c.c. of diluted acid being suitable quantities for each such bottle. It is washed very thoroughly by decantation, at first with tap water, and later on with distilled water, until the wash water is free from chloride. It is collected on a filter paper placed in a Buchner's funnel, pumped as dry as possible, and then spread out on a new unglazed porous plate. The starch should be dried at a gentle heat (110° F.) as quickly as possible. When dry, the starch is triturated in a porcelain mortar and rubbed through a fine hair sieve.

Starch solution.—In determining diastatic capacity, the starch must be dissolved in boiling water at the rate of 2 grms. of the starch per 100 c.c. of water; the solution is then cooled to 70° F. for use. It should be perfectly mobile (not gelatinous) indicating perfect conversion into soluble starch, and show only a negligible reducing action on Fehling's solution; and it should be neutral to litmus solution.

The water used in making up the starch solution must be pure. Commercial distilled water frequently contains ammonia, nitrous acid, and other impurities, which appreciably influence diastatic conversion, and, therefore, the result. The water should be redistilled with addition of a little potassium permanganate and soda (the solution used in water analysis will do), in a glass apparatus provided with a trap, until the distillate is pure and neutral to litmus solution.

Preparation of Fehling's solution.—(A) *Copper solution.* Recrystallised copper sulphate (69·2 grms.) is to be dissolved in water and the solution made up to 1 litre at 60° F. with distilled water.

(B) *Alkaline tartrate solution.*—Rochelle salt (346 grms.) and caustic soda (150 grms.) are to be dissolved in about 600 c.c. of distilled water, the solution cooled and made up to 1 litre at 60° F. with distilled water.

The two solutions are to be kept separate, and equal volumes mixed for each day's work, from which mixture the volumes specified in the analytical methods are measured out at 60° F.

Preparation of the indicator.—One grm. of ferrous ammonium sulphate and the same quantity of ammonium thiocyanate are dissolved in 10 c.c. of water at a moderate temperature, say at 120° F., and immediately cooled; 5 c.c. of concentrated hydrochloric acid are then added. The solution so obtained has invariably a brownish-red colour, due to the presence of ferric salt, which latter must be reduced. For this purpose zinc dust is the most satisfactory reagent to employ, and a mere trace is sufficient to decolorise the solution if pure reagents have been employed.

When kept for some hours, the indicator develops the red coloration by atmospheric oxidation. It may, however, be decolorised by the addition of a further quantity of zinc dust, but its delicacy is decreased after it has been decolorised several times. For practical purposes the indicator may be too delicate, and it is recommended to prepare it the day before it is required for use, as it gives the best results after the second decolorisation.

Recommendations as to sampling.—It is obvious that samples sent for analysis should, so far as possible, be fairly representative of bulks, and this requires the

more care when the bulks (whether from maltings or deliveries) are large, and when the malt contains any appreciable number of hard corns, and further, when there is any marked irregularity in curing.

In the case of deliveries, samples should be drawn from at least 10 sacks if the consignment amounts to over 100 sacks, or if the parcel be smaller, then from 10 per cent. of the number of sacks. The sample should be withdrawn, not from the surface of a sack, but from a depth at least as far from the surface as the hand will reach when buried up to the wrist.

These bulk samples should be put into a large tin kept for the purpose, and well shaken; a smaller tin (of at least a pint capacity) is then filled from the larger one, and sent to the analyst, the remainder being reserved in other similar tins if the analysis is to be checked. The lids of all tins containing samples for analysis should fit well, and it is desirable as an additional safeguard in those cases in which special airtight tins are not employed to affix gummed paper round the junction of the lid and tin. Malts are really better sent in clean, carefully dried, stoppered bottles. Stoppered beer bottles answer the purpose.

In sending malts from heaps, surface samples should be avoided as in the case of sacks, and three to six samples should be withdrawn and mixed in a large tin, a small tin or bottle being filled with a portion of the mixture and sent for analysis. When the malt lies in bins a sample from the spout will generally fairly represent the bulk if the bin has been drawn upon. If not, the bin should be probed at different depths, five or six samples withdrawn, mixed in a large tin, and a small tin or bottle filled from the mixture and sent for analysis.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 207.)

National Chemical Laboratory (Chemische Reichsanstalt) for Germany.

The Council of the German Chemical Society purposes petitioning the Government to grant the establishment of a National Chemical Laboratory on the lines of the "Physikalische Reichsanstalt." The work of the Laboratory is to include (i.) the International Atomic Weights Commission; (ii.) the International Commission on Analysis; (iii.) the International Commission for the Analysis of Artificial Manures and Foodstuffs (Animals). In favour of its proposal special attention is directed by the Council to the example of Great Britain, which, by its Alkali Act (1863) has not only conferred benefits upon the manufacturer, but has also largely contributed to the purification both of the air and of the water courses. By this and other movements, it is pointed out, Great Britain has during last century accentuated the importance of the relations of chemical science to industry.

Trade Report.

Canals and Waterways; Royal Commission on ——.

The King has been pleased to appoint a Royal Commission to inquire into the canals and inland navigations of the United Kingdom and to report on—

(1) Their present condition and financial position.

(2) The causes which have operated to prevent the carrying out of improvements by private enterprise, and whether such causes are removable by legislation.

(3) Facilities, improvements, and extensions desirable in order to complete a system of through communication by water between centres of commercial, industrial, or agricultural importance, and between such centres and the sea.

(4) The prospect of benefit to the trade of the country compatible with a reasonable return on the probable cost.

(5) The expediency of canals being made or acquired by public bodies or trusts and the methods by which and what should be the system of control and management of such bodies or trusts.

The following are the Royal Commissioners:—The Right Hon. Lord Shuttleworth (Chairman), Lord Kenyon, Lord Brassey, K.C.B., Lord Farrer, the Right Hon. Sir John Dorington, Sir John Brunner, M.P., Sir Francis Hopwood, K.C.B., C.M.G. (Permanent Secretary to the Board of Trade), W. J. Crossley, Esq., M.P., Russell Rea, Esq., M.P., J. F. Remnant, Esq., M.P., P. Snowdon, Esq., M.P., Henry Vivian, Esq., M.P., L. A. Waldron, Esq., M.P., R. C. H. Davison, Esq., C.E., J. P. Griffith, Esq., C.E., Dr. A. J. Herbertson, J. C. Inglis, Esq., C.E., H. F. Killick, Esq., John Wilson, Esq.

W. B. Duffield, Esq., M.A., barrister-at-law, will act as secretary.

New Books.

Metropolitan Water Board. Reports on the Results of the Chemical and Bacteriological Examination of the London Waters, for the Month ending November 30, 1905 (No. 1), and December, 1905 (No. 2). By Dr. Houston, Director of Water Examinations, Metropolitan Water Board. Price 2s. 6d. nett.

Report No. 1 is printed *in extenso*, as being the first issued, filling 87 pages and containing 9 maps. It is shown that in all during the month of November, 285 samples have been taken and analysed, and 699 have been examined bacteriologically. The Report (No. 2) for December is considerably summarised, and only occupies 8 pages. There have been examined chemically, 247 samples, and bacteriologically, 600 samples during this month.

Chemistry of the Proteids. By Gustav Mann, M.D., B.Sc., University Demonstrator of Physiology, Oxford. Based on Prof. Otto Cohnheim's "Chemie der Eiweisskörper." Macmillan and Co., Ltd., London. The Macmillan Company, New York. 1906. Price 15s. nett.

8vo volume, containing 584 pages of subject matter, with an alphabetical index. The subject matter is subdivided as follows:—I. Reactions of Albuminous Substances. II. Dissociation Products. III. Synthesis of Albumins. IV. Constitution of Albumins. V. Albumoses and Peptones. VI. Salts of Albumins. VII. Halogen-Albumins and Allied Matter. VIII. Physical Properties of Albumins. IX. Classification of Albumins. X. The Albumins Proper. XI. The Proteids. XII. The Albuminoids.

Mineral Resources of the United States. Department of the Interior, United States Geological Survey. Calendar Year, 1904. David Day, Chief of Division of Mining and Mineral Resources. Government Printing Office. Washington. 1905.

8vo volume, containing 1234 pages of subject matter, and an alphabetical index. The text deals with the following subjects:—I. Iron Ores. II. Statistics of the American Iron Trade for 1904. III. Manganese Ores. IV. Gold and Silver. V. Copper. VI. Lead. VII. Zinc. VIII. Aluminium and Bauxite. IX. Mercury. X. Steel and Iron-hardening Metals. XI. Nickel and Cobalt. XII. Chromium. XIII. Tungsten. XIV. Molybdenum. XV. Vanadium and Uranium. XVI. Titanium. XVII. Manganese. XVIII. Platinum. XIX. Lithium Minerals. XX. Antimony. XXI. Arsenic. XXII. Bismuth. XXIII. Tin. XXIV. Coal. XXV. Coke. XXVI. Gas, Coke, Tar, and Ammonia at Gas Works, and in Retort Coke Ovens. XXVII. Petroleum. XXVIII. Natural Gas. XXIX. Asphaltum and Bituminous Rock. XXX. Stone. XXXI. Clay-Working Industries. XXXII. Cement. XXXIII. Precious Stones. XXXIV. Talc and Soapstone. XXXV. Abrasive Materials. XXXVI. Borax. XXXVII. Bromine. XXXVIII. Fluorspar and Cryolite. XXXIX. Gypsum and Gypsum Products. XL. Phosphate Rock. XLI. Salt. XLII. Sulphur and Pyrites. XLIII. Barytes. XLIV. Mineral Paints. XLV. Fuller's Earth. XLVI. Asbestos. XLVII. Flint and Felspar. XLVIII. Glass-Sand and Other Sand. XLIX. Graphite. L. Magnesite. LI. Mica. LII. Mineral Waters.

JOURNAL OF THE

Society of Chemical Industry.

No. 6.—Vol. XXV. SUPPLEMENT. March 31, 1906.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

LONDON SECTION.

The next meeting of the London Section will be held at the Chemical Society's Rooms, Burlington House, Piccadilly, on Monday, April 2nd, when the following papers will be read:—"The Ropiness in Flour and Bread, and its detection and prevention," by E. J. Watkins; "The Rösе-Herzfeld and Sulphuric Acid Methods for determinining the Higher Alcohols," by V. H. Veley, F.R.S.

List of Members Elected.

March 23rd, 1906.

Bowers, H. L., 50, Colborne Street, Toronto, Ont., Canada, Consulting Chemist and Metallurgist.

Burrough, Ernest Jas., Cale Street Distillery, Chelsea S.W., Rectifier.

Compton, Miss N. J., Library, University of Nebraska Lincoln, Neb., U.S.A., Librarian.

Fernyhough, F., The Abbey Cottage, Leek, Staffs., Print Works Manager.

Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.

Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.

Harris, Wm. G., jun., 25, William Street, Toronto, Ont., Canada, Metallurgist.

Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.

Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

Lee, William, 43, Daisy Bank, Heaton Park, Manchester, Works Chemist.

Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

Lyon, Geo. A., Lowell Machine Shop, Lowell, Mass., U.S.A., Selling Agent.

McDowall, William, Oficina Santa Luisa, Taltal, Chile, South America, Analytical Chemist.

Mawson, Fred. E., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Merchant.

Olmsted, Fred. A., American Writing Paper Co., Holyoke, Mass., U.S.A., Chemical Engineer.

Palm, Otto G., 41, Colborne Street, Toronto, Canada, President (Atteaux Dye. and Chemical Co.).

Pennymore, Percy G., Eskbank Iron and Steel Works, Lithgow, New South Wales, Chemist and Blast Furnace Manager.

Peterson, Chas. A., 106, Front Street East, Toronto, Canada, Chemist.

Reid, James, Moffat Mills, Airdrie, N.B., Chemist.

Reinhold, Gustave C., 11, Hervey Road, Blackheath, S.E., Works Manager.

Stebbins, Chas. H., 113, Malvern Street, Melrose, Mass., U.S.A., Assistant Chemist, Boston Navy Yard.

Tillson, Henry E., 12, Derby Street, Concord Junction, Mass., U.S.A., Dyer.

Trotz, Johan O. E., 311, Main Street, Worcester, Mass., U.S.A., Consulting Engineer.

Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.

White, Wm. T., c/o American Hide and Leather Co., Lowell, Mass., U.S.A., Leather Manufacturer.

Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.

Wikner, Sigurd A., Hull Road, Hedon near Hull, Tar Works Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the journal depends.]

Baer, Dr. S. H., l/o New York; 212, South 7th Street, St. Louis, Mo., U.S.A.

Bain, J. Watson, l/o Charles Street; School of Practical Science, Toronto, Canada.

Bernays, Jos., l/o Newgate Street; Blenheim Club, St. James Square, London, S.W.

Brooks, H. Kibbe, l/o Swanton, Vt.; Claremont, N.H., U.S.A.

Brown, Walter B., l/o Chicago Heights; 89, Board of Trade Building, Chicago, Ill., U.S.A.

Buchanan, E. F., l/o Nürnbergerstr.; Eisenacherstrasse, 10[II], Berlin, W.

Burford, S. F., l/o Kirby Muxloe; Beechworth, Stoneygate Road, Leicester.

Burkhardt, Dr. G. A.; all communications to Pragerstrasse, 12, Berlin W. 50, Germany.

Davidson, Alex., jun., l/o Glasgow; 8, Traquair Park, Corstorphine, Midlothian, N.B.

Emery, Arthur L., l/o Crossley Building, 83-85, New Montgomery Street, San Francisco, Cal., U.S.A.

Greville, H. Leicester, l/o Catford; 39, Croft Road, Bromley, Kent.

Harrington, Dr. B. J.; Journals to University Library, McGill University, Montreal; and communications 295, University Street, Montreal, Canada.

Harrison, W. H.; all communications to Knostrop Sewage Works, Leeds.

Highley, A., l/o Horsforth; 26, Parkfield Avenue, Bradford Moor, Bradford, Yorks.

Hill, Sydney; all communications to Eastholme, Princes' Avenue, Hull.

Howard, Tom, l/o Isleworth; (communications) Floral Villa, Lampton Road, Hounslow, and (Journals) c/o Williams Bros. and Co., Hounslow, W.

Jackson, Samuel, l/o Madras; Edzell Park Avenue, Knaresborough, Yorks.

Joplin, G. C.; Journals to 12, Harrington Street, Sydney, N.S.W., Australia.

Journand, Louis, l/o Bourg de Péage; Epaillage Chimique, Pont Evêque, près Vienne (Isère), France.

Langmuir, F. L., l/o Freiburg; Herold's Institute, Drummond Road, Bermondsey, S.E.

Major, Ernest, l/o Balmain, P.O.; Eagle Paint Works, Snails Bay, Balmain, Sydney, N.S.W.

O'Shea, Prof. L. T.; all communications to Dept. of Applied Science, St. George's Square, Sheffield; Prof. of Applied Chemistry, University of Sheffield.

Pedler, Sir Alex., F.R.S., l/o Calcutta; retain journals.

Pizey, J. H., l/o Glasgow; Bella Vista 19, Minas de Rio Tinto, Prov. de Huelva, Spain.

Pope, Prof. W. J., F.R.S., l/o Higher Broughton; Corchester, Bramhall, Cheshire,

Pratt, Walter E., l/o East Road; "Patchetts," Caton, near Lancaster.

Prentice, Jas.; Journals to 5, Ashgrove Terrace, Partickhill, Glasgow.

Rodwood, Iltyd J., l/o Belvedere; The Chestnuts, Erith Road, Bexley Heath, Kent.

Rüger, Richard, l/o Ash Leigh; 8, Alroy Road, Anfield, Liverpool.

Schaffer, H. A., l/o Spring Garden Street; 301, Burke Street, Easton, Pa., U.S.A.

Scrymgeour, W., l/o Southern Cross; Lewiss Street, Lamington Heights, Kalgoorlie, West Australia.

Smith, R. F. Wood, l/o Bartholomew Close; 9, Lower Thames Street, London, E.C.

Teeple, Dr. J. E., l/o Easton; Industrial Laboratories, 164, Front Street, New York City, U.S.A.

Ward, Dudley R.; all communications to Mysore Gold Mine, Marikuppam, Mysore State, S. India.

Worstall, R. A., l/o Chicago; 522, Church Street, Evanston, Ill., U.S.A.

Change of Address Required.

Davies, W. Rhys, l/o 60, Northampton Terrace, Bradford.

Deaths.

Claudet, Francis G., Ennismore, Willesden Lane, London, N.W. March 13.

JOURNAL OF THE

Society of Chemical Industry.

No. 6.—Vol. XXV. SUPPLEMENT. March 31, 1906.

HON. TREASURER:—
Samuel Hall, East London Soap Works, Bow, E.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

LONDON SECTION.

The next meeting of the London Section will be held at the Chemical Society's Rooms, Burlington House, Piccadilly, on Monday, April 2nd, when the following papers will be read:—"The Ropiness in Flour and Bread, and its detection and prevention," by E. J. Watkins; "The Rösе-Herzfeld and Sulphuric Acid Methods for determinining the Higher Alcohols," by V. H. Veley, F.R.S.

List of Members Elected.

March 23rd, 1906.

Bowers, H. L., 50, Colborne Street, Toronto, Ont., Canada, Consulting Chemist and Metallurgist.

Burrough, Ernest Jas., Cale Street Distillery, Chelsea S.W., Rectifier.

Compton, Miss N. J., Library, University of Nebraska Lincoln, Neb., U.S.A., Librarian.

Fernyhough, F., The Abbey Cottage, Leek, Staffs., Print Works Manager.

Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.

Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.

Harris, Wm. G., jun., 25, William Street, Toronto, Ont., Canada, Metallurgist.

Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.

Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

Lee, William, 43, Daisy Bank, Heaton Park, Manchester, Works Chemist.

Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

Lyon, Geo. A., Lowell Machine Shop, Lowell, Mass., U.S.A., Selling Agent.

McDowall, William, Oficina Santa Luisa, Taltal, Chile, South America, Analytical Chemist.

Mawson, Fred. E., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Merchant.

Olmsted, Fred. A., American Writing Paper Co., Holyoke, Mass., U.S.A., Chemical Engineer.

[C.S.] 26,178 (1904). Vogt. Apparatus for producing combustion gases under pressure. March 7.

„ 26,556 (1905). Campbell, Binnie and Reid (Smith). *See under* X.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 5435. Marriott. Impts. in pitch in its application to artificial fuel making as a waterproof agglomerant and preservative.* March 6.

„ 5872. Brown. Treating paraffin wax. March 10.

[C.S.] 7699 (1905). Van der Ploeg. Manufacture of emulsions of heavy mineral oils or the like. March 21.

„ 17,464 (1905). Johnson (Deutsche Continental Gas.-Ges.). *See under* II.

„ 18,174 (1905). Ziegler. Kiln for distilling peat. March 14.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 4687. Imray (Soc. Chem. Industry in Basle). Manufacture of a red vat dyeing dyestuff.* Feb. 26.

„ 5244. Ransford (Cassella und Co.). Manufacture of disazo dyestuffs. March 3.

„ 5245. Ransford (Cassella und Co.). Manufacture of polyazo dyestuffs. March 3.

„ 5749. Newton (Bayer und Co.). Production of new azo dyestuffs and intermediate products. March 9.

„ 5890. Newton (Bayer und Co.). Manufacture of a new dyestuff of the anthracene series. March 10.

„ 5959. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. March 12.

„ 6189. Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of azo-colouring matter.* March 14.

„ 6198. Lake (Chem.-Fabr. Griesheim-Elektron). Manufacture of blue sulphurised dyestuffs.* March 14.

[C.S.] 14,578 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds and colouring matters of the anthracene series. March 14.

„ 14,787 (1905). Ransford (Cassella und Co.). Manufacture of trisazo dyestuffs. March 21.

„ 16,227 (1905). Imray (Meister, Lucius und Brüning). Manufacture of blue colouring matters of the quinoline group and photographic surfaces sensitised therewith. March 21.

„ 16,632 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of methylanthraquinone. March 21.

„ 18,176 (1905). Cooper (Bayer und Co.). Manufacture of anthracene dyestuffs. March 14.

„ 23,034 (1905). Kalle and Kalle. Manufacture of *o*-oxymonoazo dyes of the naphthalene series. March 21.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 4728. Hey and Smith. Discharging or removing dye from wool, silk and other fibres, and bleaching, carbonising or sterilising such fibres. Feb. 27.

„ 4981. Rhodes. Apparatus for preparing, dyeing, scouring, ageing, settling, bleaching, or otherwise treating with liquids, pieces, warps, or other fibrous material. March 1.

[A.] 5246. Ransford (Cassella und Co.). Production of easily dischargeable claret shades on cotton goods. March 3.

„ 5613. Horridge and Cornall. Printing and dyeing textile fabrics.* March 8.

„ 5836. Bailey. Machines for washing or scouring textile piece goods. March 10.

„ 5845. Whiteley. Machines for drying, shrinking or ageing textile fabrics. March 10.

„ 6072. Friedrich. Manufacture of silk-like threads and cellulose solutions therefor. [Belg. Appl., March 13, 1905.]* March 13.

„ 6166. Gorrand. Manufacture of fireproof artificial silk.* March 14.

„ 6207. Ingham. Manufacture of waterproof fabrics. March 14.

[C.S.] 4755 (1905). Linkmeyer. Manufacture of artificial threads. March 14.

„ 4765 (1905). Linkmeyer. Manufacture of lustrous cellulose threads. March 14.

„ 4779 (1905). Tatterson. Wool-washing machines. March 14.

„ 5296 (1905). Zeitschner. Process of bleaching textile fibres, yarns and fabrics. March 21.

„ 9809 (1905). Frankenstein, Spencer, Spencer and Lyst. Printing calico and similar fabrics. March 14.

„ 13,053 (1905). Ainley. Machines for washing and scouring textile fabrics. March 21.

„ 15,524 (1905). Johnson (Badische Anilin und Soda Fabrik). Discharging dyed materials and pastes to be employed therein. March 7.

„ 17,026 (1905). Jones. Wool-scouring machines. March 7.

„ 21,125 (1905). Boult (Bond). Manufacture of waterproof fabrics. March 14.

„ 23,911 (1905). Lohmann. Method of filling the pores or interstices of woven fabric with pulverised substance. March 21.

„ 26,381 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of pastes for the discharge of dyed textile fabrics. March 7.

VI.—COLOURING WOOD, LEATHER, PAPER, ETC.

[A.] 5342. Imray (Meister, Lucius und Brüning). Dyeing paper pulp. March 5.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 4972. Ray. Manufacture of common salt.* March 1.

„ 5151. Raschen, Wareing, and the United Alkali Co., Ltd. Purification of arsenical sulphuric acid and the obtainment of arsenic therefrom. March 2.

„ 5169. Laureau. Treatment of marine plants for the extraction of chemical, mineral and organic matters and their employment in arts and industries. March 2.

„ 5427. Ray. Manufacture of common salt. March 6.

„ 5428. Ray. Manufacture of common salt.* March 6.

„ 5478. Clemm. Conversion of alkali sulphate and bauxite or other aluminiferous material into alumina and alkali compounds containing sulphur.* March 6.

„ 5775. Johnson (Feld). Production of ferrocyanides from cyanogen contained in gases. March 9.

[A.] 5776. Johnson (Feld). Production of nitrate of ammonia. March 9.

„ 5852. Brünler. Apparatus for oxidising the nitrogen of the air for the production of nitric acid.* March 10.

„ 5901. Brünler. Utilisation of the nitrogen of the air by oxidation and conversion of the product into nitric acid or its salts.* March 10.

„ 6122. Pezzolato and Felice. Separation of sulphates of alumina and potash from solutions.* March 13.

„ 6142. James. Production of liquid air or other gases. March 14.

„ 6329. Barnes, Spence, and Spence and Sons, Ltd. Manufacture of titanium compounds. March 16.

[C.S.] 10,475 (1905). Morgan Crucible Co., Ltd., and McCourt. Treatment of non-metalliferous ores or the like for the separation of their constituents. March 7.

„ 10,722 (1905). Bale. Treatment of the pan scale of salt pans and its product. March 7.

„ 16,893 (1905). Shoop. Lime kilns. March 21.

„ 20,837 (1905). Grossmann. Manufacture of sulphate of ammonia. March 14.

„ 24,507 (1905). Teichner. Production of peroxide of hydrogen. March 14.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 4723. Emery and Emery. Kilns for firing ceramic ware. Feb. 27.

„ 5302. Pauls. Composition for making grinding tools.* March 5.

„ 5368. Touya. *See under* IX.

„ 5605. Sievert. Glass melting and pouring apparatus. [Ger. Appl., March 11, 1905.]* March 8.

[C.S.] 15,398A (1905). Bennett and Mastin. *See under* XIII*A*.

„ 18,545 (1905). Naylor. *See under* I.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 4661. Ford. Manufacture of artificial stone. Feb. 26.

„ 4662. Ford. Manufacture of artificial stone. Feb. 26.

„ 4663. Ford. Manufacture of artificial stone. Feb. 26.

„ 5132. Thompson. Manufacture of building and other blocks. March 2.

„ 5368. Touya. Artificial stone for grinding and abrasive purposes. March 5.

„ 5540. Gen. Cement Co., Ltd. (Passow). Manufacture of cement. March 7.

„ 5628. Tissington. Manufacture of cement. March 8.

„ 6034. Neal. Distemper to represent stone. March 13.

„ 6113. Jurschina. Manufacture of artificial stones, bricks, or like articles.* March 13.

„ 6333. Hadlington and Hinton. Continuous brick kilns and the like. March 16.

[C.S.] 4194 (1905). Boult (Reiche). Manufacture of hydraulic binding substances or cements. March 7.

„ 5765 (1905). Assoc. Portland Cement Manufrs. (1900), Ltd., Bamber and Layton. Manufacture of Portland cement. March 7.

„ 7043 (1905). Wolman. Composition of matter for impregnating wood. March 7.

„ 16,849 (1905). Earle. *See under* XIII*A*.

[C.S.] 20,296 (1905). Baur. Machinery for preparing or treating loam, clay, and the like. March 14.

„ 2704 (1906). Hall. Manufacture of faced or enamelled bricks, slabs, tiles and the like. March 14.

X.—METALLURGY.

[A.] 4796. Walker (Just). Recovery of precious metals from ores and other material.* Feb. 27.

„ 4904. Parnell. Smelting ores. Feb. 28.

„ 4999. Hodgkinson. Treatment of small mine or waste products of calcined iron ores for the more complete extraction of iron.* March 1.

„ 5029. Coupe-Annable, and The Ferro Alloys Synd., Ltd. Manufacture of ferro-chromium. March 1.

„ 5030. Coupe-Annable, and The Ferro Alloys Synd., Ltd. Manufacture of ferro-chromium. March 1.

„ 5031. Coupe-Annable, and the Ferro Alloys Synd., Ltd. Manufacture of ferro-molybdenum. March 1.

„ 5173. Cowper-Coles. Recovery of gold from cyanide solutions. March 3.

„ 5479. Lébédeff and Poméranzoff. Treatment of metallic sulphide ores preparatory to obtaining metals therefrom. March 6.

„ 5595. Kinchin. Iron alloy or compound. March 8.

„ 5655. Leaver and Buch. Treatment of flux skimmings of zinc, tin, or similar metal. March 8.

„ 5675. Cowper-Coles. Manufacture of standard silver. March 9.

„ 5716. Blackmore and Howard. Furnace for calcining or sulphating ores at low temperatures. March 9.

„ 5784. Fitzmaurice. Treatment of ores. March 9.

„ 5989. Hennay and Wilson. Treatment of metallic ores. March 12.

„ 6005. Justice (Bethlehem Steel Co.). Furnaces.* March 12.

„ 6210. Maunder. Smelting and treatment of complex, refactory and other ores. March 14.

„ 6426. Hadfield. Treatment of magnetic materials.* March 16.

„ 6484. Tropenhas. Manufacture of steel by the pneumatic process.* March 17.

[C.S.] 5260 (1905). Sulman, Picard and Ballot. Ore concentration. March 14.

„ 5817 (1905). Simpson (Simpson). Conversion of iron into steel. March 7.

„ 6468 (1905). Soc. Electrometallurgique Française. *See under* XI.

„ 6556 (1905). Hutchings. Method and apparatus for washing and concentrating metalliferous, diamondiferous and other deposits and tailings from ore crushing. March 21.

„ 7251 (1905). Bayliss, Jones and Bayliss, Ltd., and Milner. Puddling furnaces. March 7.

„ 10,312 (1905). Baillot. Cupola furnaces. March 7.

„ 11,268 (1905). Brayshaw. Process of hardening high speed steel. March 21.

„ 12,200 (1905). Haddan (Fellner und Ziegler). Process for treating finely-granulated or pulverised ores. March 7.

„ 13,297 (1905). King's Norton Metal Co., Ltd., Bayliss, Brownsdon and Smith. Treatment of gun barrels and other metallic surfaces for the removal of fouling therefrom. March 21.

„ 13,955 (1905). Zimmer. Apparatus for cleaning and separating minerals. March 14.

„ 19,525 (1905). Lean (Maschinenbau Anstalt Humboldt). *See under* XI.

[C.S.] 19,655 (1905). Dor-Delattre. Zinc furnaces. March 14.

„ 26,556 (1905). Campbell, Binnie and Reid (Smith). Apparatus for washing and separating coal and other minerals. March 14.

XI.—ELECTRO-CHEMISTRY, AND ELECTRO-METALLURGY.

[A.] 4683. Sanders. Manufacture of wire, bars and the like by electrodeposition. Feb. 26.

„ 4684. Cowper-Coles. Production of electrotypes. Feb. 26.

„ 4716. McDonald. Electrolytic apparatus.* Feb. 26.

„ 4726. Cowper-Coles. Manufacture of metallic foil or leaf. Feb. 27.

„ 5493. Fiedler. Secondary batteries.* March 6.

„ 6088. British Thomson-Houston Co., Ltd. (General Electric Co.). Electrodes. March 13.

„ 6089. British Thomson-Houston Co., Ltd. (General Electric Co.). Resistance material. March 13.

„ 6283. Kuehnrich. Electric furnaces. March 15.

[C.S.] 4668 (1905). Cowper-Coles. Manufacture of copper electrotypes and apparatus therefor. March 7.

„ 6468 (1905). Soc. Electrometallurgique Française. Electrical production of cast iron. March 21.

„ 7720 (1905). Leitner. Manufacture of accumulators. March 21.

„ 7903 (1905) Fennell and Perry. Electric accumulators or secondary cells. March 7.

„ 18,427 (1905). Lester. *See under* XVIII*B*.

„ 19,525 (1905). Lean (Maschinenbau Anstalt Humboldt). Magnetic ore separators. March 7.

„ 21,437 (1905). Kother. Electrodes for use in the manufacture of bleaching liquors. March 14.

„ 22,901 (1905). Bagnall. Electroplating vats. March 21.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 4688. Kosters. Manufacture of viscid or fluid emulsions of oils, fats or the like. *Feb. 26.

„ 6289. Chapman and Knowles. Lubricating compounds.* March 15.

[C.S.] 10,437 (1905). Brewer and Hardy. *See under* XIV.

„ 24,030 (1905). Kremer, and Ges. f. Abwässerklärung. Apparatus for the recovery of fats and the like. March 21.

„ 2680 (1906). Crowley and Payne. Lubricating oil. March 21.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 5015. Heide (Union Lead and Oil Co.). Apparatus for making white lead.* March 1.

„ 5048. Porter and Ward. Composition for cleaning painted surfaces. March 1.

„ 5999. Grasfland. Manufacture of paint.* March 12.

[C.S.] 14,202 (1905). Dunnett, Nelson and Nelson. Anti-fouling paints and compositions. March 14.

„ 14,611 (1905). Dunnett, Nelson and Nelson. Anti-fouling paint or composition. March 14.

[C.S.] 15,308A (1905). Bennett and Mastin. Manufacture of permanent pigments from glass. March 7.

„ 16,840 (1905). Earle. Colour washes for brickwork and other surfaces. March 14.

„ 1279 (1906). Potter. Paint. March 21.

(*B.*)—RESINS, VARNISHES.

[A.] 4678. Poppf. Manufacture of linoleum or like material. Feb. 26.

„ 5773. Linoleum Manufacturing Co., Ltd., and Vincent. Apparatus for the manufacture of linoleum, &c. March 9.

[C.S.] 6751 (1905). Lederer. Solutions of organic compounds suitable as lacquers, varnishes, waterproofing and impregnating media, and for the manufacture of films, filaments and insulating materials. March 7.

„ 17,187 (1905). Morris. Manufacture of substitutes for felt, linoleum, oilcloth, leather, &c. March 7.

(*C.*)—INDIA-RUBBER.

[A.] 4692. Gratz. Processes for obtaining pure caoutchouc, guttapercha and the like. [Ger. Appl., Feb. 21, 1906].* Feb. 26.

„ 4701. Grätz. Processes for obtaining caoutchouc. [Ger. Appl., Feb. 2, 1906.]* Feb. 26.

„ 5486. Soc. en Commandite pour actions Michelin et Cie. Process of utilising rubber waste. [Fr. Appl., March 30, 1905.]* March 6.

„ 6183. Granier and Froger-Delapierre. Compound for coating caoutchouc to preserve its natural properties. March 14.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 5169. Laureau. *See under* VII.

„ 5407. The Bakau Co., Ltd., and Meikle. Extracting soluble matter from bark, wood and the like and apparatus therefor. March 6.

„ 6516. Spencer and Abbott. Leather finishing composition. March 17.

[C.S.] 10,437 (1905). Brewer and Hardy. Process and apparatus for extracting grease and oil from skins and hides. March 7.

„ 16,432 (1905). Luther. Manufacture of glue March 21.

„ 17,187 (1905). Morris. *See under* XIII*B*.

„ 22,525 (1905). Collardon. Manufacture of plastic masses from casein and the like. March 21.

„ 24,487 (1905). Oakes. Process for treating hides March 7.

„ 135 (1906). Harrison (Turner Tanning Machine Co.). Machine for treating hides, skins and leather. March 7.

„ 3516 (1906). Oakes. Process for treating hides March 7.

XV.—MANURES, ETC.

[A.] 6429. Chisolm. Fertilisers.* March 16.

[C.S.] 5618 (1905). Crone, Taylor and Williams. Manufacture of fertilisers and apparatus therefor March 7.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 5323. De Vecchis and Sani. Complete extraction of inulin from tubercles.* March 5.

[A.] 6009. Drost. Mashing apparatus for promoting the crystallisation of sugar masses and for intimately mixing other pulpy masses with diluting agents.* March 12.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 5135. Vloeberghs. Process of fermentation.* March 2.

,, 5147. West and Co., Ltd., and Webster. Apparatus for collecting and treating gases and other volatile products of fermentation. March 2.

,, 5619. Nathan. Vessels for use in making sterilised beer. [Ger. Appl. March 8, 1905.]* March 8.

,, 6186. Berman. Preparations of malt extract. March 14.

[C.S.] 16,071 (1905). Wittemann. Process of fermentation in relation to brewing beer and other beverages. March 21,

,, 21,547 (1905). Desvignes. Process for ageing and improving wines, brandies, alcohols and liqueurs. March 21.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—Foods.

[A.] 4659. Dreaper. Manufacture of food products and the like. Feb. 26.

,, 5195. Hansteen. Process of producing an aliment from cetraria (Iceland lichen). [Appl. in Norway, March 7, 1905.]* March 3.

,, 5224. Makin and Hardcastle. Apparatus for preparing substances in the manufacture of food-stuffs. March 3.

,, 5504. Paul. Manufacture of baking powder. [Ger. Appl., March 8, 1905.]* March 7.

,, 5818. Potthast and Woolner. Malt coffee. March 10.

,, 6110. Rigaut. Manufacture of a substitute for chicory or coffee. March 13.

,, 6375. Meyer. Preparation of coffee.* March 16.

,, 6379. Marot. Preservation of coco-nut or copra. March 16.

,, 6389. Little. Bleaching or conditioning flour or other ground cereal. March 16.

[C.S.] 21,946 (1905). Reis. Preparation of an alimentary substance. March 14.

,, 23,009 (1905). Eybert and Eybert. Treating flour with gases. March 14.

,, 25,010 (1905). Zimmermann and Buchenau. Process of bleaching and sterilising corn and its products. March 21.

,, 612 (1906). Volz. Process for making concentrated fruit syrups or extracts. March 7.

(B.)—Sanitation; Water Purification.

[A.] 5908. Kremer, and Ges. f. Abwässerklärung. Separation of solid matters from sewage and the like.* March 12.

,, 6373. Liebl. Preparation of drinking water from sea water.* March 16.

[C.S.] 4980 (1905). Travis. Purification of sewage and other foul or impure waters. March 7.

[C.S.] 5332 (1905). Declercq. *See under* I.

,, 8347 (1905). Spence, Spence, and Peter Spence and Sons, Ltd., and Ockel. Treatment of sewage and other similar sludges. March 7.

,, 18,427 (1905). Lester. Apparatus for the electrical purification of water. March 21.

(C.)—Disinfectants.

[C.S.] 88 (1906). Schulz. Insecticide and germicide compounds. March 14.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 4667. Abelspies. Hydraulic classification of finely-granulated pulp. Feb. 26.

,, 5219. Harrison (Parker). Process for reclaiming pulp from waste water.* March 3.

,, 5342. Imray (Meister, Lucius und Brüning). *See under* VI.

,, 5851. Erfurt. Utilisation of the waste water of a paper machine. [Fr. Appl., March 20, 1905.]* March 10.

,, 5972. Winter.* Substitute for wax for use as a glazing medium for coloured or like papers. March 12.

,, 6085. White. Paper.* March 13.

,, 6123. Sachsenröder. Manufacture of parchment paper. [Ger. Appl., June 5, 1905.]* March 13.

[C.S.] 6783 (1905). Desmarais, Morane, and Denis. Pumps for supplying collodions and cellulose solutions to filters and drawing apparatus. March 7.

,, 12,278 (1905). Cathelineau and Fleury. Plastic transparent product for the manufacture of fibres, films, blocks or plates. March 7.

,, 23,399 (1905). Macnaughton. Paper-making apparatus for separating impurities from the pulp. March 7.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 5032. Weizmann, and the Clayton Aniline Co., Ltd. Manufacture of camphene. March 1.

,, 5039. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new salts of hexamethylenetamine. March 1.

,, 5066. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of alkaminomethyl pentyl benzoates. March 1.

,, 6286. Fitzmaurice. Obtaining radium, preparatory treatment of pitchblende or other base. March 15.

[C.S.] 10,003 (1905). Wetter (Hoffmann-La Roche & Co.). Benzoylsalicylic acid. March 7.

,, 12,292 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of salts of *p*-aminobenzoic ether. March 7.

,, 2520 (1906). Imray (Soc. Chem. Industry in Basle). Manufacture of camphor. March 7.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 4714. Hyde. Colour photography. Feb. 26.

,, 5276. Shepherd, and Griffin and Sons, Ltd. Treatment of prints on "self-toning" paper. March 5.

[C.S.] 16,227 (1905). Imray (Meister, Lucius und Brüning). *See under* IV.

[C.S.] 19,655 (1905). Dor-Delattre. Zinc furnaces. March 14.

„ 26,556 (1905). Campbell, Binnie and Reid (Smith). Apparatus for washing and separating coal and other minerals. March 14.

XI.—ELECTRO-CHEMISTRY, AND ELECTRO-METALLURGY.

[A.] 4683. Sanders. Manufacture of wire, bars and the like by electrodeposition. Feb. 26.

„ 4684. Cowper-Coles. Production of electrotypes. Feb. 26.

„ 4716. McDonald. Electrolytic apparatus.* Feb. 26.

„ 4726. Cowper-Coles. Manufacture of metallic foil or leaf. Feb. 27.

„ 5493. Fiedler. Secondary batteries.* March 6.

„ 6088. British Thomson-Houston Co., Ltd. (General Electric Co.). Electrodes. March 13.

„ 6089. British Thomson-Houston Co., Ltd. (General Electric Co.). Resistance material. March 13.

„ 6283. Kuehnrich. Electric furnaces. March 15.

[C.S.] 4668 (1905). Cowper-Coles. Manufacture of copper electrotypes and apparatus therefor. March 7.

„ 6468 (1905). Soc. Electrometallurgique Française. Electrical production of cast iron. March 21.

„ 7720 (1905). Leitner. Manufacture of accumulators. March 21.

„ 7903 (1905) Fennell and Perry. Electric accumulators or secondary cells. March 7.

„ 18,427 (1905). Lester. *See under* XVIII*B*.

„ 19,525 (1905). Lean (Maschinenbau Anstalt Humboldt). Magnetic ore separators. March 7.

„ 21,437 (1905). Kother. Electrodes for use in the manufacture of bleaching liquors. March 14.

„ 22,901 (1905). Bagnall. Electroplating vats. March 21.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 4688. Kosters. Manufacture of viscid or fluid emulsions of oils, fats or the like. *Feb. 26.

„ 6289. Chapman and Knowles. Lubricating compounds.* March 15.

[C.S.] 10,437 (1905). Brewer and Hardy. *See under* XIV.

„ 24,030 (1905). Kremer, and Ges. f. Abwässerklärung. Apparatus for the recovery of fats and the like. March 21.

„ 2680 (1906). Crowley and Payne. Lubricating oil. March 21.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 5015. Heide (Union Lead and Oil Co.). Apparatus for making white lead.* March 1.

„ 5048. Porter and Ward. Composition for cleaning painted surfaces. March 1.

„ 5999. Grasfland. Manufacture of paint.* March 12.

[C.S.] 14,202 (1905). Dunnett, Nelson and Nelson. Anti-fouling paints and compositions. March 14.

„ 14,611 (1905). Dunnett, Nelson and Nelson. Anti-fouling paint or composition. March 14.

[C.S.] 15,308A (1905). Bennett and Mastin. Manufacture of permanent pigments from glass. March 7.

„ 16,840 (1905). Earle. Colour washes for brickwork and other surfaces. March 14.

„ 1279 (1906). Potter. Paint. March 21.

(*B.*)—RESINS, VARNISHES.

[A.] 4678. Poppf. Manufacture of linoleum or like material. Feb. 26.

„ 5773. Linoleum Manufacturing Co., Ltd., and Vincent. Apparatus for the manufacture of linoleum, &c. March 9.

[C.S.] 6751 (1905). Lederer. Solutions of organic compounds suitable as lacquers, varnishes, waterproofing and impregnating media, and for the manufacture of films, filaments and insulating materials. March 7.

„ 17,187 (1905). Morris. Manufacture of substitutes for felt, linoleum, oilcloth, leather, &c. March 7.

(*C.*)—INDIA-RUBBER.

[A.] 4692. Gratz. Processes for obtaining pure caoutchouc, guttapercha and the like. [Ger. Appl., Feb. 21, 1906].* Feb. 26.

„ 4701. Grätz. Processes for obtaining caoutchouc. [Ger. Appl., Feb. 2, 1906.]* Feb. 26.

„ 5486. Soc. en Commandite pour actions Michelin et Cie. Process of utilising rubber waste. [Fr. Appl., March 30, 1905.]* March 6.

„ 6183. Granier and Froger-Delapierre. Compound for coating caoutchouc to preserve its natural properties. March 14.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 5169. Laureau. *See under* VII.

„ 5407. The Bakau Co., Ltd., and Meikle. Extracting soluble matter from bark, wood and the like and apparatus therefor. March 6.

„ 6516. Spencer and Abbott. Leather finishing composition. March 17.

[C.S.] 10,437 (1905). Brewer and Hardy. Process and apparatus for extracting grease and oil from skins and hides. March 7.

„ 16,432 (1905). Luther. Manufacture of glue March 21.

„ 17,187 (1905). Morris. *See under* XIII*B*.

„ 22,525 (1905). Collardon. Manufacture of plastic masses from casein and the like. March 21.

„ 24,487 (1905). Oakes. Process for treating hides March 7.

„ 135 (1906). Harrison (Turner Tanning Machine Co.). Machine for treating hides, skins and leather. March 7.

„ 3516 (1906). Oakes. Process for treating hides March 7.

XV.—MANURES, ETC.

[A.] 6429. Chisolm. Fertilisers.* March 16.

[C.S.] 5618 (1905). Crone, Taylor and Williams. Manufacture of fertilisers and apparatus therefor March 7.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 5323. De Vecchis and Sani. Complete extraction of inulin from tubercles.* March 5.

Official Notices.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY. ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906.

The attention of Members is drawn to the Notice which accompanied the February 15th issue of the Journal.

The General Secretary will be obliged if those members, who have made arrangements directly with the Congress Committee in Rome, will forward their names to the Society, in order that arrangements may be made for a headquarters in Rome. It would also be of service if they would indicate their contemplated date of departure and proposed route, and also whether they have a preference for any particular hotel in Rome

Death.

Claudet, Francis G., Ennismore, Willesden Lane, London, N.W. March 13.

Birmingham Section.

Meeting held at Birmingham, on Thursday, Feb. 15th, 1906.

PROF. FRANKLAND, F.R.S., IN THE CHAIR.

THE CALORIMETRY OF VOLATILE LIQUIDS.

BY WALTER ROSENHAIN, B.A., B.C.E.

In view of the important uses of volatile liquids as fuel for explosion motors and other purposes, a method has been devised for the accurate determination of the calorific value of such substances by direct combustion in oxygen. The method described below is primarily intended for use with the coal-calorimeter designed by the author and fully described elsewhere (*) but is, with minor modifications, applicable to any form of direct combustion calorimeter. The author's calorimeter belongs to that class in which the combustible substance is burnt in a current of oxygen under a pressure only slightly higher than atmospheric; in such an instrument it is impracticable to burn a liquid either directly in a crucible, or by means of an asbestos or other wick, since the heat evolved during the earlier stages of the combustion rapidly vaporises the bulk of the liquid and either extinction or explosion results. A somewhat better method, which has found some application in practice, consists in absorbing the liquid in either powdered kaolin or in a piece of porous refractory material, such as biscuit porcelain or fire-clay. Apart from the serious errors that would arise from evaporation losses in the case of volatile liquids, this method has the great disadvantage that the close contact of the combustible with non-inflammable and comparatively cold material renders the combustion incomplete, and a small residue of unburnt liquid is always left in the pores of the absorbent medium. This fact suggested that the absorbent substance itself should be completely combustible, and a suitable material has been found in pellets of dry and somewhat compressed cellulose. A large number of pellets of approximately equal weight can be prepared from a single batch of material, and by making a few calorimetric combustions of these pellets in the dry state the calorific value per grm. can be obtained. In practice, the cellulose material used is found to have a calorific value of about 4000 calories per grm., while a pellet weighing 1 grm. will absorb about 0·5 grms. of petroleum, having a calorific value of about 11,000 calories per grm., the heat given out by the combustion of the pellet and by the oil under test being thus about equal.

For such liquids as heavy mineral oils and other less volatile liquids this method, without further precautions gives results accurate to ½ per cent. when used with the author's calorimeter, but the more volatile liquids such as petrol, alcohol, amyl acetate, &c., evaporate so rapidly that the loss in the course of the transfer from the balance to the calorimeter is much too large to be neglected (see Table I.). The pellet, after saturation with the volatile liquid, was therefore wrapped in thin tin-foil. The coating of tin-foil almost entirely stops evaporation, while it does not interfere with the combustion, the tin-foil igniting readily and burning away with the rest of the pellet.

The actual losses by evaporation from bare and wrapped pellets saturated with volatile liquids (petrol, amyl acetate and ether) are shown in Table I. It will be seen that even with so extremely volatile a substance as ether, the loss is only of the order of 1 per cent. in five minutes after the first five minutes have elapsed.

TABLE I.

Liquids.	Temp	Weight.	Loss at end of 5 mins.	Loss at end of 10 mins.	Loss at end of 15 mins.
	°C.		Per cent.	Per cent.	Per cent.
Petrol					
Bare	15	0·359	19·0	32·0	46·0
Wrapped	15	0·386	0·7	1·1	1·3
Amyl acetate					
Bare	17	0·308	5·5	9·4	14·0
Wrapped	17	0·387	0·6	1·0	1·4
Ether					
Bare	13	0·469	31·0	51·0	66·0
Wrapped	13	0·493	2·0	3·6	4·6

The evaporation during the first five minutes is sometimes found to be somewhat irregular, but a steady rate of loss is then established. The rate of loss can be ascertained by weighing the wrapped pellet five and ten minutes after first wrapping, and if the time elapsing between the last weighing and ignition in the calorimeter be noted, a correction for the small amount of loss can readily be applied. As the time in question need never exceed five minutes, the correction is always small.

In applying this method, it is, of course, necessary to know the allowance to be made for the heat evolved by the combustion of the tin-foil used in wrapping the pellet. The weight of tin-foil used is about 0·18 grms., and the calorific value under the circumstances of such a combustion lies near 2200 calories per grm., so that the total heat due to the tin-foil is of the order of 400 calories; consequently a small error in the estimation of the calorific value of the tin does not very seriously affect the accuracy of the result. In practice the calorific value of the tin cannot be determined with any great accuracy, since it is found not to burn quite completely—a minute globule of metallic tin is nearly always found in the calorimeter after the combustion. Some of these globules were carefully cleaned and their weight found to be about 0·01 grm., therefore involving an error of about 20 calories. If the stream of oxygen in not properly directed, or thick lumps of tin are formed by careless wrapping of the pellet, much larger quantities of tin may remain unburnt or be again reduced during the combustion. For the determination of the calorific value of tin used by the author in the examples given below, a combustion of a wrapped pellet of a substance of known calorific value (amyl acetate) has been employed, the correction due to the presence of the tin being easily calculated from the data thus obtained.† The results obtained in this way agree with the calorific value of tin found by the combustion of wrapped dry pellets.

(*) Phil. Mag., October, 1902; this J., 1902, 1472.

(†) The use of aluminium foil in place of tin foil has been suggested by Mr. Rees, and if foil of suitable thickness is obtainable, this may prove preferable to tin, as the risk of reduction would be absent and there would be less tendency to form organic compounds.

The method, as here described, is readily applied to such liquids as light mineral oil, petrol, alcohol, &c. With some substances, such as ether and chloroform, the tin enters into combinations which are not destroyed during combustion, so that the results are vitiated, while with benzene it has not yet been possible to avoid the deposition of soot. With those liquids, however, whose calorific values are likely to be required commercially, these complications do not arise, so that the method described affords a rapid and accurate means of testing.

The following examples of actual determinations will serve to illustrate the procedure and calculations employed :—

Determination of calorific value of tin foil, by combustion with dry pellet.

Weight of tin foil = 0·161 grms. Calorific value of dry pellet per grm. = 4210 calories.
" dry pellet = 1·053 "

Water-equivalent of calorimeter with water = 2450 grms.
Observed rise of temperature (corrected for radiation) = 1·96° C.
Total calories found = 2450 × 1·96 = 4800
Calories due to pellet = 4210 × 1·053 = 4430.
Calorific value of tin foil = 4800 − 4430 = 2290 calories per grm.

$$\frac{}{0{\cdot}161}$$

Two other determinations gave 2340 cals. and 2350 cals. respectively.
Mean value = 2330 calories per grm.

Determination of calorific value of amyl acetate.

Weight of pellet = 1·181 grms. Calorific value of dry pellet = 4210 cals. per grm.

" tin foil = 0·183 " Calorific value of tin foil = 2330 cals. per grm.

" amyl acetate = 0·502 grms Water equivalent of calorimeter (corrected for loss by evaporation) + water = 2450 grms
Observed rise of temperature (corrected for radiation) = 3·86° C.

Total calories found = 3·86 × 2450 = 9460
Calories due to pellet = 4210 × 1·181 = 4970.
" due to tin foil = 2330 × 0·183 = 430.

$$\text{Cal. value of amyl acetate} = \frac{9460 - 4970 - 430}{0{\cdot}502}$$

= 8080 calories per grm.

Other determinations gave 7950 and 8030 calories per grm
Mean value = 8020 calories per grm
Value given by Faver & Silbermann (Landolt's tables) = 7970 cals. per grm.
Two determinations of a sample of petrol gave 9970 and 9950 cals per grm.
Two determinations of a sample of methylated spirit gave 6200 and 6230 cals. per grm.

For much assistance in working out the details of the method and in making the determinations quoted above, the author is indebted to Mr. W. J. Rees.

Discussion.

The Chairman said it was very necessary that the calorific values of liquid fuels should be made more widely known, as an extraordinary amount of ignorance prevailed, even amongst scientific persons, as to the relative heat efficiencies of different combustible liquids. He would like to ask Mr. Rosenhain how the results obtained with his apparatus compared with those yielded by the Junker, the Wright, and the bomb calorimeters respectively. He would also like to know whether, in the figures given, any correction for evaporation had been applied, or whether, in practically using the calorimeter, the combustion could be so rapidly started that the weight of substance burnt might be taken as that which had actually been determined with the balance. He would further like to know whether Mr. Rosenhain had made any systematic experiments as to the possibility of burning hydrocarbons without smoke. He understood that in the case of benzene the combustion could not be effected without smoking taking place, but it would be interesting to know whether and, if so, at what terms in ascending other series of hydrocarbons combustion with smoke was unavoidable.

Mr. A. E. Tucker said it seemed to him that in the interval between the admission of the saturated pellet and the firing of it, there was an opportunity for an appreciable amount of such a vapour as petrol to mix with the oxygen or air used and either escape or lead to an explosion. Had such an objection been experienced? Mr. Rosenhain alluded to other forms of calorimeter as sometimes leading to the smothering of the flame. Some short time since he had occasion to determine the calorific values of different makes of petrol, and had used a Junker instrument. He found no difficulty in gasifying the petrol and then burning it through an ordinary Bunsen burner. The results he obtained were very satisfactory and, in his opinion, the operations with this instrument are much less liable to error than in Mr. Rosenhain's calorimeter, in which there appears to be so many required corrections. To gasify the petrol he made what was really a wick carburretor with an ordinary circular lamp wick. A measured volume or weight of petrol was run on to this wick and air, at a suitable rate and pressure, was driven through the wick. This gave an easily controlled flame at the burner, and the estimation was made in the ordinary way. His opinion was that while Mr. Rosenhain's form of calorimeter was suitable for solid fuel, the Junker instrument was preferable for volatile liquids. In Mr. Rosenhain's instrument the necessary corrections were numerous, and only a very small weight of the liquid to be tested could be taken, while with the Junker any quantity could be taken and the accuracy obtained would be correspondingly greater.

Dr. Davidson said that another source of error was using the red hot platinum wire. He found in experiments with closed vessels that it was really a very serious error, and had to be taken account of. It usually amounted to 1 per cent., and he had to determine it directly. Of course, it could be determined by electrical methods. But of this form of calorimeter, he thought Mr. Rosenhain's is undoubtedly the best. He had had experience of several, and certainly admired the mechanical contrivance of the calorimeter very much, but the searching for the coal or other combustible with a red hot wire was open to very serious objection. There were several forms of calorimeter in which the red hot platinum wire was used for igniting the coal or other combustible, and he thought in that type there was apt to be a very serious error because the substance was not always ignited at once. The usual practice was to send a current through the wire again and burn them.

Mr. Alcock suggested the use of silver leaf. No correction would have to be made for silver if it could be rendered sufficiently non-porous.

Mr. L. Archbutt asked Mr. Rosenhain whether he had endeavoured to burn these volatile liquids in the bomb calorimeter. He considered the bomb calorimeter preferable from many points of view. It was simpler, and probably more accurate. Looking at the large volume of gas bubbling through the water all the time, one wondered whether some heat was not carried away, and also whether all the carbon was burnt to carbon dioxide. No doubt Mr. Rosenhain had investigated that point.

Mr. Rosenhain, in reply, said the Junker calorimeter was a very useful apparatus for burning anything that could be burned as a flame, and the results, he had no doubt, would agree very closely. With regard to the bomb calorimeter, he thought that its advantages were greatly over-rated. The point to which he objected in the bomb was that the transfer of heat from the place where it was generated by the combustion to the place where it was measured, had to take place through a steel vessel of considerable thickness—thick enough to resist the very considerable pressure involved by the combustion which took place inside that bomb—and the transference of the heat from a gaseous atmosphere to the steel, and from that in turn to the liquid was necessarily incomplete in anything like the time which could be allowed for it. That was the reason why he thought that what one might call the atmospheric pressure calorimeter had certain definite advantages. Although in his original account of the calorimeter he advocated the use of the red hot wire for searching for unburnt coal at the end of the combustion, in the case of coal he had long ago abandoned that practice, because there never was any unburnt coal if the experiment was properly

done. In the course of 50 or 60 experiments he looked for unburnt coal, but he never found any. As regards the correction for the heat put into the calorimeter by the electric current that was allowed for in the initial calibration. The calorimeter could be calibrated by the combustion in it of a substance of known value. Provided that the red hot wire was used for a standard length of time in all cases, then in future no further correction was needed. The amount of heat to be put in by the wire was allowed for in the figure for the water equivalent. That was really the most convenient way, provided that care was taken always to keep the wire hot for a definite length of time.

As regards the risk of explosion, referred to by Mr. Tucker, a glance at his figures would show that the amount of evaporation going on even in ten minutes would be so slight that there was no risk whatever from explosion. The suggestion to use silver leaf had occurred to him long ago, but the difficulty was that silver leaf would not ignite. If silver foil was used he doubted very much if one would succeed in doing more than melting it, and possibly burning the pellet in the hole that was melted through the silver, but a wrapping that burnt away was preferable. The systematic investigation of the hydrocarbons in regard to smokeless combustion was matter for the future. As yet we had not learned the best way to arrange the oxygen supply. Petrol could be made to smoke by arranging the oxygen badly, and if the oxygen could be made to play upon the benzene pellet the combustion would be complete in that case also. The point raised as to the completeness of the combustion in the calorimeter had been carefully tested by analysis, and he had found that there was no trace of carbon monoxide formed if the oxygen was really saturated with moisture. The smokelessness of the combustion, the absence of smell, and the absence of carbon monoxide were very good evidence that the combustion was really complete. Another advantage was that the instrument was comparatively inexpensive compared with the Bomb, but there was no doubt whatever that this method of using wrapped pellets was applicable to any form of calorimeter.

London Section.

Meeting held at Burlington House, on Monday, March 5th, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

THE IGNITION OF NITRO-COMPOUND EXPLOSIVES IN SMALL-ARM CARTRIDGES.

BY W. D. BORLAND.

The discussion of the subject of the ignition of nitro-compound powders in small-arm cartridges acquires an added interest when it is remembered that it is now exactly 100 years since Forsyth proposed to replace flint and steel by a percussion powder consisting of "oxymuriate of potash, sulphur and carbon," and thus laid the foundation for future developments. His invention was dormant for nearly the first third of the 100 years, the second third saw various developments in connection with black powder ignition, the last 30 years have witnessed the growth of nitro-compound explosives with the more critical demands which they make for properly regulated conditions of ignition.

A glance at the velocity tables alone, given in this paper, indicates that whilst with carefully manufactured explosives for ballistic purposes, there is a considerable latitude permissible in ignition and other conditions of use, yet even within the limits of correct behaviour there are varying degrees of excellence and to trace out the factors which make for excellence or failure is an interesting study.

When the gun striker falls upon the cap of the cartridge a variety of results may follow. If the metal of the cap shell be too thick in proportion to the blow or the composition insufficiently sensitive, there may be a miss-fire. If the blow be of minimum strength and just sufficient to develop enough heat, the composition immediately between anvil and striker will commence to burn, and if the composition be a slow one, and especially if it contains inert substances, it may happen that combustion takes place so slowly through the mass that heat is dissipated as quickly as produced, and the charge burns or fumes quietly without incandescence or noise. With a more rapid composition the whole may burn, developing gas and heat sufficiently fast for the products to be expelled as a low pressure jet of compressed gases and molten matter, potassium chloride, antimony oxide or sulphide, &c.

With the ideal composition and striker blow the whole charge burns at a rate proportioned to the heat receiving capacity of the explosive without undue waste on the case, the jet containing solid matters in regular distribution, which, by reason of their high specific heat per unit volume, are able to convey to the explosive sufficient quantity of heat and at a suitable temperature and volume to start its decomposition.

Were the igniter wholly gaseous, such as fulminate of mercury, then the heat units necessary would be delivered in large bulk, and at such a high pressure that the cap shell would be unable to withstand setting back into the striker hole. Moreover, the enormous pressure of the jet would entirely disturb the carefully proportioned initial surface of the explosive, to say nothing about the risk of detonation. Mixing with powdered glass, as in earlier days, makes matters worse; heat units are absorbed by the glass, and, for the same number of heat units usefully given to the explosive, the volume of gas becomes larger per heat unit than before.

Turning away from fulminate, and trying 3 mols. of potassium chlorate and 1 mol. of antimony sulphide, the converse result is obtained, *i.e.*, too little gas in proportion to heat units, insufficient sensitiveness, and too great bulk for the ordinary cap shell. The characteristics of this mixture are:—457 grm. calories per grm.; 95 c.c. of gas; temperature of combustion, 1860° C. Trying the effect of 3 mols. of mercury fulminate and 2 mols. of potassium chlorate, producing 668 grm. calories per grm., and 244 c.c. of gas, an improved proportion of gas to heat is evident, but the violence of the mixture condemns it. Finally, a compromise between mercury fulminate and antimony sulphide is adopted, and varying relative proportions of these materials, together with potassium chlorate, are now usually employed.

Or other materials may be used, such as (*a*) 4 mols. of basic thiocyanate and 20 mols. of potassium chlorate; (*b*) 1 mol. of lead thiocyanate and 3 mols. of potassium chlorate, producing per grm. respectively:—(*a*) 551 grm. calories and 151 c.c. of gas; (*b*) 585 grm. calories and 163 c.c. of gas. Or powdered glass, sulphur and meal powder, may be added, or, as recently suggested, (*) chromates of lead or mercury, together with fulminate of mercury and powdered glass or lead peroxide may be employed (though no opinion is expressed as to the stability of such a mixture), but, whatever the material be, the whole course of events from striker blow to explosive is as follows:—

Ignition of portion of composition affected by striker blow.

Propagation of explosion through mass of composition and development of total heat of combustion.

Heat absorbed by cap shell, cap chamber and anvil.

Heat lost in performing work on cap shell.

Heat lost by effect of passage of gases through fire-holes.

Temperature lost by work required to move solid particles of the products, *i.e.*, imparting kinetic energy, but restored when particles come in contact with the explosive.

The final result is net calories delivered in time and at temperature dependent upon rapidity of reaction and temperature of combustion and in a more or less voluminous form. Thus, dealing with the gaseous products alone, carbon dioxide and sulphur dioxide will carry 37

(*) Eng. Pat. 27,006, 1904.

per cent. more heat than oxygen, nitrogen, or carbon monoxide at same temperature and of same volume.

The rapidity of flow of the jet determines rapidity of delivery of heat units to the explosive, the temperature of the jet is also an essential element of rapidity of heat interchange, whilst the proportion of gases to solids has its bearing on volume and temperature for a given number of heat units. Under the Explosives Act the maximum weight of composition is limited to 0·5 grain or, if not more than 25 per cent. of fulminate of mercury be present, to 0·6 grain. The minimum is determined by the quantity which will make a coherent disc in the cap shell, therefore, within these limits the composition must be adjusted to give total heat within limiting temperature of combustion of, say, 2400° to 3200° C., based on present knowledge, together with a suitable volume of gases, varying according to the colloidal or fibrous character of the explosive.

No single one of these factors can be taken by itself in the valuation of an igniter for a particular purpose; they must be considered in their mutual relation to each other and in connection with known facts as to composition, specific heat, conductivity, nature and extent of initial surface, and increasing or decreasing surface of burning of the explosive.

There is no suggestion that even the most accurate knowledge of individual functions can ever take the place of ballistic trials. With military rifle ammunition especially, once the given explosive and igniter are tuned together, then rigid adherence to specification does, undoubtedly, work out with success. But suppose a new explosive to be in course of adaptation to a particular arm, the igniter which proved perfectly satisfactory with the old explosive may be found unable to develop the anticipated qualities of the new one. The question will then arise, shall the igniter be adapted to the explosive or *vice versa*. If the former course be determined, then knowledge of individual functions will be found of value and will materially assist the solution of the question.

Again, in powder standardisation the igniter, is as much in evidence as standard solutions are in the laboratory, and apart from actual manufacture of ammunition, the explosives manufacturer is forced to regard the igniter as a test reagent, if his product is to preserve the necessary commercial latitude of action under the varying conditions, which obtain with sporting cartridges to a far greater extent than with rifle, and especially service ammunition; for with sporting arms provision must be made for every calibre of weapon, varying proportions of explosive to projectile, different materials of cases and wads, different co-efficient of friction and resistance for different sizes of shot, and, above all, for explosives highly different in chemical and physical qualities, demanding the fulfilment by the igniter of conditions precedent for efficient action.

The object of this paper is not to lay down a specification of what constitutes the ideal igniter, but rather to present results in a tabulated form and indicate the general lines and methods on which research seems profitable, endeavouring also to ascertain whether data obtained by thermo-chemical calculations may be applied in a practical manner. The difficulties of research are considerable, the igniter performs its functions in a time which cannot well be more than 0·001 second, its maximum weight of charge may not exceed 0·6 grain (0·0392 grm.), to make investigations of any use, such must be undertaken under the conditions which obtain in the cartridge case, so far as cap chamber, anvil and fire-holes are concerned, and instruments which are ordinarily available for measurements of temperature, or heat units, are found to be either too delicate to withstand explosive action, or too gross to take account of variations with so small a quantity of material.

During the whole history of nitro-compound explosives, experimental work has not been wanting; frequent references to the subject will be found in various journals especially those devoted to shooting and explosives; the names of Griffiths, Reid, Toms and Brownsdon in England are associated with published investigations of this subject.

The author's own work has included the following:—(*a*) 1892: Description of apparatus for measuring sensitiveness to blow, effect of shape of striker, effect of angle of striker to cap, time of travel of cap products and energy of explosion. (*b*) 1896: photographic records, (*c*) the use of thermo-couples, and (*d*) a method of recording duration of incandescence upon a sensitive plate revolving at a high speed; and more recently, as will be described, a spectro-photometric method of observation, with a view to elucidation of temperatures; this physical work has been collated with analytical work on compositions and ballistic trials.

No investigation can be regarded as satisfactory which does not deal with the following questions:—(*a*) Composition either determined analytically or accurately stated in the case of manufacturing trials. (*b*) Relation of gaseous and solid products. (*c*) Rapidity of application. (*d*) Total heat. (*e*) Temperature. (*f*) Regularity and a latitude under varying conditions. (*g*) And the relation of observed to calculated results.

Details of methods for chemical analysis of compositions need not be here discussed as they are of a comparatively simple character, but, for the individual analyses of caps, the volumetric method for the estimation of mercury fulminate described by H. W. Brownsdon (this J., 1905, 381) proves satisfactory. The determination of the relative proportions of gaseous and solid products of the igniter is carried out by the author in the following manner:—The percussion cap is accurately weighed, inserted in the particular type of cartridge in which it is to be used, so that all the details of cap chamber, anvil, and flash holes, are those of practical working and the cartridge case closed with a plug, the plug being of lead if a metallic case be used and of asbestos and felt wadding if a paper case be employed. The total cap, case and plug are then weighed, and after weighing fired in the appropriate rifle or sporting gun. After cooling for ten minutes (though in fact less is needed) a clean hole is stabbed in the wall of the case and the gaseous products allowed to escape and become replaced by air, this operation only requiring a few minutes. The solid products, including condensed mercury, are deposited upon the internal walls of the case, and on re-weighing, the loss represents permanent gases. If it be desired to estimate the condensed mercury, this is effected by heating the stabbed case at 100° C. until constant weight is obtained; but if this estimation is desired the case must be metallic and not of paper.

The weight of composition originally present in the cap is determined by removing the fired cap from the cartridge and weighing and subtracting the figure from the original weight.

The figures obtained in a series of estimations form a very good check upon regularity of manufacture and combustion; they have also been found to run in excellent agreement with those demanded by theory, the calculated results given on Table IV. having all been checked by direct estimations by the above method. It is, however, desirable to offer a word of caution when paper cartridge cases are used; these are not always truly gas-tight, and in the first rush of gases mercury vapour may be carried away and be thus estimated as permanent gas. To avoid any possibility of doubt on this score metallic rifle cases, in which the sporting cap chamber is inserted and which will therefore receive the sporting cap under its own conditions of anvil and flash-hole, are preferably employed.

The problem of the *comparison of velocities of application of the igniter to the explosive* cannot be expressed in quite such simple terms as the foregoing, but it is found in practice that there are two methods of investigation which lead to valuable practical results, one being a a species of crusher gauge test and the other dealing with duration of incandescence of the solid products.

In the first method, which was described by the author

(*a*) This J., Vol. XII., 1893, p. 709.
(*b*) Sporting guns and gunpowders, pub. Horace Cox., 1900, p. 210—220.
(*c*) This J., Vol. XXIV., 1905, p. 381.
(*d*) Quelques notes sur les poudres sans fumée. H. Quersin Imprimerie Vanbuggenhoudt. Bruxelles. 1899.
(*e*) Experts on guns and shooting. G. T. Teasdale-Bucknell

in 1892, the cap *in its own cap chamber* is inserted to form a gas-tight fit in the end of an accurately bored tube, in which a plunger with 0·0005 in. clearance is placed, a crusher lead 0·325 diameter by 0·500 length, being placed at the end of the tube opposite to the cap chamber. In the case of large readings being expected, a crusher copper, preferably of the Holden conical form is used in place of lead.

The ejection of the cap products drives the plunger upon the crusher with greater or less velocity according to the gas volume, temperature and rapidity of reaction, and the measured crushing is referred to accepted standard tables.

Taking, for example, two similar compositions, say, A^3 and A^4, where the only difference was that of aggregation and intimacy of mixture of the ingredients, A^4, by reason of its better incorporation, produced an energy figure corresponding to the crushing effect of a weight of 395 lbs., whilst the figure for A^3 is 345.

Bearing in mind that the total amount of material in these particular trials is only 0·0324 grm. and that the heat capacity of the metal of the apparatus, cap and cap chamber is relatively unlimited, the conclusion drawn is that the velocity of production and discharge of the gaseous and solid matters is greater in A^4 than A^3, the reaction taking place so quickly in A^4 that heat losses are less than in A^3. This became very evident in the spectro-photometric test described below, in which the caps are fired in glass tubes for observation, A^4 frequently blew the tubes to pieces, whereas with A^3 this never occurred.

This is shown by comparing B and E; here equal volumes of gas are produced, yet, in spite of the grm. calories per cap being greater in B than in E, the energy figure is 299 for B against 358 for E. The larger percentage of mercury fulminate in E and also a larger area of flash-hole explains the more rapid ejection.

In comparing caps of the same composition and weight different energy results can only be ascribed to different rates of combustion, but if weights vary, then the results should be referred to unit weight. With compositions differing in their characteristics the ratio of energy to total heat is the most useful expression, whilst if deductions are to be drawn as to chamber pressures produced by various igniters with semi-colloidal powders in sporting guns, gas volume must also be taken into account, as this determines the initial amount of explosive subjected to ignition.

The investigation of the duration of incandescence of the solid products was first described in 1896. It consisted in firing the cap into a glass tube to prevent air cooling and exposing a photographic plate revolving in the plane of its surface to the radiations of the incandescent solids, a screen with a slit in it being placed between the tube and the plate. The plate being stationary and the cap fired, only a narrow band of image the width of the slit was produced on development, but when the plate revolved at 3000 to 4000 revolutions per minute the band of image became V-shaped, the angle of increase being measured by projecting the image by an optical lantern on a circular protractor and from that, the velocity of revolution being known, the duration was arrived at.

The absolute determination of *quantity of heat per cap* is an extremely difficult matter owing to the small quantity of material to be dealt with at a time, and to the heat losses which take place when a cap is fired in a cartridge case and in contact with firing mechanism. The figures, therefore, given in this paper are the calculated ones, but they have been compared in their relation to each other by flashing on thermopiles. A bismuth-antimony pile of 25 couples, 0·2 by 0·1 by 1 in., is a robust instrument and gives concordant readings from day to day provided the galvanometer is standardised with a Clark cell used in conjunction with a high resistance, about 200,000 ohms being necessary. Readings of increased magnitude can, of course, be obtained by using a large number of couples, in practice a pile of 50 couples of bars, 0·1 by 0·1 by 1 in., is employed as well as the 25 couple instrument. The value of this method lies in the fact that the thermopile indicates not only quantity differences but also time differences, and magnifies up irregularities of action, and is, therefore, a most delica test for regularity of manufacture. Where the tim element is preferably eliminated, the thermopile face covered with a metal plate insulated from the pile b mica or lacquer, the plate acts as an accumulator an rapidly passes on its heat to the thermopile, producin galvanometer readings which give good agreement wit calculated figures for quantities of heat per cap, not onl in the comparison of individuals of the same compositio and velocity of reaction, but also of different materia of different rates of combustion.

Passing to *temperature* valuations the question a once arises, how can these be dealt with withou *quantity* of heat acting as a disturbing influence. If a endeavour be made to estimate the temperature of th jet in a closed vessel (such as the cartridge case whe loaded with powder undoubtedly corresponds to) th cooling effect of the material of the vessel at once make any such procedure dependent upon quantity of heat.

If the estimation be in an open vessel or in air, the the objection presents itself that the gases are expande and thereby cooled, cooling the solids with them Even then, a thermometer or thermo-junction must b of infinitely small weight if heat quantity is to have n effect, moreover, the further question of galvanometer inertia enters in.

Any method of temperature valuation must, therefore, be independent of mass, and this led to radiation observations being undertaken, in the first instance photographically, and later spectroscopically.

The relation of calculated temperatures of combustion of various carefully-made practical mixtures to observed results was taken as the basis of work, it being argued that if a sufficiently accurate relation of observed to theoretical results could be discovered, and also if this relation would hold good for various materials, there would be not only a check upon the correctness of the formulæ assigned to each reaction, but a means of valuing temperatures of unknown mixtures.

Taking the view that the practical igniter (which excludes mercury fulminate used alone) is really a high-pressure gas jet containing incandescent solid matters, and looking on the cap as a sort of retort in which a reaction takes place with considerable violence and ejects the contents through the neck, *viz.*, the flash or fire holes, it seemed that photographs of the ejected mass would record the shape of the incandescent jet and the completeness with which the solids are broken into spray or otherwise ejected in a more coherent form. It was found that caps producing faulty spray production, as shown photographically, were always unreliable in their effects on ballistics, but it was also found that there were enormous differences of intensity of photographic image, and that whilst many caps gave good photographs on rapid plates with a lens aperture of f2·2, others required with the same plates an aperture of f0·7 to yield the same density; further, that low calculated temperatures of combustion were always associated with feeble photographs and incandescence of a yellow colour, whilst increased calculated temperatures of combustion were co-related with increased density of photographic image and incandescence passing towards whiteness. Spectroscopic investigation failed to reveal any specific spectra accounting for the varying intensities and colours, in fact other than the sodium D lines, the spectra observed in some thousands of instances have only been continuous spectra due to hot solid bodies. It was also observed that cap composition, producing yellow incandescence and feeble photographic effect, produced continuous spectra of low intensity throughout, whilst with incandescence tending to whiteness and strong photographic effect, the continuous spectrum tended to brilliancy. Following the principles adopted in optical pyrometry, observations were then made by means of a shutter eye-piece of various separate portions of the spectrum comparing intensities of radiation, and again it was found that throughout the spectrum the portions varied in brilliancy in accordance with photographic activity, ordinary visual colour examination and calculated temperature.

A right and left-handed reflecting prism capable of passing into the spectroscope two fields in juxtaposition

from two sources of radiation without absorbing more of one than of the other was constructed for the purpose, and direct comparisons made of the intensities of radiation emitted by the incandescent solids of the cap and those given by a known source of light.

After many trials a small incandescent lamp in conjunction with a milliamperemeter and variable resistance, was found to be the most convenient as a standard radiant. Precautions now of a well-known sort for "ageing" the lamps were naturally adopted, to obtain constancy of radiation for given current consumption.

The question then arose whether the radiation intensities could be expressed in terms of temperature of the standard radiant. Application was made to M. Féry, whose work in optical pyrometry is well known, and an optical pyrometer of his design * with specially open scale was placed at the disposal of this work. It thus became possible to calibrate (and check from time to time) the incandescent lamp for temperature in terms of current in milliamperes, as in Holborn and Kurlbaun and also Féry's own method, and so to refer intensities to a standard.

In carrying out this investigation the cartridge case is cut off near the base and inserted in the end of a glass tube, 5 ins. by $\frac{3}{4}$ in. internal diameter. † The exact dimensions of the tube have not, within the limits of observation, been found to influence the results, and up to a distance of about 3 ins. from the fire-holes or hole, the particular point observed is not very material, though as a matter of fact a distance of $1\frac{1}{2}$ ins. for sporting caps and 2 ins. for rifle caps (with their larger charges) is usually adopted. The tube method is chosen in preference to observation of the flash holes on account of the greater ease of sighting and diminished risk of damage to spectroscope.

The spectroscope preferred is of the constant deviation type as it has fixed tubes, and it is easy to pass through the spectrum without altering adjustments. The spectroscope slit must be fairly wide on account of the brief duration of the spectrum, the necessary width of slit depending upon the distance of spectroscope from firing tube. Care must be taken to keep the distance of standard radiant from spectroscope the same as that of firing tube from spectroscope.

Trials have also been made based upon the observation of length of spectrum visible when a narrow slit is used. For this purpose either an eye-piece scale in the constant deviation instrument or the ordinary reflected millimeter scale in the case of the ordinary spectroscope is necessary. On observing the radiations from the firing tube, the visible spectrum appears to extend more or less away from the red according to calculated temperature of combustion. It is known that even at 1000° C., from Lummer and Pringsheim's curves, the wave length of maximum energy is at 235 outside the visible spectrum, so this method really resolves itself into comparison of visibility in the blue, and is not so convenient or accurate as the comparison of red intensities.

The figures are given in Table IV. for intensities of radiation in terms of temperature of the comparison incandescent filament show to what extent they are in agreement with temperatures calculated by Le Chatelier and Mallard's formula, the mean being 47·1 per cent. under the conditions adopted, the difference between the calculated and observed being accounted for by the heat losses referred to at the commencement of the paper, to "black body" correction for the solids and most of all to temperature reduction due to adiabatic expansion of the gaseous products.

That the solids have not black body emissivity is found by observations in the green, where intensity of the incandescent solids is found to be slightly higher than in the red. That is to say, when agreement *in the red* with standard radiant has been arrived at, on shifting the field of observation to the green, there is found to be greater intensity from the cap products. But, with the exception of C, practically the same materials are dealt wit in this series of trials, in fact even with C the large pe cent. of potassium chloride probably brings about ver similar conditions to the other mixtures and therefor renders "black-body" correction practically the sam throughout.

The delicacy of a method of this sort is seen by referrin to curves describing growth of intensity as compared wit growth of temperature. Thus in the red, Le Chatelie gives the following comparisons:—

°C.	Intensity at 0563 wave length.
900	1·0
1000	3·9
1100	12·0
1200	32·0
1300	81·0
1400	165·0
1500	325·0
1600	624·0
1700	1120·0

His remarks as to black body corrections may b quoted. "The variations of radiation with temperatur are sufficiently marked so that the errors committed i neglecting the emissive power are small. Except fo bodies exceptionally white the emissive powers at higl temperatures are superior to 0·5. By taking them equa to 0·75 the greates errors between 1000° and 1500° wil be from 25° to 50°."

In recording radiation intensities for manufacturing purposes, an absorption plate, ruled with strips of gradatec densities, is placed in front of a sensitive plate in a repeating back, and successive strips crossing the absorp tion strips are exposed to the radiation from the firing tube as used in spectroscopic observations, caps of known calculated temperatures being used to standardise each plate, the number of strips through which different inten sities of radiation will pass being noted by examination o the negative by reflected light.

If only a small amount of work is to be done, the Chapman-Jones plate tester is perfectly satisfactory, but care should be taken to develop the plates used in com parison with each other in the same dish. As a matter of detail ferrous oxalate is invariably used for this work.

The differences of effect are of a large order and amply suffice to differentiate radiation intensity, which, in its turn, is referred to temperature of combustion.

The value of this method of observation lies in elimination of personal error and in the non-disturbance of results by the effect of variations of quantity. Only such a portion of the contents of the firing tube is permitted to radiate upon the photographic plate as corresponds to the minimum quantity cap, and thus the portion of the tube employed is always saturated with incandescent matter. The comparison by this and the spectroscopic tests of caps G and H is interesting, for H contains twice the quantity of the same mixture as G, but only produces equal radiation effect.

In practice a 2 in. length of the tube is left bare, and with a rapid plate like the Ilford Monarch good readings are obtained with the Chapman-Jones plate-tester at a distance of 6 ins.

With mixtures made with reasonable care, and which give calculated gas production and comparative agreement as to total heat, the knowledge gained by the spectroscopic or photographic method as to temperatures furnishes a further proof that theory is not being unduly strained when an endeavour is made to argue from composition to characteristics and thence to ballistics. But if this is so, so far as ultimate results are concerned, regularity and rapidity of action must always be determined experimentally, for physical conditions and exact degree of dryness largely influence these factors.

As referred to later, varnish and coating materials modify the behaviour of the main composition, and therefore experimental determinations must always run side by side with calculated results.

From a practical point of view the influence of temperature *qua* temperature upon ignition is of the utmost importance, especially at or near the limiting temperatures

* For full description of the Féry absorption pyrometer, see "High Temperature Measurements," Le Chatelier, 1904, page 227. For description of instrument and discussion of accuracy of standard light used in this instrument, see "Optical Pyrometry," page 221 (Waidner & Burgess, Bull. No. 2, Bureau of Standards, Washington).

† That is to say:—Practically the diameter of 12-bore cartridge case.

between which the standardisation of present-day powders has been effected. What the future may have in store in the way of explosives demanding a low or high temperature igniter is another question altogether, but with existing explosives, defective and sluggish ignition is always to be feared, especially in cold weather with low temperature ignition, and too rapid ignition if temperature of igniter be above the upper limit. Heat interchange, then, becomes so rapid and local that "jar" or shock is produced, and in a shot gun this is made manifest by the production of "balling" of the shot. Observations over a long period of years have shown what a fertile source of "balling" too high a temperature of ignition may be, and the explosive appears to be acted upon so locally that the effect is not necessarily shown up in enhanced chamber pressures.

In dealing with the relation of ignition characteristics to ballastics, the deductions drawn must necessarily be on broad lines, which are justified not only by special trials but by experience over a long period of years and under varied conditions of loading, climate and so forth.

Table I. gives ballistics obtained with Mark I. Cordite 31·85 grs. and 215 gr. bullet with caps F,G,K,L, which differ widely in their characteristics.

The latitude of action of this particular explosive is very marked in this series of trials, and whilst there is a small advantage obtained either with increased temperature or rapidity of discharge of the igniting substance, the differences are too small to permit sound deductions being drawn beyond this—that it is highly satisfactory for a service explosive to be as independent of its igniter as it has proved to be within the limits of these trials.

Table II. deals with another nitroglycerin and nitrocellulose explosive, and reveals a somewhat different condition of things, not perhaps quite unexpected from the lower temperature of combustion and the more fibrous character and larger initial surface of this explosive as compared with Mark I. cordite.

The caps used for this series were F, G, K, L, M, described in Table IV.

F is an example of per-oxidation, moderately high temperature and large ratio of gases to solids. G and K are typical of hypo-oxidation, low temperature and lower ratio of gases to solids. L and M of complete combustion when the aluminium coating is not taken into account, but of hypo-oxidation and high temperature and smaller ratio of gases to solids when the aluminium enters the reaction.

These results indicate that the low energy cap G gives the best ratio of velocities to pressures compared with K and L. On the other hand, the experimental igniter M, which carries much higher heat units per unit volume, gave practically the same ratio of velocity and pressure but higher intrinsic numbers.

Whether the use of an igniter whose calculated temperature of combustion may rise as high as 4000° C. is desirable under conditions of tropical storage and use is quite an open question, but it marks a new departure and is worthy of serious investigation. It is found to yield a maximum of heat units, temperature and percentage of solids, to obtain which the high temperature of combustion of metallic aluminium has been taken advantage of, the composition being coated with powdered aluminium more or less insulated by means of varnish.

The degree of insulation of the metallic coating from the main composition (as this cap is at present made) appears to control the amount of aluminium which enters into the reaction and to this the difference between L and M is probably to be ascribed.

As shown in Table II., the ballistic results obtained with F and K ignition are apparently anomalous. The energy test shows little difference, yet K produces more pressure than F. Total heat of F is larger than with K, but velocities of K are higher. These results are ascribed to larger flash-holes in the case of F, causing a more local application of heat to the explosive than is the case with small flash-holes in K and the consequent high-pressure jets effecting a more perfect distribution of ignition material.

In Table III. the external and internal ballistics in the 12-bore sporting gun are set forth, in conjunction with caps A, B, C, D, E, L and powders 1, 2, 3. The powd are all three of the fibro-colloidal class, that is to say, t they are not completely gelatinised, Powder II. be more gelatinised than Powder I. Powder III is, ev with the most suitable igniter, near the bottom limits efficiency and well illustrates what happens with such explosive and a weak cap. In this series of trials t charges of powder and shot, also the method of waddi are those usually regarded as standards for the particu powders and calibre of arm. The results are set out terms of velocity over 20 yards (V), pressure at 1 in. fr breech (P), recoil expressed in feet per second veloci of recoil imparted to a 7 lb. gun (R); Time elapsi between striking of cap and exit of shot from muzzle (T (In this last connection it may be noted that a time (of more than 0·006 second indicates slow ignition, at 0·0 second the hesitation is noticeable without instrumen at 0·015 second the "hang-fire" is marked.) (D) Patte is 30 in. circle at 40 yards from a 28 in. barrel of modifi choke boring.

With Cap D and Powders I and II the hesitation distinct, though Powder II is less sensitive than Powder to the bad effect of the weak cap.

On the upper limit, Powder II develops less pressu than I with a rapid cap, and would thus appear to posse greater latitude of action.

Connoting Tables III. and IV. it would appear that tot heat units in the igniter influence velocity, but that tem perature is an important factor in determining time ignition provided a sufficient quantity of heat is al present.

With Cap A[4] and Powder II the effect of rapidity ejection of the igniter, though at a low temperature, marked in its power to produce short time of ignition bu with enhanced pressure and no gain in velocity.

Caps A, B and C may be regarded as satisfactory pr ductions, yet they are of entirely different types, and larger quantity of material is used in B to obtain th necessary heat and gas production. It will be note that B contains a mixture yielding a higher proportio of solids than A, develops a lower temperature, and i more progressive in its action as evidenced by the energ test. The reaction of B does not reach complete com bustion, the oxygen present being insufficient to oxidis all the carbon of the fulminate to CO_2 or to attack all th sulphide of antimony, the unoxidised residue of whic can be found in the products of combustion.

Cap A is an excellent and typical example of a mixtur calculated for reactions involving per-oxidation, it is mor gaseous in its products, produces a higher energy and higher temperature than B, a smaller charge is therefor required, *viz.*, 0·027 grm., including the tinfoil, as com pared with 0·0481 grm. in B.

Whether the presence of free oxygen in the gaseous pro ducts has any influence upon ignition is at present an oper question, though on theoretical grounds the applicatio to an explosive of an oxidising flame instead of a reducin one would appear to involve a greater certainty and regularity of ignition, but, as stated above, data are wanting on this point. Apart from this, experience o the varying conditions of sporting ammunition employ ment has shown that the chances of regularity are bette with a composition calculated for complete combustion.

Cap C is particularly interesting as involving peroxi dation and large percentage of solids, also as consti tuting a departure from ordinary practice in that it con tains neither mercury fulminate nor antimony sulphide, but consists of a mixture of potassium chlorate and sulphocyanide of lead, though not in the most advan tageous proportion, there being present a large excess of chlorate, which produces free oxygen but to an unnecessary extent, unless the cap were coated (as it is not) with tinfoil to react with the free oxygen and so increase not only temperature but also percentage of solid products. The advantages of a mixture which only contains two constituents make this type worthy of further study.

The inferences from A, B and C are that total heat may vary from 10 to 17 grm. calories, total gas not exceeding 5 c.c. including mercury vapour; rapidity differences shown by energy test, if of a fairly large order, do undoubtedly show up in chamber pressures, but with

semi-colloidal powders gas volume of igniter is an important factor in pressure production. The comparison of A with A^3 and A^4 in Tables III. and IV., illustrate this point.

For powders of the semi-colloidal type, as at present standardised, the upper limit of temperature of igniter, calculated by Le Chatelier and Mallard's formula, is placed at 3200° C., beyond which heat transfer becomes so rapid as to cause jar and shock and frequently "balling" of shot.

Cap D is of a type now happily nearly obsolete, it contains powdered glass, variable quantities of sulphur and mercury fulminate, and the quantity of charge is insufficient to produce necessary total heat units, whilst on the other hand its rapidity of action and high percentage of gaseous products prevent an increased charge being used.

Cap E is an empirical imitation of B, and is another example of a reaction only extending to hypo-oxidation. It was supposed that with reduced charges of powder and shot in a cartridge case reduced in length advantage would be gained as compared with A. But in practice this is not realised, with Powder I there is practically no difference, whilst with Powder II there is actually a loss of velocity produced by E as compared with A. Experience with reduced charges leads to the conclusion that the maximum igniter is required to overcome the effect of reduced resistance and so arrive at the proper chamber pressure associated with perfect combustion.

Cap E was originally intended for use with a completely gelatinised explosive of small granulation, it having been found that with ordinary caps of that period, bad hang fires occurred, and the expedient was adopted of making the flash-hole sufficiently large to allow a few granules to pass through and remain in actual contact with the composition, and so give the explosive the advantage of the highest temperature available from the igniter. But it has since been found in practice that an igniter of higher temperature of combustion in a chamber with ordinary flash-hole which does not make special provision for the granules to sit in contact with the composition answers equally well. The inference as to the value of temperature, *qua* temperature in certain cases, especially with powders in which gelatinisation has been carried to a considerable extent, is obvious.

Cap J is a most excellent example of careless manufacture, the charge is deficient in quantity; the percentage of fulminate of mercury varies from 29·5 to 36·53 per cent.; the antimony sulphide from 8·93 to 19·00 per cent.; powdered glass from 8·09 to 16·62 per cent.; potassium chlorate from 30·34 to 50·05 per cent.; varnish from 1·15 per cent. to 4·76.

One remarkable feature of this cap is that on very slight heating it practically loses its explosive qualities, though individual caps behave in this respect to a different degree, and the explanation appears to lie in the quantity and nature of the varnish material which, on warming, soaks into the composition and isolates the components from each other. The ballistic results were characterised by extreme irregularity.

The effect of varnish is always a factor to be reckoned with, and as leading to divergence from calculated results. The influence of small proportions of carbonaceous materials such as resin, paraffin, vaseline, in modifying the action of explosives, is well known and cap composition is not exempt from such influence.

The material used to coat the composition, partly to protect it against moisture, and partly to prevent undue sensitiveness, and possibility of explosion *en masse* if caps are in transit or during handling, is of equal importance with, and in some ways of greater importance than, the varnish. Various materials are in use for the purpose, tinfoil (frequently containing large percentages of lead) paper, chlorated paper, varnished paper and recently powdered aluminium. The nature of the coating material is set forth in Table IV., and it will be observed that A is tin-foiled, whilst A^1, A^2, A^3, and A^4 are not. The ballistic results of Table III. and cap tests and characteristics of Table IV. show the ultimate effect of the foil, and amongst other data attention is called to the fact that A^2 compared with A contains a 25 per cent. increase of charge, and then does not produce such good ballistics as does Cap A when its charge is increased 12 per cent. by an addition of foil.

In the case of powdered aluminium being employed as coating agent, the effect on the reaction is still greater, for aluminium does not even demand free oxygen, but is able to exercise a preference over either carbon monoxide, or antimony sulphide, or both, replacing the moderate calories of combustion yielded by these compounds, by its own very large heat production.

Aluminium can react even with antimony sulphide, the substitution involving a net gain of 92 kilo calories for the molecular reaction—

$$Al_2 + Sb_2S_3 = Sb_2 + Al_2S_3.$$

A similar reaction between aluminuim and antimony sesquioxide produces 162 kilo calories..

The difficulty of stating what reactions really do take place with energetic materials renders experimental knowledge of comparative temperatures absolutely essential.

The molecular gramme-calories of tin burning in oxygen are 141,300, those of aluminium being 393,000, but this means that the stannic oxide formed carries 941 grm. calories per grm. and the alumina, 3,853. Comparing these grm.-calories per grm. with those given in Table IV. for the various compositions, it is at once evident that, starting with compositions ordinarily giving some 500 grm. calories per grm., the addition of materials which can add respectively 941 and 3853 must be large in effect even when the addition is comparatively small in amount.

The bearing on temperature is seen in Table IV., in the comparison of A and A^1, A^2, A^3, A^4, but it may be here remarked that the low specific heats per unit weight of stannic oxide and alumina, compared with those of carbon dioxide and oxygen, are an additional influence upon temperature increments.

On the other hand, if, as in Cap B, there is no free oxygen present, the tinfoil coating is blown away and simply adds to the fouling.

In sporting guns the presence of a tin-fouling is not a very serious matter; but in small-bore rifles a fouling of this sort is particularly objectionable, therefore, if caps intended for use in small-bore rifles must be foiled to comply with regulations of safety, their composition should always be such as will burn the tin to stannic oxide.

Other influences, such as aggregation of the particles and the proper incorporation of the mixture, must not be disregarded. Cap A^4 deals with this question in Table IV. In addition to these the thickness and elasticity of metal of cap shell, the area of percussion, the position and area of flash-holes, and the blow used for percussion must be continually kept in mind. The practical conclusion to which a careful examination of the tables leads, is that whilst with carefully-manufactured explosives there is considerable latitude of action, yet it is in apparently small details that the conditions of highest excellence are to be found; the extent of the industry involved (to say nothing of the public service) and the interest attaching to investigations of the sort render the subject not unworthy of attention, this communication is, therefore, offered as a record of progress and state of knowledge.

Acknowledgment is gratefully made to the Superintendent and officials of the Royal Laboratory, Woolwich, for the use of a pyrometer in the early stages of the investigations; to Messrs. F. W. Jones and H. Melville Smith, for a supply of carefully-prepared materials; and to Mr. H. Frodsham for valued help throughout.

TABLE I.

Mark I., Cordite. Rifle, 0·303. *Bullet*, 215 *grs.*

Charge.	Ignition.	Velocity.
31·85 grs.	F	2007
"	G	2004
"	K	2010
31·40 grs.	G	1997
"	L	1999

TABLE II.

M.D. Cordite. Rifle, 0·303. *Bullet*, 215 *grs.*

Charge.	Ignition.	Velocity.	Pressure.
31·80 grs.	K	2015	—
"	L	2056	—
33·50 grs.	G	2084	—
"	L	2109	—
35·80 grs.	F	2132	18·07
"	G	2123	17·60
"	K	2137	18·88
"	L	2159	18·08
"	M	2283	18·93

TABLE III.

12-*Bore sporting gun.*

Ignition.	Powder I.					Powder II.					Powder III.				
	V.	R.	P.	T.	D.	V.	R.	P.	T.	D.	V.				
A	1062	15·98	3·42	0·0044	175	1056	14·71	3·10	0·0042	170	1010				
A^1	—	—	—	—	—	1090	14·49	3·10	0·0046	—	—				
A^2	—	—	—	—	—	1017	14·22	2·70	0·0067	—	—				
A^3	—	—	—	—	—	1023	14·49	3·30	0·0046	—	—				
A^4	—	—	—	—	—	1027	14·68	3·56	0·0039	—	—				
B	1082	16·53	2·90	0·0058	150	1070	15·00	3·00	0·0056	157	1008				
C	1035	15·70	3·20	0·0050	210	1026	14·75	2·93	0·0048	190	955				
D	940	13·20	2·30	0·0146	—	951	12·10	2·40	0·0062	—	740				
I	976	14·67	2·70	0·0061	—	993	13·37	2·60	0·0053	—	882				
Reduced { A	1002	—	2·67	0·0041	—	1017	—	2·60	0·0042	—	—				
Charges { E	940	—	2·21	0·0061	—	967	—	2·35	0·0050	—	—				

TABLE IV.

Reference mark of cap.	A.	A^1.	A^2.	A^3.	A^4.	B.	C.	D.	E.	I.	F.	G.	H.	K.	L.	M.
Total contents, in grms.	0·027	0·0235	0·0195	0·0324	0·0324	0·0479	0·0246	0·0198	0·0461	0·0282	0·0386	0·0378	0·0778	0·0412	0·0468	0·0468
Coating material	0·0035 tinfoil	—	—	—	—	0·0081 tinfoil	0·0030 paper	0·0012 paper	0·0045 tinfoil	0·0036 tinfoil	0·0045 tinfoil	varnish only	varnish only	varnish only	0·0025 aluminium in powder 0·0419	0·0025 aluminium in powder 0·0419
Composition, in grms.	0·0235	0·0235	0·0195	0·0324	0·0324	0·0399	0·0216	0·0186	0·0436	0·0176	0·0323	0·0378	0·0778	0·0412	58·3	60·0
Solid products, by weight, per cent.	54·0	45·3	45·3	45·3	45·3	61·4	63·8	53·9	65·86	53·0	54·0	61·2	61·2	61·2	624 to 815	
Grm.-calories, per grm.	555	479	479	479	479	436	481	260	320·8	521	576	424	424	424		
Grm.-calories, per cap	14·98	11·23	9·32	15·48	15·48	17·35	10·38	4·83	13·99	12·34	21·2	16·02	32·9	18·90	29·2 to 37·8	
c.c. of gas, per grm. (Hg included).	164	205	205	205	205	127	176	154	115	146	186·5	129	129	129	141 to 122	
c.c. of gas, per cap (Hg included)	4·42	4·81	3·99	6·44	6·44	5·05	3·8	2·86	5·01	3·56	5·07	4·88	10·03	5·39	6·48 to 5·66	
Calculated T° of combustion ..	3050°	2540°	2540°	2540°	2540°	2895°	2580°	1794°	2252°	2939°	3050°	2695°	2693°	2730°	3478° to 4156°	
Radiation intensity in terms of T° of incandescent lamp.	1520°	1150°	1150°	1150°	1150°	1255°	1315°	1105°	1255°	1355°	1505°	1271°	1271°	1290°	1570°	1690°
Energy lost by crusher leads, in lbs.	386	336	224	345	395	299	407	242	358	235	454	282	978	358	442	423

Discussion.

Lieut.-Colonel Sir Hilaro Barlow said he was pleased to hear that cordite could be ignited with caps that apparently gave a large or small solid residue. Whether the modified cordite, when it came in for small arms, would do as well he could not say. Of course, a reduction from 57 per cent. of nitro-glycerine to 30 per cent. must make a considerable difference in the nature of the explosive. Naturally, with a larger portion of nitro-cellulose it would be of a harder and more horny nature. Turning to the question of ignition in the rifle, of which he knew something, as he had recently carried out an investigation for the Small Arms Committee in connection with what were called wide shots in the sighting of rifles, every individual Government ·303 rifle, before it went into service, was shot to test its sighting by the inspection branch, and each rifle had to put every one of a series of five shots into a rectangle of about 1 in. by 1½ ins. at a range of 100 ft. For some extraordinary reason a bullet would occasionally strike half an inch or more to one side or below. Assuming the velocities in a series of rounds varied by 100 f.s.—say, between 2100 and 2000 f.s.—which, it might be added, would mean exceedingly bad regularity, as the extreme variation rarely exceeded 50 f.s., while the mean variation was generally about 6 f.s., and the specification laid down that it should be less than 10. Anyone could calculate that a difference of even 100 f.s. at a 100 ft. ought not to make a difference in the point of impact, up or down, of more than one-tenth of an inch; he thought it would be rather less. But they got these errors of half an inch, and so on, and they had large and expensive trials, to try and ascertain the cause of them. In that investigation one of the first points to determine was the regularity of the ignition. It was interesting to find from Mr. Borland's statement that the question of cap composition made such extraordinarily little difference in the velocity, as it bore out his own results. Judging from the experience with cordite in big guns, one could do not do better for the purpose of an experiment, which needed an absolutely unimpeachable ammunition, than use a black powder priming, of course quite irrespective of subsequently introducing it as a service arrangement. He used 1 grain of black powder done up in a little muslin bag to make sure of the ignition, and obtained some very good results, but, he regretted to say, nothing better than he had obtained with the ordinary service cap. Of course the service composition, as they probably knew, was potassium chlorate 14 parts; antimony sulphide, 18; mercury fulminate, 8; sulphur, 1; meal powder 1; and he thought it was the presence of the meal powder which helped to make it a good composition. The best series of velocities obtained with the service cap in 10 rounds, as compared with those he obtained using black powder ignition, *viz.*, 2016, 2007, 2009, 2002, 2012, 2008, 2008, 2009, 2007, 2010 f.s.; mean observed velocity, 2009; greatest difference 9 f.s.; mean difference only 1·96 f.s.; such results were satisfactory, but more often a mean difference of six and a greatest difference of about 46 resulted. The following figures given by 20 rounds were obtained by using black powder priming:—2030, 2030, 2032, 2029, 2054, 2052, 2055, 2025, 2025, 2023, 2023, 2047, 2024, 2024, 2023, 2039, 2040, 2036, 2020, 2037. These values could be divided into some interesting groups, thus:—the first four rounds showed a mean observed velocity of 2031, the greatest difference 4, and the mean difference 1·5, which was extremely good. Then they suddenly rose from 2029 to 2054, which he did not pretend to explain, thus: 2054, 2052, 2055, and a mean difference of 1·1. Next a series of four occurred again, 2025, 2025, 2023, 2023, with a mean difference of 1; then a rise up to a single round giving 2047, and then another group of rounds much lower and so on. He mentioned this because it was suggestive; he could, however, offer no explanation. If other people could be more successful than he had been in ascertaining the causes of these remarkable variations nobody would be more delighted than he himself, and he presumed the Government would soon hear of it, and be glad to do so. Another curious feature in connection with this investigation, which he was sure of, was that in small arms the accuracy at 500 yards and longer ranges, and the regularity of velocity and accuracy at 100 ft., in no sense went together. That, again, was an extraordinary fact which he could not explain, though he had spent the last two years in trying to do so. It was the result of firing between 300 and 400 targets of 20 rounds each, one of the biggest investigations on the subject ever made. Until the "Palma Trophy" ammunition came in (and he must couple that with the King's Norton Company) the ·303 rifle was distanced by the Mannlicher and Mauser rifles. The Mannlicher and Mauser did shoot slightly better at 900 yards, and markedly better at 1000 yards, but it is equally the fact that they shot markedly worse from the point of view of regularity of velocity and patterns on a target at 100 ft. than our own rifle did. The probable explanation was that with the larger charges the King's Norton Company put into the "Palma Trophy" ammunition, and, with the higher pressures resulting, there was little doubt the bullet was better expanded, and thus the increased accuracy resulted. Although this seemed very simple now, it was a great move, and had brought the ·303 rifle up in a wonderful way.

Mr. Walter F. Reid said caps had many years ago been tested in a simple way by using black powder; but, in developing smokeless powder, they were confronted with the curious fact that they did not get the same results with similar charges of powders which were perfectly uniform in composition. Mr. Borland assisted him in some of those researches. It was true that at that time their methods were very primitive, and, as they were perhaps the first carried out in practice, they might be of interest. The cartridge case, with the cap in it, was fixed in a tube which was inserted into the gun or an apparatus with a striker similar to a gun. A certain portion of the tube was cut open and wires crossed it; at regular intervals on each wire a strand of guncotton was fixed. The number of strands that were ignited by the flash was supposed to be a measure of the force of the cap. Great differences were found in the strength of the caps. A Belgian firm then introduced caps which secured complete ignition; but sometimes it was too much for the gun, and there were many accidents. There was one kind of cap which burst a good many guns, which, of course, was attributed to the powder, although their experiments showed that the powder could not have been properly ignited. He was glad to see that Mr. Borland had been carrying out such experiments in a somewhat different way. Whilst not criticising the method he had adopted of using the spectroscope, he did not quite see the connection between the spectroscopic action and the ignition of the explosive. Again, there was a slight source of error in the use of the glass tube, because there was a very dense precipitate on that tube; the particles were projected against its side, and from the commencement of the flash there must be a diminution in the light which was transmitted. That error would depend to some extent on the composition of the cap which was flashed. Personally, he preferred the method of photographing the flash of the cap in the open air. With regard to the question of the regularity of ignition of cordite, he thought that was due to a general principle which he found out many years ago by actual tests, and which still held good. That principle was that when a compound substance of this kind was ignited, the sensitiveness of the substance was regulated by the sensitiveness of the most sensitive ingredient in it. In cordite there were two explosives, nitro-cellulose in the gelatinised form and nitro-glycerine. The latter being highly sensitive, he thought the sensitiveness to ignition was due to the presence and proportion of nitro-glycerine, and therefore with practically any cap a fairly good ignition could be obtained. That principle was found out also in a practical way when he first placed gelatinised smokeless powder on the market. For the E C powder some sportsmen recommended putting a pinch of black powder in the cartridge case.

Some points Mr. Borland had not alluded to exercised an important effect on the ignition of the charge from the cap. There was a diagram on the wall showing an anvil with rather a sharp point. The striker of the gun did not

invariably in practice, although theoretically it ought to do so, strike upon that point. The charge in the cap might not, therefore, be placed exactly between the point of the anvil and the point of the striker, and any deviation, however small, to the right or left, would alter the force of ignition, and consequently of the explosion. Again, different compositions used differed in their cohesion, so that a regular or irregular detonation depended on the amount of cohesion in the cap. Another point was the metal of which the cap was composed. Copper was an extremely good conductor of heat, and if it were used part of that heat, which should be produced quickly and in a concentrated form, was lost. A better result would be obtained when the cover of the cap was made of a badly-conducting material. The same with the tinfoil cover; it was difficult to imagine a worse substance; it acted as a sort of cushion for the percussive striker. The varnishing was a weak point, for, as Mr. Borland had pointed out, according to the amount of varnish which penetrated the mass, so was the initial explosion modified. Another matter which should be mentioned was the amount that passed through the flash-hole—the channel through which the initial explosion reached the bulk of the charge. That ought to be, not a uniform flash-hole in all cases, but proportional, not only to the contents of the cap, but also to the explosive. In sporting ammunition especially a source of many miss-fires was the loading or re-loading of the cartridge, and in the way in which the operation was carried out there was no certainty that the anvil was in exactly the same relative position in each case. If a means could be devised for fixing the anvil and cap together and placing them into the chamber, it would be much preferable to the present system. With military caps the danger was not so great. They were now coming to a totally different method of cap manufacture, namely, the wet process. Formerly, the composition was sifted in in a dry state, now it was in a wet state, and the fulminate of mercury did not become dry until it was in the cap.

Mr. W. Macnab said any information which could be given as to the nature of the ingredients used, either in the caps or detonators and their behaviour, was of the greatest importance.

Dr. O. Silberrad asked the author if he had done any work on the measurement of the pyrometric value of the products of combustion, based on the contraction they underwent in cooling from their maximum temperature. This field of research seemed to be of especial interest in the light of Sir Andrew Noble's recent experiments on propellants, carried out on these lines. In these experiments it was shown that the pyrometric value of cordite M.D. approached more nearly to 4220° C. than 2320, as calculated from the present accepted specific heats. Regarded from a similar standpoint, therefore, should not the figures given by the author read 5500, &c., more nearly than 3050, &c., in degrees centigrade as based on the air thermometer? The author's figures would, however, still be strictly comparative, and as such of great interest and value. In reference to the method of estimating mercury some work, recently published by the American Bureau of Technology, tended to show that even on firing a rifle, in the ordinary manner, sufficient mercury remained behind in the cartridge case to cause serious deterioration of the metal when the caps used contained fulminate. In the light of this, did it not seem possible that greater precautions were necessary in carrying out the estimation?

He would also like to refer to the work of Mettegang and Bichel on the determination of the absolute velocity of detonation, reported at the Fifth Congress of Applied Chemistry in Berlin. The method used by these investigators depended upon the consecutive interruption of two wires carrying a divided current running through the two ends of a long cartridge, and subsequently through the secondary coil of an induction coil, the sparks produced on the rupture of the wire being recorded on a revolving drum. In the case of gelatine dynamite the velocity recorded approached 4½ miles per second (6915 m). In this connection he would point out that interesting information might result from a comparison of the author's figures on the time of ignition required by any specific cap composition with its absolute velocity of detonation.

Mr. R. J. Friswell said he was perfectly satisfied, after seeing the experiments, that the spectroscopic method was really a valid one for estimating temperatures.

Numbers were given on the table showing the cubic centimetres of gas per cap, but it would be interesting to know whether the volume was calculated at 0° and 760 mm., or by the Le Chatelier formula, or at the temperature as observed by the radiation intensity of the lamp. If they were calculated at either of the latter temperatures they must be from five to ten times the volume shown on the table; and it was possible that some relation would be established with the numbers given as the energy test in lbs. One other point to which the author had alluded was the question of the area of percussion. He investigated this some time ago, being led to it by some experiments as to the cause of the local explosion of liquid films under percussion, and he began to consider the question whether the effect on the cartridge might be accounted for by the position of the anvil; because, if the striker was not absolutely central, as Mr. Reid had pointed out, very different results would follow when the striker hit the cap. In the case of the ogival-headed anvil a blow striking at an angle might occur which would cover a considerable area on the side of the anvil, or a blow might fall exactly on the edge; whether one or the other occurred depended entirely on the position the anvil occupied, which, of course, was not determinable when the cartridge was placed in the gun. In his experiments he reversed things. He took a large anvil and inverted the cap, using the striker on the inside thereof. He then proceeded to reduce the striker in size, and kept on filing it down until it became a point. He thus succeeded at last in bringing about a state of affairs in which the striker could be driven through the cap without causing an explosion. Before reaching that there was a stage at which, when the striker was driven in, a slight sputtering took place at the point, which did not extend to the rest of the composition, and before that there was another stage at which the striker started a slight combustion at the point of impact which slightly extended and then caused the contents of the cap to be projected in a mass upwards. He concluded from these experiments that great importance was to be attached to the area of percussion, to which is due the amount of initial explosion in the cap.

Mr. Thorne said the point mentioned by Mr. Reid, as to the question of miss-fires and hang-fires, had received a good deal of attention from the Gun Makers' Association. Attempts were being made to standardise the relation between the gun chamber, the cartridge case, the anvil and the striker.

Mr. H. Melville Smith said that with Mark 1 cordite it did not matter whether the hammer struck the middle of the anvil or its side; the results were practically the same, as the cap was driven down on the anvil. Again, with regard to the shape of the striker—with fuses and small munitions the strikers were made as pointed as possible and finished on an oil stone so as to make sure of absolutely good ignition; this went to prove that shape of anvil differed greatly under various circumstances. The sporting cartridges certainly seemed to show that with such a large number of different powders it was almost impossible to make a universal cap. This was a matter of some moment as the Gun Makers' Association were proposing a standard. He feared there was trouble ahead for anyone who standardised.

Dr. H. W. Brownsdon asked if Mr. Borland had made any analytical examination of the solid products of combustion. He had been surprised to find compositions containing more chlorate than was required for the complete combustion of the fulminate and stibnite, according to generally-accepted equations, yield a certain amount of sulphide in the solid products of combustion. The question was, how had the oxygen of the chlorate divided itself up amongst the various products of combustion, and if, as certainly was the case, some sulphide escaped oxidation, it seemed to him very probable that

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means unusual to find 15 per cent. variation, whilst a sample recently examined showed that the charges varied from 0·0370 grm. to 0·0506 grm., *i.e.*, 30 per cent. on the mean weight.

As regards analysis of products this would be interesting if it could be ascertained that no secondary reactions took place as cooling progressed; but the igniter does its work at a high temperature and in the hot atmosphere produced in the cartridge when the first particle of igniter emitted meets the explosive. But, unfortunately for value of analysis of products, this condition does not exist when the cap is fired in a cold closed vessel.

Mr. Guttmann's observations as to the effect of admixture of the cap ingredients was borne out by the author's experience with A^4, referred to in the paper. The exact percentage of moisture also exercised a controlling influence upon rapidity, as the author had frequently found after drying samples of unfoiled and unvarnished caps to constant weight, and subjecting them to the crusher test after progressively increasing periods of exposure to the air.

He had carried out various methods for time comparisons, but at present is inclined to attach most importance to the crusher readings, taken in conjunction with knowledge of total heat and gas production as a guide to rapidity of emission of the igniter, and of the instances referred to by Mr. Guttmann, considers F to be more violent in its action than M.

Mr. Axel Carsen wrote as follows:—"I am able to supplement Dr. Silberrad's remarks by explaining that the rate of detonation of a large number of explosives was determined at the Schlebusch Carbonite Works by means of Mettagang's Recorder, an electro-chronograph described in Bichel's 'New Methods of Testing Explosives' (Chas. Griffin and Co., Ltd., London, 1905). During these tests it was found that, apart from the chemical composition and physical character of the various explosives, the velocity of detonation depended to a certain extent upon the diameter of the cartridges, *i.e.*, that up to a certain point the former increased with the latter. Beyond such maximum, which, however, varied for different explosives, the rate of detonation remained constant. A standard diameter of 30 mm. (about 1¼ in.) was ultimately fixed upon.

"In testing fulminate of mercury some considerable difficulty was met with on account of the danger of handling this compound; indeed, it seemed out of the question to work with quantities involved by the diameter adopted for blasting explosives. A diameter of 6·45 mm. (¼ in.) was then used, which gave a velocity of 3920 m. per second, and it was concluded that, with diameters approaching that adopted for other brisant explosives, the rate of detonation of fulminate of mercury would certainly far exceed that measured for any of the latter, *viz.*, some 8000 m. per second.

"In connection with Mr. Borland's 'energy' values, I should like to mention that Bichel applies the rate of detonation to the calculation of the *vis-viva* or percussion force of explosives. Assuming that for all practical purposes the observed rate of detonation equals the velocity of the molecular projection, he adopts the formula

$$\frac{mv^2}{2}$$

in which $m = \frac{weight\ of\ explosive}{981}$, and v = rate of detonation. This method might possibly commend itself to Mr. Borland as a means of checking his results.

"We are all familiar with the various factors which require consideration in standardising smokeless sporting powders to cartridge cases of different make, but for the most part these are merely questions of workmanship. The keynote is in the cap, and exact knowledge of its composition and characteristics derived from tests such as suggested by Mr. Borland presents a valuable guide to manufacturers. Not long ago I had to examine a certain new type of nitrocellulose powder, and I found that when loaded in foreign cases (which were recommended) this powder gave fairly good results. As soon as English cases were substituted, however, there was a marked change; for, whilst still giving 'pleasant shooting' and good patterns, the powder lost considerably in velocity (except up the barrel, where an increase took place), and the pressure went up to a prohibitive figure. This could not, evidently, be traced to position of anvil and firing holes, strike of hammer or case-material, but was due to a change in the cap composition.

"Even in the case of detonators, which usually contain 85 per cent. of fulminate, quality and uniformity play an important part in developing the full potential of mining explosives—a fact which, although recognised, is too often forgotten in passing judgment on their efficiency."

Yorkshire Section.

Meeting held at Leeds, on Monday, February 26th, 1906.

MR. THORP WHITAKER IN THE CHAIR.

AN INVESTIGATION OF THE BARIUM AND CALCIUM SALTS OF GALLIC, PROTOCATECHUIC AND DIGALLIC ACIDS.

BY H. R. PROCTER AND H. G. BENNETT

(Contribution from the Leather Industries Laboratories, University of Leeds).

The following experiments were suggested by a paper on a "New Method for the Analysis of Tannin and Tanning Materials," by Parker and Payne (this J., 1904, page 648). Since its publication this method has been subjected to various criticisms, but it is noteworthy that the discussion has chiefly been in connection with the relative merits of collin and hide-powder, whilst the figure called the "Total Absorptive Value" has escaped attack, and, in view of the fact that it is based upon the formation of a definite metallic compound, has even been hailed as a step in the right direction. It seemed, however, that the evidence given in support of the reliability and significance of these results was inconclusive, and it was considered desirable, therefore, to make some experiments with a view to ascertaining whether the figures obtained in this way were at all consistent and reliable, and if any theoretical significance could be attached to them. To do this it is evidently necessary to experiment at first with bodies of known constitution, and which could be obtained in a sufficiently pure condition, before applying the method to tannins and tanning materials of which the constitution is unknown. Parker and Payne had, to a certain extent, attempted this with gallic and digallic and ellagic acids, but some preliminary experiments showed that their figures required confirmation. Recrystallised gallic acid was therefore chosen for these experiments, along with protocatechuic acid, and also digallic acid as the only tannin about which anything definite is known.

Now it is well known that in alkaline solution both tannic and gallic acids are extremely oxidisable, and, although the products of oxidation are not well investigated, it seemed probable that they were of an acid character, such as to affect the apparent amount of alkali used for neutralisation, and experiment proved this to be the case. Keeping this in mind, the exposure to air involved in ordinary filtration, as used by Parker and Payne, was obviously a probable source of error, and hence efforts were made to eliminate it. This was done in various ways—by working in an atmosphere of coal gas or of petroleum-ether vapour, but preferably by mixing the solutions in the presence of the latter and filtering through a "Berkefeld filter-candle" directly into a self-filling burette, the top of which was connected with a closed apparatus free from oxygen, arranged so that either a partial vacuum or a pressure could be produced in the

burette, as desired. The arrangement of the apparatus is shown in the illustration.

Experiments with baryta.

Baryta was in the first instance experimented with in preference to lime, since it avoided possible complications introduced by the use of sugar in the lime solution, and in absence of oxygen was equally easy to work with.

1. *Gallic acid.*—The first experiments were done with a view to finding whether the precipitate with baryta was completely insoluble, and the gallic acid, therefore, removed entirely from solution. The proportions of Parker and Payne were used, but the quantities halved, *i.e.*, 100 c.c. of N/50 gallic acid (3·76 grms. per litre) and 150 c.c. of approximate N/5 baryta (made by standardising a cold saturated solution), the filtrate obtained through the Berkefeld candle being titrated against a measured quantity, generally 10 c.c., of N/10 hydrochloric acid.

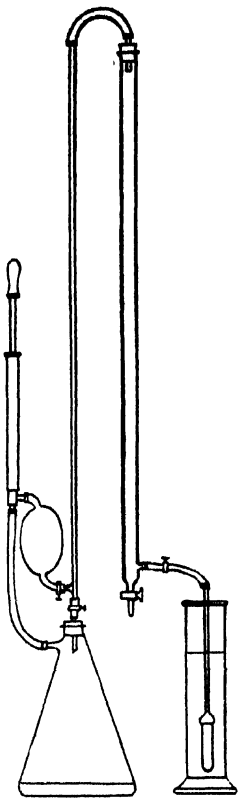
The results obtained in this way were extremely inconsistent and without obvious meaning. Moreover the time of standing before filtration made a considerable difference in the results, thus:—

Hours standing.	Neutralisation value.*
0	24·7
3	25·5
5	26·2
24	32·6

In all these experiments the filtrate, on exposure to air, oxidised rapidly, and deposited a precipitate, mostly dark green, but varying in colour, showing clearly that all the gallic acid had not been precipitated, but that the barium compound was partly soluble even in excess of baryta. Now experiments with gallic, protocatechuic, salicylic and benzoic acids and some phenols, have shown that these bodies become neutral to phenolphthalein and other indicators sensitive to weak acids when sufficient alkali has been added to saturate the carboxyl group; and no precipitate is formed till or near the point at which this saturation is reached, and it is obvious therefore that the precipitate is of a basic character and alkaline to indicators. The soluble part of the precipitate would, therefore, on titration with phenolphthalein and N/10 hydrochloric acid act like free alkali, and hence the figures obtained above are lower than they would be were the precipitate insoluble.

In the calculation of these results, it also became very evident that the large excess of alkali (considered essential by Parker and Payne), being used for the indirect determination of a comparatively small quantity of gallic acid, was a source of error and unreliability, for small differences in the titration obviously correspond to comparatively large variations in the actual neutralisation value of the gallic acid. To get results, therefore, of any reliability and significance, it was necessary not only to lower the excess of baryta used, but also in some way to render the barium precipitate insoluble, and the filtrate unoxidisable. Both these objects were accomplished by the addition of a suitable quantity of alcohol (80 per cent.), which made the precipitate quite insoluble. The next experiments were done with 100 c.c. of gallic acid solution, and 100 c.c. baryta and the solution made up to 250 c.c. with alcohol. The neutralisation values now obtained ranged between 40 and 50, but were still rather variable. This was remedied to some extent by thorough mixing and long standing, three similar experiments showing, after 48 hours' standing, the values 41·9, 41·3, 43·6. It is obvious that the highest figure theoretically possible, assuming that the carboxyl and all three hydroxyls were saturated, would be 40.

Some experiments were now made to illustrate any effect which varying quantities of alcohol might have on the neutralisation value. The same quantities of baryta and acid were used in each case, and the solution



made up to various volumes with alcohol. After standing overnight, the following figures were obtained:—

Total volume.	Neutralisation value.
250 c.c.	43·4
275 c.c.	46·2
300 c.c.	48·6

Hence, although the use of alcohol in moderate quantity is an advantage in completing the precipitation, the use of larger quantities causes the neutralisation value to increase considerably. With the smaller quantity of alcohol, the following results were obtained:—

Total volume, 250 c.c.; 100 c.c. *acid, and* 100 c.c. *baryta solution.*

Experiment.	Neutralisation value.
1	43·6
2	44·0
3	43·5
4	43·4

showing that all the four (OH) groups of gallic acid, both carboxylic and phenolic, are saturated in this case with barium, and that the larger quantities of alcohol probably cause the precipitate to carry down with it, mechanically, some more baryta. To eliminate this co-precipitation, it was found necessary to:—(1) Use a still smaller excess of baryta (150 c.c. acid to 100 c.c. alkali); (2) carry out the precipitation at the water-bath temperature, which also gave a precipitate more coagulated, and therefore easier to filter; (3) add the baryta gradually to the hot mixture of alcohol and acid so that the baryta is never in excess until the precipitation is complete, and then to heat the mixture on the water-bath for 20—30 minutes. By these means the error attributed to co-precipitation was much reduced, and 41·5 was obtained, confirming the figure 40 as representing

* No. of c.c. N/5 alkali absorbed by 100 c.c. of N/50 gallic acid. Each 10 c.c. of N/5 alkali used corresponds, therefore, to one valency either carboxyl or hydroxyl of the gallic acid.

the true neutralisation-value of 100 c.c. N/50 gallic acid. This corresponds to absorption by 1 grm. of dry gallic acid of 125 c.c. N/5 baryta. Parker and Payne give 1 grm. dry gallic acid = 177·75 c.c. N/5 alkali ("Collegium," 1904, p. 267). This figure would correspond to the neutralisation of 5·69 eq. of alkali, by 1 eq. of gallic acid—obviously an impossible result, and presumably a clerical error.

2. *Protocatechuic acid.*—Some experiments were now made with N/50 protocatechuic acid (3·08 grms. per litre) with a view to determining the solubility of its barium precipitate, and also in the hope of confirming the above view of the constitution of these precipitates. It was found, however, that in aqueous solutions, no precipitate was produced, and that although alcohol did produce precipitation it by no means completed it, and that larger quantities of alcohol resulted merely in the baryta being thrown out of solution.

In a similar way, N/5 sugar-lime gave no precipitate with protocatechuic acid, and the addition of alcohol, even in small quantities, resulted in the precipitation of lime. It is by no means certain, though not improbable that free protocatechuic acid exists in natural tanning materials, but in any case it is a derivative of all catechol tannins, and its behaviour may probably be taken as typical.

3. *Digallic acid.*—These experiments were made with a commercial sample of pure gallotannic acid. The moisture was estimated (12 per cent.) at 100° C., and a N/50 solution made up, assuming the rest to be digallic acid (7·318 grms. per litre). If no alcohol was used, the neutralisation values varied between 50 and 60, and increased with standing:—

Stood.	Neutralisation value.
0 hours	49·0
24 ,,	54·3
36 ,,	59·5

As the filtrate oxidised on exposure to air, it was concluded that precipitation was not complete, and hence alcohol was again used. It is, of course, possible that this imperfect precipitation was due to the gallic acid which is present as a constant impurity. The neutralisation values now varied between 60 and 70, and still increased with the time of standing.

The effect of precipitating hot, and of heating was noticed, and after trying various times and conditions it was found that the results converged to a consistent neutralisation value of 76·0 after 1½ hours heating on the water-bath. As also observed with gallic acid, hot precipitation and subsequent heating was an advantage as regards rapid filtration. Concordant results were not obtained under any other conditions.

It was noted that, if the filtration be carried out immediately after precipitation, the results approximate to 60, which would correspond to the saturation of all the six hydroxyl groups of digallic acid; but that if the mixture be allowed to stand or is heated, the value increases. This is best explained on the assumption that the digallic acid is hydrolysed by the action of the baryta, and that 2 mols. of gallic acid being produced, the true neutralisation-value approximates now to 80, the lower number actually found being due to the non-tannin impurities present in the sample; since any gallic acid present would be estimated along with that produced by hydrolysis and would not cause very serious error.

Experiments with N/5 sugar-lime.

1. *Gallic acid.*—Some preliminary experiments with varying excess fully bore out the remarks made in case of baryta as to the unreliability of using large excesses, both on account of co-precipitation and from the magnitude of the error which is involved in small differences in titration.

When no alcohol was used, the filtrate was easily oxidisable on exposure to air, though perhaps to a less extent than in the case of baryta, and hence the addition of alcohol was again tried. The error due to co-precipitation was, however, much more considerable in this case than with baryta, and was perceptible even when the alcohol was diminished to comparatively small quantities, the neutralisation values decreasing with the decrease of alcohol from 50 towards 40.

The actual results are as follows:—

Precipitation hot, and mixture heated half an hour, 150 c.c. of gallic acid solution and 100 c.c. of sugar-lime (N/5).

Added alcohol.	Neutralisation value.
50 c.c.	49·2
40 c.c.	47·9
30 c.c.	46·7
20 c.c.	45·5
10 c.c.	44·1
5 c.c.	13·6
(Precipitation cold and mixture not heated.)	
(Filtered at once.) 50 c.c.	47·0
(After standing two or three days with occasional shaking.) 50 c.c.	49·3
50 c.c. water and no alcohol	42·0

The results confirmed the view that the real neutralisation value is 40, corresponding to the saturation of all hydroxyl groups; but we have not yet succeeded in the case of sugar-lime of eliminating at the same time both the errors of co-precipitation and of solubility.

Some experiments were made using cane-sugar syrup in place of alcohol, in the hope of rendering the precipitate insoluble by virtue of its alcoholic structure, and at the same time abolishing co-precipitation, but the result showed that sugar to have a very peculiar effect on the lime precipitation, changing its colour, bringing a great deal of it into solution, making the filtrate deep yellow and much more easily oxidisable, and rendering the end-point of the titration indefinite. The results showed also a considerable increase in the neutralisation value, which rose to 49·2. What this means is difficult to see, but the sugar evidently introduces another unknown chemical change, and still further complication in the method, and is therefore best avoided altogether. Experiments with sugar-baryta fully bore out the above observations, quite similar effects being observed.

2. *Protocatechuic acid* was not experimented with quantitatively with sugar-lime for similar reasons to those which prevented its titration with baryta (v.s.).

3. *Digallic acid.*—It was thought desirable to confirm the view as to the hydrolysis of digallic acid by alkalis by making a few experiments with sugar-lime in addition to those with baryta. No alcohol was used. The results show neutralisation values of about 50 when the mixture is filtered and titrated at once, and that this increases with time and with heating until the figure reaches 74·8, which is obtained after two hours' heating on the water-bath. This fully bears out the theory that the digallic acid is, as one would expect, hydrolysed by the lime to 2 mols. of gallic acid, and the near agreement between the figures obtained when the reaction is complete for both baryta and lime, is an interesting confirmation of the idea that the discrepancy from the theoretical 80 is due to the impurity of the sample.

Further experiments.

Some experiments have also been made with the tannin of quebracho. An aqueous solution of the partially-purified tannin was made, and by repeated filtration through the candle was made clear.

1. 50 c.c. contained 0·2124 grm. soluble matter. 150 c.c. when mixed with 100 c.c. N/5 sugar-lime gave a reddish-brown precipitate, which was filtered at once with the usual apparatus. The filtrate was deep yellow, and easily oxidisable, with precipitation. The result showed that 100 c.c. of the solution absorbed 21·85 c.c. of N/5 alkali (*i.e.*, 1 grm. dry substance = 51·43 c.c. sugar-lime).

2. The same quantities of tannin and baryta solution were now mixed, and, as it was noticed that the filtrate was as yellow as before, the solution was made up to 300 c.c. with alcohol, and filtered. The filtrate was now decidedly less yellow, but the colour and oxidisability were still present. The result showed 100 c.c. tannin solution = 23·21 c.c. N/5 baryta, *i.e.*, 1 grm. dry substance = 54·21 c.c. N/5 baryta.

3. A further experiment, in which the sugar-lime (100 c.c.) was added to the hot tannin solution (150 c.c.) and

the mixture heated 1¾ hours, showed a considerable increase in its absorptive value. 100 c.c. = 30·97 c.c. N/5 sugar-lime (*i.e.*, 1 grm. tannin = 87·03 c.c. lime). In this case the filtrate was even more yellow than in experiment 1.

These experiments show, we think, that the compounds of quebracho tannin with both lime and baryta are soluble in water, but they are less soluble in water with alcohol added. As this can only be done in case of baryta, it is possible that a series of experiments might determine that particular quantity of alcohol which would make the quebracho-tannin compound with baryta quite insoluble, but it is clear that this quantity must be a greater proportion than any hitherto used, and which would probably cause serious co-precipitation. This it is impossible to examine, but it is conceivable that in presence of quebracho-tannin only the error might be a constant one. If the quantity of alcohol is much increased, baryta is itself thrown out of solution. This is only an illustration of what must happen with the rest of the tannins, the amount of alcohol necessary for complete precipitation will differ in each case; and when determined for every tannin, other errors would have to be made constant by exactitude of manipulation, &c. The last experiment, recorded above, also points very strongly to the hydrolysis or decomposition of the tannin by the alkali, and this opens up the same questions of solubility, &c., which were discussed in connection with digallic acid.

The authors conclude from the above experimental work that the Parker-Payne method in its original form is altogether unreliable and useless. Apart from the unsatisfactory experimental methods, and the obvious liability to error involved in the indirect determination of a small quantity by the use of a large excess of another reagent, it is evident that in these experiments we are dealing with precipitates which are not definite metallic compounds of gallic and digallic acids, &c., but of indefinite constitution and which vary in composition with all variations in methods of working, concentration, temperature, method and order of admixture, &c. Moreover, the method is liable to break down at any time upon the question of the solubility of the precipitate, since its whole theory assumes the insolubility of the compound formed with lime or baryta, and this is found to vary with the different tannic acids, and in fact it is known that gambier and some other tanning materials do not give a precipitate at all with lime or baryta.

This objection to the method might be overruled if we could accept the assumption of Parker and Payne that "the majority of tanning materials depend upon the anhydrous digallic acid content for their activity as tanning agents." If this were true, and we were estimating the same thing every time, we might hope for a general method on these lines. Unfortunately, it is well recognised by all organic chemists that the tannins form a class of very varied constitution, and all the variations which Parker and Payne ascribe to the mysterious entity "colour-weight" are equally well explained by the much more natural view that the tannins vary in molecular weight, and, consequently, in their percentage-absorption by gelatinous fibres.

Again, the observed hydrolysis of digallic acid in the presence of alkalis is further evidence for the unreliability of the method. What occurs with digallic acid is only typical of what will happen, in all probability, with most other tannins, so that we have to face the question not only of the solubility of precipitates of the tannins with baryta and lime, but also that of the products of hydrolysis. These are not at all well investigated, and it is quite a possibility, for example, that some tannin would give protocatechuic acid as one of its products of hydrolysis which, as shown above, cannot be estimated by this method. As a general method of analysis, therefore, the process is useless, though it is quite possible that it might be so modified as to give reliable results in many cases for a given material. It is greatly to be regretted that we are driven to these conclusions, since the method appears at first sight very promising, especially on account of the sharp end-reaction of the reagents with phenolphthalein. A rapid process for the control of tannery liquors is very urgently needed, and if at the same time it could estimate their acidity, its value would be still further increased.

Discussion.

Mr. A. Guthrie said that he had tried the method when it was first published, but obtained disappointing results. Owing to the hot weather at that time, the temperature of the liquors was about 35° C., and this affected the solutions noticeably. Immediately after filtration the filtrate was clear, but quickly became turbid owing to rapid oxidation. High results were invariably obtained.

Mr. T. Fairley asked whether methylated spirits or pure alcohol was used in these experiments. It was commonly understood that these complex bodies were unstable in alkaline liquids, and pyrogallic acid was well known as a rapid absorbent of oxygen under such conditions. This property was possessed in a less degree by other similar bodies. He thought precipitation by salts of the heavier metals in place of those of the alkaline earths might be of use in the work.

Mr. F. K. Kopecky said he always thought that it was useless to attempt this kind of work with tannins in alkaline solutions.

Mr. H. G. Bennett thought there might be a possibility of working with tannins in alkaline solutions if free access of air were prevented. Errors due to this might be eliminated by using the special apparatus mentioned in the paper, in place of experiments conducted like those of Payne and Parker with open funnels and beakers, and exposed filtration. The whole method stood or fell on the solubility or insolubility of the precipitates, and, as this would vary with each tannin, it would be, therefore, necessary to determine the requisite quantity of alcohol to be used for each different tannin.

Prof. H. R. Procter, in reply, said that some of the salts of the heavy metals did give good results. He had tried precipitation with copper and treatment with ammonium carbonate, as Dreaper suggested, and obtained good results under certain conditions. Pure alcohol was used in all the experiments.

Meeting held at Leeds, on Monday, February 26th, 1906.

MR. THORP WHITAKER IN THE CHAIR.

THE ESTIMATION OF AMMONIA IN USED LIME LIQUORS.

BY H. R. PROCTER AND DOUGLAS McCANDLISH

(Contribution from the Leather Industries Department of the University of Leeds).

When a hide is placed in a fresh lime liquor, practically no unhairing action takes place at first. If the liquor has previously had hides taken through it, or is allowed to stand in contact with hide for a sufficient time, a putrefactive action takes place, due to the action of bacteria upon the organic matter of the hides. The lime will now have acquired the property of softening the epidermal layer in which the hair-roots are situated, so that the hair can be easily removed. In addition to this, it will exert a solvent action upon the hide itself. The exact nature of the products of the combined action of the bacteria and lime upon the hide is not known, but one thing is certain, that ammonia is always formed together with ammo-compounds of uncertain constitution. It may be said, speaking generally, that the amount of ammonia in a liquor is proportional to its age; the older it is, the more ammonia is present in it. As the solvent action of a liquor increases with the age, and ammonia itself has a solvent action, it follows that the ammonia will afford a standard by which the activity of a liquor may be judged. It is, therefore, of importance to the tanner to know the amount present in the "limes" with some degree of accuracy. The estimation of ammonia in such a liquor appears at first sight to be a simple matter, the method which naturally suggests itself is that of distillation in an ordinary Kjeldahl's ammonia

the true neutralisation-value of 100 c.c. N/50 gallic acid. This corresponds to absorption by 1 grm. of dry gallic acid of 125 c.c. N/5 baryta. Parker and Payne give 1 grm. dry gallic acid = 177·75 c.c. N/5 alkali ("Collegium," 1904, p. 267). This figure would correspond to the neutralisation of 5·69 eq. of alkali, by 1 eq. of gallic acid—obviously an impossible result, and presumably a clerical error.

2. *Protocatechuic acid.*—Some experiments were now made with N/50 protocatechuic acid (3·08 grms. per litre) with a view to determining the solubility of its barium precipitate, and also in the hope of confirming the above view of the constitution of these precipitates. It was found, however, that in aqueous solutions, no precipitate was produced, and that although alcohol did produce precipitation it by no means completed it, and that larger quantities of alcohol resulted merely in the baryta being thrown out of solution.

In a similar way, N/5 sugar-lime gave no precipitate with protocatechuic acid, and the addition of alcohol, even in small quantities, resulted in the precipitation of lime. It is by no means certain, though not improbable that free protocatechuic acid exists in natural tanning materials, but in any case it is a derivative of all catechol tannins, and its behaviour may probably be taken as typical.

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Stood.	Neutralisation value.
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24 ,,	54·3
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As the filtrate oxidised on exposure to air, it was concluded that precipitation was not complete, and hence alcohol was again used. It is, of course, possible that this imperfect precipitation was due to the gallic acid which is present as a constant impurity. The neutralisation values now varied between 60 and 70, and still increased with the time of standing.

The effect of precipitating hot, and of heating was noticed, and after trying various times and conditions it was found that the results converged to a consistent neutralisation value of 76·0 after 1½ hours heating on the water-bath. As also observed with gallic acid, hot precipitation and subsequent heating was an advantage as regards rapid filtration. Concordant results were not obtained under any other conditions.

It was noted that, if the filtration be carried out immediately after precipitation, the results approximate to 60, which would correspond to the saturation of all the six hydroxyl groups of digallic acid; but that if the mixture be allowed to stand or is heated, the value increases. This is best explained on the assumption that the digallic acid is hydrolysed by the action of the baryta, and that 2 mols. of gallic acid being produced, the true neutralisation-value approximates now to 80, the lower number actually found being due to the non-tannin impurities present in the sample; since any gallic acid present would be estimated along with that produced by hydrolysis and would not cause very serious error.

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The actual results are as follows:—

Precipitation hot, and mixture heated half an hour, 150 c.c. of gallic acid solution and 100 c.c. of sugar-lime (N/5).

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Some experiments were made using cane-sugar syrup in place of alcohol, in the hope of rendering the precipitate insoluble by virtue of its alcoholic structure, and at the same time abolishing co-precipitation, but the result showed that sugar to have a very peculiar effect on the lime precipitation, changing its colour, bringing a great deal of it into solution, making the filtrate deep yellow and much more easily oxidisable, and rendering the end-point of the titration indefinite. The results showed also a considerable increase in the neutralisation value, which rose to 49·2. What this means is difficult to see, but the sugar evidently introduces another unknown chemical change, and still further complication in the method, and is therefore best avoided altogether. Experiments with sugar-baryta fully bore out the above observations, quite similar effects being observed.

2. *Protocatechuic acid* was not experimented with quantitatively with sugar-lime for similar reasons to those which prevented its titration with baryta (v.s.).

3. *Digallic acid.*—It was thought desirable to confirm the view as to the hydrolysis of digallic acid by alkalis by making a few experiments with sugar-lime in addition to those with baryta. No alcohol was used. The results show neutralisation values of about 50 when the mixture is filtered and titrated at once, and that this increases with time and with heating until the figure reaches 74·8, which is obtained after two hours' heating on the water-bath. This fully bears out the theory that the digallic acid is, as one would expect, hydrolysed by the lime to 2 mols. of gallic acid, and the near agreement between the figures obtained when the reaction is complete for both baryta and lime, is an interesting confirmation of the idea that the discrepancy from the theoretical 80 is due to the impurity of the sample.

Further experiments.

Some experiments have also been made with the tannin of quebracho. An aqueous solution of the partially-purified tannin was made, and by repeated filtration through the candle was made clear.

1. 50 c.c. contained 0·2124 grm. soluble matter. 150 c.c. when mixed with 100 c.c. N/5 sugar-lime gave a reddish-brown precipitate, which was filtered at once with the usual apparatus. The filtrate was deep yellow, and easily oxidisable, with precipitation. The result showed that 100 c.c. of the solution absorbed 21·85 c.c. of N/5 alkali (*i.e.*, 1 grm. dry substance = 51·43 c.c. sugar-lime).

2. The same quantities of tannin and baryta solution were now mixed, and, as it was noticed that the filtrate was as yellow as before, the solution was made up to 300 c.c. with alcohol, and filtered. The filtrate was now decidedly less yellow, but the colour and oxidisability were still present. The result showed 100 c.c. tannin solution = 23·21 c.c. N/5 baryta, *i.e.*, 1 grm. dry substance = 54·21 c.c. N/5 baryta.

3. A further experiment, in which the sugar-lime (100 c.c.) was added to the hot tannin solution (150 c.c.) and

top of the tube. Over the top of B is placed the inverted head of a thistle funnel, the aperture where the stem was connected having been carefully sealed. This acts as a distributor for the liquid which is carried up tube B, causing it to run back evenly over the broken glass contained in the tube. The tube A is connected with U-tubes, containing sulphuric acid and caustic soda, to remove any ammonia and carbon dioxide contained in the laboratory air (as shown in Fig. 2), the other outlet of the boiling-tube being connected to a U-tube containing normal acid, which in turn is connected to the vacuum pump. It is advisable to have a spray catcher (a bulb containing glass beads) attached to the normal acid tube, in order that there may be no loss when air is rapidly drawn through the acid.

The estimation of ammonia is carried out in the same way as in the previous method. The filled tube is placed in the water-bath raised to 90° C., and the ammoniacal liquor introduced through A, a filter-funnel being attached for this purpose, and slight suction applied at the outlet tube to facilitate the operation. It is found convenient to use 50 c.c. of lime-liquor and absorb the ammonia in 30 to 40 c.c. of N/50 sulphuric acid, but the strength of the latter should be increased if very old lime liquors are being examined. When the experiment is in progress, the liquor is continuously raised to the top of tube B, thrown back by the thistle-funnel upon the broken glass and runs to the bottom of the tube. In this way a continuous circulation of the liquor takes place. It was proved that all the ammonia was driven off from known quantities of ammonium salts in 30 minutes, and that on repeating the determination several times with the same lime-liquor consistent results were obtained. There is no difficulty caused by frothing, as the thistle-funnel breaks any bubbles which are formed, and so does away with this source of trouble. Beyond the preliminary work of fixing up the apparatus there is not much trouble in carrying out the determination by this method. A point which specially commends it to a chemist in a tannery is that after having been started, the experiment requires no further attention until the half hour is completed and the final titration of the acid has to be made. Obviously, if preferred, air can be forced instead of sucked through the apparatus.

DISCUSSION.

Mr. THORP WHITAKER said he was much impressed by the similarity of the useful apparatus described, to the Soxhlet extractor. They were alike in working continuously.

Mr. T. FAIRLEY thought the method might turn out to be of use in the estimation of ammonia in many cases where heat was undesirable. In the estimation of ammonia in urine he had known it necessary to let the urine stand six or seven days over sulphuric acid. If fermentation set in, the decomposition of urea might result, with consequent error. Any method, therefore, which gave hopes of differentiating between ammonia originally present in bodies and that formed from derivatives of ammonia during the process of treatment with alkali and distillation, would be welcome.

Mr. D. MCCANDLISH mentioned that the air was freed from carbon dioxide before passing through the apparatus, in order to prevent deposition of calcium carbonate on the broken glass. If this took place it would necessitate constant cleaning of the apparatus.

Prof. H. R. PROCTER said that a larger amount of broken glass might be useful. The idea of raising a liquid by a current of air could be applied to several methods. He thought the old method for the determination of small quantities of ammonia was now quite discredited.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 211.)

ENGLISH PATENTS.

Tanks [Settling] for the purpose of producing a liquid free from suspended solids. J. Fieldhouse, London. Eng. Pat. 2520, Feb. 8, 1905.

THE tank consists of two parts—an inner one, cylindrical in shape and conical at the bottom, which is surrounded by an outer circular tank divided into two or more radial compartments and also conical at the bottom. The inner tank serves as a distributing chamber, and communicates by separate conduits with the outer tanks, which serve as settling chambers. Sludge valves are provided at the bottom of the tanks, the one at the bottom of the inner tank being protected by a cone-shaped arrangement which prevents deposition of sludge on the sloping walls of the lower part of the tank. From the outer tank the clear liquid flows under scum boards over a sill into a collecting channel, which leads to the discharge pipe. The scum boards are movable, and when lowered allow the scum to be periodically run off through a separate valved channel.—W. P. S.

Disintegrating, drying and mixing machine. H. L. M. Mundy, J. R. Broadley, and H. S. Rhodes, Leeds. Eng. Pat. 4426, March 3, 1905.

THE materials to be treated are placed in a horizontal cylindrical vessel supported by a hollow shaft on trunnions, and surrounded by an outer, double-walled, horizontal cylinder, forming a heating jacket. Either, or both of the cylinders may be rotated, and in the same or in opposite directions. The inner cylinder is provided with arms or beaters which may be attached either to the interior of the cylinder, or to the shaft, and also with a conveyor, or with rakes, for the purpose of removing the material when treated. The materials are charged and the vapours evolved escape, either through the hollow shaft and trunnions, or through special openings in the ends of the cylinder.—W. H. C.

High temperatures; Apparatus for measuring ——. A. F. Spooner, London. From La Compagnie pour la Fabr. des Compteurs et Materiel d'Usines à Gaz, and C. Fery, Paris. Eng. Pat. 5668, March 17, 1905.

THE invention relates to the high temperature measuring apparatus described in Eng. Pat. 18,382 of 1904 (this J., 1905, 210), which consists of a thermo-electric telescope and a recording galvanometer. A number of movable sector-shaped screens are placed in front of the mirror which concentrates the heat rays upon the thermo-couple. The screens can be moved by a screw so that any desired sector-shaped fraction of the surface of the mirror can be exposed to the heat rays. The position of the screens is indicated by a pointer on a graduated circle, and the instrument is calibrated for different ranges of temperature. For comparatively low temperature observations a large portion of the surface of the mirror is used, and for higher ranges of temperature correspondingly smaller fractions of the surface of the mirror are left uncovered by the screens. In this way the whole range of temperatures which can be measured by the same instrument is increased.—W. H. C.

UNITED STATES PATENTS.

Separating-machine. H. Baldwin, Youngstown, Ohio. U.S. Pat. 812,972, Feb. 20, 1906.

THE materials to be separated are delivered into a feeding-

placed just inside a tapering chamber near its larger , which has openings at the same end for the discharge the coarser and heavier particles, and at the smaller for the lighter and finer ones. A blast of air is intro- ed with a whirling motion into the larger end by an rnal fan; the air carrying forward the lighter particles ses through the apparatus, leaves at the smaller end is returned to the fan. The internal feeding fan is losed by a "peripheral wall" provided with an adjust- s opening, through which the materials to be treated directed into the whirling air current.—W. H. C.

er-press. S. Thurstensen, Assignor to H. Vogt lachine Co., Louisville, Ky. U.S. Pat. 813,121, eb. 20, 1906.

s claim is for a filter-press into which the material to iltered is fed by a rotating worm or screw, which passes ig the whole length of the press through openings ged near the upper end of each plate. The plates ribbed and covered by filter-screens attached to the es, and any undue pressure on the latter is avoided projections or "hubs," which extend through the le length of the press.—W. H. C.

FRENCH PATENTS.

er for pulp. L. C. Trent. Fr. Pat. 358,538, Oct. 14, 1905.

U.S. Pat. 806,213 of 1905; this J., 1906, 7.—T. F. B.

ing apparatus. L. C. Trent. Fr. Pat. 358,539, Oct. 14, 1905.

U.S. Pat. 806,214 of 1905; this J., 1906, 8.—T. F. B.

GERMAN PATENTS.

uids under pressure; Device for the filtration of ——. Grosz and Ganz und Co., Akt.-Ges. Ger. Pat. 3,135, Nov. 7, 1902.

filtering device consists of a flat slab of porous ter-stone" covered by a sheet of filter-paper, which eld in place upon the filter-stone by the inflowing d.—A. S.

ring [Photographic developers, &c.]; Apparatus —— *with exclusion of air.* P. Dinglinger. Ger. t. 162,821, Aug. 28, 1904.

apparatus consists of two bottles fitted air-tight on r side of a stopper. The stopper has two holes gh which tubes pass, the upper end of one tube flush with the upper side, and the lower end of the tube flush with the lower side of the stopper. One e tubes contains paper-pulp, glass-wool or the like, acts as a filter. One of the bottles is filled with the d to be filtered, the different parts of the apparatus itted together, and the whole is reversed, when the d flows through the filter into the other bottle. The ratus is recommended for the filtration of photographic lopers.—A. S.

ensation mist; Process for the prevention of ——. J. Ephraim. Ger. Pat. 163,370, Nov. 10, 1903.

he condensation of vapour, the formation of fine frequently offers difficulties, as the extremely fine cles of liquid of which the mist is composed, pass gh the condenser unchanged. According to the nt invention, the gaseous mixture containing the mist is warmed until the latter has partially dis- ared, and is then again cooled. In this way the particles of liquid are converted into vapour, which, bsequent cooling, condenses to larger drops that are ed by the condenser. The operations may be ted as often as is necessary.—A. S.

orating apparatus. S. Duffner. Ger. Pat. 163,444, March 9, 1904.

Invention relates to evaporating apparatus, in which ylindrical heating units are arranged in tiers, with rtical heating tubes of one unit disposed directly the corresponding tubes in the unit below. Accord- ing to the present patent the heating units increase or decrease, or otherwise vary in diameter from the lowest one upwards, and are so arranged that sufficient space is left between them and the walls of the evaporator for the free downward movement of the liquid being evaporated, whereby, it is claimed, effective circulation is ensured.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 213.)

Coal-testing in America. Times, Eng. Supp., March 7, 1906.

THE United States Government has, with the sanction of Congress, decided to continue the work of testing the coals and lignites of the various States. This work was begun at St. Louis, during the exhibition, under the supervision of the Director of the United States Geological Survey. Congress has made the necessary appropriation for the present year, and it is probable that coal-testing will become one of the permanent duties of the Geological Survey. The mines are sampled under the rules prescribed by the Geological Survey and the American Chemical Society. When the coal is received at the plant, and as it is unloaded, it is sampled by taking small quantities at frequent intervals from the conveying apparatus, the coal in the meantime having been passed through rolls and reduced to a uniform size—1½ ins., and smaller. From the conveyors the coal is transferred to storage bins, and as drawn from these for testing purposes, at different portions of the plant, it is again sampled for analysis. Some of the conclusions of the preliminary report are as follows: (1) When coal is converted into gas and used in a gas engine, its average efficiency for power purposes is from 100 to 150 per cent. greater than when used under boilers. (2) The poorer grades of coal, rated according to their steam-raising qualities, give better results in the gas producer than the higher grades of steam coals. (3) Lignites used in the gas producer, in power-raising efficiency are equal to or better than steam coals used under boilers. (4) Many coals high in sulphur or ash can be materially improved for steaming, coking, or briquetting purposes by washing. (5) Some non-coking coals can be made to produce a fair quality of coke by an addition of coal-tar pitch to the charge of coal. A comparative statement of some of the results obtained at the coal-testing plant in the generation of power (1) by the boiler and steam engine, and (2) by the producer and gas engine, shows a saving in favour of the latter method (eliminating any possible differences of cost of installation and of operation) of more than 50 per cent. in every instance, and in one case the amount of coal consumed per horse-power per hour by the boiler plant was nearly three times that used in the producer. [T.R.]

ENGLISH PATENTS.

Filaments for electric incandescent lamps; Manufacture of incandescing ——. A. Just and F. Hanaman, Budapest, and Ver. Elektricitäts Act.-Ges., Ujpest, Hungary. Eng. Pat. 11,949, June 7, 1904.

SEE Addition of June 10, 1905, to Fr. Pat. 347,661 of 1904; this J., 1905, 1220.—T. F. B.

Nickel; Production of ——. H. S. Elworthy, St. Albans, and E. H. Williamson, London. Eng. Pat. 7714, April 11, 1905.

NICKEL oxide or other nickel compound is first reduced by heating at 400° C. in hydrogen, water-gas or other reducing gas, and the metallic nickel produced is then further heated at 1200° C. in an atmosphere of hydrogen or other inert gas for some time. The porous and coherent mass is then crushed to grains of the required size, which may be used as the active material for converting oxides of carbon and hydrogen into methane, according to Eng. Pats. 12,461, of 1902, and 14,333 of 1904 (this J., 1903, 900; 1905, 1006).—A. G. L.

United States Patents.

Gas producing and consuming apparatus; Power ——, C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 812,194, Feb. 13, 1906.

This system for the production and consumption of power-gas comprises a gas-producer, from which the gas is led by a pipe, which passes through a cooling vessel containing water, to a gas engine. The products of combustion are taken from the engine by a pipe, which also passes through the cooling vessel, and are returned to the producer. Means are also provided for mixing with the products of combustion, after they have passed through the cooling vessel, air from the atmosphere, and steam from the water vaporised in the cooling of the products of combustion.—W. C. H.

Gas; Apparatus for producing — —. C. Marconnet, Paris. U.S. Pat. 813,726, Feb. 27, 1906.

See Fr. Pat. 340,075 of 1904; this J., 1905, 745.—T.F.B.

Gas washer and scrubber; Combined — —. L. P. Lowe, San Francisco, Cal. U.S. Pat. 812,217, Feb. 13, 1906.

The combined gas washer and scrubber consists of an L-shaped shell. The horizontal portion is provided with an overflow, and with a gas-inlet which extends below the level of the overflow. It is divided into two chambers by a transverse partition, and the vertical portion—or scrubber—is also divided into two chambers by a vertical partition. The shell of the vertical portion, next to the horizontal portion, extends into the latter, but not to the bottom. The gas enters the horizontal portion—or washer—passes over the transverse partition in it, and up the first chamber of the vertical portion to the top, from which it is conducted by a pipe to the bottom of the second chamber; and in each of these chambers a spray is provided.—W. C. H.

Gas purifier. L. P. Lowe, San Francisco, Cal. U.S. Pat. 812,218, Feb. 13, 1906.

The purifier consists of a casing divided vertically into a horizontal series of chambers; each chamber is provided with a vertical partition dividing it into two compartments, which are connected at the bottom. At the bottom of each chamber is a door, opposite to the vertical partition. Movable supports are arranged in each compartment for purifying material. Over the chambers, and parallel to them is a pipe, which communicates with the chambers by valved connections; valves are also arranged in the pipe over each partition. By this system the gas is passed in succession through the chambers.—W. C. H.

French Patents.

Combustible gaseous mixture; Process and apparatus for producing a ——. C. K. Harding. Fr. Pat. 358,620, Oct. 18, 1905.

See U.S. Pat. 803,534 of 1905; this J., 1906, 170.—T.F.B.

Filament; [Electric furnace for making] An indestructible —— *for lighting and heating.* G. Michaud and E. Delasson. Second Addition, dated Sept. 30, 1905, to Fr. Pat. 346,307, Sept. 17, 1904. XII., page 271.

German Patents.

Lignite and the like; Process for briquetting — *by means of magnesium oxychloride (magnesia cement) produced within the same.* A. Eckl. Ger. Pat. 163,365, Oct. 22, 1903.

The dry lignite is impregnated with hydrochloric acid gas, and then mixed with a paste of magnesia and water. —A. S.

Retort; Vertical—— for the manufacture of coal gas. J. Hasse. Ger. Pat. 163,533, July 24, 1903.

The gas-outlet pipe extends centrally through the retort and is provided with openings through which the gas passes from the retort into the pipe. The retort is narrower at the top than at the bottom, whilst the gas-outlet pipe tapers in the reverse manner. In the closing device at the bottom of the retort, are one or more channels through which water-gas, oil-gas, carburetting agents, or the like may be introduced and mixed with the coal-gas produced in the retort. The chief advantage of this form of retort is that the shape and size of the annular retort chamber can be altered at will by replacing the gas-outlet pipe by another of different form.—A. S.

Retort; Vertical —— for carbonising peat. F. Sellnow. Ger. Pat. 165,266, Sept. 30, 1903.

The retort is heated by means of an outer heating jacket, a central vertical tube, and two transverse tubes at the top and bottom respectively, all communicating with one another and with the chimney. On the under side of the lower transverse heating tube are openings through which a strong draught is created by the chimney. The gaseous and tarry decomposition products formed above this heating tube are thus sucked down through the layer of hot peat-charcoal below the heating tube, before escaping to the chimney.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 214.)

Paraffin; Detection and determination of — *in mixtures with ceresin.* F. Ulzer and F. Sommer. XXIII., page 286.

Icthammon. U.S. Customs Decision, Jan. 20, 1906. It has been decided that icthammon, while similar in use to ichthyol was not in fact ichthyol, and hence not free of duty as "ichthyol" under paragraph 626 of the tariff. The assessment of duty at 25 per cent. *ad valorem*, under paragraph 68, as a "medicinal preparation," was affirmed. [T.R.] R. W. M.

French Patent.

Mineral oils; Apparatus for testing ——. C. Roth. Fr. Pat. 358,598, Oct. 17, 1905. Under Int. Conv., Nov. 24, 1904.

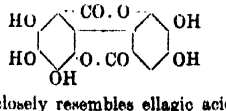
See Eng. Pat. 21,518 of 1905; this J., 1906, 236.—T.F.B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 216.)

Hydroxybenzoic acids; Some oxidation products of the ——. *II.* A. G. Perkin. Chem. Soc. Trans., 1906, **89**, 251—261.

The present paper deals with the oxidation products obtained from gallic acid by the action of potassium persulphate in presence of dilute and of strong sulphuric acid (see this J., 1905, 1087). In dilute sulphuric acid solution, the chief oxidation product consists of a pale brown substance, which, after being purified by crystallisation from pyridine, forms small, pale yellow, prismatic needles, which do not melt below 360° C. The compound, flavellagic acid, $C_{14}H_8O_9$, yields a penta-acetyl derivative melting at 317°—319° C. On treatment with boiling potassium hydroxide solution, it yields a compound, $C_{13}H_8O_8$, closely resembling the pentahydroxydiphenylmethylolid obtained in a similar manner from ellagic acid and which is, therefore, considered to be the corresponding hexahydroxy compound. The following formula is given for flavellagic acid:—



Flavellagic acid closely resembles ellagic acid, but has a somewhat yellower appearance, whilst its solution in alkali

has a well-marked green tint. When treated with nitric acid containing nitrous acid it gives, on subsequent dilution, a blood-red coloration (Griessmayer reaction), which has long been considered as characteristic of ellagic acid. It dyes mordanted wool in shades similar to, but stronger than those produced by ellagic acid, *viz.*, on chromium mordant, yellowish-olive; on aluminium, pale greenish-yellow; on tin, pale yellow; and on iron, dark olive-brown.

By the oxidation of gallic acid, dissolved in concentrated sulphuric acid, a mixture of ellagic and flavellagic acids is produced.—A. S.

Diazo-compounds from diamines (o-, m-, and p-Diamines; benzidine). L. Vignon. Bull. Soc. Chim., 1906, **35**, 126—129.

THE author endeavoured to combine the tetrazo-compounds of *m*- and *p*-phenylenediamine with aniline to form diazoamino compounds of the type $C_6H_4(N_2.NHC_6H_5)_2$ but without success. The action of 2 mols. of diazobenzene solution on 1 mol. of *o*-, *m*- and *p*-phenylenediamine respectively in presence of excess of potassium carbonate and a large quantity of alcohol was then investigated, in the hope that the diazo groups might be transferred from the one nucleus to the other. With *o*-phenylenediamine a tarry unstable mass was obtained, which evolved much nitrogen with acids. It could not be purified or analysed, but the author considers that it is probably $C_6H_4(NH.N_2.C_6H_5)_2$. With *m*-phenylenediamine a smoother reaction was observed. In presence of sodium acetate a red precipitate was obtained, which gradually became tarry and formed a reddish-brown magma. On washing with water and crystallising from alcohol, reddish-yellow crystals of Chrysoidine were obtained. The author considers that these were formed according to the following equations:—

$$2C_6N_2.N_2Cl + C_6H_4(NH_2)_2 = C_6H_4(NH.N_2.C_6H_5)_2 + 2HCl \text{ and}$$
$$C_6H_4(NH.N_2.C_6H_5)_2 + H_2O = C_6H_5N_2.C_6H_3(NH_2)_2 + C_6H_5OH + N_2.$$

In presence of *p*-phenylenediamine, diazobenzene solutions decomposed violently. The author has obtained a series of new derivatives, which he will describe later, by combination of tetrazotised benzidine with aniline.—E. F.

Diaminoanthraquinones. E. Noelting and W. Wortmann. Ber., 1906, **39**, 637—640.

MENTION is made in Beilstein's "Handbuch der organ. Chem." of the following diamino compounds, some of which form the subject of the present investigation:—(1) *a*-Diaminoanthraquinone (Anthracene Orange) melting at 236° C., obtained by Boettger and Petersen from dinitroanthraquinone; (2) *β*-diaminoanthraquinone prepared from dinitroanthraquinone according to Fritzsche; (3) 1.2-diaminoanthraquinone obtained from alizarin and ammonia, which has been proved to be an imide and not a diamino compound, the true 1.2-derivative being formed by nitrating the ester of 1-aminoanthraquinonecarbamic acid and subjecting the product to hydrolysis and reduction; (4) 1.5-diaminoanthraquinone obtained by Roemer; and (5) 1.4-diaminoanthraquinone. A 2.6-derivative melting at 310°—312° C. has also been obtained by heating the corresponding disulphonic acid with ammonia.

The dinitroanthraquinone obtained by Roemer by the action of nitric acid on a solution of anthraquinone in strong sulphuric acid is said to be a mixture of the 1.5-derivative, the *a*-derivative described by Boettger and Petersen and a *δ*-derivative. By reducing this compound with sodium sulphide and treating the product with sulphuric acid, the authors obtained a soluble and an insoluble portion, from which they isolated respectively the 1.8- and 1.5-diamino compounds. The former melts at 262° C., is sparingly soluble in ether, but dissolves readily in other solvents; whilst the latter melts at 319° C., and yields anthrarufin when diazotised. They, however, failed to obtain evidence of the existence of the *a*-compound described by Boettger and Petersen. From the dinitroanthraquinone prepared by Fritzsche by heating anthracene with dilute nitric acid, the authors by the action of reducing agents obtained 2.7-diaminoanthraquinone, which crystallises from alcohol in orange-yellow needles melting above 330° C., and yields iso-anthraflavic acid on diazotisation. For the production of the 1.4-derivative, *a*-aminoanthraquinone was acetylated, nitrated, hydrolysed and reduced, or its oxamic acid was nitrated in sulphuric acid solution and reduced with sodium sulphide in an alkaline solution. The tetra compound was obtained by nitrating the dioxamic acid of 1.5-diaminoanthraquinone suspended in strong sulphuric acid and reducing the dinitro compound. It crystallises in reddish-brown needles melting at 332° C. Attempts to produce triaminoanthraquinone from the diamino derivative by nitration led to the formation of dinitrodiamino compounds.—D. B.

Morin; Synthesis of ——. St. v. Kostanecki, V. Lampe and J. Tambor. Ber., 1906, **39**, 625—628.

MORIN (1.3.2′.4′.tetrahydroxyflavonol) was prepared synthetically in small quantity by heating 2′-hydroxy-4′.6′.2.4-tetramethylchalkone,

$$(CH_3O)_2(OH)C_6H_2.CH{:}CH.C_6H_3(OCH_3)_2,$$

with dilute acids in alcoholic solution; converting the 1.3.2′.4′-tetramethylflavanone,

$$(CH_3O)_2.C_6H_2\langle \begin{matrix} O \\ CO.CH_2 \end{matrix} \rangle CH.C_6H_3(OCH_3)_2,$$

into *a*-isonitroso-1.3.2′.4′-tetramethoxyflavanone,

$$(CH_3O)_2.C_6H_2\langle \begin{matrix} O \\ CO.C{:}N(OH) \end{matrix} \rangle CH.C_6H_3(OCH_3)_2$$

by means of amyl nitrite and hydrochloric acid; and then boiling the latter substance with hydriodic acid (sp. gr., 1.9). It is obtained from dilute alcohol as a light yellow crystalline powder, m. pt., 290° C., which dissolves in concentrated sulphuric acid with a light yellow, strongly fluorescent colour. A direct comparison with the natural product showed the identity of the two substances.—H. L.

Triphenylmethane dyestuffs united by a glutaconic aldehyde chain; Influence of methyl groups on the shade of ——. F. Reitzenstein and J. Rothschild. J. prakt. Chem., 1906, **73**, 192—206.

By treating triphenylmethane dyestuff leucobases with dinitrophenylpyridine chloride according to Zincke's method (Annalen **333**, 314), dinitraniline is formed together with substances such as that represented by the formula:—

$$[(CH_3)(NH_2)C_6H_3]_2{:}CH.C_6H_4.N{:}CH.CH{:}CH.CH{:}CH.NH_2Cl.C_6H_4.CH{:}[C_6H_3(NH_2)(CH_3)]_2$$

in which two triphenylmethane dyestuff nuclei are coupled together by the glutaconic aldehyde chain. The condensation products are stated to produce brighter and stronger shades than an equal quantity of the original dyestuffs. The dyeing power is weakened by the introduction of methyl groups in the *o*-position. (See Reitzenstein and Runge, J. prakt. Chem., **71**, 57.)—H. L.

Persian berry colour. U.S. Customs Decision, Jan. 26, 1906.

THE claim of the importer that sulphonated Persian berry colour is dutiable at ½*c.* per lb. under paragraph 22 of the tariff was overruled. The article in question is used for colouring food products, and the Board expressed the view that it was dutiable at 20 per cent. *ad valorem* under section 6 as a "manufactured article, unenumerated."

[T.R.] R. W. M.

ENGLISH PATENTS.

Dye; Process for the manufacture of a yellow sulphur —— [*Sulphide dyestuff*]. Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen-on-Rhine, Germany. Eng. Pat. 5449, March 15, 1905. Under Int. Conv., March 23, 1904.

SEE Ger. Pat. 157,862 of 1904; this J., 1905, 615.—T. F. B.

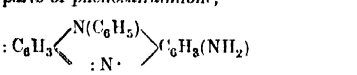
Indigo preparations; Manufacture of ——. O. Imray, London. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 7390, April 7, 1905.

FINELY-DIVIDED indigo is mixed, preferably whilst moist,

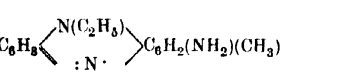
with a saccharide soluble in water and useful or non-injurious in a fermentation vat, the saccharide being of such concentration that it prevents or hinders the growth of micro-organisms such as moulds, &c., which might damage the dyestuff when the product is stored. A product is thus obtained which is more readily miscible than pure indigo with the liquid of the dye-vat. The manufacture may be carried out in many ways, for instance, by mixing indigo paste with syrup, glucose, molasses, &c., and evaporating *in vacuo* or in cans or drums to a highly concentrated paste or solid. For example, 800 parts by weight of indigo are used with 500 to 2000 parts by weight of molasses to produce pastes of 40 to 60 per cent. strength; or indigo cakes are pressed, by preference hydraulically, and the product stirred in a kneading machine with molasses, melted glucose, &c. This process may also be applied to tolyl-indigos, halogenated indigos and their homologues.—E. F.

Dyestuffs [*Sulphide dyestuffs*]; *Manufacture of red, dark red to violet sulphurised* ——. O. Imray, London. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 14,543, July 14, 1905.

HYDROXYLATED azines, or their alkyl, aryl, sulphonic, carboxylic and like derivatives, or their sulphurised derivatives, are heated with alkali polysulphide in presence of copper or of copper compounds. The effect of the copper is such that the shade of the dyestuff which is produced is much redder, whilst at least equally clear, and, therefore, more valuable, than if no copper is present; also, the resulting dyestuffs are much faster to light. The reaction is carried out either by the so-called melt-process, in which case it is advantageous to use a reflux condenser to maintain a constant temperature and concentration, or by boiling an aqueous or alcoholic solution of the material and the sulphide, or a solution of the sulphide with the material in suspension. By preference an enamelled or lead-lined vessel is used, as iron influences the shade. Copper vessels are not very practical as an indefinite amount of copper enters into reaction. For example, 15 parts of the hydrochloride of 2-amino-2'-hydroxyphenazine are heated with 83 parts of crystallised sodium sulphide, 38 parts of sulphur and 10·5 parts of crystallised copper sulphate dissolved in 20 parts of hot water. The mixture is first evaporated till the temperature attains 110° C.; a reflux condenser is then attached and heating continued for about five hours. The product dyes in bluish copper-red shades from a sulphide bath. Again, for example, 15 parts of phenosafraninone,



are heated gradually to about 135° C., whilst stirring, with 85 parts of crystallised sodium sulphide, 37·5 parts of sulphur and a quantity of copper sulphide paste corresponding to 10·5 parts of crystallised copper sulphate. This dyestuff yields strong reddish-violet shades, very fast to light. If the phenosafraninone be replaced by the ethosafraninone



from *p*-nitrosophenol and *m*-monoethyltoluylenediamine, a Bordeaux red dyestuff is obtained, said to be of previously unattained clearness and beauty, and very fast to light.—E. F.

Polyazo colours [*Azo dyestuffs*]; *Manufacture of* ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 13,804, July 4, 1905.

SEE U.S. Pat. 807,119 of 1905: this J., 1906, 65.—T. F. B.

Zinc-formaldehyde hydrosulphite; *Manufacture of* ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 81, Jan. 1, 1906.

ACCORDING to Eng. Pat. 7592 of 1905 (this J., 1905, 1299 and 1300), a zinc-formaldehyde sulphoxylate, soluble with difficulty in water, can be obtained by the interaction of zinc dust, sulphur dioxide and an aqueous formaldehyde solution at about 100° C., or by stirring for a considerable time in the cold. According to the present patent a readily soluble zinc-formaldehyde hydrosulphite is obtained by the interaction of the above-mentioned components, with cooling, or with avoidance of external heating, if the reaction is stopped before the difficultly soluble zinc-formaldehyde sulphoxylate separates. For example, 357·5 parts of zinc dust are suspended in 2000 parts of a 15 per cent. aqueous formaldehyde solution and a current of sulphur dioxide is passed in, with stirring, until the increase in weight is about 640 parts. The temperature is preferably maintained at about 20° C. by cooling, and should not in any case exceed 50° C. The liquid is then filtered from the residue of zinc dust and evaporated to a syrup.—E. F.

UNITED STATES PATENTS.

Dye and process of making same; Red azo ——. G. Kalischer, Frankfort on Maine, Germany, Assignor to Cassella Colour Co., New York. U.S. Pat. 813,155, Feb. 20, 1906.

ONE mol. of an aromatic diazonium compound is combined, in alkaline solution, with 1 mol. of 5-hydroxynaphthodiaminobenzaldehydin-7-sulphonic acid (see U.S. Pat. 807,117 of 1905; this J., 1906, 65). The dyestuff is soluble in water giving a red solution, and in sulphuric acid to a bluish-red solution.—T. F. B.

Dye [*Sulphide dyestuff*] *and process of making same; Orange-yellow sulphur* ——. R. Gley, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 813,643, Feb. 27, 1906.

SEE Eng. Pat. 27,091 of 1904; this J., 1905, 1167.—T. F. B.

FRENCH PATENTS.

Dyestuffs of the anthracene series; Production of ——. Soc. Anon. des Produits F. Bayer et Cie. Second Addition, dated Sept. 7, 1905, to Fr. Pat. 343,608 of March 29, 1904. Under Int. Conv., Nov. 21, 1904.

YELLOW dyestuffs are obtained by treating 1.3-dihalogeno-2-aminoanthraquinones with metallic salts in presence of strongly alkaline substances such as alkali hydroxides, sodium amide, &c. The new dyestuffs dissolve in alkalis in presence of reducing agents, forming a blue vat which dyes unmordanted cotton in blue shades turning to yellow by the action of the air. For example, a mixture of 100 kilos. of 1.3-dibromo-2-aminoanthraquinone, 1000 kilos. of nitrobenzene, 5 kilos. of cupric chloride and 40 kilos. of sodium hydroxide is heated to 150° C. for two to four hours until the quantity of yellow dyestuff no longer increases. The melt is allowed to cool to 100° C., and the precipitate filtered off and washed with nitrobenzene, alcohol, and dilute hydrochloric acid. It may contain small quantities of the blue dyestuff described in the original patent, which can be separated, as it crystallises out from a mixture of equal parts of sulphuric acid of 66° B. and 60° B. respectively, in which the yellow dyestuff remains dissolved. Its solution in sodium hydroxide solution dyes cotton in blue shades turning to brownish-yellow in the air. The nitrobenzene in the above method of preparation may be replaced by other diluents such as naphthalene.—E. F.

Dyestuffs of the anthracene series; Production of new ——. Soc. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 358,271, Oct. 4, 1905. Under Int. Conv., Feb. 11, 1905.

IT is already known that by treating dinitroanthrarufindisulphonic acid with alkali sulphides in alkaline solution, the nitro-groups are reduced in a normal manner, diaminoanthrarufindisulphonic acid being formed. This substance is a blue dyestuff, known commercially as "Alizarinsaphirol B." According to the present patent, if dinitroanthrarufindisulphonic acid is treated with alkali sulphide in neutral or weakly acid solution, an entirely different

dyestuff is obtained which yields very pure green shades on unmordanted wool. This same product may also be produced by other methods, as follows:—When dinitroanthrarufindisulphonic acid is treated with hydrogen sulphide in neutral or weakly acid solution, a new product is obtained, dyeing wool in violet shades, which the patentees call "the intermediate product." When this intermediate product is heated with alkali sulphides or hydrosulphides it forms the above-mentioned green dyestuff very readily. The latter is also obtained by prolonging the action of hydrogen sulphide on dinitroanthrarufindisulphonic acid in neutral or weakly acid solution, or by treating the intermediate product with hydrogen sulphide. The green dyestuff forms an addition product with hydrogen sulphide. This is also produced by prolonging still further the action of hydrogen sulphide on dinitroanthrarufindisulphonic acid in neutral or weakly acid solution, or on the intermediate product. It is readily converted into the green dyestuff; for instance, by heating with water. The new green dyestuff may also be obtained by the action of thiosulphuric acid or its salts on dinitroanthrarufindisulphonic acid in neutral or acid solution. This reaction is accelerated by the addition of an alkali sulphite. The new dyestuff is probably formed by simultaneous reduction and introduction of sulphur into the molecule. It forms a green sodium salt, only very slightly soluble in dilute sodium hydroxide solution, by means of which it may be purified and separated from diaminoanthrarufindisulphonic acid. It dyes unmordanted wool in green shades from an acid bath, and chrome-mordanted wool in yellowish-green shades. For example 10 kilos. of the sodium salt of dinitroanthrarufindisulphonic acid are dissolved in 700 litres of hot water and 10 kilos. of 50 per cent. acetic acid. A solution of 25 kilos. of crystallised sodium sulphide in 100 litres of water is then added at 75° C., with stirring. At first, whilst the liquid is still acid, the intermediate product is formed, the solution assuming a violet colour. When the acid is saturated this is converted, during the second stage of the operation, into the green dyestuff. The liquid becomes greenish-blue and the dyestuff separates in the form of small green needles. The intermediate product may be salted out from its solutions by means of potassium chloride, and after isolation in this manner may be reduced separately.—E. F.

Indigo white and its homologues; Production of chlorinated ——. Badische Anilin und Soda Fabrik. Fr. Pat. 358,864, Oct. 25, 1905. Under Int. Conv., Sept. 20, 1905.

See Eng. Pat. 21,746 of 1905; this J., 1905, 1298.—T.F.B.

Lakes [from azo dyestuffs] suitable as substitutes for Chrome Yellow; Process for preparing yellow ——. Fr. Pat. 350,431, Dec. 28, 1904. XIII.J., page 274.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 218.)

Titanium; Manufacture of compounds of ——, *and their application in dyeing.* F. Erban. Chem.-Zeit., 1906, 30, 145—146.

In referring to the preparation of titanium hydroxide from rutile, the author gives an account of a method adopted about ten years ago, when this substance first attracted practical interest owing to its property of combining with dyestuffs. It consists in melting the ore with sodium hydroxide, lixiviating the mass with water, washing the residue free from alkali, dissolving it in hydrochloric acid, and treating the solution with alkali to precipitate the titanium as hydroxide. The product is freed from iron by adding sodium sulphide, washing the precipitate and treating it with sulphurous acid. It is then converted into the double oxalate of titanium and ammonium by treatment with oxalic acid and ammonium oxalate. Thirty parts of rutile containing 80—90 per cent. of titanic acid gave 120 parts of "oxalate."

By mordanting cotton with tannin and titanium previous to dyeing with basic dyestuffs, Kearns and Barnes (this J., 1897, 44) obtained fast colours. Dreher (this J., 1902, 1329), however, asserts that the dyeings on tanned leather with titanium salts are too pale in colour to be of practical value, a statement which is in disagreement with the author, who finds that these compounds act more efficiently than mordants consisting of tannin and antimony. For the production of yellow and orange shades fast to rubbing and washing, he recommends the use of a yellow bottom composed of tannin and titanium shaded with Auramine G or O, Acridine Orange or similar dyestuffs. Fast scarlets may be obtained by dyeing Safranine, Rhodamine, Acridine Red or Pyronine on the same bottom. Methylene Violet and Heliotrope give purple shades, Capri Blue, Thionine Blue, Nile Blue and Setoglaucine Green and Methylene Green olive colours. Titanium may also be applied as mordant on cotton in the form of hydroxide, but the colours obtained present no striking characteristics. When dyed on a tannin and titanium ground, the fastness of Gallocyanines is greatly increased.—D. B.

Sulphide dyestuffs as discharge colours on α-Naphthylamine Claret; Printing of ——. F. Iwanowski. Z. Farben-Ind., 1906, 5, 85—86.

A "fairly dark" blue discharge on α-Naphthylamine Claret may, it is stated, be produced with Immedial Indone R conc. and Rongalit C by means of the following printing colour: 80 grms. of Immedial Indone R conc., 40 grms. of caustic soda of 41° B., 40 grms. of glycerin, 370 grms. of alkaline thickening, 50 grms. of china clay, 260 grms. of Rongalit C, and 100 grms. of water. The alkaline thickening is prepared with 400 grms. of gum (1:1), 100 grms. of dextrin, 470 grms. of caustic soda (41° B.), and 30 grms. of turpentine. The goods are printed, steamed for 15 minutes in the absence of air, washed off in cold water, and soaped.—H. L.

Silk Yarn; Imitation ——. U.S. Customs Decision.

The United States Circuit Court of Appeals, January 16, 1906, held that artificial silk yarn, which in texture, quality and use resembles equally silk and cotton yarns, but being in fact produced from short fibre cotton, is not dutiable by similitude as "silk yarn" at 30 per cent. *ad valorem*. In view of the fact that the yarn consists of cellulose, the Court held it to be dutiable by similitude as "cotton yarn" under paragraph 302. This decision overrules both the United States Circuit Court and the Board of General Appraisers. The Treasury Department January 31, 1906, has acquiesced in this decision.

[T.R.] R. W. M.

Chlorine; Action of silent electric discharge on ——. F. Russ. VII., page 264.

English Patents.

Steaming apparatus; Continuous open fabric ——. J. Wood, Ramsbottom, Lancs. Eng. Pat. 1547, Jan. 26, 1905.

The fabric is supported in the steaming chamber in festoons by rods or tubes carried on travelling chains. At the feeding end of the steam chamber the fabric is moved by a pair of nip rollers, which lower it in festoons between the supporting rods. These nip rollers may be readily disengaged and withdrawn by mechanism which is described. An improved festooning arrangement is described, consisting of a swinging guide moved periodically by each rod supporting the fabric as it is carried forward by the endless chain. The fabric may enter and leave at the bottom of the steaming chamber, to enable a greater density of steam to be more conveniently obtained. In any case the fabric enters over suitable steam-heated rollers. The steam may be produced by boiling water, in a well on the floor of the chamber, by means of closed or perforated steam pipes. The steam may be removed by down-take pipes ending near the top of the chamber, and arranged against the inner face of the walls, and similar up-take pipes for the steam may also be used. The rods or pipes supporting the fabric

can be partially rotated, so that all parts of the fabric may be completely exposed to the steam. This is effected by means of star-wheels attached to the ends of the rods, which engage on pins connected with cast-iron supports, on which the star-wheels slide.—E. F.

Shaded effects on fabrics; Method and apparatus for producing —— by padding. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on Maine, Germany. Eng. Pat. 10,195, May 15, 1905.

The invention relates to a padding process for printing fabrics with stripes of colour, so as to produce rainbow effects, and consists in applying the colours or mordants to a well wrapped roller of a padding machine, in such a manner that they merge into one another in unnterrupted gradations, and then transferring them by the pressure of a second roller to the fabric, which passes through the machine. For supplying the wrapped roller with the different solutions, endless bands are used, such as strips of felt, distributed in large numbers over the entire width of the machine, which, by rubbing against the roller, convey to it the colours from a series of vessels below. In another device the colour trough of the machine is divided into separate compartments, each containing one of the solutions, which are conveyed to the wrapped roller by a divided roller rotating in the trough, and having vertical slits to accommodate the partitions separating the different compartments.—D. B.

Galvanisers' waste products; Treatment of —— for the recovery of metal and the formation of other substances [Fireproofing solution and pigment]. S. E. Sanders. Eng. Pat. 4334, March 2, 1905. X., page 268.

Paper, textile fabrics or the like; Coating —— with viscose or mixtures thereof with pigments, and apparatus therefor. L. Lilienfeld and V. Tedesko. Eng. Pat. 5214, March 13, 1905. VI., page 263.

United States Patents.

Substances; Apparatus for degreasing ——. H. Roeske, Assignor to E. Printz, Philadelphia, Pa. U.S. Pat. 810,223, Jan. 16, 1906.

A tank, containing supports for the materials to be treated, is connected by two pipes with the top and bottom respectively of a condenser. Above the supports a propeller is mounted so as to be rotatable in opposite directions. Driven in one of these, it draws air or vapour from the tank to the upper pipe, when the materials are being treated, by a method of partial immersion, in the grease-solvent employed; moved in the opposite direction it forces air and the vaporised solvent through the lower pipe to the condenser, after the greater part of the solvent has been withdrawn from the tank.—E. B.

Potash leaching apparatus [for raw wool]. E. F. Bornhardt, Leisnig, Germany. U.S. Pat. 813,078, Feb. 20, 1906.

The raw wool is fed by rakes into a channel having a perforated bottom, secured over a reservoir containing the washing fluid, and divided into compartments. Sprinkler pipes, supplied by pumps with liquid from the reservoir, are arranged over the channel from the bottom of which the liquid is returned. The compartments into which the reservoir is divided have communicating openings through which the liquid flows from one to the other, the flow being controlled by the influx of water to the last compartment, in which the height of the liquid is regulated by a float. Pressing rollers receive the washed wool from the end of the channel.—E. S.

Fabrics; Process of ageing dyed ——. P. F. Vogel, St. Louis, Mo., Assignor to W. F. Calmore, Philadelphia, Pa. U.S. Pat. 810,312, Jan. 16, 1906.

Fabrics, which have been "subjected to the action of an oxidisable dye," are removed from the bath in which they have been immersed, and are exposed to air, the temperature of which is gradually first increased and then decreased until it has become normal, when they are removed to a chamber in which the ageing is completed, by continuously moving them through an atmosphere at or below the normal temperature.—E. B.

Fabrics; Process of oxidising ——. B. Cleff, Rauenthal, Germany, Assignor to the Susquehanna Silk Mills, New York. U.S. Pat. 810,394, Jan. 23, 1906.

Tissues, after being immersed in a bath containing a salt of aniline or an analogous compound and suitable oxidising compounds, are placed in a drying apparatus in which the oxidation is started. They are then introduced for a relatively short time into a highly heated and moist atmosphere in a closed chamber, where the oxidation is completed.—E. B.

Waterproof compound. O. H. Nowak, Assignor to E. Smith, Chicago, Ill. U.S. Pat. 809,731, Jan. 9, 1906.

The claim is for a waterproofing mixture composed of a dihydroxynaphthylmethane compound, soluble in water, caseïn or other albuminoid or "adhesive," with or without a solvent for the latter, and a "colouring ingredient." The mixture is applied in aqueous solution.—E. B.

Materials or articles resistant to water and chemicals; Process for rendering ——. C. Kochmann and J. Kaufmann, Berlin. U.S. Pat. 813,218, Feb. 20, 1906.

See Eng. Pat. 16,744 of 1905; this J., 1905, 1225.—T.F.B.

French Patents.

Silk; Process of making brilliant threads similar to ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 350,442, Dec. 30, 1904.

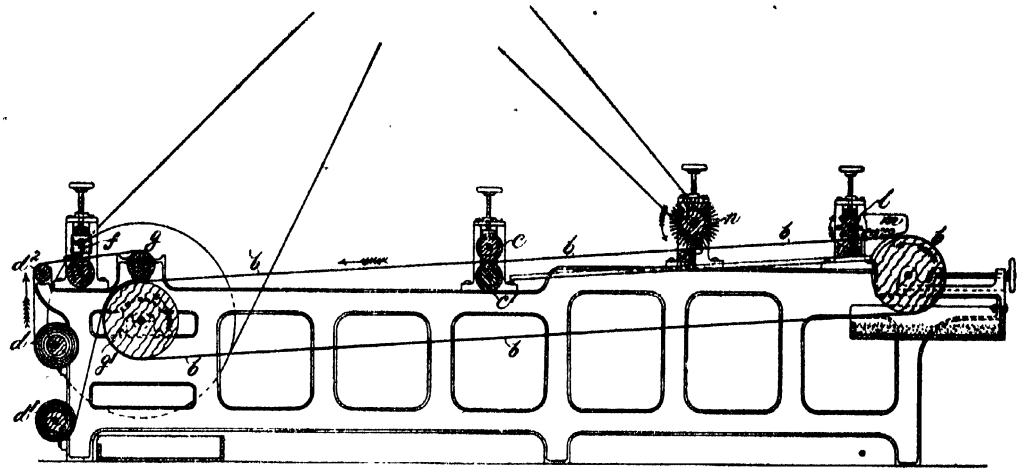
See Eng. Pat. 28,733 of 1904; this J., 1905, 1299.—T.F.B.

Silk charged with tin compounds; Rendering —— resistant to destructive atmospheric agencies, and to perspiration. Soc. Anon. Coop. per la Stagionatura e l'Assaggio delle Sete ed Affini. Fr. Pat. 358,033, Sept. 26, 1905.

To render them more resistant to light, heat, "atmospheric agents," and to the soiling action of perspiration and chlorides, silk yarns and tissues, charged with tin compounds, are treated, after dyeing, with thiourea, quinol (hydroquinone), or a derivative of one of these compounds, quinol- (hydroquinone-) sulphonic acid being mentioned as especially suitable for the purpose. Silk tissues in the pure condition may also be "finished" with the same compounds to enable them to resist staining with chlorides and perspiration. The compounds are applied in solution, in the free state or in the form of salts. They possess the advantage, compared with thiocyanates (sulphocyanides), the use of which has been claimed for the same object (Eng. Pat. 25,728 of 1904; this J., 1905, 129), of not being susceptible to discoloration through contact with iron.—E. B.

Tissues; Machine for coating —— with finely divided materials. The Barnwell Machine Co., Ltd. Fr. Pat. 358,209, Oct. 2, 1905.

This apparatus, designed to effect the coating, in a continuous manner, of textile tissues with layers of finely divided materials, is constructed as follows:—An endless travelling apron, *b*, (*see* figure), driven in the direction indicated by the arrow, receives at a convenient point, *m*, in its course, the finely divided material with which the tissue is to be covered, which is deposited in a rough layer from a fluted cylinder, *l*, revolving in a box with a slit in its bottom. The material is evenly spread by a revolving brush, *n*, and is then pressed down upon the apron by two cylinders, c, c^1. The tissue to be coated is drawn from a roller *d*, to a roller, d^1, passing, on its way to the latter, successively over a roller, d^2, under a device, *f*, where a solution of indiarubber in solvent naphtha, or a similar adhesive solution, is applied to its surface, and, finally, between two pressure rollers, g, g^1. Here, the tissue and apron being brought into contact,



the layer of finely divided material is transferred from the latter to the prepared surface of the former.—E. B.

Textile tissues and wood; Use of non-hygroscopic compounds [Borate and phosphate of zinc] in rendering —— non-inflammable. H. Rose. Fr. Pat. 350,378, Dec. 7, 1904.

Textile tissues, wood and similar materials, are rendered non-inflammable by precipitating upon them zinc phosphate, zinc borate, or a mixture of both compounds. These are applied in ammoniacal solution, and become deposited in and upon the materials as the ammonia is volatilised during the process of drying the materials. The compounds employed, do not, it is stated, effloresce or absorb moisture from the air.—E. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 179.)

English Patent.

Paper, textile fabrics or the like; Coating —— with viscose or mixtures thereof with pigments, and apparatus therefor. L. Lilienfeld and V. Tedesko. Vienna. Eng. Pat. 5214, March 13, 1905.

In order to obtain uniform coatings on continuous supports, the paper, to which the viscose has been applied, is passed round a supporting roller, beside or above which revolves a distributing roller at a suitable speed in a direction contrary to that in which the paper is travelling, a doctor or scraper being applied to the periphery of the distributing roller to remove the excess of viscose taken from the coated surface by the roller.—D. B.

German Patents.

Dyeing leather; Process of ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 164,504, June 5, 1904.

Leather is dyed by immersion in a solution of an aminoliphenylaminesulphonic acid and an oxidising agent, with or without addition of another dyestuff; the liphenylamine derivative is obtained by condensing *o*-nitrochlorobenzenesulphonic acid (NO_2:SO_3H:Cl = 1:3:4) with *m*-phenylenediamine, chloro-*m*-phenylenediamine, or *m*-toluylenediamine, and reducing the product. Grey-blue to blue-black shades are obtained on chrome leather, and grey-black on ordinary leather by this method.

—T. F. B.

Dyeing leather with sulphide dyestuffs; Process of ——. L. Cassella und Co. Ger. Pat. 163,621, June 18, 1904.

The present specification deals with a process of dyeing leather with sulphide dyestuffs without the use of an alkali sulphide as solvent, the solvent used in the present case is a solution of a formaldehyde-hydrosulphite compound.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 219.)

Arsenic from hydrochloric acid; Removal of ——, for use in the Marsh-Berzelius method. A. R. Ling and T. Rendle. XXIII., page 285.

Sodium carbonate and hydroxide; Densities of solutions of ——. R. Wegscheider. Monatsh. f. Chem. 1906, 27, 13—30.

The author has recalculated his formulæ (this J. 1905, 730), as he found that some of Lunge's densities were based on water at 4° C., and others not. He has corrected the latter accordingly, and the resulting formulæ are, for sodium carbonate:—

$$d_t = d_{(w)t} + (0{\cdot}053348 - 0{\cdot}0^4 5650t + 0{\cdot}0^6 3603t^2)N_t - (0{\cdot}0010962 - 0{\cdot}0^5 3583t + 0{\cdot}0^7 1873t^2)N_t^2$$

or

$$d_t = d_{(w)t} + (0{\cdot}0103829 - 0{\cdot}0^4 15527t + 0{\cdot}0^7 643t^2)P + (0{\cdot}0^4 3689 + 0{\cdot}0^6 1534t - 0{\cdot}0^8 865t^2)P^2,$$

and for sodium hydroxide

$$d_t = d_{(w)t} + (0{\cdot}0116027 - 0{\cdot}0^4 25111t + 0{\cdot}0^6 10222t^2)P - (0{\cdot}0^4 10817 - 0{\cdot}0^6 367 48t + 0{\cdot}0^8 2034t^2)P^2.$$

For discussion of the limits of agreement with observations the original must be consulted.—J. T. D.

Bismuth, Peroxides of ——. I. Oxidation of bismuth compounds by gaseous chlorine in presence of potassium hydroxide solution; the so-called "bismuthic acid" and the so-called "bismuth tetroxide dihydrate." A. Gutbier and R. Bünz. Z. anorg. Chem., 1906, 48, 162—184.

The authors made an exhaustive investigation on the action of gaseous chlorine on bismuth compounds in presence of potassium hydroxide solution, Deichler's experiments (this J., 1899, 616) being repeated. It was found that for the formation of peroxides of bismuth, the presence of alkali and its nature and concentration are of importance. It is only in presence of potassium hydroxide that compounds are formed, which yield yellow to red coloured products on treatment with concentrated nitric acid. It was found that those products which yielded the largest quantity of the red-coloured peroxide on treatment with nitric acid, contained the greatest proportion of active oxygen. Notwithstanding numerous attempts, the authors were unable, by the action of

chlorine on bismuth compounds, in presence of potassium hydroxide, to obtain uniform products or to isolate from the reaction-products definite chemical compounds. They are, therefore, unable to confirm previous statements as to the existence of "bismuthic acid" and "bismuth tetroxide dihydrate."—A. S.

Bismuth; Peroxides of ——. *II. Oxidation of bismuth oxide by electrolytic chlorine in presence of potassium hydroxide, and the so-called "potassium bismuthate."* A. Gutbier and R. Bünz. Z. anorg. Chem., 1906, **48**, 204—206.

Deichler, in 1899 (this J., 1899, 616), stated that the hitherto unknown "potassium bismuthate, $KBiO_3$," is formed when a mixture of bismuth oxide, potassium hydroxide solution, and potassium chloride is electrolysed. The authors have repeated Deichler's experiments, but have never succeeded in obtaining a homogeneous substance; the product of the electrolysis is not a "potassium bismuthate," but a mixture of compounds, as previously described (see preceding abstract). On treating the product with hot, concentrated nitric acid, there is obtained not "bismuthic acid" as stated by Deichler, but a mixture of peroxides of bismuth.—A. S.

Phosphorus sulphides. H. Giran. Comptes rend., 1906, **142**, 398—400.

The author heated to a high temperature in sealed tubes, mixtures in various proportions of sulphur and phosphorus, and determined their solidifying points. There were four maxima on the resulting curve, at 167°, 296°, 272°, and 314° C., corresponding to the four compounds P_4S_3, P_2S_3, P_2S_5, and PS_4, and four minima indicating eutectics near in composition to P_2S, PS, PS_2, and PS_3.—J. T. D.

Sulphur, sulphate; The system ——. K. Brückner. Monatsh. f. Chem., 1906, **27**, 49—58.

The author has systematically examined the action of sulphur on metallic sulphates, when heated with them in a covered porcelain crucible, or when its vapour is passed over the red-hot salts. The alkali and alkaline-earth sulphates all yield mixtures of sulphide, thiosulphate and polysulphide, probably formed by the following reactions:—

$2M_2SO_4 + S = 2M_2SO_3 + SO_2$; $4M_2SO_3 = M_2S + 3M_2SO_4$;
$M_2SO_3 + S = M_2S_2O_3$; $4M_2S_2O_3 = M_2S_5 + 3M_2SO_4$.

The sulphates of magnesium, beryllium, and aluminium practically do not react with sulphur. The sulphates of other metals all yield sulphides, but in some cases the sulphide and oxide react and yield the metal (bismuth, lead, antimony), and in some cases the oxide itself is formed (uranium).—J. T. D.

Chlorine; Action of the silent electric discharge on ——. F. Russ. Monatsh. f. Chem., 1905, **26**, 627—646.

Kellner, in 1891, patented a process for increasing the bleaching effect of chlorine by subjecting it to the action of the silent electric discharge (Eng. Pat. 22,438 of 1891; this J., 1892, 354). Mellor, in 1904, found that chlorine, which had been subjected to the electric discharge, showed a shorter induction period in the reaction between hydrogen and chlorine under the influence of light than ordinary chlorine (see Chem. Soc. Proc., 1904, **20**, 140, 196). The author has investigated this "activation" of chlorine, using as a basis of measurement the action of the chlorine on benzene. It was found that the effect is due to the combined action of ultra-violet light rays and the silent electric discharge, and is much less pronounced if one of these factors be suppressed. The rate of "activation" of the chlorine is greater in a quartz vessel than in a glass one, the former being penetrated more readily by the ultra-violet rays. Chlorine dried by means of sulphuric acid or phosphorus pentoxide is not so susceptible to the effect of the electric discharge or ultra-violet rays as ordinary moist chlorine. The active chlorine retains its activity for long periods at the ordinary temperature, but is rendered inactive by heating, by the passage of electric sparks, or by treatment with water. (See also Fr. Pat. 352,198 of 1905; this J., 1905, 892.)—A. S.

Pyrites; Determination of sulphur in ——. F. Raschig. XXIII., page 285.

Nitrogen combustion; Theory of the ——. P. A. Guye. XI*A*., page 270.

English Patents.

Lime; Process for hydrating ——. J. Reaney, jun., Baltimore, U.S.A. Eng. Pat. 20,454, Oct. 10, 1905.

See U.S. Pat. 803,506 of 1905; this J., 1905, 1230—T. F. B.

Leucite and substances containing the same; Process for treating ——. A. Piva, Rome. Eng. Pat. 2463, Feb. 7, 1905.

See Fr. Pat. 351,338 of 1905; this J., 1905, 845.—T. F. B.

Air; Liquefying atmospheric —— *in several portions differing in composition.* Soc. l'Air Liquide, Paris. Eng. Pat. 26,435, Dec. 19, 1905. Under Int. Conv., March 30, 1905.

See Fr. Pat. 352,856 of 1905; this J., 1905, 969.—T. F. B.

United States Patents.

Potash leaching apparatus [for raw wool]. E. F. Bernhardt. U.S. Pat. 813,078, Feb. 20, 1906. V., page 262.

Metallic oxides; Process and apparatus for producing ——. L. Fink-Huguenot, Paris. U.S. Pats. 813,785 and 813,786, Feb. 27, 1906.

See Fr. Pat. 342,432 of 1904; this J., 1904, 936.—T. F. B.

French Patent.

Cupric chloride; Manufacture of ——, *and its transformation into cupric sulphate.* G. Darier. Fr. Pat. 350,421, Dec. 22, 1904.

Copper turnings and water are subjected in a closed stone vessel (having the usual inlets and outlets) to the action of chlorine gas. The action is feeble at first, but becomes vigorous owing to the formation of cuprous chloride, which quickly absorbs chlorine, with rise of temperature, to form the cupric salt, the solution of which is withdrawn and crystallised. By heating the crystallised cupric chloride with strong sulphuric acid, in a suitable vessel connected to a receiver for collection of the hydrochloric acid evolved, cupric sulphate is formed.—E. S.

German Patents.

Hydrochloric acid containing arsenic; Process for the purification of ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 164,355, April 15, 1904.

The process consists in treating the impure acid with compounds of vanadium dioxide. When an indigo blue, sulphuric acid or hydrochloric acid solution of vanadium dioxide is added to hydrochloric acid containing arsenic, metallic arsenic is immediately precipitated, especially if the acid be warm. The blue colour of the vanadium dioxide compounds changes to the green of vanadium sesquioxide compounds. In practice the hydrochloric acid gas from the salt-cake pans or furnaces is led through a concentrated hydrochloric acid solution of vanadium dioxide contained in an earthenware vessel, perforated plates being provided to ensure intimate contact between liquid and gas. When the vanadium solution is exhausted, the separated arsenic is filtered off, and the vanadium sesquioxide re-converted into vanadium dioxide electrolytically.—A. S.

Sulphuric acid obtained by the contact process; Method for the clarification and purification of ——. M. Liebig. Ger. Pat. 164,722, July 24, 1904.

Sulphuric acid manufactured by the contact process is dark-coloured, probably owing to organic impurities. According to this invention the acid is treated at the ordinary temperature with a metallic peroxide, such as lead peroxide or barium dioxide, and then passed through a suitable filter, *e.g.*, a sand-filter.—A. S.

Carnallite and other haloid double salts of the alkaline-earths; Apparatus for the continuous treatment of fused —— by electrolysis. E. Haag and F. Glinicke. Ger. Pat. 163,413, Jan. 20, 1904. XI*A*., page 271.

Sodium chromate; Electrolytic manufacture of —— from chrome iron ore. Chem. Fabr. in Billwärder vorm. Heil und Sthamer A.-G. Ger. Pat. 163,541, Feb. 28, 1904. XI*A*., page 271.

Ammonia-soda manufacture; Process for the [electrolytic] treatment of the waste solutions of —— with recovery of brine for use over again. A. Riedel. Ger. Pat. 164,726, March 8, 1904. XI*A*., page 271.

Cyanamide; Process for preparing —— from sodium-cyanamide solutions. Deutsche Gold- und Silberscheide-Anstalt vorm. Roessler. Ger. Pat. 164,724, March 17, 1904.

SODIUM-CYANAMIDE solution is mixed with sulphuric acid in sufficient quantity to render it neutral or very faintly acid, the concentrations of the solution and of the acid being so adjusted that the total quantity of water present is not greater than that which can be fixed by the sodium sulphate produced, to form Glauber's salt. The cake of Glauber's salt and cyanamide is extracted with absolute alcohol or ether, and the cyanamide is recovered from the solution by crystallisation. A. S.

Sulphuretted hydrogen and finely divided sulphur; Process of Producing ——. P. Mochalle. Ger. Pat. 164,322, April 12, 1904.

SUGAR (100 grms.) is melted with sulphur (5 to 10 grms.), and heated for ten minutes; the melt is allowed to cool, and is then broken up. On treatment with water, hydrogen sulphide is evolved, and sulphur, in a finely divided state, separates. The melt may, if desired, be dissolved in sodium carbonate solution, evaporated to dryness, and then treated with water.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 219.)

Potters' materials; Plasticity of ——. J. W. Mellor. Trans. Eng. Ceramic Soc., 1905-6, **5**, 72—73.

THE author heated separately ground felspar and ground Cornish stone with water, under great pressure (below 75 atmospheres) in sealed tubes for a few days, at from 250° to 300°. Four important facts were noticed. First, the plasticity of the materials was increased, and the new plasticity was not of the pseudo or temporary character produced by the addition of foreign materials like soft soap, tannin, gums, &c. Second, the outlines of the particles, under the microscope, had lost their clear, sharp definition, and become more or less irregular and blurred. Cushman found the same difference in a less degree between felspar ground in cold water and felspar ground dry. Third, the outlines could be more readily stained with Safranine or with Malachite Green than before the action. Fourth, the water in which the materials were heated, after the action, contained a quantity of soluble salts. This agrees with an experiment of Daubrée's, in which a solution of potassium silicate was obtained by the prolonged action of water upon ground felspar.

The author has applied the same treatment to other bodies with the following results:—With ground flint, there was little, if any, perceptible difference before and after treatment. The plasticity of china clay was slightly improved, while ground earthenware and china pitchers "became relatively quite plastic." He points out that only those materials were made appreciably plastic that contain alkalis in combination with silica and alumina, and considers that liquid water and not steam is the potent agent. The process also works better if the water is changed, probably because this prevents the recombination of the soluble materials with the bodies from which they have been removed.—W. C. H.

Porcelain body and its toughness; Relation between the composition of a ——. E. Ogden. Trans. Amer. Ceramic Soc., 1905, **7**, 370—396.

A LARGE number of mixtures were made from the following raw materials:—Brandywine felspar, Golding's flint, English ball clay, English china clay, and English whiting. All the porcelains were burnt at the temperature of cone 10. It was found that an increase in the RO fluxes (alkalis and alkaline-earths) increased the translucency and fineness of structure. The greatest toughness was shown with 0·25 RO, the toughness decreasing as the RO fluxes increase; if part of the RO consisted of lime, an increase in stoniness and toughness was noted. For the same RO content, an increase in clay increased the fineness of structure and degree of vitrification, but rendered the porcelain more brittle.—A. G. L.

China bodies in the enamel kiln; Cause and prevention of the brown stain in ——. B. Moore. Trans. Eng. Ceramic Soc., 1905—6, **5**, 37—41.

BROWN patches and blotches sometimes appear when the ware is fired in the enamel kiln, although when taken from both the biscuit and glost ovens it may have looked sound and good (often, however, of a greenish tint). The defect appears to have first occurred in the Longton district about 25 years ago. Chemical analysis of defective pieces did not indicate anything abnormal to account for the stains. The author took as a normal china body:—44 parts of bone ash, 30 of stone, and 26 of clay. Experiments with every variety of bone procurable, did not show the cause of the stains, and with a dry buff variety of stone, green-coloured ware was always obtained, and the tint was improved, towards white, by an increase of this constituent. Brown-stained ware was, however, always obtained when the stone was decreased, and the clay increased, for example, with a mixture of bone, 44; stone, 23·5; and clay, 32·5 parts.

The author discusses three factors that influenced the introduction of such a body composition, *viz.*:—1. The use of a very dry stone. 2 Too much clay compared with stone. 3. An improper system of mixing—the most important of all.

The use of a very dry stone became prevalent about 30 years ago, and, as the china body seemed deficient in plasticity, an increased amount of clay was employed, and a body of the type: 44 parts of bone, 28 of stone, and 28 of clay came to be used. With regard to mixing, the change from the slip kiln to the press, diminished the chances of good mixing which arose in the case of the slip kiln. Further, in many cases, the second "ark" in the slip house is not large enough to hold the whole of the charge of bone, stone and clay, fed into the first ark or "rough pot," so that if any material is taken out of the second ark before all the charge in the first has been "blunged," the slip cannot be uniform.

The author considers that the green colour is due to a ferrous phosphate, which changes in the kiln to a ferric phosphate. From some experiments made with mixtures of bone ash and silica and fired at an "easy" and a full heat, and from the losses in weight after firing, it was found that the phosphoric acid displaced by silica, appeared to distribute itself among the bases present, when the materials were well mixed, and not fired in layers. Consequently this distribution would be most likely to occur in pressed ware, which is said to be nearly always the case in practice; pressed ware shows a darker colour than cast ware.—W. C. H.

Glazes; Cornwall stone and felspar in raw lead ——. L. B. Coulter. Trans. Amer. Ceramic Soc., 1905, **7**, 356—369.

IT is found that raw lead glazes shrink less in drying and burning when Cornwall stone is used as an ingredient than with felspar, the reason being that when the latter is used, additional alumina in the form of clay must be supplied, and that the clay has a high drying and burning shrinkage. If the Cornwall stone or felspar is used merely as a source of alkali, the first produces the more fusible glaze for a low requirement of alkali, whilst, if much alkali is needed, felspar gives a more fusible glaze. This arises from the

fact that in the Cornwall stone the alkaline-earths and alkalis are already more or less combined with the alumina and silica, and hence fuse more readily than is the case with felspar, to which additional silica and alumina must be added; on the other hand, if much alkali is wanted, the quantities of alumina and silica added, if it is introduced as Cornwall stone, are so high as to give a refractory glaze. The cost of Cornwall stone glazes exceeds that of felspar glazes by about 2 or 3 per cent. (in the United States).—A. G. L.

Glazes; Solubilities of metallic oxides in ——. I. and II. C. E. Ramsden. Trans. Eng. Ceramic Soc., 1905–6, **5**, 1—23.

GLAZES are mixtures of various silicates and borates and cannot be regarded as definite chemical compounds. The physical characteristics of a glaze are those of a solid solution. The section of a piece of glazed ware shows three layers—(*a*) an outer skin of clear glaze, (*b*) an intermediate layer consisting of glaze and body mixed in varying proportions and (*c*) the body itself. As in the case of the aqueous solution of a salt, so in the case of a glaze to which an excess of a metallic oxide has been added; after cooling, there is no evidence at present as to what are the relative proportions of oxide which has been dissolved and then again separated, and oxide which has been undissolved all through the experiment. Further, in the case of glazes, the colouring matter which has been dissolved may separate, not as free oxide, but combined with some constituents of the glaze. The amount of metallic oxide that a glaze can take up whilst still remaining clear depends upon (*a*) the chemical composition of the glaze, (*b*) the physical properties of the glaze, such as viscosity, fluidity, &c., (*c*) the physical condition of the chromatic oxide, (*d*) the temperature to which it is subjected, and (*e*) the rate of cooling.

The object of the investigation was to gain information on these points, and also to note the effect of variations of the glaze formula, and of temperature on the colour obtained; the effect of variations of the amount of metallic oxide used, and what volatilisation of it, if any, occurred. Twelve series of glazes, maturing at about 1050° C., were made, the proportions of the constituents being varied in the individual members of each series. The glazes ranged from the comparatively simple mixtures of litharge and silica to more complex forms containing sodium carbonate, lime, boric acid, &c.; wherever possible they were compounded "raw," only those containing alkalis and boric acid being fritted. Definite percentages of oxides of nickel, manganese, chromium, copper, iron, cobalt and uranium were introduced (only the first and second are considered in this paper). At least three different mixtures of each oxide were made with each glaze, and fired at 1000°, 1050°, and 1100° C.; the cooling curves are given for each temperature, the last being steeper than either of the others. All the trials with plumbic glazes were fired under fire-clay boxes, smeared with a particular glaze ($1{\cdot}0PbO$; $0{\cdot}1Al_2O_3$; $1{\cdot}2SiO_2$); and the leadless trials under boxes smeared with a glaze of the following composition:—

$$\left.\begin{matrix}0{\cdot}6Na_2O\\0{\cdot}4CaO\end{matrix}\right\}\ \left\{\begin{matrix}0{\cdot}1Al_2O_3\\0{\cdot}5B_2O_3\end{matrix}\right.\ \left\{\begin{matrix}2{\cdot}5SiO_2\\\end{matrix}\right.$$

I. Nickel oxide.—The solubility of this oxide, in glazes maturing at a temperature not exceeding 1100° C., never exceeds 1 per cent. of the protoxide, but varies with the composition of the glaze. In lead glazes the amount of nickel oxide dissolved can be increased by raising the acidity to 1·5 molecular part, by increasing the content of silica, and also in the same way with alkali glazes, and an increase of temperature in both cases seems to increase the solubility. In both lead and alkali glazes the solubility is increased by substituting boric acid for silica, while maintaining the high acidity; but the molecular ratio of silica to boric acid must never be less than 2 to 1, or opalescence will occur, even with moderately quick cooling. The solubility is also increased by the addition of a small quantity of tin oxide, not exceeding 2 per cent., to a lead glaze; the increased solubility is probably due to the solution of a small quantity of tin oxide in the glaze, the acidity of which is thus increased. In both lead and alkali glazes an increase in alumina decreases the solubility of the nickel oxide, and raising the firing temperature does not counteract its effect; on the other hand, devitrification may occur if the alumina content is decreased too much. To ensure solubility in the absence of R_2O bases, the PbO must not be less than 0·7 of a molecular part; if the PbO exceeds that amount, the solubility may be increased by replacing a portion of it by other RO bases, such as lime, zinc oxide, and, in some cases, magnesia. Though no single oxide is as powerful a solvent as lead oxide, yet a mixture of bases is better than any one alone. Zinc oxide increases the solubility in a very distinct way, and may replace lead oxide up to 0·2 of a molecular part. The solubility is also increased by replacing lead oxide and other RO bases by alkalis.

It was found from the trials that the best results were obtained at a firing temperature of 1050°; in most cases at 1100° C. dark spots occurred, due to local separation of the nickel oxide. These separations are less likely to occur when the rate of cooling is rapid. With lead glazes the colour was straw-brown, except when magnesia was present, when the colour became distinctly green, especially at 1100° C. The alkali glazes were grey, but an increase of nickel oxide, alumina, or boric acid in them converted the colour to brown. No volatilisation of nickel oxide was detected in these experiments.

II. Manganese oxide.—In this set of experiments, manganese carbonate was used in amounts equivalent to 1, 2, and 4 per cent of the monoxide, and with the glazes used, the amounts dissolved varied between these extremes, at temperatures below 1100° C. The solubility is increased by altering the composition of the glaze in the same ways as described for nickel oxide, with two exceptions. Unlike nickel oxide, the solubility of manganese oxide is not affected by the addition of alumina to an alkali glaze. In both the oxides considered, the decrease in solubility that accompanies the increase of alumina, may be due to the increased viscosity of the glaze by alumina. In the case of manganese oxide, the replacement of part of the silica by boric acid does not increase the solubility of the oxide. Though firing at 1050° increased the amount of oxide dissolved, better colours were obtained at 1000° C., and, as before, coloured separations are less likely to occur when the rate of cooling is rapid. The colour of the glazes with manganese oxide, generally claret-brown, is considerably modified by alteration in the composition of the glazes, and of the firing temperature. An increase of silica, or the presence of litharge, zinc oxide or lime, gave pink tints, but alumina and boric acid gave brown tints. The only indication of volatilisation was that some of the glazes, containing 4 per cent. of manganese monoxide, were coated with a film, apparently of condensed manganese oxide.

The colouring matter is the most expensive component of "majolica" glazes; hence these experiments have a practical value, in that they show the conditions necessary for the solubility of the oxide, and the conditions that affect the colour, which is generally better when the solubility is complete, whilst many defects arise from the separation in the glaze of colouring compounds and from supersaturation.—W. C. H.

[Glass] Beakers. U.S. Customs Decision, Jan. 22, 1906.

BEAKERS used for chemical purposes are dutiable at 60 per cent. *ad valorem* as "blown glass ware" under paragraph 100 of the present tariff. [T.R.] R. W. M.

Glassware; Chemical ——. U.S. Customs Decision, Jan. 29, 1906.

PHOTOGRAPHIC baths and glass tubing are dutiable at 60 per cent. *ad valorem* under paragraph 100, as "blown glassware," and evaporating dishes, the edges of which had been ground and polished, are dutiable at the same rate and the same paragraph as "ground glassware." [T.R.]
R. W. M.

ENGLISH PATENT.

Clay or similar materials; Drying of various substances, such as ——. T. M. Stocker, St. Austell, Cornwall. Eng. Pat. 2102, Feb. 2, 1905.

THE invention consists essentially in securing a more even heating of the drying chamber by arranging that the air necessary for the combustion of the producer or other gas in the flues below the drying chamber, enters by a number of ports distributed along these flues. The flues may be constructed according to the inventor's Eng. Pat. 2097 of 1905 (this J., 1906, 219).—A. G. L.

FRENCH PATENT.

[*Ceramic objects.*] *Use in the ceramic industry of earths occurring in alluvial deposits, either naturally of special composition, or else artificially mixed.* J. Dessane. First Addition, dated Sept. 27, 1905, to Fr. Pat. 354,201, May 9, 1905 (this J., 1905, 1110).

IN order to do away with the grinding of the worked clay, as described in the main patent, which grinding is necessary only to incorporate uncombined particles of iron oxide and of silica with the mass, the clay is purified from these particles by levigation as usual. The resulting loss of about 15 per cent. of the material is more than counterbalanced by the gain due to avoiding grinding, requiring a lower temperature for the burning and giving higher value to the finished article.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 220.)

Bauxite; Advantages of —— as a refractory material. A. J. Aubrey. Eng. and Mining J., 1906, **81**, 217–218.

THE advantages of bauxite as a refractory material for lining open-hearth furnaces, rotary cement kilns and lead-refining furnaces are discussed. It is stated that a lining of bauxite, 6 in. thick, in a cement kiln was in good condition after ten months' continuous service, and that, as a lining for lead-refining furnaces, bauxite lasts from five to six times as long as firebrick.—A. S.

UNITED STATES PATENTS

Dust in roads; Process for the prevention and laying of ——. W. M. Sandison, Ayton, Scotland, Assignor to H. G. McKerrow, Newton, Mass. U.S. Pat. 813,389, Feb. 20, 1906.

SEE Eng. Pat. 18,904 of 1904; this J., 1905, 443.—T. F. B.

Cement-kiln; Oscillating ——. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York, N.Y. U.S. Pat. 812,834, Feb. 20, 1906.

THE cement-kiln consists of an inclined barrel, lined with refractory material, of greater lateral than vertical diameter, and which can be automatically rocked. The kiln tapers from the lower end, at which there is arranged an exterior furnace with grate and ash-pit, to the higher end, which communicates with a stack and feed for the raw material. A conduit fitted with a fan-blower is also arranged so as to return products of combustion from the stack end to the ash-pit below the grate.—A. G. L.

Cement; Production of ——. B. Grau, Kratzwieck, Germany. U.S. Pat. 813,965, Feb. 27, 1906.

SEE Fr. Pat. 343,152 of 1904; this J., 1904, 985.—T. F. B.

FRENCH PATENTS.

Building material; Silico-calcareous ——. C. de la Roche. Fr. Pat. 350,340, Nov. 23, 1904.

SEE Eng. Pat. 25,884 of 1904; this J., 1905, 1233.—T.F.B.

Textile tissues and wood; Use of non-hygroscopic compounds [Borate and phosphate of zinc] in rendering —— non-inflammable. H. Rose. Fr. Pat. 350,378, Dec. 7, 1904. V., page 263.

Wood; Process of caulking —— during impregnation or dyeing. G. Kron. Fr. Pat. 358,602, Oct. 17, 1905. Under Int. Conv., Jan. 9, 1905.

SEE Eng. Pat. 20,791 of 1905; this J., 1906, 122.—T.F.B.

Fireproofing combustible materials; Solution for ——. The Fire-Resisting Corporation, Ltd. Fr. Pat. 358,736, Oct. 21, 1905. Under Int. Conv., March 13, 1905.

SEE Eng. Pat. 5209 of 1905; this J., 1906, 182.—T. F. B.

Stone and pavements; Manufacture of artificial —— E. Philippe. Fr. Pat. 350,439. Dec. 30, 1904.

FOR making artificial stone, 1000 litres of sea-sand, and 500 of calcined magnesia are mixed with 75 litres of a magnesium chloride solution at 34° B., containing 1 per cent. by weight of calcined alum, 2 of zinc carbonate, 3 of lead acetate, and 2 of mercuric chloride, and with 25 litres of a solution of zinc sulphate at 12° B. For pavements, wall-facings, &c., 25 litres of soft sawdust, 2 of crushed stone, &c., and 9 of magnesia are mixed with sufficient of the above two liquids to give a semi-liquid paste.—A. G. L.

Furnace with generator gas as fuel, for roasting limestone, dolomite and other analogous materials. E. Schmatolla. First Addition, dated Sept. 26, 1905, to Fr. Pat. 352,549, Feb. 17, 1905.

THE improvement in the furnace described in the main patent (compare Eng. Pat. 4245 of 1905; this J., 1905, 925) consists in distributing the gas by bringing the latter through a channel to the middle of the base of the furnace, the channel then dividing into others arranged in a cross, star or T-form. These channels end in the ascending ones. A portion of the gas is introduced into the interior of the furnace by a central channel ascending directly from the middle of the base of the furnace.—B. N.

Silicon carbide; Process of making solid moulded forms of ——. Gebr. Siemens und Co. Fr. Pat. 358,599, Oct. 17, 1905.

SEE Eng. Pat. 21,347 of 1905; this J., 1906, 122.—T. F. B.

Cement; Manufacture of impermeable and acid-resisting ——. R. Liebold. First Addition, dated Oct. 5, 1905, to Fr. Pat. 345,421, Aug. 8, 1904 (this J., 1905, 31).

IN the present modification the impregnation of the burnt but unground cement with a solution of a fatty material is made whilst the cement is still warm (at about 50° C.), the water used for dissolving the fatty material being quickly driven off by the heat contained in the cement, which latter can consequently be ground immediately after the impregnation. Suitable fatty materials are ½ per cent. of Japan wax or ¼ per cent. of fatty acids (stearine) dissolved in a hot alkaline solution.—A. G. L.

X.—METALLURGY.

(*Continued from page* 222.)

Blende and precipitated zinc sulphide; Roasting of ——. J. Krutwig. Congrès de Chim. Pharm., Liège, Sec. II., 419.

WHEN blende or precipitated zinc sulphide is heated in a stream of air, decomposition begins about 450° C. with the former, and 327° C. with the latter; in a stream of oxygen the respective temperatures are 366° and 280° C. At temperatures above these, the decomposition of the precipitated sulphide is always more rapid, and proceeds farther than that of blende, and is, indeed, more rapid in air than that of blende in oxygen. In no case is the proportion of sulphate formed considerable; its absolute amount increases with the temperature, though but slightly (to 6—8 per cent.), but the ratio of sulphate to oxide is smaller at high than at low temperatures. This is

fact that in the Cornwall stone the alkaline-earths and alkalis are already more or less combined with the alumina and silica, and hence fuse more readily than is the case with felspar, to which additional silica and alumina must be added; on the other hand, if much alkali is wanted, the quantities of alumina and silica added, if it is introduced as Cornwall stone, are so high as to give a refractory glaze. The cost of Cornwall stone glazes exceeds that of felspar glazes by about 2 or 3 per cent. (in the United States).—A. G. L.

Glazes; Solubilities of metallic oxides in ——. I. and II. C. E. Ramsden. Trans. Eng. Ceramic Soc., 1905–6, **5**, 1—23.

GLAZES are mixtures of various silicates and borates and cannot be regarded as definite chemical compounds. The physical characteristics of a glaze are those of a solid solution. The section of a piece of glazed ware shows three layers—(*a*) an outer skin of clear glaze, (*b*) an intermediate layer consisting of glaze and body mixed in varying proportions and (*c*) the body itself. As in the case of the aqueous solution of a salt, so in the case of a glaze to which an excess of a metallic oxide has been added; after cooling, there is no evidence at present as to what are the relative proportions of oxide which has been dissolved and then again separated, and oxide which has been undissolved all through the experiment. Further, in the case of glazes, the colouring matter which has been dissolved may separate, not as free oxide, but combined with some constituents of the glaze. The amount of metallic oxide that a glaze can take up whilst still remaining clear depends upon (*a*) the chemical composition of the glaze, (*b*) the physical properties of the glaze, such as viscosity, fluidity, &c., (*c*) the physical condition of the chromatic oxide, (*d*) the temperature to which it is subjected, and (*e*) the rate of cooling.

The object of the investigation was to gain information on these points, and also to note the effect of variations of the glaze formula, and of temperature on the colour obtained; the effect of variations of the amount of metallic oxide used, and what volatilisation of it, if any, occurred. Twelve series of glazes, maturing at about 1050° C., were made, the proportions of the constituents being varied in the individual members of each series. The glazes ranged from the comparatively simple mixtures of litharge and silica to more complex forms containing sodium carbonate, lime, boric acid, &c.; wherever possible they were compounded "raw," only those containing alkalis and boric acid being fritted. Definite percentages of oxides of nickel, manganese, chromium, copper, iron, cobalt and uranium were introduced (only the first and second are considered in this paper). At least three different mixtures of each oxide were made with each glaze, and fired at 1000°, 1050°, and 1100° C.; the cooling curves are given for each temperature, the last being steeper than either of the others. All the trials with plumbic glazes were fired under fire-clay boxes, smeared with a particular glaze ($1{\cdot}0PbO$; $0{\cdot}1Al_2O_3$; $1{\cdot}2SiO_2$); and the leadless trials under boxes smeared with a glaze of the following composition:—

$$\left.\begin{matrix}0{\cdot}6Na_2O\\0{\cdot}4CaO\end{matrix}\right\}\ \left\{\begin{matrix}0{\cdot}1Al_2O_3\\0{\cdot}5B_2O_3\end{matrix}\right.\ \left\{\begin{matrix}2{\cdot}5SiO_2\\\end{matrix}\right.$$

I. Nickel oxide.—The solubility of this oxide, in glazes maturing at a temperature not exceeding 1100° C., never exceeds 1 per cent. of the protoxide, but varies with the composition of the glaze. In lead glazes the amount of nickel oxide dissolved can be increased by raising the acidity to 1·5 molecular part, by increasing the content of silica, and also in the same way with alkali glazes, and an increase of temperature in both cases seems to increase the solubility. In both lead and alkali glazes the solubility is increased by substituting boric acid for silica, while maintaining the high acidity; but the molecular ratio of silica to boric acid must never be less than 2 to 1, or opalescence will occur, even with moderately quick cooling. The solubility is also increased by the addition of a small quantity of tin oxide, not exceeding 2 per cent., to a lead glaze; the increased solubility is probably due to the solution of a small quantity of tin oxide in the glaze, the acidity of which is thus increased. In both lead and alkali glazes an increase in alumina decreases the solubility of the nickel oxide, and raising the firing temperature does not counteract its effect; on the other hand, devitrification may occur if the alumina content is decreased too much. To ensure solubility in the absence of R_2O bases, the PbO must not be less than 0·7 of a molecular part; if the PbO exceeds that amount, the solubility may be increased by replacing a portion of it by other RO bases, such as lime, zinc oxide, and, in some cases, magnesia. Though no single oxide is as powerful a solvent as lead oxide, yet a mixture of bases is better than any one alone. Zinc oxide increases the solubility in a very distinct way, and may replace lead oxide up to 0·2 of a molecular part. The solubility is also increased by replacing lead oxide and other RO bases by alkalis.

It was found from the trials that the best results were obtained at a firing temperature of 1050°; in most cases at 1100° C. dark spots occurred, due to local separation of the nickel oxide. These separations are less likely to occur when the rate of cooling is rapid. With lead glazes the colour was straw-brown, except when magnesia was present, when the colour became distinctly green, especially at 1100° C. The alkali glazes were grey, but an increase of nickel oxide, alumina, or boric acid in them converted the colour to brown. No volatilisation of nickel oxide was detected in these experiments.

II. Manganese oxide.—In this set of experiments, manganese carbonate was used in amounts equivalent to 1, 2, and 4 per cent of the monoxide, and with the glazes used, the amounts dissolved varied between these extremes, at temperatures below 1100° C. The solubility is increased by altering the composition of the glaze in the same ways as described for nickel oxide, with two exceptions. Unlike nickel oxide, the solubility of manganese oxide is not affected by the addition of alumina to an alkali glaze. In both the oxides considered, the decrease in solubility that accompanies the increase of alumina, may be due to the increased viscosity of the glaze by alumina. In the case of manganese oxide, the replacement of part of the silica by boric acid does not increase the solubility of the oxide. Though firing at 1050° increased the amount of oxide dissolved, better colours were obtained at 1000° C., and, as before, coloured separations are less likely to occur when the rate of cooling is rapid. The colour of the glazes with manganese oxide, generally claret-brown, is considerably modified by alteration in the composition of the glazes, and of the firing temperature. An increase of silica, or the presence of litharge, zinc oxide or lime, gave pink tints, but alumina and boric acid gave brown tints. The only indication of volatilisation was that some of the glazes, containing 4 per cent. of manganese monoxide, were coated with a film, apparently of condensed manganese oxide.

The colouring matter is the most expensive component of "majolica" glazes; hence these experiments have a practical value, in that they show the conditions necessary for the solubility of the oxide, and the conditions that affect the colour, which is generally better when the solubility is complete, whilst many defects arise from the separation in the glaze of colouring compounds and from supersaturation.—W. C. H.

[Glass] Beakers. U.S. Customs Decision, Jan. 22, 1906.

BEAKERS used for chemical purposes are dutiable at 60 per cent. *ad valorem* as "blown glass ware" under paragraph 100 of the present tariff. [T.R.] R. W. M.

Glassware; Chemical ——. U.S. Customs Decision, Jan. 29, 1906.

PHOTOGRAPHIC baths and glass tubing are dutiable at 60 per cent. *ad valorem* under paragraph 100, as "blown glassware," and evaporating dishes, the edges of which had been ground and polished, are dutiable at the same rate and the same paragraph as "ground glassware." [T.R.]
R. W. M.

the boiling being prolonged, or more flux added, if found necessary, until a proper fireproofing solution is obtained. This is then drawn off, and the heating of the residue continued until the latter is dry, when it is "bruised" to a powder, from which metallic zinc is removed by sifting. The final residue, consisting of zinc oxide and chloride, &c., is used as a fireproof paint. The addition of lime may be omitted if the solution obtained is sufficiently clear without it.—A. G. L.

Slag; Apparatus for disintegrating ——. G. K. Hamfeldt, Beaver, Pa., U.S.A. Eng. Pat. 22,932, Nov. 8, 1905.

THE molten slag while flowing in a tube or conduit is subjected to the action of a stream of water moving in the same direction, whereby it is thrown laterally outwards against the walls of the tube and completely disintegrated. —J. H. C.

UNITED STATES PATENTS.

Iron ore; Process of reducing ——. G. M. Westman, New York. U.S. Pat. 812,247, Feb 13, 1906.

WATER is sprayed into a current of air, and the air is then heated to vaporise the water. The mixed air and steam are passed through incandescent coke mixed with limestone, whereby a mixture of carbon monoxide and hydrogen, free from sulphur, is formed. The proportion of air to steam is so regulated that the temperature of the gaseous mixture produced is about 1100° C., and this mixture is caused to act upon the ore to be reduced in presence of a small percentage of carbon.—A. S.

Manganese steel; Process of treating [toughening] ——. W. Brinton, High Bridge, N.J., Assignor to Taylor Iron and Steel Co., New Jersey. U.S. Pat. 812,811, Feb. 20, 1906.

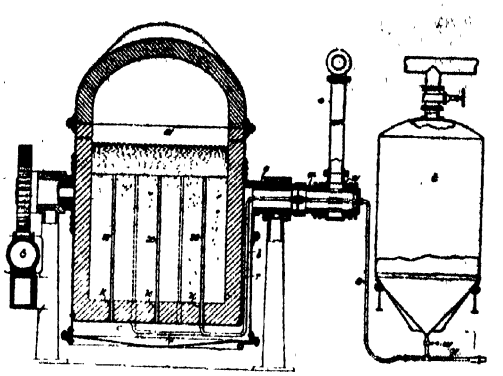
THE invention relates to a method of toughening manganese-steel. The steel is cast into its finished shape, allowed to solidify to a point at which it can be handled, and then covered with sand to check the cooling and to retain within the casting a part of its original heat, corresponding to a temperature of from 150° to 1000° F., according to the size, character and design of the article. At this point the steel is placed in a furnace previously heated to a temperature substantially corresponding to that of the article, heated rapidly to a predetermined temperature above a forging temperature, and then quickly cooled by immersing it in water.—A. S.

Metals [Iron and steel]; Process of treating ——. H. H. Goodsell, Indiana Harbor, Ind. U.S. Pat. 813,206, Feb. 20, 1906.

PLATES of sheet iron and steel are passed through a volatile liquid, dried by aid of heat, and then subjected to the action of a body of vapour heated unequally in different portions thereof, the plates being first exposed to portions of vapour at a relatively low temperature (400° F.) and then to portions of successively higher temperature (up to 900°—1200° F.). The plates are finally allowed to gradually cool in the open air.—A. S.

Smelting and converting ores; Process and apparatus for ——. A. M. Day, Butte, Mont. U.S. Pats. 812,186 and 812,785, Feb. 13, 1906.

THE apparatus consists of a smelting vessel, *a*, provided with a wind-box, *c*, and tuyères, *k*, and mounted on trunnions. One of the trunnions, *e*, is hollow, and communicates through the passage, *l*, with the wind-box, *c*. This trunnion has a detachable extension, *m*, which turns in the sleeve, *n*, on the main air-supply or blast-pipe, *o*. There is also a number of closed receptacles, *t*, for holding "fluent material" (fuel, fluxes, silicious materials), each of which is connected at the top with a source of compressed air, and has at the bottom a valve-controlled connection, *w*, with an auxiliary blast-pipe, *v*. The auxiliary blast-pipes are connected with flexible pipes, *s*, joined inside the trunnion extension, to pipes, *r*, leading to some of the tuyères. The process consists in covering the charge of ore with a molten substance containing sufficient heat to start the fusion of the charge, supplying air under



pressure from the main blast-pipe, *o*, through some of the tuyères to the top of the ore-charge, and injecting with separate and distinct air-blasts, fuel, fluxes and silicious materials from closed reservoirs, *t*. The tuyères are formed with fusible extensions, *x*, so that the blasts of air, &c., are still injected near the "melting-level" as the fusion of the ore-charge proceeds downwards.—A. S.

Ores; Process of treating ——. E. W. Arnold, Assignor to V. Selna, San Francisco, Cal. U.S. Pat. 812,473, Feb. 13, 1906.

THE process consists in "heating a body of ore to incandescence by directing into and against the ore a blast of a suitable hydrocarbon, and impregnating the incandescent ore with a mixture of chlorine gas and charcoal-fumes, in the proportion of about 2 parts of chlorine to 1 part of charcoal-fumes."—A. S.

Precious metals; Apparatus for treating slimes, &c., for the recovery of ——. C. Gluyas, Johannesburg, Transvaal. U.S. Pat. 812,418, Feb. 13, 1906.

THE apparatus consists of a series of elevating-wheels, each wheel being provided with a number of sets of elevating buckets, into which the material is fed in succession. Interposed between the different elevating-wheels are aërating devices consisting of a number of "superposed helically-disposed launders."—A. S.

Aluminium; Method of granulating ——. W. Hoskins, Lagrange, Ill. U.S. Pat. 812,493, Feb. 13, 1906.

ALUMINIUM and other metals, the oxides of which have a high melting point, are granulated by forcing an oxidising gas into the molten metal whilst subjecting the latter to mechanical stirring or agitation. As the mass cools, it solidifies in the form of superficially oxidised particles. —A. S.

Titanium; Process of combining —— with other metals. F. E. Canda, New York, Assignor to Chrome Steel Works, Chrome, N.J. U.S. Pat. 813,278, Feb. 20, 1906.

TITANIUM-BEARING material, and the material which is to be combined with titanium, are melted separately, and the molten substances poured simultaneously into a suitable receptacle. For example, titanium is combined with iron or steel by melting ferro-titaninm by the action of an electric current and adding it to the iron or steel which has been melted separately.—A. S.

Soldering compound. A. R. Hussey, Chicago, Ill. U.S. Pat. 812,494, Feb. 13, 1906.

SOFT soldering metal, composed, for example, of 1 part of tin and 3 parts of lead, is granulated, mixed with beeswax impregnated with zinc chloride, formed into bars or sticks, and coated with a skin of metal, *e.g.*, tinfoil, fusible at a moderate temperature. The beeswax may be hardened by admixture with resin.—A. S.

Coal; Apparatus for making artificial —— [*from slag*]. C. L. Mansfeldt, Munhall, and D. Cubbage, Swissvale, Pa. U.S. Pat. 812,650, Feb. 16, 1906.

See Eng. Pat. 22,932 of 1905; preceding these.—T. F. B.

FRENCH PATENTS.

Coal; Manufacture of —— *and fusion or reduction of iron or other materials or metals.* E. T. Zohrab. Fr. Pat. 358,710, Oct. 21, 1905. Under Int. Conv., Oct. 21, 1904.

See Eng. Pat. 22,688 of 1904; this J., 1905, 1019.—T. F. B.

Phosphatic manure [*from slag*]; *Assimilable* ——. F. Laur. Fr. Pat. 350,443, Dec. 31, 1904. XV., page 275.

Ores with calcareous gangue; Process of concentrating low-grade ——. J. de Coppet. Fr. Pat. 358,089, Oct. 6, 1905.

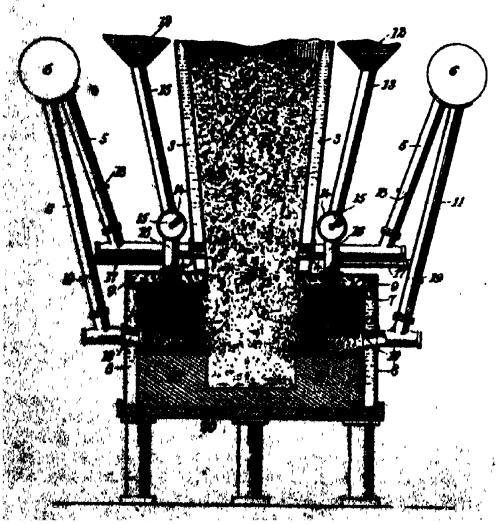
THE ore is first roasted and then exposed to the atmosphere, whereby the lime formed on roasting falls to a fine powder, which can be separated more or less completely by sifting.—A. S.

Cooling and drying of large volumes of moist air [*for blast-furnaces*]; *Continuous process for* ——. Masch. Anst. Humboldt. Fr. Pat. 358,512, Oct. 14, 1905.

THE moist air is first passed, under considerable pressure, through a cooling chamber, the cooling coils of which have becomed covered with ice, and through which the cooling medium is not circulating. The ice is melted and the air is partially cooled, and is then passed at a lower pressure through other cooling chambers through the coils of which the cooling agent is circulating. The remaining moisture is desposited on the coils as ice, and the cooled, dried air passes away. By a system of valves and dampers the direction of the air through the series of coolers can be varied, so that, while some are working actively as coolers, others are having the ice melted by the incoming air. Further claim is made for utilising the heat of the waste gases from a blast-furnace or from gas-engines to liberate the ammonia used as the refrigerating medium from the water by which it has been absorbed after it has effected the cooling.—W. H. C.

Furnace; Blast ——. W. Kemp. Fr. Pat. 358,645, Oct. 18, 1905. Under Int. Conv., June 30, 1905.

THE furnace is shown in cross-section in the accompanying diagram. It consists of an ore-chamber surrounded by a water-jacket, 3, and disposed above a fuel-chamber, 7, which is also surrounded by a water-jacket, 8, 9, and extends the whole length of the furnace. Two sets of



tuyères, 4, and 10, respectively, are provided, connected separately to the blast-pipes, 5, by the pipes, 6, and 11, having dampers, 18, and 16. The hearth, 20, has, on either side, walls, 21, of refractory material. In starting the furnace some wood is set on fire in the fuel-chamber, the blast is started, and coal is gradually introduced from the hoppers, 12, through the pipes, 13, and 14, the latter being provided with screw-conveyors, 15, which feed the coal through the pipes, 16, into the fuel-chamber. The pipes, 16, are connected to pipes, 11, by tubes, 17, so that a downward current of air passes through 16, and prevents the coal becoming ignited before it reaches the fuel-chamber. When the coal in the fuel-chamber is heated to incandescence, ore is fed in at the top of the furnace, and gradually forms a heap in the middle of the fuel-chamber, so that when the furnace is in operation, the ore is reduced without becoming admixed with the fuel. When the ore to be reduced, contains sulphur, the dampers, 18, are opened to a suitable extent, and the sulphur is burnt by the blast entering the furnace through tuyères, 4, before the ore reaches the fuel-chamber.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 223.)

(A.)—ELECTRO-CHEMISTRY.

Nitrogen combustion; Theory of ——. P. A. Guyé. Chem. Ind., 1906, **29**, 85—88.

WHEN nitrogen and oxygen unite at the temperature of the electric arc, nitric oxide is the product, which, when its temperature falls below 500°—600° C., unites with more oxygen to form nitrogen peroxide. From this are formed by well known and purely chemical reactions nitric acid or nitrates. The reaction $N_2+O_2 \rightleftarrows 2NO$ is reversible, and the higher the temperature the more rapidly is equilibrium attained in the direction of formation of NO; so that the most favourable conditions for yield of product are found in extremely high momentary arc-temperatures followed by extremely rapid cooling. These conditions are reached in practice by passing a stream of air through the arc or by causing the arc continually to change its position. The most favourable results yet attained give a yield of 800—900 kilos. of nitric acid per kilowatt-year at the arc, which probably means, allowing for dissociation during cooling, 500 kilos. per kilowatt-year of actual yield. Under favourable conditions for electric generation, this would work out to about 12 frs. per 100 kilos. of nitric acid; and, as the present price of that amount is, as acid, 45 frs., and as nitre, 35 frs., there is a reasonable prospect of nitric acid being profitably produced by the new process. The author points out that in manufacturing crude calcium cyanamide, the necessary nitrogen is often obtained from liquid air, the oxygen of which is then a waste product. If this oxygen were applied to enrich the air subjected to the influence of the electric arc, the yield of nitric oxide would be increased; thus the manufacture of calcium cyanamide and that of nitric acid might be carried on concurrently more economically than either separately.—J. T. D.

Hydrogen peroxide and other compounds; Note on the formation of —— *by means of the Tesla-discharge.* A. Findlay. Z. Elektrochem., 1906, **12**, 129.

As Nernst has stated (Z. Elektrochem., 1905, **11**, 710) that hydrogen peroxide could not be detected when an electric spark is passed through a mixture of oxygen and water vapour, the author records some preliminary experiments in which hydrogen peroxide was formed by a Tesla brush-discharge through water vapour. Oxides of nitrogen are produced from nitrogen and oxygen, ammonia from nitrogen and hydrogen, and hydrazine from ammonia and nitrogen under similar conditions.—J. T. D.

Thiosulphates; Electrolytic formation of ——. Levi and Voghera. Atti. R. Accad. dei Lincei Roma, 1905 (Ser. 5), **14**, 433; Z. Elektrochem., 1906, **12**, 131.

It is shown that upon electrolysis of mixed solutions of sulphides and sulphites, thiosulphates are produced. This is ascribed to reaction at the anode between the ions as they are discharged.

$$SO_3'' + S'' + 2\oplus = S_2O_3''.$$

The best results are obtained in a cell without diaphragm, and when the electrolysis is carried out at 25° C. The variation of the current density between 16·6 and 33·3 ampères per sq. dm. does not appear to influence the yield. A current efficiency of from 9 to 16·6 per cent. was obtained in the different experiments.—R. S. H.

Metals, especially gold and palladium; Determination of —— by electric conductivity measurements. J. Donau. XXIII., page 285.

Bismuth; Peroxides of ——. *II. Oxidation of bismuth oxide by electrolytic chlorine in presence of potassium hydroxide, and the so-called "potassium bismuthate."* A. Gutbier and R. Bünz. VII., page 264.

Chlorine; Action of silent electric discharge on ——. F. Russ. VII., page 264.

ENGLISH PATENTS.

Electric furnaces and electrodes for use in them. E. F. Price, G. E. Cox and J. G. Marshall, Niagara Falls, U.S.A. Eng. Pat. 5984, March 21, 1905.

SEE U.S. Pat. 785,832 of 1905; this J., 1905, 446.—T.F.B.

Electrolytic apparatus; W. P. Thompson, London. From the Decker Manufacturing Co., Wilmington, U.S.A. Eng. Pat. 4100, Feb. 27, 1905.

SEE Fr. Pat. 352,029 of 1905, this J., 1905, 897.—T. F. B.

Batteries; Secondary ——. I. Kitsee, Philadelphia. Eng. Pat. 13,427, June 29, 1905.

SEE U.S. Pat. 793,881 of 1905; this J., 1905, 850.—T. F. B.

Electrolysis of water; Apparatus for the ——. K. J. Vareille, Levallois-Perret, France. Eng. Pat. 20,217, Oct. 6, 1905.

SEE Fr. Pat. 355,652 of 1905; this J., 1905, 1240.—T.F.B.

UNITED STATES PATENTS.

Furnace; Electric ——. J. E. Ober, Schenectady, N.Y., Assignor to General Electric Co., N.Y. U.S. Pat. 812,801, Feb. 13, 1906.

THE furnace comprises a carbon tube, with two cylindrical end portions, and an intermediate portion of less diameter, heated by the passage of the current through its wall. A sheath is formed by wrapping paper around the end portions, and the space between the intermediate portion of the tube and the paper is filled with a sintered mass of finely-divided titanium carbide, which is non-hygroscopic and refractory. A packing of heat-resisting material, such as coke, surrounds the carbide and the end portions of the tube.—B. N.

Flour; Method of [electrically] treating ——. J. E. Mitchell, Assignor to Alsop Process Co. U.S. Pat. 812,764, Feb. 13, 1906. XVIII*A*., page 278.

Bleaching liquors; Apparatus for [electrolytically] preparing ——. F. L. Bartelt, Bristol. U.S. Pat. 813,688, Feb. 27, 1906.

SEE Eng. Pat. 16,185 of 1904; this J., 1905, 678.—T. F. B.

FRENCH PATENTS.

Filament; [Electric furnace for making] an indestructible —— for lighting and heating. G. Michaud and E. Delasson. Second Addition, dated Sept. 30, 1905, to Fr. Pat. 346,307, Sept. 17, 1904 (this J., 1905, 125, 612 and 1057).

THIS addition relates to an electric furnace for fusing the materials employed in making the filaments. The furnace consists of a base or block in which is sunk a carbon crucible, in which the materials are fused. One electrode passes up into the crucible through the bottom, and the other is arranged to hang down into the crucible. The materials are supplied from a feeding hopper, and the fused material is drawn out in the form of a filament by means of a rod. The success of the operation requires that the fluidity of each composition is determined and the rate of drawing adapted to it. The materials specified are alumina, lime, silica or magnesia, rendered conductors by an addition of carbon, vanadium, osmium or tantalum, and the quality of the radiation is determined by an addition of an oxide, such as chromium oxide.—W.C.H.

Chlorates and perchlorates; Electrolytic manufacture of alkali ——. M. Couleru. Fr. Pat. 358,798, Oct. 24, 1905.

SEE U.S. Pat. 788,631 of 1905; this J., 1905, 620.—T.F.B.

GERMAN PATENTS.

Electrodes of alkaline accumulators; Employment of cellulose derivatives for the separation of the ——. Kölner Akkumulatorenwerke Gottfried Hagen. Ger. Pat. 165,233, Aug. 3, 1904.

THE electrodes of alkaline accumulators are separated by an intermediate layer or layers of artificial silk, prepared by precipitating a cuprammonium solution of cellulose with sulphuric acid.—A. S.

Carnallite and other haloid double salts of the alkaline-earths; Apparatus for the continuous treatment of fused —— by electrolysis. E. Haag and F. Glinicke. Ger. Pat. 163,413, Jan. 20, 1904.

THE invention relates to improvements in apparatus for the electrolysis of fused carnallite and other haloid double salts of the alkaline-earths, in which provision is made for the separate discharge of the liberated metals and the gaseous decomposition products. The chamber in which the molten decomposition products collect is provided with an overflow tube for the escape of the light metal, and also, at the bottom, with grooves or passages through which the residue passes into a receptacle, from which it is continuously discharged by means of a siphon-tube. —A. S.

Sodium chromate; Electrolytic manufacture of —— from chrome iron ore. Chem. Fabr. in Billwärder vorm. Hell und Sthamer A.-G. Ger. Pat. 163,541, Feb. 28, 1904.

A FUSED mixture of chrome iron ore and caustic soda is electrolysed and air is simultaneously introduced, whereby it is stated sodium peroxide is formed and acts as an oxygen-carrier.—A. S.

Ammonia-soda manufacture; Process for the [electrolytic] treatment of the waste solutions of —— with recovery of brine for use over again. A. Riedel. Ger. Pat. 164,726, March 8, 1904.

THE waste solutions are mixed with strong brine, and electrolysed for the decomposition of the calcium chloride into calcium hydroxide and chlorine. The residual salt solution is used again in the process for dissolving further quantities of salt.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Strontium; Preparation and properties of ——. Guntz and Rœderer. Comptes rend., 1906, **142**, 400—401.

THE authors have prepared strontium by a method exactly analagous to that for barium (this J., 1906, 80), as a silver white metal, readily tarnishing in air, melting at 800° C. It readily decomposes water or alcohol in the cold. Its heat of oxidation is intermediate between those of barium and calcium.—J. T. D.

ENGLISH PATENT.

Smelting of ores, iron sand and the like; [Electric] Method of and apparatus for ——. T. S. Anderson, Sheffield. Eng. Pat. 6001, March 22, 1905.

VERTICALLY adjustable and water-jacketed electrodes are provided within the furnace and electro-magnets below the floor of the furnace. The current passes in succession through the electrodes, the air-space between the electrode and the slag-line, the slag, and the molten metal; and returns through a wire which has its terminal at the base of the furnace. The current is regulated by varying the breadth of the air-space. The ore is made to fall between the electrodes, where it is melted; it then falls into a receiver from which it may be withdrawn through a tapping hole.—J. H. C.

UNITED STATES PATENT.

Metals of the earthy alkalies: Process for the electrolytic production of ——. C. Suter and B. Redlich, Ratibor, Germany. U.S. Pat. 813,532, Feb. 27, 1906.

SEE Eng. Pat. 26,655 of 1903; this J., 1903, 1299.—T.F.B.

FRENCH PATENTS.

Nickel or its alloys; Manufacture of —— [*electrically*]. G. H. Gin. First Addition, dated Sept. 26, 1905, to Fr. Pat. 344,202, June 22, 1904 (this J., 1904, 1098).

THE process described in the main patent is extended to the production of other metals or alloys free from carbon, such as chromium, manganese, tungsten, molybdenum, ferro-chromium, ferro-tungsten, &c. The outer vessel of the electric furnace is formed from a basic silicate of the metal to be obtained, and the electrodes of a silicide of the same metal. The final slag may be used for the regeneration of the reducing silicide.—B. N.

Carborundum or boron carbide; Manufacture of formed or moulded articles of ——. F. Bölling. First Addition, dated Sept. 30, 1905, to Fr. Pat. 353,017, Mar. 29, 1905 (this J., 1905, 976).

INSTEAD of heating articles of pure carbon in a bed of carborundum or of boron carbide, as described in the principal patent, the carbon articles are now heated in cavities made in pieces of carborundum or of boron carbide. In this way the silicon or boron penetrates the carbon more thoroughly, and the surface is less altered, any factory marks, &c., on the latter not being effaced.—A. G. L.

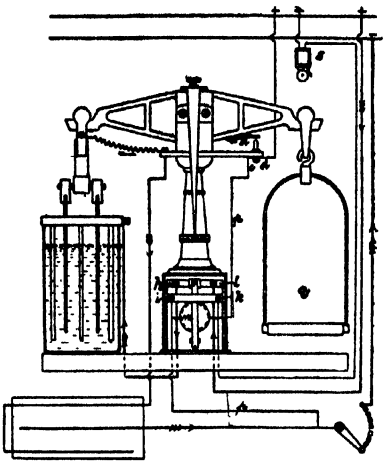
Carborundum or boron carbide; Manufacture of formed or moulded articles of ——. F. Bölling. Second Addition, dated Sept. 30, 1905, to Fr. Pat. 353,017, March 29, 1905 (this J., 1905, 976).

THE modification consists in heating the articles made of pure carbon in a bed consisting of a mixture of sand and carbon, or of boric acid and carbon, instead of in a bed of carborundum or boron carbide, as described in the principal patent.—A. G. L.

GERMAN PATENT.

Voltametric balance for obtaining a definite weight of deposit in electrolytic baths, an electro-magnet being used as current interruptor. H. Helbig. Ger. Pat. 162,591, March 17, 1904.

THE apparatus is shown in the accompanying figure, the normal path of the current being indicated by the arrows. When weights are placed in the scale-pan, *q*, the projecting piece, *a*, on one arm of the balance is brought down on to the contact piece, *c d*, forming a circuit, *p*, in which the electro-magnet, *m*, is included. As soon as the weight of the electrolytic deposit is sufficient to bring the balance back to the normal position, the circuit, *p*, of the electro-magnet is opened, and by release of the armature of the magnet, the main circuit is broken by rupture of the contact between *k* and *l*, whilst



simultaneously by means of the contacts, *i*, *h*, a circuit including the bell, *s*, is formed.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 224.)

Cod-liver oil and other fish oils; Examination of ——. II. R. T. Thomson and H. Dunlop. Paper read before Scottish Section Soc. Chem. Ind., Jan. 16, 1906. 1—8.

IN a former paper (this J., 1905, 741) the authors showed that the refractive index had no independent value as a test of the purity of cod-liver oil, and they now describe experiments to show that it throws no additional light on the effect of oxidation. A sample of cod-liver oil that had been kept for three years in a bottle, from which the air was not entirely excluded, gave the following results:—Iodine value (Wijs) 156·5; butyro-refractometer reading at 25° C., 80·3; saponification value, 191·4; specific gravity at 15° C., 0·9368; free acid, as oleic acid, 1·24 per cent.; Reichert-Wollny value, 2·0. If the Reichert and saponification values of this oil were alone taken into account, the presence of a small amount of an oil such as porpoise oil would be indicated, but the iodine value and specific gravity show that oxidation has taken place. In the authors' experience the Reichert-Wollny value for fresh cod-liver oil is less than 1, but in a partially oxidised oil it may exceed 3. In the colour test with sulphuric acid, this partially oxidised oil gave only a brown coloration, and not the characteristic reaction. A sample of fresh seal oil gave the following results:—Iodine value (Wijs) 162·6; butyro-refractometer reading at 25° C., 76·2; saponification value, 190·0; unsaponifiable matter, 0·24 per cent.; sp. gr. at 15° C., 0·9267; free acid, as oleic acid, 0·29 per cent.; specific rotatory power, - 0·19; Reichert-Wollny value, 0·6; molecular equivalent of fatty acids, 284·0. This oil of undoubted purity, gave a distinct violet coloration with sulphuric acid, both before and after stirring, whilst the fatty acids also gave a similar though more fugitive coloration. The same reaction was also given by this oil after being kept for two months in a closed bottle. Fish oils generally become darker on saponification, but this was not the case with the seal oil. The authors' general conclusion is that seal oil might be added in large proportion to cod-liver oil without risk of detection by analytical methods.—C. A. M.

Oils; Behaviour of vegetable —— with regard to polarised light. M. A. Rakusin. Chem.-Zeit., 1906, 30, 143—144.

THE author asserts that Walden's work on this subject has been forgotten. (See, however, Lewkowitsch, "Oils, Fats and Waxes," p. 210.) He has examined 24 vegetable

oils in a Soleil-Ventzke apparatus and has observed marked rotation in the following cases:—Castor oil, +8 to +8·65°; croton oil, +14·5° to +16·4°; sesamé oil, 1·9° to 2·4°; and laurel oil, +14·4°. The values of the first three oils agree well with those obtained by Walden, and in the author's opinion +8° may be regarded as a constant for castor-oil. The rotations were determined in a 200 mm. tube, whilst that of the semi-solid laurel oil was determined in an ether solution in a 50 mm. tube. It was found that the rotation of this oil was not due to chlorophyll, for an ethereal solution of chlorophyll was opaque to polarised light, even in a dilution of 1:3200. The following results were obtained with the other oils, a 200 mm. tube being used except where otherwise stated:—Olive oil, +0·2°; arachis oil, —0·4°; almond oil, —0·1°; rape oil, —0·1° to —0·2°; back mustard seed oil, —0·1° (in 100 mm. tube); cottonseed oil, —0·1°; hemp seed oil +0·1° (in 100 mm. tube); linseed oil, +0·2° (in 100 mm. tube); cameline oil, —0·1°; poppy oil, +0·1°; walnut oil, +0·15; sunflower oil, +0·1°; cacao butter (50 per cent. solution in benzene) +0·1° (×2); cocoa-nut oil (50 per cent. solution in benzene), +0·19° (×2); palm oil, +0·1° (×2); reseda oil +0·6°; and jasmine oil +0·9°. The high values of the two last oils were attributed to the presence of essential oils.—C. A. M.

Cottonseed Oil and Oil Cake trade of Marseilles. For. Off. Ann. Ser., No. 3534.

COTTONSEED oil imports at Marseilles during 1905 reached a net total of 32,448,588 kilos.; of these 32,282,968 kilos. came from America, 80,253 kilos. from the United Kingdom, and 85,367 kilos. from other countries. During 1904 less than half this amount was imported—15,003,403 kilos.—whereof 13,384,415 kilos. came from America, 1,323,846 kilos. from the United Kingdom, and 295,142 kilos. from other sources. Imports from America show an increase from an average of 13,500,000 kilos. for the three preceding years to 32,282,968 kilos., whereas imports from the United Kingdom fell from an average of 1,250,000 to 80,253 kilos.

During 1905, 179,700 tons of oil-cake were produced at Marseilles. Of this amount 58,000 tons were made from shelled earthnuts from Bombay, Coromandel and Mozambique, 42,000 tons from copra, 24,000 tons from the residue of gingelly seed imported from India and Africa, 20,000 tons from unshelled earthnuts. Other kinds of oil cake included those manufactured from the residues of white gingelly from the Levant, 1,800 tons; linseed, 7,200 tons; rape seed and colza, 200 tons; Egyptian cotton seed, 11,000 tons; poppy seed from India and the Levant, 2,200 tons; castor oil from India and the Levant, 9,600 tons; palm kernels, 1,400 tons; mowra and others, 2,300 tons.

Marseilles imported from foreign countries 29,800 tons of oil cake made from Russian colza and 3000 tons of other kinds, a total of 32,800 tons against 33,000 tons for 1904. Northern France, Germany and Scandinavia are the best buyers of the Marseilles earthnut cake. The South of France consumes a considerable quantity of oil-cake for manure, used in raising early vegetables.

[T.R.]

Oleic Acid. U.S. Customs Decision, Jan. 18, 1906.

THE United States Circuit Court affirmed a decision of the Board of General Appraisers, which held oleic acid or red oil to be dutiable at 25 per cent. *ad valorem* under paragraph 1 of the tariff as an "acid not specially provided for." In view of the fact that the evidence showed other uses for the article than soap making, the claim of the importer for free entry as an "oil commonly used in soap making and fit only for such use" under paragraph 568 was overruled. [T.R.] R. W. M.

ENGLISH PATENTS.

Fats, fat oils, resins and the like; Purification of ——. C. Fresenius, Offenbach a/Main, Germany. Eng. Pat. 10,387, May 17, 1905.

SEE Fr. Pat. 354,810 of 1905; this J., 1905, 1117.—T. F. B.

[*Castor*] *Ricinus oil product; Manufacture of* ——. Oelwerke Stern-Sonneborn, Akt.-ges., Hamburg, Germany. Eng. Pat. 24,935, Dec. 1, 1905. Under Int. Conv., Dec. 9, 1904.

CASTOR oil is heated in an autoclave or closed boiler under pressure until it will mix with mineral oil in any proportion. The most suitable temperature is 260° to 300° C., with a pressure of 4 to 6 atmos., the time required being about 10 hours. It is stated that there is no risk of forming a gum-like product as in methods where the oil is distilled.—C. A. M.

[*Castor*] *Ricinus oil product; Manufacture of* ——. Oelwerke Stern-Sonneborn, Akt.-ges., Hamburg, Germany. Eng. Pat. 24,936, Dec. 1, 1905. Under Int. Conv., Dec. 9, 1904.

CLAIM is made for a modification of the method described in the preceding patent. It consists in heating the oil beneath a reflux condenser, suitable conditions being a temperature of 260° to 300° C. and a pressure of 4 to 6 atmos.—C. A. M.

FRENCH PATENT.

Fatty matter; Process of extracting —— from products containing it, by means of carbon tetrachloride. P. Bernard. Fr. Pat. 350,427, Dec. 24, 1904.

SEE Eng. Pat. 18,867 of 1905; this J., 1906, 188.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 225.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Galvanisers' waste products; Treatment of —— for the recovery of metal and the formation of other substances [*Fire-proofing solution and pigment*]. S. E. Sanders. Eng. Pat. 4334, March 2, 1905. X., page 268.

Lithopones; Manufacture of —— by the electrolysis of sulphates or chlorides of soda, and consecutive production of caustic soda. J. B. and A. Candau, Eaux-Bonnes, France. Eng. Pat. 5882, March 20, 1905.

SEE Fr. Pat. 341,827 of 1904; this J., 1904, 904.—T. F. B.

Paint; Method of preparing white ——. A. van der Schuijt, E. Kuntze and W. Overman, Amsterdam. Eng. Pat. 12,998, June 23, 1905.

SEE Ger. Pat. 163,524 of 1904; this J., 1906, 224.—T. F. B.

Paints, varnishes and the like; Process of manufacture of ——. E. A. Ruch, Paris. Eng. Pat. 16,787, Aug. 18, 1905.

SEE Fr. Pat. 350,018 of 1904; this J., 1905, 978.—T. F. B.

UNITED STATES PATENT.

Lead compounds; Dry method of preparing ——. J. P. Neville, Oakland, Cal. U.S. Pat. 812,357, Feb. 13, 1906.

THIS invention relates to a dry method of preparing white lead, red lead, and litharge for commercial use, and consists in subjecting the material to the action of a pulveriser so as to reduce it to a powder, the latter being then withdrawn from the pulveriser by air suction. The flowing body of air is impregnated with a gas, such as ozone, "to oxidise and eliminate all foreign substances and such acetate of lead as may be contained in the powdered carbonate carried by the body of air." The dust-laden air is discharged into an "arrester," wherein the heavier particles of lead carbonate are deposited, and the air is finally discharged into a "collector" to finally free it from any particles of carbonate still suspended in it.—B. N.

FRENCH PATENT.

Lakes [from azo dyestuffs] suitable as substitutes for Chrome Yellow; Process for preparing yellow ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,431, Dec. 28, 1904.

SEE Eng. Pat. 28,259 of 1904; this J., 1905, 1243.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Gutta-percha Resin. U.S. Customs Decision, Jan. 11, 1906.

RESIN extracted from gutta-percha for the purpose of purifying the latter, is dutiable under section 6 of the tariff at 20 per cent. *ad valorem* as a "manufactured article unenumerated." The claims of the importer for free entry as "crude resin," and at 10 per cent. *ad valorem* as an "unmanufactured article unenumerated" were overruled. [T.R.] R. W. M.

UNITED STATES PATENT.

Turpentine; Process of refining ——. G. O. Gilmer, Assignor to American Turpentine and Tar Co., Ltd., New Orleans, La. U.S. Pat. 813,088, Feb. 20, 1906.

THE crude turpentine, obtained by the distillation of turpentine-bearing wood, is allowed to settle and the pyroligneous acid and other liquids of greater specific gravity than turpentine are drawn off. The separated turpentine is then mixed with about 50 per cent. of pure water and the mixture is distilled at such a temperature, above that of boiling water, that both are vaporised together. The vapours are condensed and separated, and the turpentine is treated with sufficient lime-water or other liquid alkali to neutralise the acids present, and air is blown through the liquid to aërate and agitate it. After settling, the turpentine is again separated and distilled with water at a temperature of approximately 335° F., the vapours are condensed and the turpentine is finally separated by settling and decantation from the water that has distilled over with it.—W. H. C.

(*C.*)—INDIA-RUBBER, ETC.

Latex; New East African —— and the product of its coagulation. E. Marckwald. Gummi-Zeit., 1906, **20**, 491—492.

THE latex, the botanical source of which is not given, had a sp. gr. of 1·0429 and the following composition:—Water lost at 100° C., 58·55; mechanical organic impurities, 2·30; mineral constituents, 0·35; resins, 32·75; rubber-like substance, 5·40; and albuminoid matter, 0·65 per cent. A sample of the product of coagulation sent to the author had an appearance somewhat similar to that of raw balata, which it also resembled in properties. The following was its composition:—Water lost at 100° C., 12·78; mechanical organic impurities, 3·82; mineral constituents, 10·94; resins, 60·17; and rubber-like substance (containing small quantities of albuminoids), 12·29 per cent. The rubber-like substance behaved normally towards solvents and precipitants, resembling rubber and not gutta-percha in not being precipitated from solution by ether.

The resins were separable into two substances, melting at about 80° C., and about 130° C. respectively. The mineral constituents included about 10 per cent. of alum used in the coagulation process. The coagulation product as prepared by the author (*a*) by dilution of the latex, and boiling, (*b*) by the addition of 5 per cent. acetic acid to the latex, had the following compositions respectively, after washing and drying:—

	Product (*a*).	Product (*b*).
	Per cent.	Per cent.
Mineral constituents	0·83	0·80
Albuminoid matter	1·57	1·58
Resins	78·29	79·43
Rubber-like substance	19·81	18·24

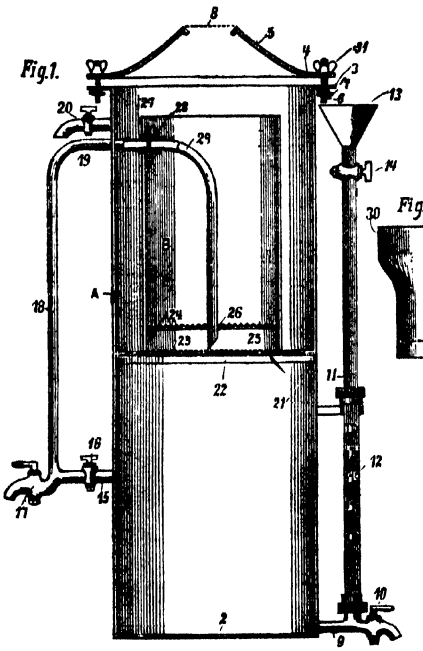
—E. W. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 225.)

Extractor for tanning materials. H. C. Reed. Collegium. 1906 [193], 49.

Fig.1.



THE method of using the apparatus is as follows, the parts being assembled as shown by the drawing:—

The bark or other material is introduced into the cup, B, and rests upon the wire mesh screen, 26, and prevented by it from passing to the bottom of the cup. If it is desired to extract the same at a temperature less than that of boiling water, water at the desired temperature is introduced into the vessel, A, through the funnel, 13, and pipes, 11 and 9, or cold water may be thus introduced to the vessel and the temperature thereafter raised by a heater placed under the bottom of the vessel, A. The water is then run into the vessel until it overflows through the faucet, 20, thus surrounding the cup, B, with water at any desired temperature not exceeding 212° F. Water can be introduced into the cup, B, by pouring it into the same or by closing the overflow faucet, 20, and allowing the water to rise in the vessel until it shall overflow the edge of the cup, B, or by means of an inverted vessel filled with water, the open mouth of which dips below the level of the water in cup, B, and which automatically replenishes the water in cup, B, at a rate equivalent to the lowering of the level of the water therein. The water percolates through the material in the cup carrying the soluble matters therefrom through the screen to the bottom. When the water in the cup rises above the top of the siphon, the solution in the bottom of the cup will flow through the siphon and may be drawn off through the faucet, 17. The rapidity of percolation and outward flow through the siphon, is controlled at the faucet, 17.

If it be now desired to extract by means of condensed steam, the faucet, 10, is opened and the water in the vessel is drawn down to the desired level indicated by the gauge glass, 12. The faucet, 10, is then closed and the condenser attached to the top of the vessel, A. Heat is applied to the bottom of the vessel, A, and the steam from the water therein passes through the partition, 22,

and around the cup, B, into the condenser, whence the condensed water drops back into the cup, B, upon the contained material. The cup, B, is thus gradually filled by the water until the siphon is covered, when the liquor is siphoned out of the bottom of the cup in the manner described. If continuous extraction be desired, the faucet, 17, is kept closed and the cock, 16, opened to the desired extent, thus maintaining circulation through the apparatus.

It has been found advantageous to vary the size of the cup with the bulk of the material to be extracted, and for this reason cups of the style shown in Fig. 2 were designed. When small amounts of material are extracted, a greater mechanical action results from the use of a cup of a size only sufficiently large to comfortably contain it, and better extraction results.

Tanning materials; Action of formaldehyde on ——. [*Differentiation of pyrogallol and protocatechuic groups.*] E. Stiasny. Pharm. Centralh., 1906, **47**, 27.

By boiling 50 c.c. of the clear decoction of a tanning material, of the usual strength, for ten minutes under a reflux condenser, with 10 c.c. of hydrochloric acid solution (1·1), and 10 c.c. of formaldehyde solution (40 per cent.), protocatechuic tanning substances can be distinguished from those of the pyrogallol group. The former, including quebracho, catechu, mallet-bark, mangrove, hemlock, pine, fir, Aleppo pine, mimosa, birch, willow, palmetto, cajotta, oak bark, canaigre, kermek, *Pistacia lentiscus*, sumach, and gambier are entirely precipitated. Pyrogallol materials, such as oakwood, chestnut, galls, valonia, myrabolans either give no precipitate, or but a slight one. By allowing the reaction to proceed at normal temperatures for everal days, materials of the protocatechuic group may be separated into two classes, one of which is entirely, the other only partially, precipitated. The latter includes oak, fir, and birch barks, palmetto, sumach, and some kinds of quebracho extract. This reaction enables the adulteration of tanning materials of the protocatechuic group with those of the pyrogallol group to be detected; for instance, the presence of oakwood or chestnut wood extract in quebracho extract, but the method cannot be employed quantitatively. Tannin-containing fruits, such as divi-divi, algarobilla, teri, and bablah, give a copious precipitate due to the presence of gallic acid. Algarobilla, after the removal of the gallic acid, gives no precipitate, whereas divi-divi gives a copious one, probably of ellagic acid. Sumach, on account of its large percentage of gallic acid, falls into the protocatechuic group. After removing this, its pyrogallol characters become evident.—J. O. B.

Hydroxybenzoic acids; Some oxidation products of the ——. *II.* A. G. Perkin. IV., page 258.

Casein. U.S. Customs Decision.

The United States Circuit Court, January 18, 1906, held that certain *caseine industrielle* is free of duty as "lactarene" under paragraph 594 of the free list. The Board of General Appraisers had held the article to be dutiable at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under section 6, but in view of additional testimony, showing that casein was commercially known as lactarene, the above decision was rendered. The Treasury Department, February 3, 1906, acquiesced in this decision, but on information received that the record in the case was incomplete, and that the commercial designation of casein can be shown not to be lactarene, the Department, February 12, 1906, ordered another case to be prepared for trial. [T.R.] R. W. M.

English Patent.

Leather; Preparation for the preservation and waterproofing of ——. H. Schowalter, Ladenburg, Germany. Eng. Pat. 21,443, Oct. 21, 1905.

See Fr. Pat. 357,525 of 1905; this J., 1906, 130.—T.F.B.

XV.—MANURES, Etc.

(*Continued from page* 130.)

Nitrification: Influence of organic matter on ——. A. Müntz and E. Lainé. Comptes rend., 1906, **142**, 430—435.

The authors' experiments show that humus, in whatever abundance it may be present, is not prejudicial to nitrification, and, indeed, is rather favourable to it. Humus, however, is not necessary for nitrification can be produced in soils poor in organic matter. The humus seems to aid the multiplication of nitrifying organisms, and as a rule a soil contains more active organisms and is more prone to enter into nitrification as it contains more humus.

—J. T. D.

French Patent.

Phosphatic manure [from slag]; Assimilable ——. F. Laur. Fr. Pat. 350,443, Dec. 31, 1904.

Molten slag, as it flows from a metallurgical or other furnace, is received in a supplementary furnace or in a heated receptacle, in which it is mixed with powdered natural phosphates, such as coprolites, phosphorites, &c. It is stated that the tricalcium and dicalcium phosphates are decomposed by the silica in the slag, new and more fusible silicates being formed, whilst the phosphoric acid present is rendered soluble and assimilable by plants. The product obtained may be granulated and powdered.

—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 227.)

Sugar cane experiments in the Leeward Islands. Report on experiments conducted at Antigua and St. Kitts in the season 1904-5. Part I. Experiments with varieties of sugar cane. The Imperial Department of Agriculture for the West Indies, 1905.

Experiments on the cultivation and selection of improved varieties of the sugar cane have been conducted at the experiment stations in Antigua and St. Kitts. The canes were cultivated throughout in the same manner as the ordinary crop of the estate so as to give results closely comparable with those obtained by the planter. The severe drought in Antigua, however, was such as to cause the sugar crop to drop from the normal 13,000 tons to 7,800 tons. The rainfall in St. Kitts, though heavier than in Antigua, was irregular and gave varying results on the different estates. In Antigua the following canes stand out as specially worthy of attention:—B. 156, Sealy Seedling, B. 306, B. 208, D. 74, D. 95 and D. 109, both as plant canes and ratoons. At St. Kitts the best results were obtained with Caledonian Queen or White Transparent; B. 208 and B. 147 were satisfactory, and D. 74 and D. 116 are recommended for cautious planting. B. 208, heads the list of canes grown as ratoons with a yield of 30 tons per acre, and 8·508 lb. of sugar in the juice (per Imperial gall.), and the opinion is expressed that this cane may be generally introduced at St. Kitts to occupy a useful position with the Caledonian Queen and B. 147. There was an almost complete absence of rotten canes, a result directly traceable to the introduction of new varieties of cane. In order to ascertain whether any of the 35 varieties under experimental cultivation exhibited any evidences of abnormal quotients of purity due to high polarisation, juice from each variety grown at Cassada Garden was examined by the Clerget method, using the factor 144. Six of these show what may be regarded as abnormally high apparent purities, namely Red Ribbon, Queensland Creole, D. 74, D. 89, D. 99 and D. 116. During the recent dry season, considerable trouble has been experienced from "gum" which appears to be worse when the normal development and ripening of canes are arrested.

In the following table the results are given of those varieties which gave most satisfactory results:—

No.	Name of cane.	Direct polarisation.	Polarisation due to sucrose — Clerget.	Apparent sucrose lbs. per gall.	True sucrose lbs. per gall.	Difference between true sucrose and apparent sucrose.	Apparent purity.	True purity.	Difference between true purity and apparent purity.
1	Sealy seedling ..	83·5	83·6	2·171	2·174	+ 0·003	91·1	91·8	+ 0·1
7	White transparent	86·6	86·2	2·252	2·241	— 0·011	94·8	94·4	— 0·4
10	Caledonian Queen	87·3	86·6	2·270	2·252	— 0·018	95·0	94·2	— 0·8
13	B. 306	85·8	85·6	2·231	2·226	— 0·005	92·2	91·9	— 0·3
14	B. 208	87·5	86·8	2·275	2·257	— 0·018	94·2	93·5	— 0·7
15	B. 156	75·9	75·8	1·973	1·971	— 0·002	89·2	89·1	— 0·1
16	B. 147	81·4	81·5	2·116	2·119	+ 0·003	93·2	93·3	+ 0·1
27	D. 74	78·4	77·1	2·038	2·005	— 0·033	89·0	87·6	— 1·4
28	D. 89	81·8	79·9	2·127	2·077	— 0·050	91·9	89·7	— 2·2
29	D. 95	82·4	81·8	2·143	2·127	— 0·016	92·4	91·7	— 0·7
30	D. 99	81·9	80·6	2·129	2·096	— 0·033	92·1	90·6	— 1·5
32	D. 116	78·7	77·4	2·046	2·012	— 0·034	89·2	87·7	— 1·5
35	D. 109	79·2	79·0	2·059	2·054	— 0·005	90·9	90·7	— 0·2

—L. J. DE W.

Indian cane jaggeries; Use of saturation in the refining of ——. B. Ryznar. Z. Zuckerind. in Böhmen, 1906, **30**, 233—258.

THE process of double carbonatation and saturation, followed by a sulphitation of the thick juice, as practised in the beet sugar industry, may be applied with advantage in the refining of Indian cane jaggeries. The experiments of the author, based on analyses of the scums and juices at each stage have led him to recommend the following treatment for this class of raw sugar:—The jaggery is melted to a juice of 20° B. It is then warmed or cooled to a temperature of 45°—50° C. and is treated without delay with a quantity of milk of lime, equal to 4·5 per cent. of calcium oxide on the weight of the raw jaggery. The juice is saturated with carbon dioxide until it possesses a residual alkalinity equal to 0·06 grm. of lime per 100 c.c.; it is then heated to 60° C. and filtered. For the second carbonatation, 1 per cent. of lime, calculated on the original jaggery, is added, the juice is rapidly saturated until neutral, heated to 70° C. and filtered; it is then boiled, filtered again, and concentrated to a density of 25°—30° B. If the acidity of the thick juice exceed 0·03 per cent., calculated as calcium oxide, lime is added to reduce it to that degree of acidity, and sulphur dioxide is then passed in until the acidity, expressed as calcium oxide, reaches 0·06 per cent. After that, the juice is boiled and refined in the usual way. According to the analyses, the above treatment effected the removal of 27·86 per cent. of the total non-sugar constituents of the jaggery (30·58 per cent. of the organic and 18·62 per cent. of the mineral impurities) and eliminated 74·74 per cent. of the colouring matter. The bulk of the purification is effected by the first saturation, but the other treatments cannot be omitted without loss of efficiency, since the precipitation of certain coloured impurities, *e.g.*, basic calcium glucinate, requires the close observance of certain conditions of alkalinity and temperature only obtainable by double saturation.—J. F. B.

Sugars; Action of secondary asymmetric hydrazines [*Ethylphenylhydrazine*] *on* ——. R. Ofner. Monatsh. Chem. 1906, **27**, 75—80.

NEUBERG (this J., 1902, 506) stated that methylphenylhydrazine only yields osazones with ketose sugars and not with aldoses, but the author (this J., 1905, 47) and Ost (this J., 1905, 935) have shown that such is not the case. The author has now studied the action of ethylphenylhydrazine on levulose and dextrose.

An osazone is prepared from levulose by treating a solution of 3·6 grms. of the sugar in 15 c.c. of water with 8·2 grms. of ethylphenylhydrazine, 8 c.c. of 50 per cent. acetic acid, and 2 c.c. of alchool. An oil is formed after a few minutes which crystallises after a few hours. The osazone crystallises from 50 per cent. alcohol as fine yellow needles melting at 143° C., yield 60 per cent. The same osazone is formed from dextrose by treating 1·8 grms. of the sugar dissolved in 12 c.c. of water with 4·2 grms. of the hydrazine, 4 c.c. of glacial acetic acid and 3 c.c. of alcohol at the ordinary temperature, for about 20 hours; yield 55—60 per cent. If the mixture be heated, the osazone can be separated in the crystalline form after only two to three hours.

Dextrose ethylphenylhydrazone is prepared by heating 5·4 grms. of dextrose with 30 c.c. of 90 per cent. alcohol and 4·3 grms. of the hydrazine. After evaporation *in vacuo* at the ordinary temperature, the syrup begins to crystallise in about two days. The crystals retain alcohol of crystallisation and soften at 80° C., but if the alcohol be removed, the substance melts fairly sharply at 116°—118° C.; yield 60—70 per cent.—J. F. B.

Worts and sugar solutions; Determination of extract in ——. H. van Laer. XXIII., page 286.

Sugar bounties and excise tariff; Australian ——. Bd. of Trade J., March 8, 1906.

AN Act of the Australian Commonwealth, entitled the "Sugar Bounty Act, 1905" (No. 23 of 1905), was assented to on the 21st December, 1905. This Act provides that after 1st January, 1907, there shall be paid out of the Consolidated Revenue Fund to every grower of white-grown cane or beet within the Commonwealth, a bounty on all such cane or beet delivered for manufacture after that date and before the 1st January, 1913, at the following rates:—

Sugar cane.—6s. per ton calculated on cane giving 10 per cent. of sugar, to be increased or decreased proportionately according to any variation from this standard.

Beet.—60s. per ton on the actual sugar-yielding contents of the beet.

It is further provided, however, that the rates payable on all such cane or beet delivered during the years 1911 and 1912 shall be respectively two-thirds and one-third of the aforesaid rates.

The "Excise Tariff, 1905" (No. 24 of 1905), which was assented to by the Federal Parliament on the same day, *viz.*, 21st December, 1905, as the Sugar Bounty Act of 1905, provides that the excise duty imposed on sugar by the excise tarift of 1902 shall be increased from 3s. to 4s. per cwt. of manufactured sugar from 1st January, 1907, to 1st January, 1913, provided that the excise duty payable on sugar produced from cane delivered for manufacture in 1911 and 1912 shall be two-thirds and one-third of the above rate respectively. [T.R.]

UNITED STATES PATENT.

Starch; Process of preparing soluble ——. A. F. J. S. and H. A. R. A. Haake, Hamburg, Germany. U.S. Pat. 813,647, Feb. 27, 1906.

SEE Eng. Pat. 885 of 1903; this J., 1903, 754.—T. F. B.

FRENCH PATENTS.

Sugar; Process of refining ——. K. Dorant. Fr. Pat. 358,659, Oct. 19, 1905.

RAW sugar of good quality is treated with a limited, predetermined quantity of water so that the exterior portions only of the crystals are dissolved, whilst the central portions remain undissolved. It is stated that in this manner the

whole of the impurities are obtained in the melted syrup, and that the undissolved residue consists of perfectly pure sugar. The syrup is separated and refined in the usual manner, whilst the residual crystals are collected and used for making clairce syrup or for other purposes. —J. F. B.

Wood; Rotary digester for the saccharification of ——. Comp. indust. des alcools de l'Ardèche. Fr. Pat. 358,696, Oct. 20, 1905.

THE digestor for converting wood-wastes, such as sawdust, into fermentable sugar consists of a horizontal rotary cylinder with circular plates forming the two ends. The cylinder is mounted on a hollow shaft through which steam is supplied to a series of heating tubes disposed parallel to the axis and arranged at various distances from the same at points on circles concentric with the wall of the cylinder. The heating tubes project through the ends of the drum, and are connected by a radial steam pipe outside the digester with the central steam supply on the one side, and by a similar series of radial pipes with a central condensed water outlet on the other side. At the exit side of the apparatus each heating tube is provided with a cock, the handle of which is operated automatically by fixed pins placed at the highest point of rotation. Thus the heating pipes are opened for a moment and closed automatically during each revolution, so that the water which has condensed in the pipes is regularly discharged.—J. F. B.

Starches and dextrins; Manufacture of phonograph records from ——. Comp. gen. de phonographes, cinématographes et appareils de précision. First Addition, dated Oct. 10, 1905, to Fr. Pat. 358,366, Oct. 9, 1905 (this J. 1906, 227).

IN addition to starches and dextrins, other amylaceous materials, such as meals of cereals and leguminous seeds or glutens may be employed for moulding discs and cylinders. An addition of formaldehyde, tannin, gallic acid or salicylic acid may be used with advantage for antiseptic purposes. A better agglutination may be obtained by mixing sodium carbonate, alumina or magnesia or their salts with the starchy materials employed. —J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 230.)

Fungi [*Glœosporium*]; *Formation of sporulating yeast-like forms of* ——. P. Viala and P. Pacottet. Comptes rend., 1906, **142**, 458—461.

THE formation of endogenous spores similar to ascospores has been regarded as a characteristic of true yeasts and mycoderma, serving to distinguish them from the yeast-like forms of the filamentous mould fungi. The authors' studies on the parasitic fungi which cause the anthracnosis of the vine and the plane tree (species of *Glœosporium*), show, however, that these fungi also possess this property. In saccharine media the fine, filamentous mycelium soon becomes divided by cross walls and breaks up after a time into cells which multiply by budding like yeasts, and continue to do so when transplanted to fresh media. These cells stand morphologically midway between those of *S. apiculatus* and *S. ellipsoideus*; they produce small quantities of alcohol, and form endospores under the same conditions as the true Saccharomycetes. These yeast-like cells can be slowly re-transformed into the original mould fungus by suitable treatment. This observation re-opens the question enunciated by Pasteur, whether the wild and industrial yeasts are not really forms originally derived from mould fungi, which have become fixed more or less permanently in their present state.—J. F. B.

Yeast species; Influence of formaldehyde on the reproductive energy, the fermentative energy and the generation period of various ——. J. Hirsch. Allg. Z. Bierbrau u. Malzfab., 1905, **33**, 351; Z. ges. Brauw., 1906, **29**, 118.

VARIOUS species of yeast, including Saaz, Frohberg and Logos culture yeasts and certain wild yeasts, were digested for one hour at 20° C. with varying proportions of commercial formalin; the yeasts were then separated in a centrifugal machine and stirred up with water, and known quantities of cells were cultivated in a medium composed of cane sugar and yeast water. Very small quantities of formaldehyde were found to have a stimulating influence on the reproductive energies of the yeasts at 3° C., with the exception of Saaz yeast. As a general rule the fermentative energies reached their maximum points when the reproductive energies were beginning to be affected adversely. As soon as reproduction and fermentation began to be inhibited by the increasing proportions of formaldehyde employed, the invertive power of the yeasts towards cane sugar rose considerably, the increase in the case of Frohberg yeast being very marked. Formaldehyde does not hinder the secretion of invertase. The proportions of formaldehyde per 100 c.c. of wort which were required to kill the yeast cells varied according to the species; thus, for Frohberg and Logos yeasts 4·5 mgrms. of formaldehyde were necessary; for *S. Pastorianus III.*, 3·1 mgrms.; for Saaz yeast and *S. ellipsoideus I.*, 2·8 mgrms. The time of action necessary for the death of all the cells varied with the temperature; in the case of Frohberg yeast the necessary duration of action was 30 minutes at 18° C., 45 minutes at 25° C., and 35 minutes at 37° C. As regards the generation period the culture yeasts were more resistant to formaldehyde than the wild yeasts; very small doses of formaldehyde shortened the period between one generation and the next.—J. F. B.

Ozone; Physiological action of —— *on* [*Organisms*]. W. Sigmund. Centrabl. Bakt. II., 1905, **14**, 400; Z. ges. Brauw, 1906, **29**, 133—134.

THE author has studied the action of ozone on enzymes, fermentative processes and bacteria. All the enzymes studied, *viz.*, diastase, emulsin, pepsin, invertase, ptyalin, pancreatin and rennet, suffered a decrease in their activity, which differed in degree not only with the different enzymes but also with one and the same enzyme. The degree of inhibition was found to depend on the quantity of ozone, on the velocity of the current of ozonised air or oxygen, and on the time of action, also on the degree of purity of the enzyme and on the concentration and quantity of the enzyme solution. A destruction of the diastase in 50 c.c. of malt extract was effected in six hours by the passage of a current of ozonised air at a velocity of 1·5 litre per hour, the proportion of ozone (O_3) in the air being 1 mgrm. per litre, *i.e.*, a total quantity of 9 mgrms. of ozone. The action of ozone on invertase in more dilute solutions was more intense. The fermentative power of yeast was distinctly weakened by the action of ozone to an extent varying greatly with the intensity of ozonisation. Small quantities of ozone had a relatively slight effect on the fermentative power, corresponding to the large proportion of organic matter contained in the yeast, and which had first to be acted on; larger quantities of ozone lowered the fermentative power considerably, at all events when measured by the action on cane sugar. In none of these experiments was the combined fermentative power of the yeast towards cane sugar [invertase and zymase] destroyed completely. As regards the influence of ozone on acetification, excluding the direct oxidation of the alcohol by the ozone, it was found, under the conditions studied, that the development and activity of the acetifying bacteria were only temporarily weakened or delayed; the bacteria rapidly recovered and then seemed to possess a slightly increased activity as compared with untreated bacteria.—J. F. B.

Vinegar factories; Pure cultivated bacteria in ——. W. Henneberg. Centralbl. Bakt. [Abth. 2], 1905, **14**, 661; Z. ges. Brauw., 1906, **29**, 117.

HITHERTO the employment of pure cultures of acetifying bacteria has not been applied in vinegar making by the German "quick-vinegar" process. The author has, however, now isolated two species of these bacteria, and has been working one of them on an industrial scale for three months. The vinegar is produced at a strength of 11·5 per cent. and is perfectly clear and rich in bouquet. The culture is being supplied to the factories working the

"quick vinegar" process for the purpose of starting their acetifiers. The author is also preparing pure cultures of wine-vinegar bacteria for similar purposes.—J. F. B.

Malt analysis; Use of closed mashing beakers for ——. O. Pankrath. XXIII., page 286.

Worts and sugar solutions; Determination of extract in ——. H. van Laer. XXIII., page 286.

Beer analysis with the refractometer. E. Ackermann and F. Foggenberg. XXIII., page 286.

Malting industry of Germany. Bd. of Trade J., March 8, 1906.

THE quantity of barley and other grain used for brewing purposes in Germany amounted to 796,408 tons in 1901, 745,805 tons in 1902, and 771,169 tons in 1905. Malt substitutes used in Germany (such substitutes are illegal in Bavaria) amounted to 14,962 tons in 1901, 13,444 tons in 1902, and 13,665 tons in 1903.

The hops grown in the German Empire in 1905 amounted to 607,000 centners. In Germany hops are, in most instances, not sufficiently dried till they pass into the hands of the dealer, who puts them into the required condition. In some instances hops are sent out sun- or air-dried for immediate use to local brewers.

[T.R.]

ENGLISH PATENTS.

Diastase; Production of pure ——. S. Fränkel, Strassburg, Germany. Eng. Pat. 5845, March 20, 1905.

A COLD water extract of malt is sterilised by filtration through a clay or other suitable filter; it is then fermented by a pure culture of Logos or Frohberg yeast, preferably under vacuum. The yeast ferments the sugars and higher carbohydrates, and removes a large proportion of the nitrogenous matters from the solution, but does not diminish the diastatic power. The fermented liquid is filtered and evaporated at a low temperature *in vacuo*; the product is finally freed from all dialysable bodies and is dried by evaporation *in vacuo*.—J. F. B.

Brewing and other purposes; Manufacture from grain of material for use in ——. E. C. Schrottky, Calcutta. Eng. Pat. 21,754, Oct. 25, 1905.

RAW or previously steamed grain is treated with a glucose solution and pressed brewers' yeast in the proportion of about 4 parts of each constituent per 100 parts of grain. The mixture is fermented at about 115° F. for two to three days, drained, and the grain washed with water at 120° F., again drained and covered over. Here it remains for two days at 120°—150° F. The grain is then either steamed for use or dried. Such modified grain is mashed with malt for brewing purposes, or employed for the preparation of food products. (See also Eng. Pat. 23,277 of 1904; this J., 1905, 1248.)—J. F. B.

Brewing apparatus. O. Imray, London. From C. Rach, New York City. Eng. Pat. 21,928, Oct. 27, 1905.

SEE U.S. Pat. 804,979 of 1905; this J., 1905, 1318.—T.F.B.

Beers; Process for sterilising and preserving ——. P. A. Roche, Paris. Eng. Pat. 18,748, Sept. 16, 1905.

SEE Fr. Pat. 350,182 of 1904; this J., 1905, 1248.—T. F. B.

UNITED STATES PATENT.

Beers or malt liquors; Manufacture of English ——. N. H. Claussen, Copenhagen, Denmark. U.S. Pat. 813,199, Feb. 20, 1906.

SEE Eng. Pat. 28,183 of 1903; this J., 1904, 1230.—T.F.B.

GERMAN PATENT.

Beer containing iron; Process for preparing ——. M. Barsickow. Ger. Pat. 164,245, May 8, 1904.

BALLS of pure metallic iron are sterilised by treatment with alcohol and ether, and then placed in casks which are completely filled with the beer. After eight to ten days at about 15° C. the beer is drawn off; it contains iron equivalent to 0·025—0·06 grm. of ferric oxide per litre. Beer containing iron is stated to possess a fuller flavour and better "head-" forming and -retaining properties than ordinary beer.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 232.)

(A.)—FOODS.

Silk-fibroin; Formation of a dipeptide by the hydrolysis of ——. E. Fischer and E. Abderhalden. Ber., 1906, **39**, 752—760.

SILK-FIBROIN was treated with an excess of 70 per cent. sulphuric acid for five days at 18° C., the solution was freed from sulphuric acid and concentrated under reduced pressure. For purification, the product was digested for eight days with active pancreatic juice, and the tyrosine so produced was removed by crystallisation. For the separation of the dipeptides from the amino-acids, advantage was taken of the ease with which the ethylic esters of the latter are volatilised. The product, after the removal of the tyrosine, was esterified by the action of alcohol and gaseous hydrogen chloride. When the alcoholic solution was distilled, the esters of the amino-acids, mainly glycocol and alanine, were removed in the distillate. The residue was treated with dry ammonia gas to convert the dipeptides into the diketopiperazine derivatives, which are readily crystallisable. In this manner the authors obtained a fairly high yield of a dipeptide derivative identical with glycyl *d*-alanine anhydride prepared synthetically. This anhydride was split up on hydrolysis into a mixture of glycyl-*d*-alanine and *d*-alanyl-glycine and may have been derived from either of these dipeptides in the crude product. There is reason, however, to believe that the dipeptides produced by the hydrolysis of silk fibroin consist mainly of glycyl-*d*-alanine, since alanyl-glycine does not resist the action of pancreatic juice; a small quantity of glycyl-tyrosine was also found. Hydrolysis of silk by concentrated hydrochloric acid yielded the same product as was obtained by the action of sulphuric acid.—J. F. B.

Cocolio. U.S. Customs Decision, Dec. 26, 1905.

AN article invoiced as cocolio, prepared from cocoanut oil, and used as an edible fat, is dutiable at 3½ c. per lb. as "cocoa butterine." Other cocoanut oil products were held to be either dutiable as above stated when fit for food, or free of duty as "cocoanut oil" when suitable for soap making. [T.R.] R. W. M.

ENGLISH PATENTS.

Peptone; Manufacture of silk fibroin ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,956, June 22, 1905.

SEE Fr. Pat. 355,805 of 1905; this J., 1905, 1249.—T.F.B.

Brewing or other purposes; Manufacture from grain of material for use in ——. E. C. Schrottky. Eng. Pat. 21,754, Oct. 25, 1905. XVII., see col. 1.

UNITED STATES PATENTS.

Flour; Method of [electrically] treating ——. J. E. Mitchell, Assignor to Alsop Process Co., St. Louis, Mo. U.S. Pat. 812,764, Feb. 13, 1906.

AIR is subjected to the action of a flaming electric discharge

and the gases produced are, after passing through intermediate chambers where they are cooled and mixed, conducted to a vessel containing the flour to be treated. —W. P. S.

Flour; Art of treating ——. E. E. Werner, Indianapolis, Ind. U.S. Pat. 812,777, Feb. 13, 1906.

THE flour is subjected to the action of the gas produced by passing a current of air laden with ammonia over heated copper oxide or other substance capable of yielding oxygen.—W. P. S.

Peptone; Process of making silk fibrom ——. J. Altschul, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 813,272, Feb. 20, 1906.

SEE Fr. Pat. 355,805 of 1905; this J., 1905, 1249.—T.F.B

Albumin from vegetable substances; Process for extracting ——. F. W. Gaertner, Niagara Falls, N.Y. U.S. Pat. 813,373, Feb. 20, 1906.

VEGETABLE substances in the form of meal are digested with seven to ten times their weight of a solution of salt containing about 3·5 per cent. of salt, at a temperature of 30°—40° C. for about five hours, in order to extract the albumin. The solution is then filtered and boiled, and the coagulated albumin is collected and dried. The albumin so obtained is ground and bleached by means of a solution containing about 12 lb. of sodium peroxide, and 16 lb. of sulphuric acid per 100 galls., together with a little alkali. The bleached albumin is then washed, dried and ground to a fine powder.—J. F. B.

GERMAN PATENT.

Milk powder from whole milk; Preparation of —— H. J. Bucka, C. Hansen, and O. B. Wimmer. Ger. Pat. 164,795, May 26, 1901.

THE milk is evaporated first, *in vacuo*, in the ordinary manner, with continual agitation, until it contains from 25 to 30 per cent. of water, and then, with access of air, at a temperature below the melting point of the milk-fat until the water-content is reduced to 16—20 per cent. The evaporated milk is now powdered and further dried at the temperature mentioned, until a product containing not more than 14 per cent. of water is obtained. It is stated that in this way a milk powder is produced in which the fat is present in the form of small globules, surrounded by dried "blue milk," which prevents the fat from decomposing.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Sewage, A study of the process of nitrification with reference to the purification of ——. H. Chick. Roy. Soc. Proc. 1906, 77 B, 241—266.

THE objects of the present research were mainly the chemical study of the course of the nitrification occurring during the filtration of sewage, the isolation of the organisms concerned, and the study of the question of absorption of ammonia upon the surface of filtering material previous to nitrification. The investigations were carried out in Vienna and in Munich. The results obtained show that nitrification of ammonia occurs in two stages, and is due to the activity of two classes of bacteria, one producing nitrites and the second oxidising the nitrites to nitrates. The organisms belong to the same group as those concerned with nitrification in soils. That organisms so susceptible to the presence of organic matter are able to live and do their work in sewage filters may be explained by the fact that they are protected, to a certain extent, by the presence of other organisms, which view is strengthened by experimental results. The nitrifying organisms, moreover, probably live and multiply low down in the filter where the amount of organic matter is small, as porous materials, such as coke, &c., are able to retain upon their surface complicated organic substances of high molecular weight, when these are presented in solution. The nitrifying bacteria are doubtless present in very great numbers in the filters, and this may also assist them in withstanding the effect of organic matter. Experiments by other observers have shown that nitrifying organisms, if present in sufficient quantity, live in the presence of amounts of organic matter otherwise inhibiting them.

In the maturing of filters, the two stages of nitrification may be markedly separate in time, or may both develope together. This difference is reciprocally related to the greater or less ammoniacal content of the sewage. In experiments with strong sewage the inhibitory action of abundance of ammoniacal compounds presumably retarded the development of the nitrate-producer, until the nitrite-producer was sufficiently well established to be converting most of the ammonia into nitrites. There is no evidence of absorption of free and saline ammonia in coke filters without contemporaneous nitrification, and the author considers the process of nitrification, during the filtration of sewage through such filters, to be an extremely rapid biological process, requiring for its completion only the time taken for the liquid to pass through the filter (three hours or so). Temperature is shown to have a marked influence on the oxidation of sewage, a higher temperature being noticeably more favourable.

The previous conclusions are chiefly drawn from experiments with continuous filters, but filters working as contact beds were also investigated, and found to be less efficient. The advantages of the continuous method would seem to lie in the much more complete aeration and efficient diffusion, and also in the stratified distribution in the filter of the different stages of the purification. Simple mechanical treatment would meet any difficulties due to clogging which might be met with in the practical employment of continuous filters, as it would probably occur in the superficial layers of the filter bed. In the case of contact beds, however, clogging necessitates the cleansing of the whole bed. The method of continuous filtration would, therefore, appear to be the most advantageous method of purifying sewage.—W. P. S.

Sulphates; Determination of —— in drinking waters. F. Raschig. XXIII., page 286.

ENGLISH PATENTS.

Sewage, trade effluents, and other foul or polluted waters; Treatment of ——. H. Spivey, Heckmondwike, Yorks. Eng. Pat. 12,481, June 16, 1905.

THE sewage is passed into a closed tank, the upper part of which is separated from the lower by a gauze partition, forming a chamber which is filled with filtering material such as coke, shingle, charcoal or the like. The liquid portion of the sewage is forced through this filter by the head of water behind it, and is then conducted to a second similar tank, and so on until it is sufficiently clear. The solids contained in the sewage collect at the bottom of the tank or tanks, whence they are conveyed by a rotating scraper into a vertical screw conveyor by which they are raised above the level of the sewage admitted to the tank and then discharged. The filtering material may be periodically cleansed by forcing water through it from the top at a high pressure, a valve being provided for this purpose.—W. P. S.

Water or other liquids; Apparatus for the treatment of —— with powdered materials. Maignen's "Filtre Rapide" and "Anti-Calcaire" Co., Ltd., and A. A. Ellis, London. Eng. Pat. 15,527, July 28, 1905.

IN water-softening apparatus, in which powdered materials are fed into the water from a reservoir by means of blades rotated in the reservoir by a water-wheel which is turned by the flow of the water to be treated; it has been found that, as the supply of powder in the reservoir decreases, the resistance offered to the motion of the wheel is lessened. The result is, that for the same rate of flow, the wheel moves faster and the proportion of the powder to the water is increased. To overcome this defect, the opening by which the powder leaves the reservoir is slowly closed by a slide. An eccentric placed on the shaft of the water-wheel, imparts a reciprocating motion to a rocking lever,

which in turn actuates a pawl, and rotates a toothed wheel. The motion of the latter, after being geared down, operates a screw which slowly closes the slide. When the reservoir has to be refilled, the slide is opened again and the whole operation is repeated.—W. H. C.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 232.)

ENGLISH PATENTS.

Paper-making apparatus. A. J. Boult, London. From O. Moritz, Pasing, Germany, and T. Moritz, Schlöglmühl, Austria. Eng. Pat. 10,880, May 24, 1905.

WHEN the width of the paper which is being made, is less than the full width of the travelling machine wire, an adjustment of the width of the suction boxes is necessary in order to prevent air being drawn through the uncovered portions of the wire. According to this invention two bands of flexible material are provided above each side of the suction box, these bands passing over pulleys capable of being moved nearer to or further from the centre of the machine, after the manner of deckle straps. The flexible bands are kept, by the suction, in intimate contact with the portions of the travelling band uncovered by paper and make a tight joint between the edge of the paper and the edge of the suction box. —J. F. B.

Pulps; Production of white —— from natural vegetable matter or from coloured or dyed waste material for use in Paper making. A. Gagedois, Donn, France. Eng. Pat. 14,385, July 12, 1905.

SEE Addition of Oct. 17, 1904, to Fr. Pat. 306,278 of 1900; this J., 1905, 344.—T. F. B.

Paper, textile fabrics or the like; Coating —— with viscose or mixtures thereof with pigments, and apparatus therefor. L. Lilienfeld and V. Tedesko. Eng. Pat. 5214, March 13, 1905. VI., page 263.

UNITED STATES PATENTS.

Fibre from cornstalks and analogous pithy plants; Process of preparing ——. A. G. Manns, Assignor to Food and Fibre Products Co., Chicago, Ill. U.S. Pat. 811,419, Jan. 30, 1906.

CORNSTALKS, bagasse and analogous pithy plants are first treated with hot water or steam to remove soluble constituents, and then disintegrated by digestion under pressure with a "suitable hot reducing liquor" sufficiently drastic to effect moderately rapid disintegration of the pith and filamentary cells and their separation from the connective tissue but not drastic enough to destroy them, except to a small extent. The fibre is then mechanically separated from the liquor and finally beaten.—E. F.

Cellulose solution. E. W. Friedrich, Blaton, Belgium. U.S. Pat. 813,878, Feb. 27, 1906.

SEE Fr. Pat. 357,171 of 1905; this J., 1906, 88.—T. F. B.

FRENCH PATENT.

Paper; Process for producing irregularly shaded ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,447, Oct. 31, 1904.

SEE Eng. Pat. 27,870 of 1904; this J., 1906, 87.—T. F. B.

GERMAN PATENT.

Electrodes of alkaline accumulators; Employment of cellulose derivatives for the separation of the ——. Kölner Akkumulatorenwerke Gottfried Hagen. Ger. Pat. 165,233, Aug. 3, 1904. XI*A*., page 271.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 233.)

Veratrum album; Alkaloids of the rhizome of —— and quantitative determination of the same. G. Bredemann. Apoth.-Zeit., 1906, **21**, 41—45, 53—56. Chem. Centr., 1906, **1**, 606—608.

THE rhizome of *Veratrum album* contain quantities of total alkaloids varying from 0·19928 to 0·9328 per cent For the determination of the total alkaloids, 12 grms. of the powdered rhizome were shaken with 120 c.c. of a mixture of equal volumes of ether and chloroform, 10 c.c. of sodium hydroxide solution added, the mixture allowed to stand for three hours with frequent agitation, and then sufficient water to cause the powder to agglomerate. After allowing to settle, the ether-chloroform solution was poured off, clarified by means of calcined magnesia and three or four drops of water, and 100 c.c. filtered off. The filtrate was shaken three times with 10 c.c. of water acidified with acetic acid, and the united extracts were made alkaline, and then shaken out three times with the ether-chloroform mixture. The solution so obtained was evaporated to dryness, and the residue dried at 100° C. and weighed.

For the separation of the different alkaloids, a solution of the total alkaloids in water acidified with acetic acid, was prepared from 5 kilos. of the coarsely-powdered rhizome, in essentially the same manner as in the determination of the total alkaloids, and this aqueous solution treated according to the metaphosphoric acid process of Salzberger (Arch. Pharm., **228**, 462). The precipitate consisting of jervine and rubijervine was washed, the filtrate made strongly alkaline with ammonia, and extracted successively with ether and chloroform, which removed protoveratrine and pseudojervine respectively.

Jervine, $C_{26}H_{37}O_3N,2H_2O$, forms white acicular prisms, resembling morphine sulphate crystals; after drying, it melts at 241° C.; it is easily soluble in chloroform, moderately in alcohol, slightly soluble in ether, and almost insoluble in benzene and petroleum ether. *Rubijervine*, $C_{26}H_{43}O_2N,H_2O$, forms acicular prisms melting at 234° C., moderately soluble in hot chloroform, less soluble in alcohol, and slightly soluble in ether and petroleum ether. *Pseudojervine*, $C_{29}H_{43}O_7N$, crystallises in thin hexagonal plates, melting at 304° C., easily soluble in chloroform, slightly soluble in alcohol, almost insoluble in ether, petroleum ether and benzene. *Protoveratrine* forms small colourless, square or hexagonal plates, moderately soluble in chloroform and hot absolute alcohol, slightly soluble in cold ether, insoluble in benzene, water and petroleum ether. From the mother-liquor from protoveratrine, the author isolated a small quantity of a base (m. pt. 230°—241° C.), which crystallised from absolute alcohol in white needles grouped together in the form of balls.—A. S.

Cocaine; Action of bromine on ——. A. W. K. de Jong. Rec. trav. chim. Pays-Bas., 1905, **25**, 7. Chem. Centr., 1906, **1**, 705.

ON shaking together aqueous solutions of cocaine and bromine, or by mixing together carbon tetrachloride solutions of the two substances, and then shaking with water, a crystallisable orange-yellow oil is obtained. The crystals are soluble in ethyl acetate, insoluble in water and ether, and slightly soluble in carbon tetrachloride. They diminish in volume at 75° C., and melt at 85° C. The compound appears to have the composition, $C_{17}H_{21}O_4NHBr.Br_2$; it easily loses bromine, and on heating with water, dissolves, with formation of cocaine hydrobromide. Cinnamylcocaine yields a similar derivative with bromine.—A. S.

Kolatin: A new glucoside from kola nuts. Goris Bull. commercial, 1905, **33**, 563.

THE fresh seeds of *Sterculia kola*, besides the kolanin of Knebel, contain another glucoside, kolatin, which forms white prismatic acicular crystals, m. pt. 150° C. The

yield is from 0·3 to 0·4 per cent. The new compound is fairly soluble in water, more so in alcohol, acetone, and ethyl acetate, less so in ether, and is almost insoluble in chloroform, even when boiled therein. It is hydrolysed by sulphuric acid into dextrose, and a substance with the characters of a phenol. The latter gives a green colour reaction with ferric chloride, and is slowly coloured orange-yellow by ammonia.—J. O. B.

Lycopodium; New adulterant of ——. C. Gallois. J. Pharm. Chim., 1906, **23**, 242—244.

THE product obtained by the action of anhydrous ammonia on dry (Austrian ?) galipot resin, at a temperature near the melting point of the resin, is employed when powdered, as an adulterant of lycopodium. The admixture is not readily detected by superficial examination, and the powder flashes in the flame like the genuine drug. It is slightly soluble in alcohol, in ether and in chloroform, these solvents removing resinous matter. Pure lycopodium yields practically nothing to the same solvents. Microscopical examination at once shows that the adulterant is in the form of irregular transparent grains, with rounded angles; under the lens it is quite distinct in appearance from the characteristic spores of which lycopodium is composed.—J. O. B.

Lichens and their characteristic constituents. O. Hesse. J. prakt. Chem., 1906, **73**, 113—176.

THE author has examined the following varieties:—*Usnea longissima. Ach., Usnea barbata, var. hirta* from San Thomé (West Coast of Africa) and Sothupara (Madras), *Usnea barbata var. florida* (Hoffm.), *Alectoria implexa* (Hoffm.), *Cornicularia aculeata* (Körber), *Rocella phycopsis* (Ach.), *Rocella peruensis* (Krempelhuber) = *R. fruticosa*, Laurer = *R. cacticola* (Darbishire), *Cetraria islandica* (*L.*), including varieties from the Cavalljoch (Vorarlberg) and the Stubaital (Tyrol). A description of triethylprotocetraric acid (cetraric acid) is here given. *Parmelia tinctorum* (Despreaux), *Parmelia conspersa* (Ehrh.), *Xanthoria lychnea* (Ach.), *Gasparrinia elegans* (Lk.) Tornab. *Ochrolechia pallescens* γ. *parella* (Mass.) = *Lecanora parella* (*L.*), *Pertusaria lactea*, Nyl. *Humatomma coccineum var.* ? *Pulveraria chlorina* Ach. = *Lepraria* (*Lepra*) *chlorina* Ach. *Lepraria latebrarum* Ach. The investigation concludes with a description of parellic acid and a list of the lichens in which it is found.—F. SHDN.

Terpenes and essential oils. 76th and *77th Communications.* O. Wallach. Annalen, 1906, **345**, 127—138, 139—154.

THE 76th communication deals with new compounds obtained from β-terpineol, the work being treated under the following headings:—Action of sodium methylate on β-terpineol-nitrosochloride; the aldehyde, $C_{10}H_{14}O$; the ketone, $C_{10}H_{14}O$.

In the 77th communication the preparation of some new heptacyclic compounds is described, *viz.*, Δ′-Methylsuberene [Δ′-methyl-(1)-cycloheptene], C_8H_{14}; methylsuberanmethoxyloxime; methylsuberenone; methyl-(1)-cycloheptanone-(2)(methylsuberone); methene-cycloheptamethylene (methenesuberene); glycol from methenesuberene: suberanaldehyde; hydroxysuberancarboxylic acid; nitrosochloride from methenesuberene.—A. S.

Citronella and lemongrass oils; Ceylon ——. C. E. Sage. Chem. and Drug., 1906, **68**, 355.

THE author has examined samples of citronella and lemongrass oils distilled at the Government Experiment Station, Peradeniya, Ceylon.

Citronella oil.—The oil was of a dark orange colour, and had the following characters:—Sp. gr. at 15·5° C., 0·884; optical rotation, —3·3°; citronellal, 36 per cent.; geraniol 41 per cent.; Schimmel's test (see this J., 1904, 886), turbid solution. The fact that the oil failed to pass Schimmel's test points to the desirability of rejecting that test as a criterion of purity for citronella oil, which should be judged by its content of odorous constituents, namely, geraniol and citronellal.

Lemongrass oil.—The sample of oil examined had the sp. gr. at 15·5° C., 0·899; aldehydes (calculated as citral), 66·5 per cent.; optical rotation, —0·2°. It was not completely soluble in ten parts of 70, 80, or 90 per cent. alcohol, but formed a clear solution with an equal volume of absolute alcohol, the solution becoming turbid, however, on addition of more alcohol. The oil possessed a finer odour than East Indian lemongrass oil.—A. S.

Essential oils; New —— [*Ocotea usambarensis Engl., and Piper Volkensii, C.D.C.*]. R. Schmidt and K. Weilinger. Ber., 1906, **39**, 652—658.

THE essential oil from *Ocotea usambarensis* Engl. is found to the extent of about 0·15 per cent. in the bark. It is a thin oil of a yellow colour and a strong smell indicating the presence of cineol. It boils between 50° and 160° C. at 10 mm., sp. gr. at 20° C., 0·913; $n_D = 1·476$; α_D at 20° C. = —11° 12′; acid value, 1·2; ester value, 12·5. The following are the principal constituents:—Myristic aldehyde, 1 per cent.; cineol, 40 per cent.; *l*-terpineol, 40 per cent.; sesquiterpene, $C_{15}H_{24}$ or $C_{15}H_{26}$, 10 per cent.; esters, 4 per cent.; traces of a ketone (semi-carbazone, m. pt. 197° C.), and small quantities of terpenes.

The leaves of *Piper Volkensii*, C.D.C., contain 0·3 per cent. of an oil. This has a light brown colour and a strong but pleasant smell. It distils over almost entirely between 90° and 175° C. at 12 mm. Sp. gr. at 20° C., 0·934; $n_D = 1·5017$; $\alpha_D = -8° 24′$; ester value, 17; after acetylating, the ester value is 66. This latter is due to the presence of 14 per cent. of an alcohol, most probably citronellol. 70 per cent. of the saponified oil distilled between 135° and 148° C. at 15 mm. One-third of this fraction consisted of limene. The remainder appeared to be a methoxylated safrol, $C_{11}H_{12}O_3$. Its bromine addition compound melted at 122° C., and the original substance on regeneration boiled at 136°—140° C.; with sp. gr. at 20° C., 1·137; and $n_D = 1·5416$.—F. SHDN.

Carline thistle (*Carlina acaulis L.*); *Essential oil from* ——. F. W. Semmler. Ber., 1906, **39**, 726—731.

THE dried roots of *Carlina acaulis* yield about 2 per cent. of a heavy oil, with sp. gr. 1·0333 at 19° C.; $n_D = 1·56960$. The constituents were isolated by fractional distillation. The first constituent, amounting to 12—15 per cent. was *carlinene*, $C_{15}H_{24}$, boiling between 139° and 141° C., with sp. gr. 0·8733 at 23·8° C., and $n_D = 1·492$. These figures show carlinene to be a monocyclic, doubly unsaturated sesquiterpene. A small quantity of palmitic acid was isolated. The chief constituent is *carlina-oxide*, $C_{13}H_{10}O$, b. pt., 167°—168° C., sp. gr., 1·066 at 17° C., $n_D = 1·586$, and optically inactive. It is reduced by sodium and alcohol to tetrahydrocarlina-oxide, $C_{13}H_{14}O$, boiling at about 135° C. at 10 mm., and at about 262° C. at ordinary pressure. This product was identical with 1-phenyl-3-*a*-furyl-propane prepared synthetically, thus indicating the relative position of the carbon atoms in carlina-oxide.
—F. SHDN.

Aniseed Oil; New method of extracting ——. P. Eberhardt. Comptes rend., 1906, **142**, 407—408.

THE author finds that aniseed oil is yielded not only by the fruit, but by the leaves of the plant. The oldest leaves are gathered in the middle of the dry season and distilled with water. This does not exhaust the plant, and forms a definite addition to the yield of oil. The oil has a slightly lower solidifying point than that from the seeds, but is essentially the same substance.—J. T. D.

Acetamide; Preparation of ——. F. M. François. J. Pharm. Chim., 1906, **23**, 230—237.

THE following method gives a yield of 91·7 per cent. of the theoretical quantity of pure acetamide, compared with 28·1 per cent. obtained by the process of Roorda Smit. (Bull. Soc. Chim., 1875, **24**, 539), 1060 grms. of hard, transparent ammonium sesquicarbonate are heated on the water-bath, in a large flask, with 2000 grms. of glacial acetic acid, so as to obtain ammonium diacetate. The flask is then fitted with an earthenware stopper, pierced with three holes, and packed with asbestos fibre. One hole carries a safety tube; the second, a thermometer; and the third, a funnel-adapter, bent at an obtuse angle. All these fittings are

packed with asbestos, or luted over with plaster, and fixed with a strip of canvas saturated with gum. The bent adapter is then fitted to a sloping Liebig's condenser, having a wide inner tube and a narrow annular jacket. The lower lateral inflow tube is removed. The jacket is three-parts filled with acetic acid, b. pt. 118° C., instead of water, so as to form a condensing zone of higher boiling point than that of water; some pieces of pumice or charcoal are introduced into the acid to prevent bumping. The upper lateral outflow tube is attached to a long upright tube to serve as a condenser to keep the acid in the jacket at a constant level. The upper end of this condenser is then connected by means of a bent tube with a descending condenser, all joints being made with asbestos. The two condensers will then have the form of an inverted V. The ammonium diacetate is heated over a gas flame, distillation being regulated by the thermometer. Decomposition commences at 135°—140° C., when the distillate consists chiefly of water, with a little acetic acid; from 140° to 195° more acid, and less water is given off. When the temperature in the flask has reached 195° C., the condenser containing the acetic acid jacket is removed, and one containing dry aniline, b. pt. 183°, substituted for it. Distillation is then resumed, when the liquid which passes over between 195° and 222° contains some acetamide. As soon as the liquid in the flask has a constant b. pt. of 222° C., the process is stopped, for the residual product is pure, almost colourless acetamide. The acetic acid in the distillates may be used again in subsequent operations. The product of this method is purer than the acetamide obtained by distillation, having the constant b. pt. 222° C. to the last drop, any acetonitrile which is formed during the process being eliminated.—J. O. B.

Anilides; Influence of catalysers on the formation of ——. N. Menschutkin. Iswiestja d. Petersburger Polyt. Inst., 1905, **4**, 181—190. Chem. Centr., 1906, **1**, 551.

The author determined the rate of acetylation of aniline, *o*-, *p*- and *m*-toluidine and *m*- and *p*-xylidine both alone and in presence of different proportions of hydrochloric, hydrobromic and hydriodic acids. The method used was that of H. Goldschmidt and Wachs (Z. physik. Chem. **24**, 353). N/1-solutions of acetic acid in the respective amino compounds were treated with molecular proportions of the corresponding hydrochloride, hydrobromide, or hydriodide, and the mixtures heated at 182° C., the course of the reaction being followed by titration with barium hydroxide solution. It was found that in presence of the haloid acids, the reaction was unimolecular, but bimolecular when these acids were absent. The accelerating effect of the acids was directly proportional to the quantity present, hydriodic acid having the greatest influence and hydrochloric acid the least. In the case of the homologues of aniline the position of the methyl groups was of some importance, the rate of acetylation being retarded by the presence of a methyl group in the ortho position, but strongly accelerated by methyl groups in the meta and para positions.—A. S.

Chloral hydrate; Decomposition of — — under the influence of light and air. N. Schoorl and L. M. Van den Berg. Pharm. Weekblad, 1906, **43**, 42—47. Chem. Centr., 1906, **1**, 650.

Tubes containing (1) 1·060 grms. of chloral hydrate and 250 c.c. of oxygen, a quantity just sufficient for its complete oxidation, (2) 2 grms. of chloral hydrate and 250 c.c. of oxygen, and (3) 5 grms. of chloral hydrate, but from which the air had been previously exhausted, were exposed for several weeks to tropical sunlight, and then their contents examined. The results obtained indicate that under the influence of sunlight, in the absence of air, the decomposition of chloral hydrate alone proceeds according to the scheme: $CCl_3.CHO.H_2O \rightarrow 3HCl + 2CO$; in the presence of an insufficient quantity of oxygen for complete oxidation the following reaction also occurs: $CCl_3.CHO.H_2O + 2O \rightarrow 3HCl + 2CO_2$, or possibly, the chloral hydrate is decomposed as in the first case, whilst the carbon monoxide is further oxidised to carbon dioxide. When the amount of oxygen present is sufficient for complete oxidation, the products found indicate that the following reactions take place:—

$$CCl_3.CHO.H_2O + 2O \rightarrow 3HCl + 2CO_2,$$
$$2CCl_3.CHO.H_2O + 7O \rightarrow 3H_2O + 6Cl + 4CO_2,$$

but here again, the carbon dioxide, water and chlorine, may be due to the secondary oxidation of carbon monoxide and hydrochloric acid formed according to the first equation given above.—A. S.

Pharmaceutical substances; Influence of the incandescent gas light on some ——. N. Schoorl and L. M. Van den Berg. Pharm. Weekblad, 1906, **43**, 47—49. Chem. Centr., 1906, **1**, 696.

Different pharmaceutical substances contained in sealed tubes of white glass and of brown, so-called anactinic, glass, were exposed at about 40° C. to an incandescent gas light, at a distance of 10 cm., in a chamber protected from sunlight. The time of exposure amounted to 478 hours. Chloroform was not altered under any of the experimental conditions. Bromoform was not altered in the brown glass tubes, but in white glass it became yellow owing to separation of bromine, whilst the development of acidity indicated the formation of hydrobromic acid. Dry iodoform behaved in a similar manner to bromoform, some iodine being separated in the white glass tubes, but with a 5 per cent. alcoholic solution of iodoform, the decomposition was much more pronounced, both in the white glass and brown glass tubes; in the case of this alcoholic solution, decomposition was caused even at a distance of 2—3 m. from the source of light. From chloral hydrate, a small quantity of hydrochloric acid was formed. Resorcinol and pyrogallol suffered alteration only where the crystals were in contact with the glass, the change being caused by the combined action of the incandescent gas light and the alkali of the glass.—A. S.

Iodine; Distribution of —— between two solvents. Y. Osaka. Mem. Coll. Sci. and Eng., Kyoto, 1904—1905, **1**, 93—102. Science Abstracts, 1906, **9 A**, 119.

The distribution of iodine between two solvents, viz., aqueous alcohol and carbon bisulphide, at 25° C., was studied; with less than 47·9 per cent. of alcohol, the two solvents mentioned are practically immiscible. For a given mixture the ratio of distribution is independent of the iodine concentration and of the relative amounts of the two phases, and is nearly identical with the ratio of the solubilities of iodine in the two solvents separately. —A. S.

Bismuth; Some salts and complex salts of ——. A. Rosenheim and W. Vogelsang. Z. anorg. Chem., 1906, **48**, 205—216.

Bismuth tartrate-nitrate, $Bi(C_4H_4O_6)NO_3,5H_2O$. A solution of bismuth nitrate rendered faintly acid with nitric acid is treated with a concentrated solution of three molecular proportions of tartaric acid. After standing for some time, white prismatic crystals of bismuth tartrate-nitrate separate out. The compound is decomposed by water, with separation of a basic salt; in alkalis it dissolves to a clear solution. On adding it, in small portions, to a boiling solution of tartaric acid, it gradually dissolves, and on cooling, *bismuth bitartrate*, $Bi(C_4H_4O_6)C_4H_5O_6,2H_2O$, free from nitric acid, separates in the form of glistening needles. This salt is also decomposed by water with formation of a basic salt. *Potassium-bismuth tartrate*, $COOK.(CHOBiO)_2COOBiO,4H_2O$. This complex salt can be prepared by: (1) adding 3 mols. of crystallised bismuth nitrate in small portions to a solution of 2 mols. of tartaric acid and about 12 mols. of potassium hydroxide in five times their weight of water, and heating the mixture, when the compound separates as a micro-crystalline powder; (2) dissolving 1 mol. of bismuth bitartrate (see above) in a concentrated solution of 6 mols. of potassium hydroxide, and allowing the mixture to stand over sulphuric acid. The compound is easily soluble in water and alkalis. Another *potassium-bismuth tartrate*, corresponding to the formula,

can be obtained, although in poor yields, from a solution containing 1 mol. of tartaric acid, 1 mol. of bismuth nitrate, and 5 mols. of potassium hydroxide. After filtering, the solution is evaporated, separated from the potassium nitrate which crystallises out, and allowed to stand over sulphuric acid. The compound separates in crystalline scales, easily soluble in water. *Ammonium-bismuth tartrate*, of corresponding composition is prepared by dissolving bismuth bitartrate in excess of ammonia, and evaporating the solution, which is kept strongly alkaline by addition of ammonia. It is decomposed by water with separation of basic compounds. The following compounds have also been prepared by the author:—*Basic bismuth thiocyanate*, $Bi(OH)(CNS)_2,5H_2O$, from thiocyanic acid and excess of bismuth carbonate; *bismuth thiocyanate*, $Bi(CNS)_3,14H_2O$, from bismuth carbonate and excess of thiocyanic acid; *potassium-bismuth thiocyanate*, $K_3Bi(CNS)_6$, *sodium-bismuth thiocyanate*, $Na_3Bi(CNS)_6$, and *ammonium-bismuth thiocyanate*, $(NH_4)_3Bi(CNS)_6,5H_2O$, prepared by evaporating over sulphuric acid a solution of 1 grm.-mol. of bismuth carbonate, and about 6 grm.-mols. of alkali hydroxide or ammonia in excess of thiocyanic acid. *Bismuth acetate*, $Bi(C_2H_3O_2)_3$, may be obtained by boiling for two hours a mixture of 2 grm.-mols. of bismuth carbonate, 4 grm.-mols of mannitol, and 300 grms. of glacial acetic acid under a reflux condenser. The bismuth acetate crystallises from the cooled filtered solution in white scales.—A. S.

Mercurous iodide; New method of preparing ——. B. Szilard. Pharm. Centralh., 1906, **47**, 31.

A KNOWN weight of mercury is agitated with three times its volume of chloroform until globules disappear. An equivalent weight of iodine, previously dissolved in a large volume of chloroform, is slowly added with continuous agitation. Combination is almost instantaneous, and the greenish-yellow iodide is precipitated. A large volume of the solvent is necessary on account of the heat generated by the chemical action. The precipitate is collected by filtration, washed with boiling water, and dried in the dark. The chloroform filtrate may be employed again for the same process. The operation should preferably be conducted at night, to avoid the action of daylight on the chloroform-iodine solution, and on the mercurous iodide formed.—J. O. B.

Calcium iodomercurates. A. Duboin. Comptes rend., 1906, **142**, 395—398.

THE author has obtained by crystallisation at different temperatures from solutions of mercuric iodide in aqueous solution of calcium iodide, three salts, corresponding to the formulæ, $CaI_2.HgI_2.8H_2O$, $CaI_2.5HgI_2.8H_2O$, and $3CaI_2.4HgI_2.24H_2O$ respectively. These are distinguished by their crystalline form, but all yield insoluble compounds with many organic substances.—J. T. D.

Palladium; Colloidal nature of solution of — obtained by means of carbon monoxide. J. Donau. Monatsh. f. Chem., 1906, **27**, 71—74.

THE almost black solution obtained by passing carbon monoxide through the aqueous solution of a palladium salt has all the properties of a colloidal solution, and no doubt contains colloidal palladium.—J. T. D.

Hydrosulphides and thioacids; Volumetric determination of organic ——. P. Klason and T. Carlson. XXIII., page 287.

Carbonyl group in aldehydes, ketones, &c.; Quantitative determination of the ——. Watson Smith, jun. XXIII., page 286.

Paraldehyde. U.S. Customs Decision.

THE United States Circuit Court, Dec. 19, 1905, overruled a decision of the Board of General Appraisers which held that paraldehyde is dutiable at 55 cents per lb. as a "medicinal preparation in the preparation of which alcohol is used." The Court found that the aldehyde from which it is prepared is not derived from alcohol, but is one of the by-products resulting from the distillation of alcohol. The decision of the Court was that it is dutiable at 25 per cent. *ad valorem*, as a "medicinal preparation in the preparation of which alcohol is not used." The Treasury Department, Feb. 3, 1906, acquiesced in this decision.—R. W. M.

Safrol. U.S. Customs Decision, Jan. 30, 1906.

SAFROL is dutiable as a "distilled oil" under paragraph 3 of the tariff. —R. W. M.

Calisaya barks; Elixir of ——. U.S. Customs Decision, Jan. 26, 1906.

ASSESSMENT of duty was affirmed at 55 cents per lb. as "alcoholic medicinal preparations" under paragraph 67, on elixir of calisaya bark and elixir of calisaya bark and coca. The claim of the importer that they were dutiable at 2 dols. 25 c. per proof gallon as "alcoholic bitters," under paragraph 292, was overruled.—R. W. M.

ENGLISH PATENTS.

Theobromine; Compounds or salts of ——. F. Hoffmann-La Roche, Basel, Switzerland. Eng. Pat. 26,821, Dec. 22, 1905. Under Int. Conv., May 30, 1905.

SEE U.S. Pat. 799,764 of 1905; this J., 1905, 1082.—T. F. B.

Anhydrides of organic acids; Production of ——. R. Sommer, Vienna. Eng. Pat. 11,058, May 26, 1905.

SEE Fr. Pat. 354,742 of 1905; this J., 1905, 1125.—T. F. B.

FRENCH PATENTS.

C-C-Dialkylbarbituric acids; Process of preparing ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 350,428, Dec. 27, 1904.

SEE U.S. Pat. 790,263 of 1905; this J., 1905, 749.—T. F. B.

Alcohols and their derivatives; Process of making aromatic ——. C. Mettler. First Addition, dated Oct. 14, 1905, to Fr. Pat. 348,951, Oct. 28, 1904. Under Int. Conv., Nov. 17, 1904.

SEE Eng. Pat. 18,674 of 1905; this J., 1905, 1188.—T. F. B.

Oxalates and oxalic acid; Process of making ——. F. A. Feldkamp. Fr. Pat. 358,785, Oct. 23, 1905.

SEE U.S. Pat. 802,980 of 1905; this J., 1905, 1254.—T. F. B.

GERMAN PATENTS.

Formaldehyde and formamide or acetamide; Process for preparing condensation products from ——. Kalle und Co., Act.-Ges. Ger. Pats. 164,610, Oct. 29, 1902, and 164,611, Nov. 15, 1902.

CONDENSATION products of the formula $R.NH.CH_2OH$ are obtained by heating formamide or acetamide with formaldehyde, preferably paraldehyde or trioxymethylene, without using a condensing agent. The products are stated to be of value as antiseptics and solvents for uric acid. If the heating be continued at a higher temperature, and particularly if 2 mols. of the acid amide are used to one of the polymerised formaldehyde, the product of condensation is methylenediformamide or methylenediacetamide.—T. F. B.

Dialkylbarbituric acids and their derivatives; Process of preparing ——. E. Merck. Ger. Pat. 163,200, March 18, 1904.

DIALKYLMALONAMINIC esters, $R_2C(CONH_2)COOK$, prepared by treating dialkylcyanoacetic esters with dilute sulphuric acid, are converted into dialkylbarbituric acids or their derivatives by condensation with urea, thiourea, or guanidine, in presence of alkaline condensing agents. —T. F. B.

Diethylmalonylcarbonyldiurea; Process of preparing ——. Chem. Fabr. von Heyden, Akt.-Ges. Ger. Pat. 165,224, July 16, 1904.

DIETHYLMALONIC esters are heated with carbonyldiurea,

$CO(NH.CO.NH_2)_2$, in presence of sodium ethylate or a similar condensing agent. The product does not yield diethylbarbituric acid when treated with 50 per cent. sulphuric acid, hence it is most probably a diethylmalonylcarbonyldiurea of the formula

$$CO:(NH.CO.NH.CO)_2:C(C_2H_5)_2.$$

—T. F. B.

Pseudoionone and its homologues; Process of preparing hydrates of ——. Knoll und Co. Ger. Pat. 164,366, May 19, 1904.

The sulphite compounds of pseudoionone or its derivatives are treated with acids (*e.g.*, sulphuric or oxalic acid, or an alkali bisulphate), when the hydrate of the sulphite compound appears to be formed. By treating these with alkalis, alkali sulphite and the hydrate of the pseudoionone derivative are formed. The hydrates are of value in perfumery.—T. F. B.

Hydrates of unsaturated organic compounds; Process of preparing ——. Knoll und Co. Ger. Pat. 165,726, Aug. 12, 1904. Addition to Ger. Pat. 164,366 (see preceding abstract).

Hydrates may be obtained from the sulphite derivatives of unsaturated organic compounds other than pseudoionone by the process described in the preceding patent. Thus hydrates of the following compounds may be prepared: — Citronellidene-acetone, carvone, citrylidene-malonic esters.—T. F. B.

Theobromine-barium and sodium salicylate; Process of preparing an easily soluble double salt of ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 164,424, May 25, 1904.

Two mols. of sodium salicylate and either 1 mol. of the barium salt of theobromine, or 1 mol. each of the sodium salt of theobromine and of a soluble barium salt, are mixed in aqueous solution; on evaporating the solution the double salt is obtained in easily soluble condition. (Compare Eng. Pat. 4958 of 1905; this J., 1905, 1254.)

—T. F. B.

8-Aminotheobromine and its alkyl or aryl derivatives; Process of preparing ——. C. F. Boehringer und Soehne. Ger. Pat. 164,425, July 14, 1904. Addition to Ger. Pat. 156,900, Sept. 2, 1903. (See this J., 1905, 560.)

By treating 8-bromo- or 8-chlorotheobromine with ammonia or an aromatic or fatty amine, the corresponding derivative of 8-aminotheobromine is obtained.—T F.B.

Phenyldihydroquinazoline; Process of preparing a benzoyl derivative of ——. Kalle und Co., Akt.-Ges. Ger. Pat. 164,426, Aug. 7, 1904.

Phenyldihydroquinazoline is treated with benzoyl chloride, preferably in pyridine solution; the pyridine is decanted off, and the product washed with water and sodium carbonate solution, and again with water. It is stated to be of therapeutic value.—T. F. B.

Sulphur or selenium in colloidal, solid and permanent form; Process for the manufacture of preparations containing ——. Chem. Fabr. von Heyden, A.-G. Ger. Pat. 164,664, March 22, 1904.

Colloidal sulphur or selenium is separated by known methods, in the wet way, in presence of albumin, albuminoids or the products of hydrolysis or decomposition of the same; the solution is acidified, the precipitate filtered off, washed, redissolved in water with addition of sufficient alkali to render the liquid neutral or faintly alkaline, and the solution, after dialysis, evaporated or precipitated by an alcohol, a mixture of alcohol and ether, or acetone. For example, 10 parts of sodium sulphide are dissolved in 200 parts of water, and one part of albumin is dissolved in the solution by agitation. The sodium sulphide is then decomposed by passing sulphur dioxide into the solution. The precipitate is filtered off, washed, dissolved in water with the addition of a little alkali, and the solution dialysed and evaporated. The colloidal sulphur is obtained as a greyish-white, permanent, amorphous substance, dissolving in water to a milky liquid which has a bluish tint by reflected light.—A. S.

Luminous [Phosphorescent] bodies; Process for the preparation of ——. Chininfabr. Braunschweig Buchler und Co. Ger. Pat. 163,648, July 2, 1904.

Zinc sulphide is ignited and mixed with small quantities of manganese sulphide or copper sulphide. The product exhibits intense phosphorescence when exposed to light-, cathode-, Röntgen- or Becquerel-rays, or when subjected to mechanical pressure.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 234.)

Glassware; Chemical ——. U.S. Customs Decision, VIII., page 266.

English Patent.

Pigment printing process. E. Bühler, Schriesheim, Germany. Eng. Pat. 12,867, June 21, 1905. Under Int. Conv., July 9, 1904.

See Fr. Pat. 354,722 of 1905; this J., 1905, 1126.—T.F.B.

German Patent.

Filtering [Photographic developers, &c.]; Apparatus for —— with exclusion of air. P. Dinglinger. Ger. Pat. 162,821, Aug. 28, 1904. I., *page* 257.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 234.)

English Patent.

Nitroglycerine; Manufacture of ——. Centralstelle f. Wissenschaftlich-techn. Untersuchungen, Neubabelsburg, Germany. Eng. Pat. 2776, Feb. 10, 1905. Under Int. Conv., Feb. 12, 1904.

See Fr. Pat. 351,454 of 1905; this J., 1905, 903.—T.F.B.

United States Patents.

Explosive compound. R. Escales, Munich-Schwabing, Germany. U.S. Pat. 812,195, Feb. 13, 1906.

This patent is for an explosive composition, consisting of an oxygen carrier, such as ammonium nitrate, and an easily oxidisable metal in the form of "metal wool," such as aluminium wool.—W. C. H.

Explosive. F. Sparre, Assignor to the E. I. Du Pont de Nemours Powder Company, Wilmington, Del. U.S. Pat. 812,958, Feb. 20, 1906.

Claim is made for explosives containing ammonium nitrate, a metallic ingredient and ungelatinised nitrocellulose, with or without the addition of a liquid hydrocarbon as kerosene, the whole being compressed if so desired. Mixtures are specified containing ammonium nitrate, a metallic ingredient, and 5—25 per cent. of nitrocellulose with or without 10 per cent. of kerosene. The use of a mixture of ammonium nitrate, ferrosilicon, and nitrocellulose is also claimed.—B. J. S.

Explosive. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Company, Wilmington, Del. U.S. Pat. 812,959, Feb. 20, 1906.

The invention comprises explosives made from the following mixtures:—Ferrosilicon and nitroglycerin with (1) an oxygen carrier, or (2) ammonium nitrate, and, if desired, (*a*) a metallic ingredient, (*b*) kerosene, (*c*) kerosene and sodium nitrate, (*d*) kerosene and charcoal. A mixture of nitroglycerin with an oxygen carrier, a metallic ingredient, a liquid hydrocarbon and charcoal.—B. J. S.

Gunpowder, and process of making same. F. I. du Pont, Wilmington, Del. U.S. Pat. 813,020, Feb. 20, 1906.

Starch is added to the powdered ingredients for making

gunpowder in the proportion of 7—8 per cent. of the whole mass, which is mixed with 5—15 per cent. of water, then subjected to sufficient heat to swell the starch granules, and pressed into the required shape.—B. J. S.

FRENCH PATENT.

Nitroglycerin; Manufacture of ——. The Eastern Dynamite Co. Fr. Pat. 358,514, Oct. 14, 1905.

SEE U.S. Pat. 804,817 of 1905; this J., 1906, 199.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 238.)

APPARATUS, ETC.

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Metals, especially gold and palladium; Determination of —— *by electric conductivity measurements.* J. Donau. Monatsh. f. Chem., 1906, **27**, 59—70.

THE solution of the metal, very slightly acidified with hydrochloric acid, is placed in a U-tube constricted at the bend and furnished with a side-tube for the entry of carbon monoxide, and its conductivity is measured. Pure carbon monoxide is then led through, and the conductivity measured from time to time till it ceases to increase. The increase in conductivity is in the case of palladium directly proportional to the amount present; in the case of gold it is not so, but the connection between the two can be expressed by the formula:

$Z = 1{\cdot}76x - 0{\cdot}0237xy + 0{\cdot}0138x^2 - 0{\cdot}00111x^2y + 0{\cdot}000738xy^2$,

where Z = mgrms. of gold in 100 c.c. of the solution, and y and x are the original conductivity and increase in conductivity, respectively, expressed in the usual Kohlrausch units multiplied by 10^6.—J. T. D.

ORGANIC—QUANTITATIVE.

Halogens; Determination of the —— in organic compounds. W. Vaubel and O. Scheuer. Chem.-Zeit., 1906, **30**, 167—168.

THE method is based on the authors' observation that organic halogen compounds, on warming with concentrated sulphuric acid, part with their halogen as hydracid or as the free element. 0·2—0·5 grm. of the substance is weighed into a dry distilling flask of about 200 c.c. capacity, and 30—50 c.c. of concentrated sulphuric acid are added from a separating funnel fitted to the flask. Gentle heat is applied and the products are passed into a solution of silver nitrate. During or after the reaction a gentle stream of air is drawn through the apparatus. The silver halide may be weighed or the excess of silver nitrate titrated.

In cases where free halogen may be evolved, metallic copper or pure filter paper is added with the substance, in order to generate sulphur dioxide, and thus ensure the absence of oxyhaloid salts. The silver sulphite formed is decomposed by boiling with 50 c.c. of concentrated nitric acid, and any silver sulphate removed by thorough washing.

The method is not recommended for such volatile bodies as chloroform or chloral, but on account of its simplicity and rapidity, is well suited for the control of industrial operations and for routine work.—F. SODN.

Paraffin; Detection and determination of —— in mixtures with ceresin. F. Ulzer and F. Sommer. Chem.-Zeit., 1906, **30**, 142—143.

THE authors confirm the statement of Berlinerblau that the refractive power of paraffin decreases with its melting point and molecular weight, but they consider that the differences are not sufficiently great in practice to render the method valueless. Thus five different kinds of paraffins gave readings in the Zeiss butyro-refractometer of 1·5 to 4; and four representative ceresins readings of 11·5 to 13, at 90° C. Experiments were also made with Crismer's method (this J., 1895, 1069) of critical solution, different solvents being used. In alcohol, *e.g.*, four different paraffins gave values of 155° to 158° C.; the ceresins, 174° to 177° C.; carnauba wax, 144° C.; and montan wax, 57° C. A mixture of ceresin with 20 per cent. of paraffin gave a critical temperature of 170·3° C., and one containing 40 per cent. of paraffin gave 166·6° C. —C. A. M.

Malt analysis; Use of closed mashing beakers for ——. O. Pankrath. Z. ges. Brauw., 1906, **29**, 141—142.

THE determination of extract in malt is generally conducted in an open mashing beaker, but owing to the evaporation from the surface of the mash, the temperature inside the beaker remains 3°—5° C. lower than the temperature of the water-bath, and this difference of temperature, varying according to whether the mash is being stirred or not, makes it very difficult to control the process. The author has devised a lid of nickel-plated metal which is fitted to the ordinary mashing beaker, clipping it with a spring-rim. This lid carries a bearing through which passes a rotary stirrer; a tubulure near the side is also provided for the thermometer. The results of mashings conducted in this manner differ slightly from those obtained with open beakers. No appreciable differences are found in the extract values, but the time required for complete saccharification is distinctly shorter, and the odour of the mash is less aromatic in the case of closed beakers than with open ones. These differences are due to the presence of partially dried layers of mash formed at the surface and on the walls in the open beakers which take longer for saccharification and which develop a slightly burnt aroma in contact with the hot sides of the vessel.—J. F. B.

Worts and sugar solutions; Determination of extract in ——. H. van Laer. Bull. prat. du Brasseur, 1905, 1497; Woch. f. Brau., 1906, **23**, 90.

THE author comments on the method employed in England for determining the extract (grms. per 100 c.c.) in saccharine solutions. This consists in dividing the excess of gravity over 1000 by a divisor, the value of which is not universally settled, the normal temperature being 15·5° C. (60° F.). The divisor originally determined by O'Sullivan was 3·85; later this was changed to 3·86 by Brown and Heron. In 1897, Brown, Morris and Millar re-determined the value of the divisor for a large number of carbohydrates, and found that it varied with the concentration of the solutions, and, in the case of saccharified liquids, with the degree of saccharification. The present practice is to use the divisor 3·86 in the case of solutions of cane sugar, invert sugar and dextrose, introducing, however, a correction for the ash. In the case of worts, some chemists use a divisor of 3·95, whilst others use one of 4·00. The official German tables, based on K. Windisch's tables, correspond fairly closely with a divisor of 3·86. The author pleads for a uniform international system, based on the latter tables for all cases where the 3·86 divisor would be used by English chemists, since the difference between 15° C. and 60° F. would introduce no appreciable error. In the case of worts it is generally recognised that Windisch's tables give values which are too high. The author, therefore, advocates the standardisation of the English system, taking the sp. gr. at 15·5°/15·5° and using the divisor 4·00 to calculate grms. of extract per 100 c.c. These values can be calculated in terms of per cent. by weight by means of the expression

$$p = \frac{x}{0{\cdot}999056.d}$$ where p = percentage by weight, x = grms. per 100 c.c.; d = sp. gr. of wort at 15·5°/15·5° and 0·999056 = density of water at that temperature. Mohr, on the other hand, deprecates the inconvenience involved in accepting the English temperature of 15·5° C., and in using two divisors, and advocates the general use of Windisch's tables, in spite of the fact that the results are too high for saccharified liquids. He contends that the composition of wort is so complex and variable that no divisor could possibly give anything but relative values.—J.F.B.

Beer analysis with the refractometer. E. Ackermann and F. Toggenburg. Z. ges. Brauw., 1906, **29**, 145—147.

THE determination of alcohol and extract in beer can be made by observing the refractometer values of the beer and the alcoholic distillate in a Zeiss immersion refractometer, and calculating the results by means of the Ackermann slide-rule (see also this J., 1905, 563 and 630). Experience has shown that although the method is, on the whole, extremely accurate, some little difficulty is met with in obtaining reliable readings in the case of dark beers. In such cases it is now recommended that the refractometer value should be observed as nearly as possible, and that a colourless solution of sugar of approximately the same refractometer value as the beer should then be prepared and observed in the instrument, which should then be adjusted so that the colourless line of separation on the scale is accurately visible. Lastly, the beer should again be examined in the instrument thus adjusted, the error due to colour being thereby reduced to a minimum. When a series of observations is made it often happens that the first two or three readings give incorrect results; this is due to the fact that the prism of the refractometer has not had time to attain the correct temperature of 17·5° C., at which the liquids are examined. The extract is calculated by the formula $E = [1 - I^1] \times 6750$, where I = the refractive index of the original beer, and I^1 = that of the alcoholic distillate. With the Zeiss immersion refractometer it is more convenient to calculate direct from the refractometer scale-values observed, R and R^1 respectively; the expression then becomes: $E = [R - R^1] \times 0{\cdot}25705$. The method is regarded as being more rapid and quite as accurate as the specific gravity method. —J. F. B.

Carbonyl group in aldehydes, ketones, &c.; Quantitative determination of the ——. Watson Smith, jun. Chem. News, 1906, **93**, 83—84.

THE author has devised certain modifications of Strache's method of estimating carbonyl groups. Strache (Monatsh. f. Chem., **12**, 514; **13**, 299), and Benedikt and Strache (Monatsh. f. Chem., **14**, 279; this J., 1893, 185, 1066), mix the aldehyde or ketone with excess of phenylhydrazine,

gunpowder in the proportion of 7—8 per cent. of the whole mass, which is mixed with 5—15 per cent. of water, then subjected to sufficient heat to swell the starch granules, and pressed into the required shape.—B. J. S.

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Articles.	Total.		To United Kingdom.
	1905.	1904.	1905.
	Tons.	Tons.	Tons.
Salt	44,567	44,907	—
Spirits	47,430	49,076	5,330
Stone	998,760	628,730	—
Sugar—			
Beet	78,831	160,573	12,114
Cane	3,788	17,455	3,448
All other	143,045	210,619	90,135
Sulphur	14,214	14,188	—
Tar and pitch	50,138	53,996	—
Tallow, soot, grease, stearine	39,375	35 349	1,397
Train oil	7,958	7,241	145
Treacle and molasses	15,816	16,721	—
Vinegar	15,436	14,773	1,429
Wood—			
Dye	43,349	26,921	—
Wine in casks	49,504	47,358	3,832
„ bottles	18,272	16,481	4,754

New Books.

THE MINERAL INDUSTRY DURING 1904. Prepared by the Editorial Staff of the "Engineering and Mining Journal," under the Supervision of Edward K. Judd. VOLUME XIII. The "Engineering and Mining Journal." New York and London. 1905. Price £1 0s. 10d. 505, Pearl Street, New York, and 20, Bucklersbury, London, E.C.

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TABELLARISCHE ÜBERSICHT ÜBER DIE KÜNSTLICHEN ORGANISCHEN FARBSTOFFE, und ihre Anwendung in Farberei und Zeugdruck. von Dr. ADOLF LEHNE. Geheimer Regierungsrat im Kaiserl. Patentamt, &c. *Mit Ausfarbungen jedes einzelnen Farbstoffes und Zeugdruckmustern*: Zweiter Ergänzungsband. Dritte (Schluss) Lieferung. Julius Springer's Verlag. Berlin. 1906. Price M.6.

THIS, the concluding number of Lehne's work, contains 48 pages or specimen-sheets (dyed and printed patterns), giving the Trade names of the Dyestuffs used in one column and the mode of employment, fastness, and method of detection on the fibre in the second column, and in the third column the specimen itself. In the second column is also given the number in Schultz's Tables in which the same dyestuff is referred to. (See also this J., 1905, 296.) The dyestuffs illustrated in this third part are as follows:—III. Triphenylmethane and Diphenylnaphthylmethane dyestuffs (cont.). IV. Pyronine dyestuffs. V. Acridine dyestuffs. VI. Oxyketone and allied dyestuffs. VII. Oxazine dyestuffs. VIII. Azine dyestuffs. IX. Thiobenzenyl dyestuffs. X. Indigo group. XI. Sulphide dyestuffs. XII. Dyestuffs of unknown constitution. At the end of this concluding part is an alphabetical index of the dyestuffs illustrated.

PRACTICAL EXERCISES IN CHEMISTRY. By G. C. DONINGTON, M.A., Senior Science Master of Leeds Grammar School. Macmillan and Co., Ltd., London. 1906. Price 2s. 6d. The Macmillan Co., New York.

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JOURNAL OF THE

Society of Chemical Industry.

No. 7.—Vol. XXV. SUPPLEMENT. APRIL 16, 1906.

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Samuel Hall, East London Soap Works, Bow, E.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

Changes of Address.

Bailey, E. M., l/o East Calder; Almond Hill, Pumpherston, Mid-Calder, N.B.
Blakemore, G. H., l/o Cobar; Great Cobar Copper Mining Syndicate, Lithgow, N.S.W.
Carlsson, Hugo, l/o Stockholm; Fagersta, Sweden.
Cayvan, L. L., l/o Indiana Avenue; 920, West Monroe Street, Chicago, Ill., U.S.A.
Chase, March F., l/o Palmerton: c/o Mineral Point Zinc Co., Depue, Ill., U.S.A.
Devas, Dr. E. W., l/o Old Charlton; 6, Walmer Place, Manningham, Bradford.
Drake, Bryant S., l/o Oakland; c/o Eastern Dynamite Co., Landing, N.J., U.S.A.
Enequist, E. E., l/o North 8th Street; 1651 New York Avenue, Brooklyn, N.Y., U.S.A.
Enequist, John, l/o Rutland Road; 3710 Avenue J., Brooklyn, N.Y., U.S.A.
Erhart, W. R., l/o Brooklyn; 81, Maiden Lane, New York City, U.S.A.
Folsom, H. A., l/o Providence; P.O. Box 1267, New York City, U.S.A.
Fox, A. Stanley, l/o South Road; Roschurst, Athelstan Road, Faversham, Kent.
Green, J. Wilberforce, l/o Alwyne Mansions; 108, Kenilworth Avenue, Wimbledon Park, S.W.
Havens, Dr. F. S., l/o New York; 1434, Pine Street, Philadelphia, Pa., U.S.A.
Hewitt, Dr. J. T., l/o Twickenham; 7, The Avenue, Surbiton.
Holgate, Arthur; communications to c/o Wm. Holgate and Sons, Ltd., Earl Street, Liverpool.
Hurlburt, A. S., l/o Baltimore; c/o General Chemical Co., Hudson Heights, N.J., U.S.A.
Laury, N. Arthur, l/o Camden; c/o General Chemical Co., 25, Broad Street, New York City, U.S.A.
Macara, Thos., l/o Glasgow; c/o Lipton, Ltd., Rouel Road, Bermondsey, S.E.
Marschall, A. J., l/o Little Falls; Madison, Wis., U.S.A.
Mayfield, A. S., l/o Beresford Avenue; Thirlmere, Newland, Hull.
Morris, Herbert N.; Journals to 13, Birch Grove, Rusholme, Manchester.
Nakagawa, S., l/o Hokkaido; c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan.
Neil, Jas. M., l/o Farnham Avenue; 12, Woodland Avenue, Toronto, Canada.
Norton, F. A., l/o S. Dakota; National Canners' Laboratory, Aspinwall, Pa., U.S.A.
Pickard, Greenleaf W.; Journals to Amesbury, Mass., U.S.A.
Pollitt, Jas. C. T., l/o Witton; Church Hill, Solihull, near Birmingham.
Potter, Rowland S., l/o Ilford; Eastbury, Upland Park Avenue, Loughton, Essex.
Prescott, S. C., l/o Inst. of Technology; 739, Boylston Street, Boston, Mass., U.S.A.
Rees, W. H., l/o Alameda; c/o Alameda Sugar Co., Alvarado, Cal., U.S.A.
Roller, H. C., l/o Brooklyn; Verona and Riverside Avenues, Newark, N.J., U.S.A.
Sadtler, Dr. S. S.; Journals to 29, South 10th Street, Philadelphia, Pa., U.S.A.
Shores, Dr. J. T., l/o Derby Road; Beaconsfield Road, Widnes.
Sims, W. Edgar, l/o Manchester; Hillcroft, Frodsham, *via* Warrington.

Articles.	Total.		To United Kingdom.
	1905.	1904.	1905.
	Tons.	Tons.	Tons.
Salt	44,567	44,907	—
Spirits	47,430	49,076	5,330
Stone	998,760	628,730	—
Sugar—			
Beet	78,831	160,573	12,114
Cane	3,788	17,455	3,448
All other	143,045	210,619	90,135
Sulphur	14,214	14,188	—
Tar and pitch	50,138	53,996	—
Tallow, soot, grease, stearine	39,375	35 349	1,397
Train oil	7,958	7,241	145
Treacle and molasses	15,816	16,721	—
Vinegar	15,436	14,773	1,429
Wood—			
Dye	43,349	26,921	—
Wine in casks	49,504	47,358	3,832
„ bottles	18,272	16,481	4,754

New Books.

THE MINERAL INDUSTRY DURING 1904. Prepared by the Editorial Staff of the "Engineering and Mining Journal," under the Supervision of Edward K. Judd. VOLUME XIII. The "Engineering and Mining Journal." New York and London. 1905. Price £1 0s. 10d. 505, Pearl Street, New York, and 20, Bucklersbury, London, E.C.

8vo volume, containing 546 pages of subject matter, and an alphabetical index. The text is sub-divided as follows:—I. Aluminium. II. Antimony. III. Arsenic. IV. Asbestos. V. Asphaltum. VI. Barytes. VII. Bauxite. VIII. Bismuth. IX. Bromine. X. Carborundum. XI. Cement. XII. Chromium. XIII. Coal and Coke. XIV. Copper. XV. Copperas. XVI. Corundum and Emery. XVII. Felspar. XVIII. Flint. XIX. Fluorspar. XX. Garnet. XXI. Gems and Precious Stones. XXII. Gold and Silver. XXIII. Graphite. XXIV. Iron and Steel. XXV. Lead. XXVI. Magnesite. XXVII. Manganese. XXVIII. Mica. XXIX. Molybdenum. XXX. Monazite. XXXI. Nickel and Cobalt. XXXII. Petroleum. XXXIII. Phosphate Rock. XXXIV Platinum. XXXV. Mercury. XXXVI. Salt. XXXVII. Sulphur and Pyrites. XXXVIII. Tin. XXXIX. Tungsten. XL. Zinc. XLI. Review of the Literature of Ore Deposits. XLII. Progress in Ore Dressing and Coal Washing. XLIII. Kaolin or China Clay. XLIV. Alaska. XLV. Klondike. XLVI. Arizona. XLVII. California. XLVIII. Nevada. XLIX. Eastern States of Australia L. Western Australia. LI. The Transvaal. LII. Mining Companies and Stock Exchanges. LIII. United States. Imports and Exports.

ELECTROCHEMISTRY OF ORGANIC COMPOUNDS. By Dr. WALTER LÖB. Authorised Translation from the Author's Enlarged and Revised Third Edition of Electrolysis and Electrosynthesis of Organic Compounds. By H. W. F. Lorenz, A.M., Ph.D. First Edition. First Thousand. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1906. Price 12s. 6d.

8vo volume, containing 292 pages of subject matter with eight illustrations, and alphabetical indexes both of authors and subjects. The subject matter is classified as follows:—PART 1. ELECTROLYTIC PROCESSES.—I. Theoretics. II. Methodics. III. Electrolysis of Aliphatic Compounds. IV. Electrolysis of Aromatic Compounds. V. Electrolysis with Alternating Currents. VI. Electric Endosmose. PART 2. ELECTROTHERMIC PROCESSES AND THE SILENT ELECTRIC DISCHARGE.—I. Theoretics and Methodics. II. The Spark Discharge and the Voltaic Arc. III. The Utilisation of Current Heat in Solid Conductors. IV. The Silent Electric Discharge and the Effect of Tesla-currents.

THE MICROSCOPY OF VEGETABLE FOODS, WITH SPECIAL REFERENCE TO THE DETECTION OF ADULTERATION AND THE DIAGNOSIS OF MIXTURES. By ANDREW L. WINTON, Ph.D. Laboratory of the Connecticut Agricultural Experiment Station, Instructor in Proximate Organic Analysis in the Sheffield Scientific School of Yale University. With the Collaboration of Dr. Josef Moeller, Professor of Pharmacology, and Head of the Pharmacological Institute of the University of Graz. First Edition. First Thousand. John Wiley and Sons, New York. 1906. Price £1 11s. 6d. net. Chapman & Hall, Ltd., London.

LARGE 8vo volume, containing 670 pages of subject matter, with 589 illustrations, a general bibliographic list, a glossary of terms (10 pages), and an alphabetical index. The text is subdivided as follows:—PART I. Preliminary; Equipment Methods, and General Principles. PART II. Grain; Its Products and Impurities. Grain. Cereals. Buckwheats. Weed Seeds, &c. Fungus Impurities. PART III. OIL SEEDS AND OIL CAKES. Oil Seeds. Cruciferous Seeds. Composite Oil Fruits. Miscellaneous Oil Seeds. PART IV. Legumes. PART V. Nuts. Palm Fruits. Walnuts. Cup Nuts. Miscellaneous Nuts. PART VI. FRUIT AND FRUIT PRODUCTS. PART VII. VEGETABLES. PART VIII. ALKALOIDAL PRODUCTS AND THEIR SUBSTITUTES. PART IX. SPICES AND CONDIMENTS. PART X. COMMERCIAL STARCHES.

TABELLARISCHE ÜBERSICHT ÜBER DIE KÜNSTLICHEN ORGANISCHEN FARBSTOFFE, und ihre Anwendung in Farberei und Zeugdruck. von Dr. ADOLF LEHNE. Geheimer Regierungsrat im Kaiserl. Patentamt, &c. *Mit Ausfarbungen jedes einzelnen Farbstoffes und Zeugdruckmustern*: Zweiter Ergänzungsband. Dritte (Schluss) Lieferung. Julius Springer's Verlag. Berlin. 1906. Price M.6.

THIS, the concluding number of Lehne's work, contains 48 pages or specimen-sheets (dyed and printed patterns), giving the Trade names of the Dyestuffs used in one column and the mode of employment, fastness, and method of detection on the fibre in the second column, and in the third column the specimen itself. In the second column is also given the number in Schultz's Tables in which the same dyestuff is referred to. (See also this J., 1905, 296.) The dyestuffs illustrated in this third part are as follows:—III. Triphenylmethane and Diphenylnaphthylmethane dyestuffs (cont.). IV. Pyronine dyestuffs. V. Acridine dyestuffs. VI. Oxyketone and allied dyestuffs. VII. Oxazine dyestuffs. VIII. Azine dyestuffs. IX. Thiobenzenyl dyestuffs. X. Indigo group. XI. Sulphide dyestuffs. XII. Dyestuffs of unknown constitution. At the end of this concluding part is an alphabetical index of the dyestuffs illustrated.

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[A.] 7535. Redfern (Basle Chemical Works). Manufacture of monazo dyestuffs. March 28.
[C.S.] 12,444 (1905). Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. April 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 6544. Jeschke. Process for contemporary dyeing, glueing and drying of coloured textile bast-ribbons. March 19.
„ 6654. Wilson. Machines for printing textile fabrics. March 20.
„ 6848. Wood, Bowden and Unwin. Calico printing machines. March 22.
„ 6932. Ingham. Manufacture of sizing, thickening, stiffening or waterproofing material for fabrics. March 22.
„ 6992. Beresin. Treatment of cotton yarns and fabrics to improve their texture and render their dye more permanent. March 23.
„ 7520. Verein. Kunstseidefabr. A.-G. Manufacture of artificial hemp-bast and the like. [Ger. Appl., Jan. 2, 1906.]* March 28.
„ 7617. Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging pastes for use in the discharge of dyed textile fibres.* March 29.
„ 7657. Dreaper. Manufacture of artificial silk and the like. March 30.
[C.S.] 6160 (1905). Muntadas y Rovira. Winding fabrics in continuous bleaching apparatus. April 4.
„ 6645 (1905). Armitage. Finishing of certain fabrics. April 4.
„ 10,691 (1905). Burt, Jackson and Finch. Extraction of grease from wool and apparatus therefor. March 28.
„ 12,545 (1905). Shuttleworth and Shuttleworth. Apparatus for washing textile fabrics. April 4.
„ 14,480 (1905). Nitritfabrik G.m.b.H. Process for mordanting wool. March 28.
„ 15,518 (1905). Pomortzeff. Treatment of tissues, fabrics and paper for increasing their durability and rendering them waterproof. March 28.
„ 50 (1906). Marshall. Washing machines. April 4.
„ 92 (1906). Villam. Machines for gassing yarns and threads. April 4.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 6529. Spence, and Spence and Sons, Ltd. *See under* I.
„ 6643. Wilson. Utilisation of alkali or tank waste, or other waste products produced by alkali manufacturers. March 20.
„ 6711. Van der Sleen. Ozone generators.* March 20.
„ 7007. Hunt (Love). Lixiviation apparatus, especially for the extraction of sodium nitrate from caliche.* March 23.
„ 7297. Lance and Elworthy. *See under* XX.
„ 7395. Dollschaft. *See under* I.
„ 7478. Fairweather (Beaver and de Nordenflycht). Dissolving plant for the recovery of sodium nitrate from caliche.* March 28.
[C.S.] 26,384 (1905). Bloxam (Gebr. Siemens und Co.). Manufacture of solid forms with the aid of silicon. March 28.
„ 26,788 (1905). Potter. Manufacture of silicon monoxide. March 28.
„ 26,899 (1905). Browne. *See under* II.
„ 2708 (1906). Tcherniac. Manufacture of sulphocyanides. March 28.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 6533. Hancock. Decoration of pottery ware. March 19.
[C.S.] 2879 (1906). Chambers. Apparatus for drawing glass. April 4.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 6946. Morgan. Cement kilns.* March 22.
„ 7316. Oddy. Manufacture of artificial building blocks. March 27.
„ 7443. Zulkowski. Manufacture of Portland cement. March 28.
„ 7464. Price. Utilising surplus heat of brick kilns.* March 28.
„ 7629. Müller. Manufacture of a moulding powder.* March 29.
[C.S.] 19,686 (1905). Freakley and Bill. Manufacture of materials for the construction of dustless roads and like surfaces. April 4.
„ 21,141 (1905). Wickre. Building blocks. April 4.

X.—METALLURGY.

[A.] 17,370A (1905). Leggo. Furnaces for treating ores and other substances.* March 30.
„ 6569. Townsend. Reduction of sulphide ores or compounds.* March 19.
„ 6937. Holland. Recovery of metals from liquids.* March 22.
„ 6955. Cowper-Coles. Rendering silver untarnishable. March 23.
„ 7146. Sulman. Ore concentration. March 24.
„ 7178. Weekley. Treatment of slimes and cognate material. March 24.
„ 7195. Rolason. Silver alloys.* March 26.
„ 7203. Cowper-Coles. Rendering silver untarnishable. March 26.
„ 7274. Hopkins. Condensation and separation of zinc vapours from other gases or vapours. March 26.
„ 7541. Howatt. Mineral washing and separating apparatus.* March 28.
„ 7546. Cowper-Coles. Rendering silver non-tarnishable. March 29.
„ 7650. Blake. Manufacture of metals. March 30.
„ 7655. Kuzel. Increasing the electrical resistance of metals. [Ger. Appl., July 26, 1905.]* March 30.
„ 7660. Bailey and Lovatt. Case hardening composition. March 30.
„ 7757. Tatlock. Production of a protective coating upon iron and steel. March 31.
„ 7770. Edwards. Concentrator for separating minerals and metals from crushed ores. March 31.
[C.S.] 5970 (1905). Thompson (Merrill). Filter presses for separating the components of the tailings of ores and other material. March 28.
„ 6556A (1905). Hutchings. Disintegrating and mixing pans used in ore dressing. March 28.
„ 6556B and C (1905). Hutchings. Washing, separating and concentrating precious matters from deposits or tailings from ore crushing. March 28.
„ 13,018 (1905). Shaw. Apparatus for washing coal and other minerals. April 4.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 11,654A (1905). Schanschieff. Accumulator plates.* March 31.
„ 6976. Bingham. Electric furnaces. March 23.
„ 6977. Bingham. Electric furnaces. March 23.
„ 6978. Gibbs. Production of articles by electro-deposition. March 23.
„ 6980. Gibbs. Manufacture of metal articles by electro-deposition. March 23.
„ 7340. Bingham. Electric furnaces. March 27.
„ 7457. Langton and Langton. Electric accumulator. March 28.
„ 7597 and 7598. Allmänna Svenska Elektriska Aktiebolag. Electrically-heated shaft furnaces. [Swed. Appl., March 30, 1905.]* March 29.

[A.] 7829. Thompson (Westdeutsche Thomasphosphatwerke). Process for causing endothermic reactions in gases by aid of electric discharges. March 31.
[C.S.] 6448 (1905). Bastian and Calvert. Substances for effecting catalytic combinations in electrolytic electricity meters. April 4.
„ 6786 (1905). Gerard and Fiedler. Plates for accumulators. April 4.
„ 7004 (1905). Reynolds. Electric furnaces. April 4.
„ 22,103 (1905). Gaiffe. Ozonising apparatus. March 28.
„ 1925 (1906). Edison. Storage battery electrode. March 28.
„ 1927 (1906). Edison. Electrode mass for storage batteries. April 4.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 6601. Blass. Process for solidifying fluid greases, tar, &c., and increasing the consistency of solid fats, resins, soaps, or the like.* March 19.
„ 6712. Jackson. Detergent. March 20.
„ 6923. Cramp. *See under* XIII*B*.
„ 7380. Samul. Manufacture of soaps, detergents, lubricants, batching, candle stock, &c. March 27.
[C.S.] 4092A (1905). Krebitz. Process for converting an insoluble soap into soluble soda soap or potash soap. April 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 7073. Clark (Standard Paint Co., Inc.). Manufacture of paint.* March 23.
„ 7819. Ephraim. Process for rendering lithopone more stable against light. [Ger. Appl., April 1, 1905.]* March 31.
[C.S.] 5872 (1905). Dreyfus. Paint. March 28.

(*B.*)—RESINS, VARNISHES.

[A.] 6601. Blass. *See under* XII.
„ 6923. Cramp. Treatment of vegetable and animal oils to thicken or dry them, especially for the manufacture of linoleum. March 22.
„ 7036. Kent. Declorising and deodorising Russian turpentine. March 23.

(*C.*)—INDIA-RUBBER.

[A.] 7064. Welch, and Harvey, Frost and Co., Ltd., Vulcanising. March 23.
[C.S.] 2247 (1906). Wilkinson, Gubbins and Quin. Apparatus for separating the component parts of rubber waste. March 28.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 7010. Lobb. Treatment of leather.* March 23.
[C.S.] 16,312 (1905). Riviere, Verroul and Bouvier. Tanning hides or skins. March 28.

XVI.—SUGAR, STARCH, GUM, ETC.

(A.) 6529. Spence, and Spence and Sons, Ltd. *See under* I.
„ 7046. Scott. Manufacture of sugar. March 23.
„ 7705. Drittler. Improved starch and process of producing the same.* March 30.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 6640. Ehrlich. Process for making fusel oil and components of fusel oil. [Ger. Appl., March 31, 1905.]* March 20.
„ 6770. Hilliard. Treatment of whisky for the removal of the noxious elements from the higher alcohols.* March 21.
[A.] 7679. Carroll. Apparatus for distilling and treating spirits. March 30.
„ 7702. Faulkner. Apparatus for producing malt extract or wort. March 30.
„ 7830. Hunt. Improving, maturing or ageing whisky and other spirits. March 31.
[C.S.] 11,453 (1905). Hahn and Reiser. Production of dry yeast. April 4.
„ 1639 (1906). Effront. Process of preparing malt by means of chloride of lime or other hypochlorite salts. April 4.

XVIII. FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

[A.] 7329. Williams. Preparation of leguminous proteins from ground-nuts and similar seeds. March 27.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 6806. Rubert and Laporta. Composition for removing and preventing incrustation in water receptacles. [Appl. in Spain, Dec. 9, 1905.]* March 21.
[C.S.] 15,872 (1905). Wollaston. Apparatus for softening and purifying water. March 28.
„ 1158 (1906). Schmidt. Purifying apparatus for liquids. April 4.

(*C.*)—DISINFECTANTS.

[A.] 6676. Smith and Davis. Disinfectants and deodorisers. March 20.
„ 7487. Newton (Bayer und Co.). *See under* XX.

XIX.—PAPER, PASTEBOARD, ETC.

(A.) 6590. Fritsch. Process for rendering paper moisture-proof and durable.* March 19.
„ 6851. Mastin. Treatment of cardboard, millboard, pulp, sawdust, fibre and the like. March 22.
„ 6942. Bosch, Bosch and Müller. Direct production of coloured cellulose articles. [Ger. Appl., April 1, 1905.]* March 22.
[C.S.] 14,789 (1905). Dobler. Sizing paper or card. March 28.
„ 15,518 (1905). Pomortzeff. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 6606. Johnson (Badische Anilin und Soda Fabrik). Production of borneol esters and isoborneol esters.* March 19.
„ 7018. Annison and Oliver. Extraction of a liquid extract of locust beans, and apparatus therefor. March 23.
„ 7125. Wellcome, Jowett and Pyman. Manufacture of a new salicylic acid derivative. March 24.
„ 7297. Lance and Elworthy. Manufacture of formaldehyde, formic acid, methyl alcohol and their derivatives. [Fr. Appl., March 24, 1905.]* March 26.
„ 7487. Newton (Bayer und Co.). Generation of gaseous formaldehyde. March 28.
[C.S.] 15,456 (1905). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of ω-alkylaminoethylbenzoates. March 28.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 6581. Nathan, Thomson, Rintoul and Scott. Manufacture of nitroglycerine. March 19.
„ 6705. Venier. Explosive composition.* March 20.
„ 6824. Weizmann, Dreyfus, and the Clayton Aniline Co., Ltd. Manufacture of explosives. March 21.

Official Notices.

EXTRAORDINARY GENERAL MEETING OF THE SOCIETY.

An Extraordinary General Meeting of the Society was held at 3.30 o'clock, in the afternoon of Tuesday, the twenty-seventh day of March, 1906, at the House of the Society of Arts, by kind permission of the Council of that Society, with the object of considering and adopting the resolution mentioned in the Requisition hereinafter set forth:—

"TO THE PRESIDENT AND COUNCIL OF THE SOCIETY OF CHEMICAL INDUSTRY."

We, the undersigned Members of the Society of Chemical Industry, hereby request that, in accordance with Bye-Law 40, you will convene an Extraordinary General Meeting of the Society with the object of considering, and if approved by the said Extraordinary Meeting, of adopting the following resolution (that is to say):—

RESOLUTION.

"That it is desirable that the Society of Chemical Industry as now existing should be incorporated under and subject to the grant of a Royal Charter and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation."

Dated this twenty-second day of December, 1905.

Here follow signatures of the following:—

Dr. Leo Backeland.	Henry de Mosenthal.
George Beilby.	Prof. Chas. E. Munroe.
V. G. Bloede.	Jas. P. Murray.
Jas. H. Bowman.	Robert W. Neff.
Eugene A. Byrnes.	Dr. Wm. H. Nichols.
Eustace Carey.	Thos. J. Parker.
Prof. Charles F. Chandler.	A. L. Norton.
Prof. Frank Clowes.	D. H. T Peploe.
Frederick P. Dewey.	Dr. W. H. Perkin.
Dr. Edward Divers.	Dr. Frederick B. Power.
Dr. A. R. L. Dohme.	Sir William Ramsay.
Thos. Fairley.	Sir Boverton Redwood.
Dr. Fred. W. Frerichs	Walter F. Reid.
Oscar Guttmann.	President Ira Remsen.
Samuel Hall.	Sir Henry E. Roscoe.
Jas. Otis Handy.	George D. Rosengarten.
Dr. B. J. Harrington.	Dr. Samuel P. Sadtler.
Dr. Edward Hart.	Alfred Gordon Salamon.
Otto Hehner.	Dr. Hugo Schweitzer.
E. Grant Hooper.	Dr. Karl F. Stahl.
David Howard.	H. E. Stuart.
H. August Huneke.	Sir Joseph W. Swan.
C. C. Hutchinson.	Prof. H. P. Talbot.
Prof. Edward H. Keiser.	M. J. Taylor.
Prof. W. R. Lang.	E. C. Thompson.
Ivan Levinstein.	Dr. T. E. Thorpe.
Arthur R. Ling.	Prof. W. A. Tilden.
Dr. E. G. Love.	Thos. Tyrer.
Anthony McGill.	John H. Usmar.
Edward Mallinckrodt.	W. H. Van Winckel.
N. H. Martin.	S. S. Voorhees.
Prof. R. Meldola.	Dr. W. H. Walker.
Dr. Rudolph Messel.	R. A. Wallace.
Dr. W. Lash Miller.	Charles Wightman.
Dr. Ludwig Mond.	Dr. H. W. Wiley.
Dr. Russell W. Moore.	Reginald C. Woodcock.

The President, Dr. Edw. Divers, F.R.S., occupied the chair. The Secretary having read the notice of meeting, on the motion of Sir Boverton Redwood, seconded by Mr. A. Gordon Salamon, the above resolution was unanimously adopted. A full account of the proceedings is in preparation.

SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome, commencing on April 25th, 1906.

The attention of Members is drawn to the Notice which accompanied the February 15th issue of the Journal.

LIST OF DELEGATES.

Board of Education.—Prof. Wm. A. Tilden, F.R.S.

Department of Agriculture and Technical Instruction, Ireland:—Prof. Walter N. Hartley, F.R.S.

Royal Society.—Prof. R. Meldola, F.R.S.; Dr. L. Mond, F.R.S.; Prof. W. A. Tilden, D.Sc., F.R.S.

Chemical Society:—Prof. W. R. Dunstan, LL.D., F.R.S.; Prof. R. Meldola, F.R.S.; Prof. J. Emerson Reynolds, M.D., D.Sc., F.R.S.; Prof. W. A. Tilden, D.Sc., F.R.S.

Society of Chemical Industry:—Prof. Edward Divers, M.D., D.Sc., F.R.S.; George Beilby, F.R.S.; Oscar Guttmann; Prof. W. R. Hodgkinson; E. Grant Hooper; Dr. J. Lewkowitsch, Dr. K. E. Markel; Dr. L. Mond, F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; Sir Boverton Redwood; Walter F. Reid; Prof. J. Emerson Reynolds, M.D., D.Sc., F.R.S.; Sir Henry E. Roscoe, LL.D., F.R.S.; Dr. W. S. Squire.

Iron and Steel Institute:—J. E. Stead, F.R.S.; Bennett H. Brough.

Royal Photographic Society:—Major Gen. J. Waterhouse; Prof. R. Meldola, F.R.S.

British Association for the Advancement of Science:—Prof. R. Meldola, F.R.S.

Faraday Society:—Dr. H. Borns; J. B. C. Kershaw.

Royal Society of Edinburgh:—Dr. James J. Dobbie, F.R.S.

Federated Institute of Brewing:—Dr. L. T. Thorne.

Institution of Mining and Metallurgy:—Prof. H. Bauerman; Bedford McNeill.

Society of Dyers and Colourists:—Sir Thomas Wardle.

Society of Arts:—Sir Boverton Redwood.

LIST OF PAPERS.

Three communications will be read before the full Congress, viz., "The Purification of Sewage," by Sir William Ramsay; "The Distillation of Metals," by Henri Moissan; "The Direct Utilisation of Atmospheric Nitrogen in the Production of Manures and Chemical Products," by A. Frank.

The following are the titles of the more important papers to be read before the various sections:—

SECTION I.—(Analytical Chemistry—Apparatus and instruments.)

"Rapport général sur les travaux de la Commission Internationale d'Analyse," by Prof. G. Lunge, of Zürich.

"Sur les caractères chimiques, physiques et commerciales des soies pures á l'état grège, mouliné et teint," by Prof. Gianoli, of Milan.

"Sur l'état actuel de la chimie analytique du caoutchouc, des objets de caoutchouc et des derivés," by Dr. E. Marckwald, of Berlin.

"Essai industriel du carborundum amorphe," by Prof. G. Chesnau.

"Détermination de l'azote dans les mélanges gazeux," by Dr. H. P. Ladoff, of Crakow.

"Séparation du fer d'avec les autres metaux et d'avec les métalloides," by Cap. Nicolardot, of Paris.

SECTION II.—(Inorganic chemistry and allied industries.)

"Sur l'industrie des engrais chimiques et du sulfate de cuivre en Italie," by Profs. Menozzi and Gianoli, of Milan.

"L'industrie de l'acide borique en Italie," by Prof. R. Nasini, of Padova.

"Acide sulfurique," by Dr. W. S. Squire, of London.

"Fused sodium peroxide and its use in air purification," by Dr. H. Philipp and R. v. Forreger, of New York.

"Ueber neuere Stickstoffquellen," by N. Caro, Berlin.

"Industrie chimique dans la Republique Argentine," by F. P. Lavalle, Paris.

SECTION III.—(Metallurgy and Mines—Explosives.)

"Le progrès de la siderurgie en Italie et particulièrement au regard des hauts-fourneaux," by Dr. U. Monsacchi, of Piombino.

"Progrès de la metallurgie du cuivre," by Jannettaz, Paris.

"Rapport sur l'état actuel de la metallurgie du fer en France," by the "Comité des forges de France."

"Die Fortschritte in der Flusseisenerzeugung," by Prof. H. Wedding, Berlin.

"Nouveaux mélanges détonantes pour charger des capsules ou des autres appareils déterminants l'explosion ou la détonation," by Dr. U. Alvisi, Caltanisetta.

"Méthode pour déterminer le brisant aux matières explosives," by A. Werner Cronquist, Stockholm.

"Ungefrierbare Nitroglycerin Sprengstoffe," by W. A. Roewer, Hamburg.

"Sprengungen unter Wasser, deren Messung und Registrirung zu halten," by Dr. H. Mettegang, Schlebusch.

SECTION IV.—(Organic Chemistry and allied industries.)

"Sur l'industrie des matières grasses en Italie," by Prof. Gianoli, Milan.

"Sur l'utilisation de l'azote de l'atmosphère au moyen du calcium et du baryum," by Dr. Piccinni, Pont St. Martin.

"Sur la soie artificielle," by Dr. E. Molinari, Milan.

"Comparison of the characters of petroleums of recent development with that of the older sources of supply," by Clifford Richardson, New York.

"Ueber die künstliche Darstellung des Camphers," by Dr. A. Hesse, Berlin.

"Die Verunreinigungen des Calciumcarbids und selbstentzündungen des Acetylens," by N. Caro, Berlin.

"Nouveaux procedés pour la fabrication du gaz d'éclairage," by Prof. P. Sabatier, Toulouse.

"Actions chimiques de la lumière," by Prof. G. Ciamician and P. Silber, of Bologna.

"Sur l'état de l'industrie tenturière en Italie," by Dr. L. Caberti and G. Taghani, of Milan.

"Formation de nouveaux colorants dans les tissus moyennant le formaldéhyde," by Dr. R. Lepetit, Garessio.

"The systematic study of absorption spectra as applied to determining problems of chemical constitution in colourless and coloured substances," by Prof. W. N. Hartley, of Dublin.

"On the chemistry of the lakes employed in dyeing," by Dr. P. D. Zacharias, Athens.

"Sur les couleurs rencontrées dans les ruines de Pompeii," by Max Meyer and P. Bonomi, of Milan.

SECTION V.—(Industry and chemistry of sugar.)

"Sur le développement de l'industrie sucrière en Italie," by Hon. Deputé Maraini, of Rome.

"Ueber die neuesten Fortschritte in der Saftgewinnung aus Rüben," by Dr. H. Claassen, Dormagen.

"Fabrication du sucre de lait par l'électrolyse," by F. Dupont, Paris.

"The effect of environment upon the composition of sugar-producing plants," by Prof. H. W. Wiley, Washington.

"The fight between cane and beet sugar," by Sigmund Stein, Liverpool.

"The chemical selection of the cane," by Dr. Kobus, Pekalongan (Java).

"Etude comparative des analyses des produits sucres," by Prof. V. Villavecchia and Dr. G. Rossi, of Rome.

"Sur le phénomene de la caramelisation," by A. Trillat, Paris.

"Dry lead defecation in optical sugar analysis," by Dr. W. D. Horne, New York.

"Le dessiccation des pulpes de betteraves et de la bagasse de la canne à sucre," by A. Huillard, Suresnes (Paris).

SECTION VI.—(Fermentation and starches.)

"Resultats obtenus à l'ancienne Station de meunerie à Berlin, surtout sur la panification," by Prof. L. Wittmack de Berlin.

"Nouvelle méthode pour déterminer la valeur des farines dans la panification," by Dr. F. Tusini, of Modena.

"Fermentation," by Dr. W. S. Squire, of London.

"What are the most suitable means for retarding the fermentation of must in hot climates to secure wines of better bouquet?" by Prof. P. D. Hah, of Cape Town.

"Eine zwanzigjährige Erfahrung in der fabrikmässiger Herstellung von Reinhefe," by Dr. H. Helm, La Haye.

"Sur la necessité d'un méthode uniforme pour la determination de l'extrait sec des mouts et matières saccharines utilisées en brasserie," by H. van Laer, Bruxelles.

SECTION VII.—(Agricultural Chemistry.)

"Analyses of Effluents of Septic Tanks for Sewage Disposal in India: A description of the Indian Government's Agricultural Chemical Research Laboratories now under construction at Pusa," by Dr. J. W. Leather, Bombay.

"Important problems of Agricultural Chemistry in the United States," by Prof. H. W. Wiley, of Washington.

"Ueber die chemischen Vorgänge bei der assimilation des elementares Stickstoffes durch Azotobakter und Radiobakter," by Dr. J. Stoklasa, Prag.

"Sur la dialyse des sols," by Dr. Ch. Garola, Chartres.

"Sur le camphre italien," by Prof. J. Giglioli, Pisa.

"Recherches et applications bacteriologiques au point de vue de la fabrication du fromage," by Prof. G. Gorini, Milano.

"Der derzeitige Stand und die Bedeutung der bacteriellen Bodenuntersuchung," by Prof. Remy, Bonn.

"Sur la recherche de l'arsenic dans l'ail," by Prof. S. Minorci, Bukarest.

"Les eaux de la région du Lac Manont pour l'irrigation du Désert," by Prof. H. D. Parodi, Cairo.

"Analyses des terres dans les régions tropicales ou subtropicales," by V. Mosséri, Cairo.

SECTION VIII.—(Hygiene, Medicinal and pharmaceutical Chemistry, bromatology.)

"Sur la constitution chimique du cerveau," by Prof. Albertoni, Bologna.

"Sur les composés du foie qui contiennent du fer," by Prof. L. Beccari, Bologna.

"Révélateurs biochimiques des microbes," by Prof. B. Gotio, Rome.

"Sur la récherche chimique légale des médicaments nouveaux," by Dr. T. Panzer, Wien.

"The toxic principle in the bitter variety of Luffa aegyptiaca," by Dr. C. L. Bose, Calcutta.

"Contribution à l'étude des matières albuminoides de l'urine et du sérum du sang," by Dr. G. Patein, Paris.

"Die Refraktometrie im Dienste der Pharmazie," by Dr. E. Riegler, Jassy.

"Rapport sur les travaux de la commission internationale d'unification des méthodes d'analyse des denrées alimentaires," by J. B. André, Bruxelles.

"The inspection of food products imported into the United States." "The use of sulphur fumes in the preparation of food products," by Dr. H. W. Wiley, of Washington.

"Pflanzenfette als Ersatzmittel der Butter und Margarine," by H. Thoms, Berlin.

"Ist eine Begrenzung der Nebenbestandtheile (sogenannten Verunreinigungen) in natürlichem Branntwein empfehlenswerth?" by Dr. Hugo Mastbaum, of Lisbon.

SECTION IX.—(Photochemistry; photography.)

"The application of photography to the solution of problems in Chemistry," by Prof. W. N. Hartley, of Dublin.

"Sur une nouvelle méthode de photographie des couleurs." "Sur une nouvelle méthode photographique permettant d'obtenir des préparations sensibles noircissant directement à la lumière et ne contenant pas des sels d'argent solubles," by A. Lumière, Lyon.

"Observations et remarques sur les travaux photographiques en couleurs naturelles," by S. De Prokondine-Gorsky, St. Petersburg.

SECTION X.—(Electro-chemistry; physical chemistry.)

"The most recent methods for the electrolytic refining of copper," by S. Cowper-Coles, of London.

"Rapport général sur l'industrie du carbure de calcium en France." "Le siliciure de carbone," by Henri Moissan, Paris.

"Electrometallurgie de l'acier: Communication sur la resistivité de l'acier en fusion," by G. Gin, Paris.

"La catalyse par les metaux communs," by Prof. P. Sabatier, of Paris.

"Sur les applications réellés de l'electrochimie á la chimie organique," by C. Marie Paies, of Paris.

"Physikalische-chemische Behandlung der Wassergasreaktion," by Prof. H. Goldschmidt, of Christiania.

"On certain cases of hydrolysis," by Dr. V. H. Veley, of Oxford.

"Mitteilung der Masseinheiten-Kommission den numerischen Wert der Gaskonstante betreffend," by W. Nernst, of Berlin.

"Ueber die Notwendigkeit eine internationale Kommission zu ernennen, um einige Koeffizienten der physikalische Chemie festzustellen," by A. Gorringer, of Trzynietz.

"Détermination du poids des gas," A. P. Lidoff, of Krakow.

"Utilisation du chlore dans les fabriques de soude électrolytique," by Ing. U. Lombardi, of Milan.

"Sur la possibilité pratique d'obtenir de l'acide nitrique par l'azote atmosphérique," by J. B. Ahrens, of Breslau.

'Toxine und antitoxine," by Prof. P. Ehrlich, of Berlin.

Liverpool Section.

Meeting held at the University, on Wednesday, March 14th, 1906.

MR. EUSTACE CAREY IN THE CHAIR.

VANADIUM AS A STEEL MAKING ELEMENT.

J. KENT SMITH.

The element vanadium until quite recently could only be considered academically, but its industrial importance in the steel trade, due to its power of imparting properties to steel which are not otherwise obtainable, is now becoming very considerable, and I therefore venture to hope that a brief *resume* of the properties of some commercial vanadium steels made by the open-hearth process may not be without interest to this Society.

Vanadium is said to be one of the "rare" elements, but it is perhaps necessary to take this description as being accurate only in a sense. As a matter of fact, vanadium in minute proportions is very widely distributed, though in such quantity or states of combination as render its extraction on a commercial scale quite out of the question.

It is not my intention to deal with the history of the metal, nor with the processes used for its extraction and reduction from the various ores adapted to this purpose, as the matter has already been dealt with at some length before this Society. Rather is it my desire to confine my remarks to some products of its application as far as steel manufacture is concerned. It will, therefore, be sufficient if, in supplement to the information given by H. P. Smith (this J., 1901, 1183), it is said that although metallic vanadium itself has a very high m. pt., an alloy of iron containing 30—40 per cent. of vanadium has a m. pt. nearly 150° C. below that of mild steel, so that by its judicious use, vanadium can be, and is being regularly, introduced into steel with ease and without undue loss.

Several years ago my attention was directed to some effects of vanadium upon a sample of steel, and it became my wish to investigate such effects as completely as possible. Some work in this direction had already been done, but the records were, in many instances, somewhat vague, and in many others apparently contradictory. In the light of present knowledge this apparent contradiction is susceptible of possible explanation in at least two directions. Firstly, the analytical determination of vanadium was none too simple at that time, and its correct estimation required the exercise of much skill and a prolonged elaboration of detail. I have said that vanadium can be alloyed with steel without undue loss, but it is by no means a corollary that the addition of a certain proportion of vanadium to steel necessarily points to the fact of that steel containing that proportion. It is then but fair to assume that figures then available would not, in some cases, be reliable indications of the effect of a specified *content* of vanadium, but rather records of the results following the *addition* of that quantity of vanadium. Again, it has been abundantly shown that, at the recalescence point, Ac1, a great rearrangement takes place, in both the static and dynamic properties of vanadium steels. (*Vide* Proc. Inst. Mech. Eng., December, 1904; Sankey and Kent Smith on the "Heat Treatment of Chrome Vanadium Steels.") The tests chronicled in the records first alluded to were almost entirely static, and much would depend upon the temperature at which forging, &c., was finished, or at which annealing was carried out; many apparent discrepancies would be thus easily explainable.

Accordingly it seemed best to me to begin such investigation *de novo*. Some five years ago Messrs. Willans and Robinson, of Queen's Ferry, Flint., placed at my disposal very complete means of carrying out such an inquiry. This, in the first place, was directed to the observation of different quantities of vanadium upon the static qualities of steels of different carbon content but in other ways similar, all conditions being kept as nearly alike as possible. Two things at once were apparent as the result of this series of comparisons: first the extraordinary intensifying static action of vanadium upon that of another constituent (in this case carbon), and secondly, the "homœopathic" doses in which it was necessary to use that vanadium in order to get the best results. The first at once led me to the conclusion that the useful field for the employment of vanadium by the steel metallurgist would lie much more probably in the direction of quaternary steels than in that of the ternary steels then experimented upon, and the second rendered the use of vanadium commercially possible: for though the cost of vanadium is considerable—its value to-day is a little more than half that of silver—the quantity required being small rendered it possible to produce commercial vanadium steels at costs roughly comparable with those of good quality nickel forging steels. It must always be remembered that it is in connection with this class of steel that vanadium steels must be considered: that is to say, in cases where requirements have to be met that ordinary "carbon" steels are powerless to cope with satisfactorily; and in no way is vanadium likely to enter into those requirements which are at present met with thorough satisfaction by the employment of the best qualities of open-hearth carbon steel. In illustration of the effect of this static action upon quaternary steels I append some results in tabular form, taken from the paper of Captain Sankey and myself above alluded to, exactly such an effect being found as was expected from the ternary tests before alluded to.

Comparative effects of chromium and vanadium on static tests.

	Elastic limit.	Ultimate tensile stress.	Elongation on 2 ins.	Reduction of area.
	Tons per sq. in.	Tons per sq. in.	Per cent	Per cent.
Crucible Steels				
Plain carbon-manganese . .	16·0	27·0	35	60·0
,, +0·5 per cent. chromium	22·9	34·0	33	60·6
,, +1·0 ,, ,,	25·0	38·2	30	57·3
,, +0·1 per cent. vanadium	28·5	34·8	31	60·0
,, +0·15 ,, ,,	30·4	36·5	26	59·0
,, +0·25 ,, ,,	34·1	39·3	24	59·0
,, +1 p. cent. chromium + 0·15 per cent. vanadium	36·2	48·6	24	56·6
,, +1 p. cent. chromium + 0·25 per cent. vanadium	49·4	60·4	18·5	46·3
Open-hearth steels.				
Plain carbon-manganese . .	17·7	32·2	34	52·6
,, ,, +1·0 per cent.				
Chromium + 0·15 per cent. Vanadium	34·4	52·6	25	55·5

It is not the province of this paper to enter into theories as to the various ways in which vanadium acts upon steel. One such action undoubtedly is to retard the segregation of the carbides. From this it was justifiable to infer that vanadium steels would be excellently suited to the employment of tempering processes; and also by analogy that commercial vanadium steels should be found reasonably free from other segregates. (Naturally I do not allude to those experimental compounds containing high percentages of vanadium which are prone to segregation from quite different causes). But the demands of modern engineering entail more and more dynamic excellence as well as static, and it is evident that in dealing with a special steel particular attention must be paid to the former, for the method of practically summing up the good qualities of a steel by an observation as to its behaviour under steady load or under a slowly applied bending action, obviously cannot be the best guide to its behaviour under widely different conditions. True, the results of simple shock resistance in the majority of cases correspond with the observed static ductility of that steel, but such correspondence is by no means invariable, and it often happens that just such cases may be the cause of "mysterious failure."

It has always been somewhat inexplicable to me why of the four usually recorded static figures, namely, elastic limit or yield point, maximum tensile strength, elongation and contraction of area, the two should have been chosen for generally summing up the strength and ductility of metal (*viz.*, maximum load and elongation), which to my mind have least bearing on the case. For I cannot myself contemplate in constructional or machinery work the useful employment of any material under tension beyond its yield point, while elongation has always struck me as being a measure of longitudinal flow rather than of the true ductility of metal, and to me the contraction of area seems to represent the true static ductility. If there were a constant relationship between the respective pairs of figures, this point would not have any practical importance, but unfortunately—or fortunately—no such constant relations exist. The static ductility is usually further evidenced by a bending test, though it would appear that the most useful and instructive form of bending test is that lately introduced by Captain Sankey, where the sample is alternately bent to 45° in either direction from the perpendicular and not only the number of bends is observed, but also the power required to make each separate bend. Another static test to which but scant attention is generally paid is the behaviour of a metal under torsion, its elastic and maximum shearing stress being observed together with its final twist-angle before shearing.

Now many of the engineering requirements of to-day render it necessary that we should know as much as possible of the behaviour of the metal under kinetic stresses. For example, it is manifestly ridiculous to attempt to sum up by means of the same "quality figures" the suitability of a metal for such different purposes as bridge building and the manufacture of connecting rods. The usual dynamic tests may perhaps roughly be grouped into four classes:—

(1.) The behaviour of a notched bar under sudden and overwhelming shock, such shock being sufficient to destroy the sample tested. Typical tests of this class would be the Fremont and the Izod (W. and R.) tests, recorded respectively in kilog. metres and in foot pounds.

(2.) The behaviour of a notched bar under repeated shocks, each shock being sufficient to permanently deform the sample slightly, the time factor being a somewhat variable item. Such tests are those of Yarrow, Seaton and Jude, &c., recorded usually empirically.

(3.) The behaviour of an unnotched bar under a rapid succession of small and alternating impacts (the time element being rendered practically a constant) until fracture occurs. The most striking examples of this type of test is due to Prof. Arnold, whose method of testing is without doubt of an importance which can hardly be over-estimated.

(4.) The behaviour of an unnotched bar under minute and rapidly applied stresses, applied transversely to the rotating bar, as in Mr. Stead's modification of Wöhler's test, or under repeated alternating stresses longitudinally applied as in Dr. Stanton's connecting rod test, and others of a similar nature. Test of class 3 and of class 4 especially encroach upon considerations of pure fatigue.

From the foregoing it will be evident that investigations which shall lead to the greatest combinations of possible static and dynamic excellence are not to be lightly undertaken in the hope of dismissing the subject quickly as one easy of solution. The diminution in impact resistance is infinitely greater than the increase in static strength in the ordinary steels, the laws of simple arithmetical proportion not applying at all, so that the doubling of the static strength (as evidenced by the elastic limit) with the retaining of the same shock resisting power, means a very great achievement; while, again, a simple ratio of the figures of the alternating test (class 3) is by no means permissible, as the test is carried out under most drastic conditions, and though no "factor" is possible of the actual test figure and the actual life, owing to the varied conditions obtaining in practice, yet it is probable that the length of this life bears relation to some power of the actual alternations figure. Thus a simple ratio of two to one in the test figure at a moderately low power of the numbers becomes thousands to one.

Large numbers of experiments upon the quaternary steels were conducted on the lines alluded to, and as a result the commercial production of five types of chrome vanadium steel was incepted. The application of and demand for these steels is steadily growing and they are now finding considerable use not only in this country but abroad; they are even being exported to France—the home of "special steel" manufacture. But before these types were put upon the market much remained to be done, and an investigation of their static and dynamic properties under widely different conditions of thermal treatment was carried out. Some of the results of this investigation were communicated to the Inst. Mech. Eng., in the memoir before indicated.

The first type of chrome vanadium steel, in the rolled or forged condition, shows an elastic limit of 35 - 38 tons per square inch, together with a contraction of area of 45—50 per cent. It bends and knots double cold, has a shock resisting power equal to that of good carbon steel having much less than half its elastic limit, superior static ductility, and a largely increased power of resisting alternations of stress and fatigue, while its resistance to torsion is much superior to mild or even to nickel "forging" steel. It welds perfectly, retaining its strength in a marked degree. By annealing this steel at 800° C. (very full cherry red), it loses static strength and becomes comparable statically to a 3 per cent. nickel steel, but its dynamic properties have now become stupendous. Its resistance figure to alternations of stress is nearly double that of excellent carbon steel, its resistance to sudden shock is superior to that of the best dead-mild steel known while its static ductility is quite equal to that of the latter, and its resistance to torsion has further improved. By quenching it from 900° C. in oil, and re-heating to 550° C., a material is obtained which has an elastic limit of 45—48 tons per square inch, an ultimate stress of 55—58 tons per square inch, an elongation on 2 ins of 20—24 per cent. and a contraction of 50—60 per cent., together with a shock resistance equal to that of *mild* steel, and an excellent wearing surface. The static ductility of the material is still equal to that of excellent mild steel, while the whole of the original high resistance to alternations of stress and fatigue is retained. Such a combination may be justly described as phenomenal. Thus in dealing with this type of material it is simple to meet most requirements in constructional work. Roughly speaking, if great static strength, great resistance to fatigue, and good ductility are required, together with reasonable resistance to shock (as, for instance, say, in bridge building), then use the material as it comes from the forge, annealing it at a blood-red heat to relieve internal stresses, of course. If one can sacrifice some static strength, and desires to have a material in which resistance to alternations of stress and impact are at a premium (as, say, in a connecting rod or an axle) anneal the material at full cherry-red. If the two sets of conditions are required together as far as is possible (as in the

Vanadium as a steel-making element. Micrographs at a magnification of 350 diameters.

N.B.—These micrographs are best examined through a reading glass



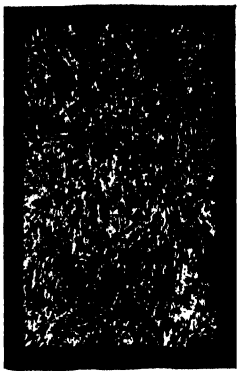
Admiralty "40 ton" forging steel



Type A—Cr. V. steel as rolled



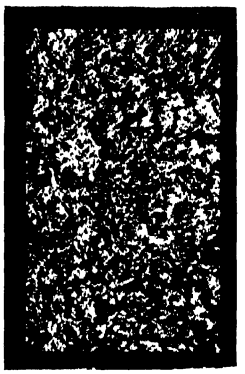
Type A Cr. V. steel annealed 800° C.



Type A Cr. V. steel oil quenched from 900° C.



Type A Cr. V. steel oil tempered.



Type A Cr. V. steel fully tempered.



Type A Cr. V. steel over tempered.



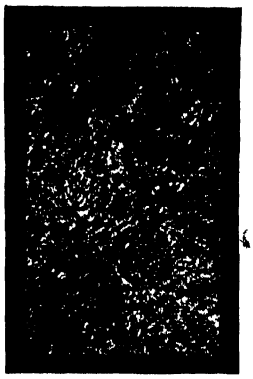
Type B Cr. V. steel as rolled.



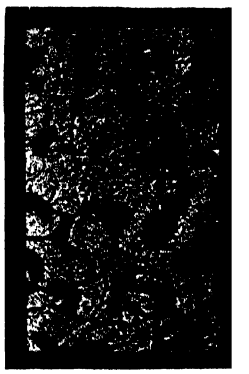
Type D Cr. V. steel as rolled.



Type D—Cr. V. steel annealed 800° C.



Type D Cr. V. steel oil tempered



Type E Cr. V. steel as rolled









Vanadium as a steel-making element. Micrographs at a magnification of 350 diameters.

N.B.—These micrographs are best examined through a reading glass



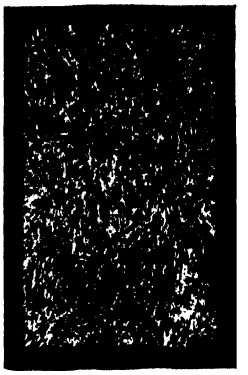
Admiralty "40 ton" forging steel



Type A—Cr. V. steel as rolled



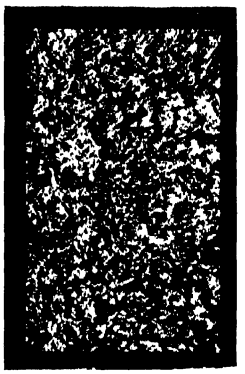
Type A Cr. V. steel annealed 800° C.



Type A Cr. V. steel oil quenched from 900° C.



Type A Cr. V. steel oil tempered.



Type A Cr. V. steel fully tempered.



Type A Cr. V. steel over tempered.



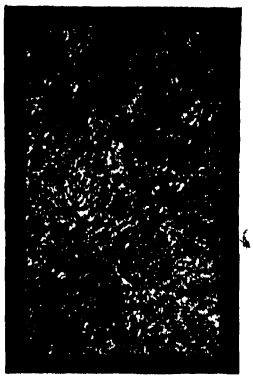
Type B Cr. V. steel as rolled.



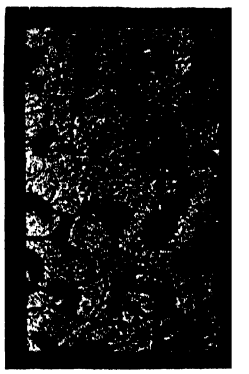
Type D Cr. V. steel as rolled.



Type D—Cr. V. steel annealed 800° C.



Type D Cr. V. steel oil tempered



Type E Cr. V. steel as rolled









Steels manufactured at Queen's Ferry by Messrs. Willans and Robinson, Ltd.

Description.	Yield point. Tons square in.	Ult. tens. str. Tons sq. in.	Elongation on 2 in.	Contraction.	Impact ft. lbs. W. & R. test.	Impact blows, Seaton & Jude test.	Alternations of stress, Arnold test.	Hand right angle bends.	Supplementary.
Carbon steels—			per cent	per cent.					
"Swedish" quality, mild	14	22½	50	60	15	—	100	18	Fulfils the most severe crushing, bending, bulging, and expanding tests. Equal to best Swedish mild steel.
*" Forging " quality ...	*17	*31	*32	*47	8	25	120	12	*Easily stands plate-bend, i.e., D=2T.
Nickel steel—									
3 per cent. nickel steel, "forging" quality ..	22	39	34	58	14	—	100	12	Bends, &c., as forging steel.
Vanadium steels—									
Chrome-vanadium "50-ton" steel (type A) as rolled.	37	53	25	50	5	25	160	15	⅛ in. sq milled bar, bends close double; 1 in. round (rolled), bends close double; welds thoroughly; twists like mild steel in flat sections; standard conditions, 6 in. length, 0·75 in dia.=3·92 twists (Nash's torsion test)
Ditto, annealed 800° C.	21	39	34	53	16	69	190	18	⅛ in. sq., milled bar, bends close double; 1 in. round (rolled), bends close double; welds thoroughly; twists like mild steel in flat sections; standard conditions, 6 in. length, 0·75 in. dia.=4·56 twists (Nash's torsion test).
Ditto, oil tempered	46	56	21	56	12	76	160	10	0·75 in round (milled), bends double (D= 2T).
Chrome-vanadium "bolt" steel (type B)	23	37	30	55	10	-	130	15	Torsion (previous conditions)=4·96 twists (Nash's torsion test).
Chrome-vanadium spring steel (type D)	45½	72½	13	44	4	—	—	—	Twists in flat tight up; $\frac{9}{16}$ in. round, bends double; after tempering a spring of it, co-efficient of safe working load=40,000; with excellent carbon spring, co-efficient of safe working load=20,000.
Vanadium case-hardening steel (type E) ...	20	25	45	69	17	—	240	—	— —
Softcore of case-hardened (type E) vanadium steel	35	45	22	60	—	—	—	—	Bends close double cold.

* This is very fully up to the best "Admiralty forging" specification.

the employment of a chromometer such as Stead's or Ridsdale's, but fitted with comparison tubes holding 100 c.c. each, and suitably graduated. A steel containing vanadium, in which the per cent. of vanadium has been accurately determined by one of the many methods available is required, and this should preferably be of somewhat the same nature as the samples examined.

One grm. of the sample or samples and standard is weighed out, and dissolved in about 40 c.c. of 25 per cent. nitric acid. When cool it is agitated momentarily with a couple of grms. of sodium bismuthate, and quickly filtered. The filtrate and washings are decolorised with a few c.c. of strong ferrous sulphate solution (acid and about half normal strength), 10 c.c. of fairly fresh hydrogen peroxide solution (prepared periodically by adding sodium peroxide to dilute sulphuric acid added), and the whole made up to 100 c.c. The solutions are compared as in estimating carbon by Stead's method, and a simple calculation by inverse proportion gives the vanadium per cent. True, hydrogen peroxide gives a colour with vanadium which develops somewhat slowly, but all the samples and the standard should be oxidised at once, and it is of no moment whether a solution "develops" its colour in a beaker or the chromometer bottle. Titanium would interfere with the estimation.

In making an investigation such as that of which the practical results are outlined, one has to so impose upon the good nature of one's friends that it would be almost invidious to single out any names for thanks; but, in addition to gratefully acknowledging the kindness of very many workers, I should like to express my thanks to Messrs. Willans and Robinson for placing so many details at my disposal; to Mr. G. N. Frankau, the head of the Queen's Ferry testing department, for valuable assistance; and to my laboratory assistant, Mr. M. H. Lewis, for help in the photographic portion of this paper.

Discussion.

Mr. Max Muspratt asked in what localities vanadium occurred in reasonable quantities. If anything like Mr. Kent Smith's hopes were raised in practice there would be a large demand, and every up-to-date metal works would see if it could not meet that demand. Were there reasonable quantities of vanadium in pyrites or in any of the various modifications of cupreous ores which were found in conjunction with pyrites. He should also like to have some idea as to the quantity of vanadium at present in use in the world. He would further like to know what became of the oxygen which was combined with the vanadium. He took it that the vanadium was used in the form of the pentoxide, and when that came into the group of three principal constituents of steel, it was difficult to know what the fate of the oxygen was. Did it attack the carbides and produce ultimately a steel which contained considerably less carbon than ordinary steel, or, failing that, to what extent would the action of the oxide at a later stage affect the steel?

The Chairman said that when Sir Henry Roscoe made his investigations on vanadium, he believed that his vanadium samples were obtained from the neighbourhood of Macclesfield, in Cheshire. It certainly surprised him to hear that vanadium was almost as widely distributed as arsenic.

Mr. G. Watson Gray said he had found some samples of strontium sulphate from the Bristol Channel district

to contain vanadium. There was no doubt in his mind that some of the discordant results obtained by the early workers on the effects of vanadium on steel were due to the impurities contained in the ferro-vanadium used. Some samples which he had examined contained large amounts of arsenic and phosphorus. As Mr. Kent Smith pointed out at the commencement of his paper, if 0·25 per cent. of vanadium were added to the steel, probably there was only 0·18 per cent. in the product, the remainder being carried away in the slag.

Mr. J. B. C. KERSHAW asked: Were the special vanadium steels made by Messrs. Willans and Robinson being employed at all by motor car makers in this country, and, if so, what amount was used per annum in this way? Vanadium was always used by steel makers in the form of ferro-vanadium, and not as oxide—as Mr. Max Muspratt supposed; and hitherto a firm of electro-metallurgists, in Switzerland, had been the chief producers of this ferro-vanadium alloy. Were Messrs. Willans and Robinson obtaining their ferro-vanadium from that firm, or were they producing it themselves from vanadium ores? Since the Swiss manufacturers had cheap water power available for production of the alloy by electric-furnace methods, it would seem unlikely that we could carry on in this country a successful and profitable business in the manufacture of the ferro-vanadium alloy.

Mr. KENT SMITH said Mr. Carey had partly answered a question when he said that Sir Henry Roscoe's vanadium came from near Macclesfield. Sir Henry was working on a deposit which existed near Alderley Edge, which to-day was of greater academic than practical value. There were various small known sources of vanadium in this country. They were mostly in "pocket" formation. The commercially valuable ores, &c., might be said to emanate from two or three places; the chief one being Spain, where vanadium existed in the form of vanadinite, containing about 3 per cent. of vanadium and 40—50 per cent. of lead. The ore was capable of hand-dressing by the most primitive means, up to about 14 per cent. of vanadium pentoxide—equal to about 8 per cent. of vanadium. There were also deposits in Yauli, where the metal existed in anthracite coal. The ash contained 45—50 per cent. of oxide of vanadium. It was necessary to burn 50 tons to obtain a ton of ash, and thus to burn 100 tons of coal to get a little over a quarter of a ton of vanadium. He believed that a French syndicate, who were working that deposit, had not been very successful. The coal was in a very inaccessible place, and transport difficulties were great, while many other circumstances were unpropitious. The Colorado sandstones contained vanadium. Sandstone would appear simpler to treat than lead ore, but it was a very difficult ore of vanadium to work. A considerable quantity of the ore was being shipped to England, he was told, and several people had experimented on it. He believed a works was being built for extracting that ore alone. With regard to the quantity used now, as already stated, in Queen's Ferry spring steel there was about 0·2 per cent., while in Queen's Ferry case-hardening steel, there was rather over 0·1 per cent. Supposing that the average grade contained 15 per cent., 3½ lb. of metallic vanadium were used to the ton; if 33 per cent. alloy was used, 10 lb. of alloy were required to the ton. A very much better quality of vanadium steel could be obtained, especially "dynamically," than nickel steel at the same price. He did not think that pyrites offered a very likely source. A sulphide of copper occurred abroad with which was associated a considerable amount of vanadium, but it was a difficult material to treat. The chief firm in this country using vanadium in large and regular quantity was Willans and Robinson, of Queen's Ferry. In reply to Mr. Max Muspratt, the metal, and not oxide of vanadium, was used in steel making. The oxygen had been got rid of or been dealt with long before the alloy reached the steel. He did not attach the same importance to the presence of arsenic as did Mr. Gray. Supposing a vanadium alloy contained 30 per cent. of vanadium and as much as 3 per cent. of arsenic, the introduction of 0·15 per cent. of vanadium means introducing 0·015—0·020 per cent. of arsenic. Ordinary steels contained, perhaps, 0·03 per cent. of arsenic, making a total of 0·05, which was not harmful. He quite agreed with Mr. Gray as to phosphorus determination. The method he had found best was to almost reduce the solution of the steel precipitate with ammonium acetate, filter, redissolve, reprecipitate with ammonia, add hydrogen peroxide, filter and then precipitate with molybdate. Mr. Kershaw spoke of the motor car industry. It would be safe to say that of the vanadium steel turned out at Queen's Ferry about 80 per cent. was absorbed by the motor car industry.

New England Section.

Meeting held at Boston, on Friday, February 2nd, 1906.

MR. HENRY HOWARD IN THE CHAIR.

COMPOSITION AND PROPERTIES OF COTTON SOFTENERS.

BY F. E. BURNHAM.

The process of dyeing tends to harshen fibres, and therefore methods and materials are sought which will reduce this tendency to a minimum. The harshening effect is especially noticeable in the dyeing of cotton warps, and efforts to overcome the trouble have resulted in a demand for a class of substances known as cotton softeners. Cotton softeners may be defined as substances designed to reduce or prevent the harshening effect of the dyeing process on cotton yarns. To a limited extent softeners may be used in dyeing raw stock and carded cotton; for piece goods their use is unnecessary, as the desired result is obtained in the finishing processes, and by the use of various finishing compounds. The commercial importance of cotton softeners is considerable, yet an examination of the literature of textile processes discloses slight information, and has led the writer to believe that the results of his investigation of the composition and properties of cotton softeners may be of interest. A preliminary examination shows that, in general, commercial cotton softeners are composed of water, soap, and oil, or, as it may be considered, an emulsion of oil in a concentrated solution of soap. Other substances may be present, but, with the exception of glycerin, are of no value, and should be regarded as adulterants; examples of such substances are sodium silicate, rosin, starch, and clay. Both soda and potash soaps are used according to the properties desired in the softeners. For a cheap softener the lower cost of the soda soap recommends it, and, when used with an oil of low melting point, fairly good results are obtained, especially if there is much glycerin present to furnish the rather essential property of hygroscopicity. The hardness of the soda soaps also gives a certain body to the fibre. In general, however, soda soap softeners are not so efficient as the potash soap softeners, because the soda soap has a tendency to dry out, and thus harshen the feel of the fibres rather than to produce the contrary and desired effect. A certain advantage which soda soaps possess, however, should not be overlooked, *viz.*, that because of their solidity they form a protective covering over the oil in the fibre, and thus prevent its turning rancid. Because potash soaps are soft and deliquescent they are generally to be preferred as softeners, their superior efficiency off-setting the lower cost of the soda, but by reason of the tendency of many oils to go rancid and develop disagreeable odours, the range of oils which it is possible to use with a potash soap is more limited than is the case with soda soaps. The choice of the alkali in the soaps used, however, is dependent, to a large degree, on the oil used, whether present as combined fatty acid, or as free oil. Mineral and fish oils are necessarily excluded; the former because they are unsaponifiable, the latter from the bad odours developed on drying them, and because of their gumminess. The field of animal and vegetable oils is a wide one, with cost an item of much importance. Olive,

cottonseed, maize, sunflower, peanut, palm, and coconanut oils are all feasible vegetable oils. Tallow, both beef and mutton, lard, tallow oil, red oil and lard oil, are all suitable animal products. The selection of a suitable oil is dependent on the cost, the melting point, the freedom from tendency to turn rancid, and the absence of unsaponifiable matter and hydroxy acids. All desirable properties cannot be expected in one oil, and the purpose for which the softeners are used will determine the choice.

While in general the use of a softener is simply to produce a good touch, yet different kinds of yarn will require slightly different treatment, and the softener be modified accordingly. Low quality yarns require the item of cost to be especially considered, and so the soda softener will be employed in such cases. For loosely twisted yarns and short staple yarns, the body-giving property of the soda soap softener recommends it. All fine yarn, tightly twisted yarns, and those from unusually harsh dyeing processes will require the potash softener. The proportions of the different constituents of a softener, *i.e.*, the water, soap, and oil, may be defined as follows:—sufficient water to dissolve the soap, and as much oil as this concentrated soap solution will thoroughly emulsify. The fact that the above conditions are frequently not observed—commercial cotton softeners being often simply mixtures of soap and water selling at prices greatly above their true market value—has led many to consider that all cotton softeners are "fake" products. No general rule governing the proportion of water, soap, and oil is followed, hence an investigation of the application and effect of softeners of varying proportion on warps became necessary.

Softeners were made up in the laboratory in accordance with the rule stated above, that the water should be sufficient to dissolve the soap, and no more oil should be present than could be held thoroughly emulsified, and the results from using such softeners, compared with those obtained by the use of commercial softeners. It was soon evident that there was too much oil in the majority of the commercial softeners, as it separated in the softening bath, and frequently caused oil stains and streaked warps. As indicated by their composition, there are two methods of preparing cotton softeners; first, by adding a warm solution of caustic alkali to an excess of oil above that required to make a neutral soap, and then thoroughly boiling and agitating; second, by making a soap, dissolving it in hot water, and adding the proper amount of oil, and then boiling and stirring the mixture. With the first method it is evident that the combined fatty acid and free oil must be the same. By the second method it is possible to have one variety of soap, *e.g.*, a palm oil soap, and a different oil, *e.g.*, olive oil; such combinations are frequently desirable both from an economical and from a practical point of view. A further advantage of the second method is that the free oil in the softener is not boiled for the long period required by the first method. When a soda soap is used because of its hardness, the free oil must be of low melting point, and unquestionably a good grade of olive oil is the most desirable for such purpose. With a potash soap, because it is soft, a harder fat or tallow may be used for the free oil. The use of these fats is also preferable as they have less tendency to turn rancid. The proportions determined by experiment, as best suited for cotton softeners, were those in which the soap, calculated on a dry basis, is three parts to one part of free oil, or, including the water, seven parts of water, three parts of soap, and one part of oil. An analysis of a soda softener made approximately on this formula gives:— Water, 64·2 per cent.; dry soap, 26·8 per cent.; oil, 9·0 per cent. A potash softener, which gave excellent results, gave on analysis:—Water, 68·4 per cent.; soap, 23·7 per cent.: oil, 7·9 per cent.

As stated above, with a soda softener olive oil is preferable for the free oil, but as a source for the combined fatty acids in the soap there is a wide range for choice; at present maize (corn) oil is a very cheap and valuable soap oil, and may even be used as a free oil with fairly good results. Bleached palm oil, however, is the usual fatty base of the soap in soda softeners, the body it gives being the reason for its selection, as thereby more water can be included in the softener. From a user's standpoint it is not superior to maize oil or tallow, and is somewhat more expensive. Cottonseed oil is on the whole less desirable in its soap making properties than maize oil, and at the present time is higher in price. For a potash softener the maize oil is suitable, and is as cheap as the fatty base for the soap, if a fairly hard tallow is used for the free oil. Red oil is also very suitable as a soap base with either potash or soda, but because of its odour should not be used for the free oil. Lard oil, while suitable for soap base, is higher in price, and offers no advantages over red oil. Beef and, in a less degree, mutton tallow are good and cheap soap bases, and beef tallow is the material *par excellence* for the free oil of a potash softener. One cotton softener, which is somewhat largely used, is sulpho-ricinoleic acid or Turkey red oil. This is, undoubtedly, a good softener, and has, in a marked degree, the general property of all good cotton softeners of brightening colours. It is, however, more expensive than the cotton softeners described, and has no compensating advantages.

It may be summarised in conclusion that a good cotton softener is composed of approximately seven parts of water, three parts of soap, and one part of oil, and that, where a soda soap is used, the free oil should be olive or maize oil, and, when a potash soap is used, it should be tallow or lard.

Meeting held at Boston, U.S.A., on Friday, March 2nd, 1906.

MR. F. E. ATTEAUX IN THE CHAIR.

COLLABORATIVE WORK ON TANNIN ANALYSIS.

BY FRITZ H. SMALL.

The tanner's original methods of analysis were primitive, and largely consisted of chewing the bark or tasting the liquor. It is little wonder, therefore, that it was regarded a remarkable feat to turn out leather of uniform quality. Many methods have, to be sure, been proposed for estimating tannin, belonging mainly to one of two groups—either (*a.*) precipitation with metallic salts, or (*b.*) with some form of gelatin.

Under (*a.*) have been suggested ammoniacal copper acetate, ammoniacal zinc acetate, lead acetate, stannous chloride, ferric acetate and other salts. Under (*b.*) various methods depending upon the use of gelatin or raw hide. Also Wagner has suggested the use of cinchonine sulphate, using Magenta as an indicator, and others have suggested various oxidation methods; but none of these methods were founded on accurate chemical knowledge. They were essentially empirical, and in general gave results of a fearful and wonderful concordance.

The first method that came into anything like general use was that of Löwenthal, originally published by him, in 1877, in the "Zeitschrift für Analytische Chemie." This was carefully studied by a commission of German chemists, who, in 1885, reported a formula for its use, which latter was advantageously modified by Hunt and Procter. In general the method consists in titrating the tannin solution in the presence of Indigo Carmine with a solution of potassium permanganate, whereby the tannin is oxidised, the Indigo serving the double purpose of regulating the oxidation by confining it to bodies more readily oxidisable than itself, and of acting as indicator. The method has some value, but also serious defects and is no longer in common use. The foundation of the methods in practical use to-day was the method proposed by Simand and Weiss in 1885. Its essential features were as follows:—The tannin solution was made up to contain from 1 to 1·2 grms. of solid matter per 100 c.c. of solution, the exact amount being determined. To 250 c.c. of the solution so prepared was added 1 grm. of powdered dry raw hide and the mixture allowed to stand several hours with occasional shakings. It was then filtered through linen. To the filtrate was added another grm. of the powdered hide and the process repeated. Then another grm. portion was added, and finally a 2-grm. portion, which was allowed

to stand some 12 hours or more. 100 c.c. of the final clear filtrate were evaporated and dried, and the difference in weight between this and the original reckoned as tannin. In 1887, Prof. Procter suggested packing the powdered hide in a tube, and allowing the tannin solution to percolate through it, whereby the tannin is removed and a clear percolate free from tannin results. This suggestion of Prof. Procter is the basis of the standard method used in the Eastern Hemisphere. In 1894, Mr. Yocum suggested putting the hide powder into the liquor and shaking vigorously in a mechanical shaker. This suggestion is the basis of the method used in America. The method in either form appears simple, but it is evidently a purely empirical method, dealing with substances whose properties are little understood, and in reality it abounds in difficulties.

Several schools for the study of matters pertaining to the tanning industry have been founded, notably at Vienna, Freiburg, Leeds, and London, and in these has been done most of the original work on methods. In America there has been no such school, and, until the recent establishment of the Leather and Paper Laboratory at Washington, no institution devoted any time to this kind of problem. It has consequently been necessary for the men actively engaged in helping to make leather to work out their own method. Realising the necessity of a uniform method, whereby concordant analytical results could be obtained, several of these leather chemists in 1894 banded together and were admitted to the "Association of Official Agricultural Chemists," as the section on tannin, under which organisation they have done much towards perfecting a method of tannin analysis.

In 1897 a meeting of leather chemists was held in London and an "International Association of Leather Trades Chemists" formed. Its object, as announced in its constitution, is to "establish standard international methods for the valuation of all materials used in the leather industries, especially as regards the drawing of samples from bulk, the processes of analysis employed, and the form in which their results are to be stated. It further aims at promoting scientific and technical knowledge in the industry, and especially at the improvement of scientific methods of control of the processes of manufacture." It is a strong organisation with some 250 members, about evenly divided between active and associate, and belonging to nine countries. It has a meeting once in two years, at which the work during the preceding interval is thoroughly discussed, and any desirable changes in the method in vogue adopted and made official. Its methods of analysis are standard for the continental countries. It publishes weekly an eight-page sheet called the "Collegium," which is the official organ of the association, and which contains both original articles and reprints of articles on subjects relating to the tanning industry. In 1903, several leather chemists, who had been associated in the tannin section of the Association of Official Agricultural Chemists, formed a separate organisation, known as the "American Leather Chemists 'Association." This now has a membership of 50, of which 30 are active.

For purposes of leather manufacture the tanner wishes to know what percentage of tannin his raw material contains and what is the composition of the liquor he obtains on leaching this raw material. There is, therefore, for the chemist—first, the problem of extracting the tannin from the raw material on a laboratory scale. Abroad the percolation method is in favour. Parker and Payne, in England, have made a rather thorough study of extraction by this method, and have concluded that for each material there is an optimum temperature at which the yield of tannin is greatest, and they have worked out for numerous materials this optimum temperature. Some doubt has been cast on this conclusion by work done last year by members of the "American Leather Chemists' Association," but the question is still open. In America the method in common use has been to extract the ground material in a copper Soxhlet apparatus. Some collaborative work on extraction by the "American Leather Chemists' Association," in 1904, showed rather wide variations in results, and an investigation of the reasons has since been undertaken. At the start it was found necessary to specify a certain maximum fineness to which all of the material to be extracted must be ground, if it was to be completely extracted in a reasonable time. Next, the Soxhlet apparatus, as ordinarily used, was found to give low results in tannin, probably because of the prolonged boiling of the liquor whereby a conversion of the tannin into some compound not tannin, possibly gallic acid, takes place; for instance, some recent experiments made in duplicate in the writer's laboratory where a sample of tannin material was extracted in a Soxhlet apparatus, the extractive in the one case being removed from the action of the heat, and in the other allowed to boil in the usual way, showed the following results:—

Myrobalans.

	Boiled.	Not Boiled.
Soluble solids	67·80	66·64
Non-tannins	28·99	17·65
Tannin	38·81	48·99

Valonia.

	Boiled.	Not Boiled.
Soluble solids	54·03	54·34
Non-tannins	19·86	16·46
Tannin	34·17	37·88

In each case the total yield of extractive was similar, but the prolonged boiling brought about a very serious loss of tannin. Several pieces of apparatus have been brought out during the past year to overcome this difficulty, notably by Messrs. Teas and Reed, and Mr. Veitch has done some valuable work along the same line. The whole question is in the hands of a committee for elucidation during the present year and some very interesting results may be expected.

Next, as regards the analysis of the tannin solution—in outline the method used is as follows:—the tannin solution is made up of such concentration as to contain from 0·35 to 0·45 grm. of tannin to 100 c.c.; 100 c.c. of this solution are evaporated and dried to give the amount of solid matter present. Some of the solution is filtered and 100 c.c. of clear filtrate evaporated and dried to give the amount of soluble solids present. Another portion of the solution is treated with hide powder to remove the tannin. The hide powder is then filtered out and 100 c.c. of the clear filtrate evaporated and dried to get the amount of soluble matter present which is not tannin. The difference between the weights of the first two residues gives the amount of insoluble matter present, and the difference between the last two the amount of tannin present. In carrying out this scheme of analysis the first difficulty arose in trying to filter out the insoluble matter. The solution is of a colloidal nature and filter paper fails in many cases to yield an optically clear filtrate even after many hours of repeated returns through the paper. The insoluble matter is, moreover, only relatively insoluble, as it is distinctly susceptible to the influence of temperature; for instance, a solution of tannin from hemlock bark filtered at 15° C. showed 4·23 per cent. insoluble, at 20° C. 3·53 per cent., at 25° C. 2·76 per cent., at 30° C. 2·21 per cent. Further, most of the usual filtering materials will combine with tannin to a certain extent and so remove tannin as well as insolubles from solution. This loss may frequently amount to several units per cent. These various points have been brought out in the collaborative work of the years past, and now by a careful prescription of conditions a method has been arrived at, which at least enables us to secure results that are reasonably concordant. The worst trouble, however, in the scheme of tannin analysis has been to remove the tannin and measure its amount. The method in vogue in America, as has been previously stated, is to shake vigorously some carefully prepared powdered hide with some of the tannin solution. Now,

no matter how carefully the hide powder is prepared, some of it is found to be readily soluble in water, or in the dilute solution of tannin employed for analysis. Further, for some inexplicable reason, it has been found impossible to prepare duplicate batches of hide powder having the same absorptive power, no matter how carefully the conditions of manufacture are duplicated. It was not until a paper by Mr. Craighill, acting on the suggestion of Mr. Weiss, published in the "Leather Trades Review," brought out the advantage of treating the hide powder before use with a solution of chrome alum, that any approach to uniformity of analysis was arrived at. Curiously enough a previous tanning of the hide powder with the chrome salt not merely largely converts the soluble hide into insoluble compounds without diminishing the power of the hide powder to absorb vegetable tannins, but it equalises the absorptive power of two powders, which before treatment with the chrome salt were very unlike. Thus two samples of hide powder tested in the writers' laboratory gave results for non-tannin material in an identical solution, varying by over 3 per cent. After these two samples of hide powder had been subjected to the preliminary chroming they gave results agreeing to within less than one-half per cent. This discovery has brought order out of chaos to a remarkable extent, and the agreement of the non-tannin values in the collaborative work done during the past few years has been very satisfactory.

The present method involves treatment of the hide powder with a dilute solution of chrome alum, then washing the hide powder free from uncombined salts, squeezing out the excess of water and adding the moist chromed hide powder to the tanning solution, which, of course, necessitates a correction for the water added with the hide powder. As these operations have to be performed each time an analysis is made, it is evident that if a hide powder could be prepared which would have the advantages of the chromed hide powder and yet be ready for use at once, it would be distinctly desirable. This is one of the matters under consideration at present, as well as certain questions affecting the details of the present process. Even the evaporation and drying of the residues in the analysis has been a source of much discordance. It has been found extremely difficult to remove all traces of moisture without bringing about a decomposition of some of the substances present in the residues. A vacuum oven might probably have done this satisfactorily, but the apparent impracticability of bringing about its universal use was against it. The difficulty seems to have been solved by the use of the combined evaporator and dryer worked out by Mr. Alsop. This consists of a copper steam bath with solid top on which the dishes rest, and a steam jacketed cover, provided with openings for ventilation, which fits down closely on to the copper top. A uniform temperature of about 98° C. is attained, and the tests of the apparatus made by Mr. Reed show that the drying is uniform over the whole top of the bath, and that after complete drying is attained, which happens in some 12 hours, no further effect of decomposition or otherwise is produced by further drying, but a constant weight is attained. The collaborative tests so far made seem to corroborate these results of Mr. Reed.

As a result, then, of the collaborative work which has been done, and of which I have been able to give only a partial and brief sketch, we have a very fairly satisfactory method for valuing the raw tanning materials. It is now possible to buy and sell such on the basis of their tannin content with the assurance that on the same sample the results of two chemists will show a very close agreement. It is also possible now to regulate the actual manufacturing processes with a degree of certainty unknown in the past.

But the work of the American Leather Chemists' Association has not been confined wholly to this one subject. It has greatly broadened out, and it is hoped and expected that its work will continue to expand. This year, for instance, in addition to the work on extraction and on the analysis of fresh solutions of tannin, work is in progress on a method of analysis of the old used liquors of a tannery, the analysis of these being complicated by the presence of acids and of excessive amounts of non-tannin material; also on the estimation of the amount of acid in these liquors and the kind, both matters of great importance to the tanner. Similarly a Committee is studying the best way of estimating the colour value of tanning materials and it is hoped to devise some method of recognising the different kinds; that is, for instance, determining how much chestnut wood and how much oak bark liquor is contained in a mixture of the two. Another Committee is formulating a method for the analysis of commercial acids in use by tanners. Still another Committee is examining the new methods proposed for the analysis of tannin; and, finally, the study of methods of analysis of the materials entering into the manufacture of chrome leather is being entered upon. As fast as these Committees arrive at results their recommendations are submitted to trial on identical samples by the active membership of the Association, and any others interested. In this way the valuable results of the past have been achieved. The process is somewhat slow, but it seems well calculated to save out the good and reject what is bad. It is to this spirit of collaboration among the leather trades' chemists that we may ascribe the present vastly improved condition of questions of analysis of tannery materials.

New York Section.

Meeting held at the Chemists' Club, on Friday, January 19th, 1906.

DR. RUSSELL W. MOORE IN THE CHAIR.

EARTH ALKALI AND ALLIED PEROXIDES: PROPERTIES AND APPLICATIONS.

BY DR. R. VON FOREGGER AND HERBERT PHILIPP.

Recently a group of oxidising compounds which, on account of their chemical and physiological properties, are of industrial interest, have been commercially procurable. The products we refer to, and which we have studied, are the peroxides of calcium, strontium, magnesium and zinc. We have not included barium peroxide, as this compound is already well known, and, besides, it would not fit in this class on account of its toxic nature.

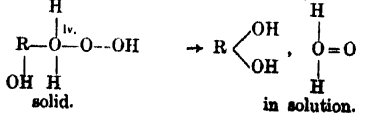
The ideal oxidiser would no doubt be ozone, because as soon as it has accomplished its functions its carrier—oxygen—escapes as a gas, and, therefore, leaves no residue. But ozone cannot be conveniently compressed, and, therefore, can only be used at the point and place of production.

The peroxides we have in mind come nearest to the above property of ozone, inasmuch as in liberating their available oxygen they leave either a colourless solid residue, which can readily be separated from the oxidised medium, or a soluble salt, both of a harmless nature.

There are many compounds known for their oxidising properties, which have proved to be applicable in certain lines, yet, due to some of their characteristic and unpleasant properties, have failed to score in other lines. It is the destiny of these earth alkaline peroxides, with their non-toxic, non-irritant, and non-corrosive actions, to enter upon these lines.

The constitution of these earth alkaline peroxides can be most easily explained by accepting a tetravalent oxygen (Kingzett, this J., 1890, 3, and Chem. News, **46**, 141). If R represent a bivalent metallic element, the peroxide is represented thus:—R=O=O, the tetravalent oxygen being the active oxygen, which we can imagine has wedged itself between the metal and bivalent oxygen of the ordinary oxide.

The hydrates of the peroxides would have the formula $R(OH)_4$, and, as we will show later, we imagine these perhydrates in solution as $R(OH)_2$, H_2O_2, and think we can demonstrate this in the following way:—



This tetravalent oxygen, which we imagine as lightly wedged in between the R and bivalent O, is ready to step out with ease, as the opportunity offers itself, thus explaining the characteristic oxidising properties of these peroxides.

Calcium peroxide.—A calcium peroxide is described in text-books with the formula $CaO_2 8H_2O$. This is the product as it is obtained, for instance, by the action of hydrogen peroxide on lime water. It appears in fine needle-like crystals, and is very voluminous. In that form, however, it has not found any industrial application. The product as it is procurable for industrial purposes is free from molecular water, and is a compound of calcium peroxide and calcium hydroxide in the form of a fine yellowish white powder. It is considerably higher in its contents of available oxygen than the crystalline product. Besides these two bodies, a third intermediary one is known, containing two molecules of water. This forms a compact, comparatively stable body, which has a different appearance from either of the two, as the crystals are extremely small. The dehydrated product can be brought back to the hydrated form with evolution of heat. It forms both hydrates, the $CaO_2, 2H_2O$, and finally, the $CaO_2,8H_2O$. De Forcrand (Compt. rend., **130**, 308; this J., 1900, 683) has found that on an average, about 3 calories are evolved by the addition of each molecule of water.

The dehydrated product is ordinarily a 60 per cent. peroxide with 13·5 per cent. available oxygen, but an 80 per cent. peroxide with 17·8 per cent. available oxygen has also been obtained.

The density of calcium peroxide preparations with an equal percentage of oxygen can vary apparently owing to the mode of manufacture. The density also varies according to the amount of calcium peroxide, the more peroxide being present, the denser the body. A product of 60 per cent. peroxide shows, on an average, the sp. gr. of 0·603, while a product of 80 per cent. we have found to have a sp. gr. of 0·74.

A line must be drawn between the solubility and dissociability of the product in water. Regarding the first, but 1 part dissolved in 7·025 parts of water at 20° C. Regarding the latter, however, it was found that from a calcium peroxide with 13·5 per cent. available oxygen, stirred in 150 c.c. water during five minutes at 10° C., 2·6 per cent. at 20° C., 2·97 per cent. and at 40° C., 8 per cent. of the total available oxygen was found by titration in the solution.

From this, the amount of dissociated oxygen is out of proportion with the solubility of the product, which can be explained by a molecular change taking place, bringing the available oxygen into an active state. Furthermore, as this oxygen in solution appears very stable, even at boiling, it must be assumed that it is there *not* in the form of free hydrogen peroxide, but as an addition to calcium hydroxide. Evidently, when the peroxide is added to the water it forms a compound with 2 mols. of water, which undergoes a molecular change when it goes into solution; thus, $CaO_2,2H_2O \rightleftharpoons Ca(OH)_2,H_2O_2$. This latter product finally splits up by heat, but at lower temperatures is formed again, thus, $Ca(OH)_2,H_2O_2 \rightleftharpoons Ca(OH)_2 + H_2O_2$, exemplifying a reversible reaction, the former equation also being of a reversible nature.

We have found that complete decomposition of calcium peroxide in aqueous solution is only obtained after boiling the same for at least six hours. It seems to be the most stable of the alkaline earth peroxides. In a dry atmosphere it is so stable that by heating up to a temperature of 200° C. it does not decompose.

Calcium peroxide seems to be non-explosive. Mixed with animal charcoal in equal parts, and detonated, it did not explode, and also on adding a few drops of concentrated sulphuric acid no combustion or explosion occurred, as is the case with chlorates and permanganates. It is readily soluble in inorganic and organic acids, forming a calcium salt and hydrogen peroxide. It is stable with organic acids; during the reaction of equivalents in the state of formation, the activity of the available oxygen is very efficient. The amount of the available oxygen in commercial calcium peroxide compared to the amount of available oxygen in the commercial 10 vol. hydrogen peroxide preparation stands in the ratio of 10 : 1.

At the Bethlehem meeting of the American Electrochemical Society last September (Eighth General Meeting, see Electrochem. and Met. Ind., 1905, 3, 377), an interesting discussion on the comparative values of calcium peroxide and calcium permanganate was started. In a neutral or alkaline solution of calcium permanganate with the formula $Ca(MnO_4)_2,5H_2O$, 1 mol. furnishes three atoms of available oxygen, or 13·2 per cent. In a sulphuric acid solution, 1 mol. of calcium permanganate furnishes five atoms of available oxygen, or 21·7 per cent. One mol. of calcium peroxide furnishes one atom of available oxygen, which, we have seen, amounts to from 13·5 to 17·8 per cent.

So, concerning the amount of available oxygen, calcium peroxide stands between the two. Concerning the character of the reaction, however, calcium peroxide may be considered preferable, as a sulphuric acid solution of this peroxide yields nothing but nascent oxygen, or hydrogen peroxide, and as the only by-product, calcium sulphate, of which but traces go into solution, and the white sediment will only in rare cases be objectionable; whereas, the manganous salts formed by the permanganate reaction are usually considered objectionable.

Calcium permanganate is of a very deliquescent nature. Although it has been tried, to use the product industrially the fact that it decomposes so very easily in the presence of organic substances, and that it is hygroscopic, place a barrier to its industrial success, though it could be manufactured very cheaply as a by-product of Weldon mud. It has only been used for purifying water, first suggested by Bordes (Woch. f. Brau., 1895, 1063).

Strontium peroxide.—This product is also a microcrystalline body—$SrO_2,8H_2O$. As with calcium peroxide, the commercial product is dehydrated, containing 85 per cent. SrO_2, the balance being strontium hydroxide. It is a voluminous white powder, of sp. gr. 0·546. Its solubility, calculated on the amount of strontium, is one part in 12,500 of water, at 20° C. Its capability of dissociating its oxygen is, however, decidedly higher than that of calcium peroxide. We have found that in an interval of five minutes, in 150 c.c. of distilled water, at 10° C., 12·4 per cent.; at 20° C., 15·78 per cent.; and at 40° C., 26·3 per cent. of the total available oxygen could be titrated in the solution. The residue of this latter solution was dissolved and the titration showed only 62·2 per cent. of the total available oxygen; about 11·5 per cent. of the total available oxygen had apparently escaped by the heating to 40°.

Strontium peroxide is, like calcium peroxide, very stable in a dry atmosphere, even at a high temperature, and can be heated up to 150° C. without loss in available oxygen.

Magnesium peroxide.—Magnesium peroxide is a white, amorphous powder, which, we think, is in reality a perhydroxide of magnesium. Magnesium peroxide as it is obtainable in the market, is a compound consisting of magnesium perhydroxide, magnesium hydroxide and constitutional water. We do not think that it is a mixture, because we have noticed that preparations containing certain amounts of available oxygen are more stable than other preparations containing more or less than these. Thus, a product containing 9·2 per cent. of available oxygen seems to be stable, whilst if a product contains less than this it gradually loses its available oxygen, till it reaches 8 per cent. available oxygen, when it again remains stable; and so we have found stable products containing 6·85 to 6·9 per cent., and also such containing 4·3 per cent. oxygen. The less available oxygen the product contains the more stable it is under atmospheric conditions. The ordinary product contains about 8 per cent. oxygen and has a sp. gr. of 0·615.

Magnesium peroxide has the solubility of 1 part in 14,550 parts of water at 20° C. Suspended in water it dissociates its available oxygen quicker than zinc peroxide, and slower than calcium or strontium peroxides, but it loses its available oxygen quicker in moist atmosphere than the other peroxides, as it is apparently more subject to the influence of carbon dioxide. In a dry atmosphere it is, however, comparatively stable, and was heated to 160° C. without any loss.

It reacts like these other peroxides with acids and certain organic matters.

Zinc peroxide.—We have found this peroxide of a rather steady constitution, the percentage of peroxide only varying according to its contents of free moisture. It seems to form no perhydrate, and, apparently, contains also no constitutional moisture. In that it differs from calcium and strontium peroxides. It represents, we believe, a mixture of zinc peroxide—averaging 50 per cent.—zinc hydroxide and free moisture. This 50 per cent. peroxide is a dense, yellowish-white powder of sp. gr. 1.571. The product of this form is very stable, and does not lose its available oxygen when heated up in dry air to 170° C. At a temperature of 100° C., the moisture evaporates without affecting the product itself, so that by this procedure the substance gains in percentage of peroxide.

Zinc peroxide suspended in water is very permanent and very slightly soluble (one part in 45,500). In acids of any kind it is readily soluble. Organic matter, if moist, or if acid in reaction, decomposes it gradually. It is indifferent to mineral hydrocarbons, inasmuch as they contain no free acid. This characteristic is essential for the preparation of ointments, a form in which it is widely used.

Zinc peroxide is a product of highly antiseptic properties, and has the advantage over other antiseptics of being odourless and non-irritant. As it is exclusively used in surgery and dermatology, we refer to the literature in existence.

Applications.—As to the application of these peroxides, one would imagine that the peroxide containing the most oxygen would be the most economical in use. Such, however, is not the case. A great advantage of these oxidising agents lies in the property that their carrier, the basic radical, is also suited to take part in the reaction.

For industrial purposes, calcium peroxide will be the one most preferred, not only on account of its large quantity of available oxygen, but on account of the property of calcium to form so many insoluble salts; whilst for physiological and chemical reactions, magnesium, strontium, and zinc peroxides are very desirable, on account of the simplicity with which their mild alkaline basis carries the available oxygen to the place where they produce autoxidation.

As the bleaching of oils should most conveniently demonstrate the oxidising power of peroxides, our experiments regarding the practical use of these products were first directed to this field. A stimulation to try them was given by the suggestion of some oil experts that sodium peroxide would be a splendid bleaching agent for oils, if its liability to set fire to organic substances under certain conditions did not call for too cautious handling, and if its saponifying properties were not so strong. These two objections, the first of which it may be said is imaginary, are entirely obviated with calcium peroxide. There is no danger whatever in handling this peroxide, and no saponification takes place.

Our experiments are merely of a suggestive nature, and it is therefore reserved for the oil expert to complete, or to entirely remodel our method provided our preliminary trials offer enough inducement.

The first trial was made on cottonseed oil, with a CaO_2, $8H_2O$, the fluffy voluminous form of which promised to be advantageous. Sulphuric acid, 66° B, was first stirred into the oil for half an hour, and then, while constant stirring, ½ per cent. of the peroxide was added. In a few minutes the dark brown colour due to the action of sulphuric acid had changed into a light greenish brown, and after a one to two hours' continuous run, the oil had the desired shade. After 24 hours the oil was filtered. The oil thus treated, however, had no keeping properties, and darkened considerably after a couple of months.

We will not go into the details of the series of experiments, which proved in many respects to be of value for the knowledge of the chemical properties of calcium peroxide, but confine ourselves to stating that the final outcome of tests was a complete reversal of the above process. We found that in adding the peroxide first, and then liberating its available oxygen by means of sulphuric acid, the bleaching was instantaneous. A 60 per cent. calcium peroxide was used, and the process as we now recommend it is as follows:—

Add, while stirring the oil, about 0·1 to 0·5 per cent. in weight of peroxide. Following this, slowly add about 0·2 of sulphuric acid, 66° B. The reaction is visible; the oil, which would turn black by the addition of sulphuric acid, becomes light at once; when all the acid is added the bleaching is also completed, so that the whole process only last about ten minutes; even after an hour, the difference in the shade will be very slight; should the oil come out slightly cloudy after filtration, the addition of 0·1 per cent. of sodium carbonate or unslacked lime will completely clarify it. To our knowledge, such a 10 minutes' bleach is something new, and the process, therefore, is worthy of being considered, with all its advantages. Besides the economy in time, this method will prove to be a great saving of material, in that the waste of oil produced by the slimy residue is but small compared to that produced by, for instance, the fuller's earth process. The condition of oil is satisfactory; it has a pure fresh flavour, which it does not lose after standing a half year, exposed or bottled, and in darkness. We also found that oil with a rancid flavour or taste is restored by the oxidation. The use of sulphuric acid cannot be objectionable if it is employed in the above way, as it is not allowed to affect the oil, and as the gypsum formed in the reaction settles quickly.

We believe that no harm is done to the oil by this process, nor is there any harmful or foreign substance introduced which might prevent it from being used as an edible oil.

During the course of the experiments it was found that the economy of work depends greatly on the finely powdered state of calcium peroxide. Only under this condition is the reaction with the equivalent of sulphuric acid an instantaneous and a complete one. If the powder is granular or lumpy, it was found that up to 30 per cent. of it is wasted, on account of the slowness of reaction. Experience further proved, that the highest efficiency is obtained with the most abrupt discharge of active oxygen, and in order to accomplish this, we have so far not succeeded in finding any other re-agent than the concentrated acid. Several acid salts, the best of which are sodium bisulphate or sodium bicarbonate, which react with the peroxide in aqueous solution, will not efficiently react on the oil, and heat alone does not produce decomposition. A 50 per cent. sulphuric acid solution was established inefficient. On the other hand, if after the acid reaction a trace of water was added, say, 1/10 per cent., the bleaching effect was slightly improved, with the disadvantage, however, that the oil was then more apt to turn out cloudy. No test was made with an 80 per cent. peroxide, but it is right to assume that with it the proportions of the two re-agents used are reduced at least 25 per cent. With olive oil similar results are obtained, as with cotton seed oil. It must be mentioned that with different grades of the same kinds of oils the degree of bleaching varies. In a similar manner this bleaching process is applicable to fats, glues, and gelatins, and we notice that, beside the bleaching effect, there also takes place, to some extent, a deodorisation and a preservative action, the cause of which is clear enough without explanation. As to the treatment of linseed oil, for which, naturally, a good oxidising agent is in place, we will reserve a special report for a later date.

As oxygen is the most natural disinfectant, and as the germicidal power of active oxygen has been established, the question suggests itself whether some of these non-toxic peroxides are useful for sterilisation and preservation. There is, too, to recommend them, the harmlessnes of these products. The fundamental motive of all the work that has been done in that direction, and that remains to be done, is the fact that an efficient and non-injurious method of sterilising and preserving food substances is not yet known. All who are following with interest the campaign which the U.S. Government has started against the use of chemical preservatives agree that the anti-ferments which are are being used at present are insidious poisons which retard digestion. The movement of the Government is justified, but at the same time we know that preservatives are a necessity in many cases, and we

may expect that the resources of chemistry will secure a successful solution of the problem.

We know that calcium and magnesium are no foreign substances to water, milk, beer, or any food substance, consequently their introduction in the form of peroxides cannot be harmful to our system. It is known that hydrogen peroxide has preserving qualities, and it is also known that this chemical in the state of formation, or that nascent oxygen produced from a peroxide, surpasses in efficiency the action of a hydrogen peroxide solution. It remains to find the proper method of applying the peroxide. That this method has to be somewhat different from the present methods is explained by the difference of the nature of the peroxides and of the group of existing preservatives. The latter are substances which prevent fermentation for a certain length of time, by checking the growth of micro-organisms and rendering the treated material immune. In doing so they also check fermentation in our system, when consumed. The peroxide preservative, on the other hand will destroy the cause of fermentation and putrefaction, and keep the treated substance in a sterilised state, provided provision is made to prevent renewed contamination. Yet the material will not be immune when consumed, and there will be nothing in it to produce an anti-digestive action.

Evidently a difficulty arises in that we have to deal with aerobic and anaerobic microbes and enzymes, the first being carriers of oxygen, and showing some resistance to active oxygen, the latter acting as a catalyser in decomposing the peroxide. Yet, the conditions are such, that they offer a clear way to overcome the difficulty. If a liquid containing ferments is treated with calcium peroxide and exposed to the air, fermentation can even be accelerated. However, if the same liquid is treated with calcium peroxide, with the exclusion of outside air, fermentation is prevented. In analogy with this, is the fact that platinum black in alcoholic liquid exposed to the air similarly produces acetic acid fermentation, whereas, without the presence of air, such action is not noticeable.

These facts are based on catalytic actions, one of which, for instance, is being utilised in the production of vinegar. Before going any further, let us find an illustration in the treatment of sweet cider. This, it is well-known, is a hard substance to preserve, that is, to keep from fermenting. Raw apple juice treated with calcium peroxide can be made to ferment sooner than it would under ordinary circumstances, and apparently larger amounts of peroxide only accelerate the fermentation. We have succeeded in preserving cider in the following manner:—

Three hundred and fifty c.c. raw juice, as it comes from the press, was treated with a mixture of 0·1 grm. 60 per cent. calcium peroxide and 0·2 grm. of 15 per cent. magnesium peroxide. The liquid was kept in a bottle, hermetically sealed immediately after the addition of the peroxides, and shaken through. The first effect is a brownish coloration of the cider, which, however, begins to fade after two weeks, and after another couple of weeks the impurities begin to settle and the original colour, somewhat brighter, is restored. No fermentation took place, after nearly four months.

Why, then, does oxygen prevent fermentation and apparently destroy the cause of it when air is excluded, yet assist the process when in contact with air? In order to find our way through this apparent contradiction we have to consider the following principles:—

Among the substances of living cells which are present in vegetables, there are two groups which have great affinity for oxygen, and which are of the utmost importance in certain processes of oxidation occurring in plant life. These are the oxydase and the catalase or superoxydase. The first has the property to bind oxygen, and the second (according to Loew) is an oxydase which acts on peroxides or their hydrates in such a manner as to liberate their oxygen in a molecular state. They transfer the molecular oxygen to the oxydase, which again partly binds and partly transfers it to other bodies producing products of oxidation, an action which is performed similar to the action of peroxides. In doing so they either regenerate themselves or become used up.

Evidently, nature has placed these products in vegetables to support the living cell, that is, to produce intramolecular respiration, as well as to play the roll of a protector. On the other hand, the molecular oxygen which they store up is just what is necessary to assist the function of the germs of fermentation. Therefore, an excess of oxygen produced by catalase of the peroxide will pave the way for these germs and accelerate fermentation.

This latter process, however, will not occur at the start. It will only begin when the functions of oxydase have been accomplished in such a way as to allow the presence of free molecular oxygen. The prime function of oxydase is to create oxidation of the near-by products; and, as oxygen always attacks the lowest cell life first, it will be a germicidal action. In that, again, it will assist the peroxide action. If, therefore, a fermentable liquid is kept closed, with exclusion of air, it is well to assume that the energy of both the peroxide or peroxide hydrate, which has not been affected by the catalase and the oxydase, will be concentrated upon a destructive action on germs. Several authors have found that oxygen in an active state has the power to destroy germs of fermentation and enzymes in a diffused state. As under the given condition the germs of fermentation are in a highly diffused state, it will be understood why a liquid under such condition will not ferment. There will be a fight, in which the germs can only gain by multitude drawn from the air.

This very short outline is only given in order to show the way in which in our opinion, food chemistry has to go, in order to utilise this most convenient and, no doubt, only justifiable means of sterilisation and preservation—oxygen.

This part of the chemistry of oxygen, which is the main part, because it concerns animal and vegetable life, is still in its infancy. Further light will be thrown on it by the study of the character and functions of oxydase and catalase. We refer to Bach and Chodat (Compt. rend, 124, 951) and to the interesting report by Oscar Loew on Catalase (U.S. Dept. of Agric., Rpt., No. 68), and to his work, "Die Chemische Energie der lebenden Zelle," München, 1899.

The aforesaid also suggests that peroxides can be used for the ageing of alcoholic liquors, and for their purification, processes which, as Pasteur has already found, are nothing but slow processes of oxidation.

It will also be understood that peroxides, when used in a certain manner, are valuable reagents in the production of alcoholic and acetic acid fermentation, in assisting the action of saccharomycetes and mycoderni.

Finally, in considering the oxidation of alcohol to aldehyde, or acetic acid, of fusel oils to valeranic acid and butyric acid, and the subsequent formation of esters with alcohol, or salts with calcium, magnesium or bone black, it will be understood that peroxides can be used as reagents in the rectification and ageing of spirits. We refer to the interesting demonstration of Fitzgerald, of Niagara Falls, at the spring meeting, 1905, of the American Chemical Society in Buffalo, showing the elimination of fusel oils by means of calcium peroxide.

Application of magnesium peroxide.—Everything that has been said regarding the application of calcium peroxide is more or less also applicable to magnesium peroxide, with the difference that we have to reckon on one-third less available oxygen, but that, on the other hand, we have here a basic radical which, in many instances, will be preferable to calcium. According to the proportion in which magnesium salts form constituents of our food they come next to calcium salts, but according to their harmlessness, or, rather, beneficial physiological properties, they stand first.

On account of its very mild alkilinity, its non-astringency, and its beneficial action upon the digestive duct, this peroxide deserves to be recognised as, perhaps, the best suitable oxidising agent to be taken internally. Its main value consists in the pronounced property of promoting metabolism and in its indisputable qualification as an internal disinfectant. It is a mild antacid.

In our opinion, magnesium peroxide is the ideal means for sterilising drinking water, as no other re-agent, except calcium peroxide, comes near to it as regards both harmlessness and convenience in handling. In referring to this, we have not in mind sterilisation on a large scale,

referred to in the above-mentioned paper for the American Electrochemical Society at the meeting in Bethlehem, where the use of calcium peroxide was proposed; we contemplate the urgent demand of the soldier in the field, the workman in tropical countries, and, sometimes, the citizen in regions where the water is known to be contaminated with typhoid bacilli, the demand for a simple and convenient means to render the drinking water instantaneously free from pathogenic germs. This, in our opinion, is accomplished by a simple tablet, similar, for instance, to effervescent lithia tablets but, in our case, being an effervescent magnesium tablet, consisting of magnesium peroxide and citric acid. This preparation in itself would be harmless, and the minutely small quantities in which it would be used, unobjectionable. Its efficiency is shown in the following tests by W. H. Park, of the New York Health Department. They were made with 28 per cent. of magnesium peroxide partly in the form of tablets mixed with tartaric acid and partly with the powder alone. The tablets consisted of 0·10 grms. of peroxide, and an equivalent of tartaric acid. Dr. Park found that two tablets killed 2,250,000 typhoid bacilli in 150 c.c. of distilled water in one minute. One tablet killed 2,250,000 typhoid bacilli in 150 c.c. of distilled water in 30 minutes. Half a tablet killed 2,250,000 typhoid bacilli in 150 c.c. distilled water in 24 hours.

To orange juice containing 2,160 bacteria per c.c., was added enough typhoid culture to make 4,380 bacteria per c.c. Magnesium peroxide was then added in the proportions of 2 grms., 1 grm., and ½ grm. to the litre respectively. One c.c., of each of these mixtures was plated in agar at the end of five and 30 minutes.

Magnesium peroxide added.	5 min.	30 min.
2 grms.	4 col.	2 col.
1 grm.	0 col.	15 col.
½ grm.	29 col.	49 col.

The agar plate and broth culture made from the mixture of orange juice + typhoid + 1 grm. magnesium peroxide at the end of 24 hours, were both sterile.

The use of strontium peroxide.—Very little can be said about the application of strontium peroxide. No doubt it will be placed among the useful oxidising agents, on account of its specific chemical and physiological properties. Strontium peroxide has one important property, *viz.*, its partial dissociability in water without the aid of acids, a property in which it stands alone among the rest of alkaline earth and allied peroxides. For this reason, for instance, it could be recommended as an ingredient for a dentrifice. Saliva being slightly alkaline in reaction, a peroxide which needs an acid reaction would be ineffective.

G. W. Morse of Jersey City, recommends the use of barium peroxide for such purpose, and apparently overlooks the fact that barium salts are not admissible in therapeutics, on account of their poisonous nature.

We cannot close this paper without referring to the sterilisation of milk. Prof. Behring, and with him the majority of authorities, declare against the use of pasteurised milk for infant feeding, as by this process the proteids of milk undergo changes which render it less digestible; and Prof. Behring, surprisingly, recommends the use of formaldehyde. His proposal finds very little approval from authorities—though more among milk dealers—and things remain unchanged; now, as before, it is known that a great percentage of infant mortality is due either to organically contaminated milk, or to milk ill-treated by chemicals, or pasteurisation. As this problem is a very delicate one, we would not touch upon it if we had not the strong belief that some benefit will result from our proposition. Hydrogen peroxide, now-a-days, is known to be capable of preserving milk to an extent, but it is not used, probably because the ordinary commercial preparation is not appropriate, and the C.P preparation, which claims to be free from acid, is too expensive and inconvenient to handle.

C. G. L. Budde, of Copenhagen, in his patented process for the sterilisation of milk by means of hydrogen peroxide, claims that by his method the constituents of milk are neither chemically nor physically changed. H. C. Sherman, A. W. Hann and A. J. Mettler, in their report on "Comparative Experiments Upon Chemical Preservatives in Milk" (J. Amer. Chem. Soc., Sept. 1905, p. 1060) added the peroxide in the proportions of 1 to 1000, 1 to 5000 and 1 to 20,000, and obtained favourable results.

If calcium peroxide were added in the proportion of 1 to 10,000, it would represent the same amount of active oxygen as is yielded by hydrogen peroxide in the proportion of 1 to 1,000. We would, however, recommend a larger amount of calcium peroxide than 1 to 10,000, as this chemical does not at once bring its total amount of available oxygen into action, as it is the case with hydrogen peroxide, but it slowly decomposes. In that reserve, the property of not being exhausted within 24 hours, as A. J. Mettler has found, lies one advantage. The rapid disappearance of hydrogen peroxide in milk, which this author has found, is probably due to the action of catalase, an action, however, which, according to the results obtained, has not been detrimental.

Another advantage is, that the alkaline earth radical of calcium peroxide will assist in neutralising lactic acid, and its alkaline earth radical is the main factor among the inorganic constituents of milk. Calcium in milk is combined with the two forms of casein. It is combined with phosphoric acid and with organic acids. Furthermore, it is known that casein, which, according to Courrant, is an acid, is stable in the presence of certain alkaline bodies, among which is lime. There is present a certain amount of free lactic acid in fresh milk, which decomposes the calcium peroxide, resulting in the formation of calcium lactate and active oxygen. The incorporation has to be done by stirring, and closed containers will have to be used. Besides these chemical facts, a physiological feature deserves attention. Lime water is given to infants to counteract the abnormal intestinal fermentation produced by bottled milk. The probabilities are that milk treated with calcium peroxide will to an extent, bear in itself, the prevention of abnormal fermentation.

From the aforesaid it is right to assume that calcium peroxide added to milk would be there not as a foreign substance, but would be assimilated, only leaving behind the beneficial bactericidal effects of active oxygen. Our statement of these facts is made in the form of a suggestion to those interested in the important problem of milk sterilisation and preservation, the final solution we feel belongs to the fields of the physiologist and bacteriologist.

Sydney Section.

THE ANALYSES OF SOME NEW ZEALAND COALS.

BY A. M. WRIGHT.

(This J., Dec. 15, 1905, pages 1213—1214.)

ERRATUM.

Page 1214.—B. Semi Bituminous and Bituminous Coals, in text below table, for "7" read "8"; for "8" read "9"; for "9" read "11"; for "11 and 12" read "13 and 14"; for "12" read "14."

Journal and Patent Literature.

I.—PLANT, APPARATUS & MACHINERY.

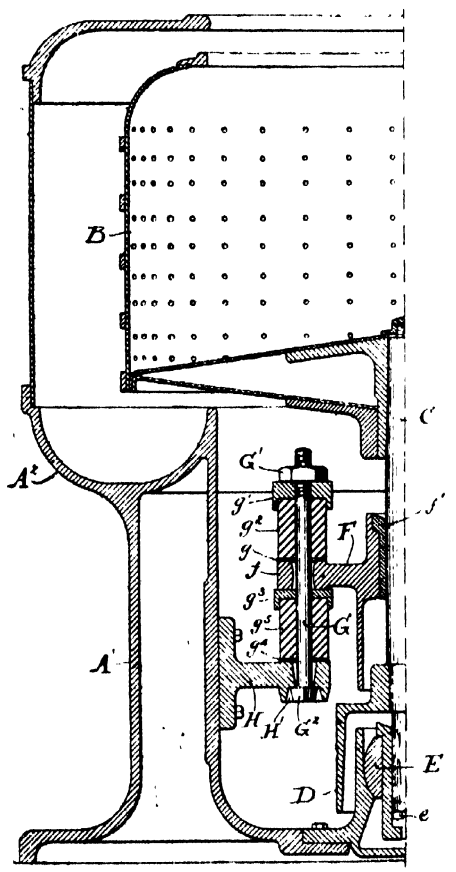
(*Continued from page 257.*)

ENGLISH PATENTS.

Temperature; Apparatus for the interchange of ——. H. Kayser, Hamburg. Eng. Pat. 4148, Feb. 28, 1905.

"THE subject of the invention" is stated to be, "a process and an apparatus by means of which hot substances of a lower temperature can be brought to a higher temperature," and the following is given as an example.—The vapour of water formed in the space above a solution of sodium hydroxide has only a temperature of 100° C., whilst the solution has a temperature of 200° C. A serpentine coil of pipe in this solution serves to convey its heat to the vapour where there is a similar coil. The vapour is heated by the coil and the heat absorbed by the vapour is transferred to the solution.—W. H. C.

Extractors; Impts. in centrifugal ——. G. Binder, Philadelphia, Pa., U.S.A. Eng. Pat. 4271, March 1, 1905. Under Int. Conv., March 25, 1904.



THE basket, B, surrounded by the fixed "curb," A^2, is carried by the spindle, C, which is supported at the bottom only, by the ball-bearings, E,e. It is consequently free to oscillate, the oscillations being limited by the "spider," F, which holds the spindle, C, by the bushing, f^1, and is provided with three equi-spaced radial arms, *f*, each of which is attached by the washers, *g*, g^1, g^3, g^4, the springs, g^2, and g^5, and the nut, G^1, to a spindle, G. The lower end, G^2, of the spindle passes through the hole, H^1, in the bracket, H, supported on the standard, A^1, as shown in the figure and, owing to the construction of the opening, H^1, it has a certain freedom of movement, limited by the tension of the springs, g^2, and g^5. The spindle, C, is driven by a belt which passes round the pulley, D, and the washers, g^1, and g^3, are made to enclose the upper parts of the springs, g^2, and g^5, to protect the latter from drops of oil.—W. H. C.

Fumes escaping from furnaces; Recovery of valuable constituents from ——. G. A. Mower, London. Eng. Pat. 6185, March 23, 1905.

A HOOD is arranged above the furnace door or other aperture from which, by means of a pipe, the fumes are conveyed to a washing tower constructed with baffles, over which water is allowed to flow so as to wash down the valuable constituents of the fumes.—J. H. C.

Distilling and condensing apparatus; Impts. in ——. E. Brown, London. Eng. Pat. 6916, April 1, 1905.

THE condenser attached to the still consists of a truncated cone with an open top, surrounded by a truncated cone with a domed top and an internal gutter (provided with a discharge pipe) round the base. Surrounding the outer cone is a chamber into which the cooling liquid is admitted through a pipe situated on about the same level as the internal gutter. The relative arrangement of the two cones is such as to prevent the steam from impinging on the collecting gutter.—C. S.

Evaporating liquids and concentrating the solids in the same; Means for —— also applicable as a smoke washer. A. B. Lennox, Newcastle-on-Tyne, and T. Mackenzie, Glasgow. Eng. Pat. 7961, April 14, 1905. (See also Eng. Pat. 13,227 of 1904; this J., 1905, 811.)

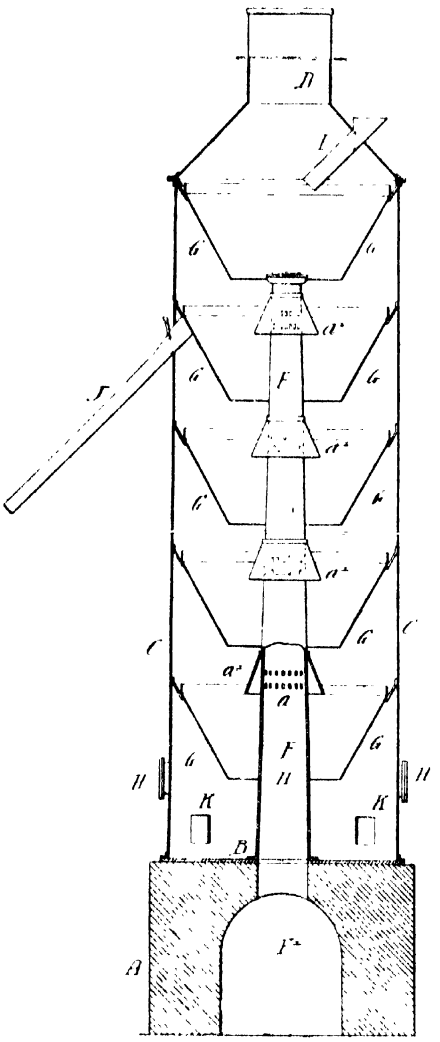
A SERIES of separate evaporating chambers are arranged in the flue leading from a boiler or furnace to a chimney. In the roof of each chamber is a spraying device, through which the liquid to be evaporated is sprayed and is evaporated by the gases traversing the flue. Any of the liquid that is not so evaporated falls to the bottom of the flue and drains into a tank, whence it is returned in a heated state, to the evaporating chambers through the spraying devices. Baffles may be provided in the chambers, to cause the flue gases to take a sinuous course. When the device is used as a smoke washer, the dirty liquid is run away into the sewer, or removed in any other way.—C. S.

Evaporating apparatus; Impts. in ——. G. R. Ray, Manistee, Michigan, U.S.A. Eng. Pat. 24,186, Nov. 23, 1905.

THE temperature in the steam-chamber of a vacuum evaporator has been found to vary in different parts of the apparatus. To overcome this defect the steam is first passed through a mixing chamber provided with baffle-plates, where it is reduced in temperature and thoroughly mixed, so that it enters the evaporator at an uniform temperature.—W. H. C.

Coolers for powdered, or granular, material. G. W. Johnson, London. From C. A. Matcham, Allentown, Pa., U.S.A. Eng. Pat. 8814, April 26, 1905.

A VERTICAL, cylindrical metal casing, C, is mounted on the base, A, and has a stack, D, at the top. The material to be cooled is fed through the valved shoot, I, and falls into the uppermost of a series of superposed deflectors, G, any surplus being carried off by the valved shoot, J.



The material passes down from deflector to deflector, and is finally removed through the doors, K, after being cooled by a current of air which enters through the tunnel, F¹. The air passes up the central tube, F, which is closed at the top, out of the openings, *a*, protected by the hoods, a^1, and over the material in the deflectors, G. The latter are of less diameter than the casing, C, so as to allow the air to pass up between their outer edges and the wall of the casing to the stack. A natural draught is thus caused through the apparatus without the use of a fan. By passing heated air into the casing through the openings, H, the apparatus can be used as a drier or a kiln.—W. H. C.

Temperature of heated articles and of furnaces, crucibles and the like; Method of and appliances for ascertaining the ——. Rudge-Whitworth, Ltd., and J. V. Pugh, Coventry, and H. L. Heathcote, Birmingham. Eng. Pat. 10,617, May 20, 1905.

The object, the temperature of which is to be ascertained, is viewed through one or more colour-screens, so constructed that at certain definite or approximate temperatures the object appears non-luminous. The screens may be either transparent cells containing a coloured solution which has definite light-absorbing properties, or the colouring matter may be emulsified with gelatin and spread on glass plates, or thin plates of coloured gelatin may be used.—W. H. C.

Separating apparatus; Centrifugal ——. Aktiebolaget Separator, Stockholm. Eng. Pat. 10,875, May 24, 1905. Under Int. Conv., May 27, 1904.

See Fr. Pat. 354,416 of 1905; this J., 1905, 1162.—T. F. B.

Centrifugal separators; Impts. in ——. A. F. Spooner, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 19,277, Sept. 23, 1905.

The combination claimed is that of a shallow, self-balancing bowl with a liner consisting of involute plates, set close together and capable of turning on a ring or the like, in order to secure a high skimming capacity.—C. S.

Drying kilns; Impts. in ——. Soc. de Constructions Mécaniques D'Alais, Alais, France. Eng. Pat. 16,294, Aug. 10, 1905. Under Int. Conv., Dec. 1, 1904.

A horizontal cylinder, mounted so that it can be rotated within a brick casing, has its interior surface provided with longitudinal plates arranged round the periphery, and forwardly projecting blades spaced in the form of a spiral, to move forward and mix the material under treatment. The latter is fed in continuously at one end, through a valve-controlled shoot, and is discharged from the other end. The hot gases from a furnace situated below the inlet end of the cylinder are caused to take a spiral path around the outside of the shell by baffles which project from the brick casing. The gases then return through the cylinder over the material to be dried, and are exhausted by a fan, along with the vapours given off, from the feed end.—W. H. C.

Kilns; Method of and means for utilising the heat in tunnel ——. G. Gröndal, Djursholm, Sweden. Eng. Pat. 17,947, Sept. 5, 1905.

To utilise the heat in intermittent tunnel kilns, air is introduced into the cooling compartment in larger quantity than is needed for the combustion of the fuel used to generate heat for the baking compartment, the excess of heated air so obtained being then conducted into the preliminary heating compartment through a suitably controlled conduit situated underneath the trucks in the cooling compartment and passing by the baking compartment.—C. S.

Ovens or stoves for heating, drying, baking, enamelling, and other purposes; Impts. in ——. A. W. Naylor, Halton. Eng. Pat. 18,545, Sept. 14, 1905.

A portable stove or oven heated by gas is constructed with the side plates fitting into specially formed grooves in the end plates. At the top of the oven is a perforated ventilating flue, the inlets to which may be closed by a sliding valve, to regulate the ventilation of the oven.—W. H. C.

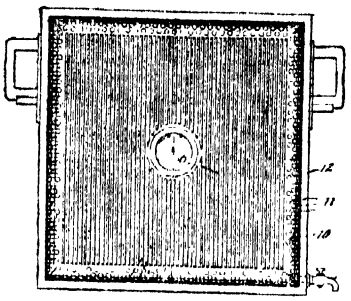
Drying process; An improved —— and apparatus therefor. A. H. Messinger and V. Popper, Vienna. Eng. Pat. 25,871, Dec. 12, 1905.

The claim relates to "stage or tier-trough drying apparatus" in which the troughs are of equal size. The two upper troughs are fed simultaneously with fresh material which is discharged when partly dried into a lower trough, common to both, the object being to avoid the loss of drying effect due to the shrinkage of the material. Claim is also made for an adjustable slide which divides the feeding shoot so that the amount of material fed to the upper troughs may be regulated, and for adjustable flaps or dampers to control the admission of heated air to the apparatus.—W. H. C.

United States Patents.

Filter-plate. W. B. Allbright, Chicago, Ill. U.S. Pat. 813,395, Feb. 27, 1906.

The claim is for a filter-plate constructed with a ribbed



centre, 6, and an outstanding rim, 12, the surface of the face, 10, between, 6, and, 12, being studded with "round knobs or buttons," 11.—W. H. C.

Mixing apparatus for dry materials. G. Raps, Stolberg, Germany. U.S. Pat. 814,233, March 6, 1906.

THE mixer consists of a tapering drum mounted horizontally, the larger end being entirely closed, whilst the smaller end is fitted with feed and discharge openings formed by means of a flange and ring, the latter spaced from the walls of the drum. A number of spiral blades are arranged inside the drum, and the whole is rotated by suitable means.—C. S.

FRENCH PATENTS.

Drying air for ventilating and general purposes; Process and apparatus for ——. C. J. S. Lambert. Fr. Pat. 359,023, Jan. 9, 1905.

THE air is first passed through a cooling chamber of any one of the usual types for drying air by contact with cooled surfaces, the point of the invention being that the air is not cooled below a point just above that at which the deposited moisture freezes. It is then passed through a second vessel where it is brought into contact with a cooled solution of calcium chloride. From the combination of these two processes certain advantages are claimed to result. In the first apparatus, as no snow or ice is formed, the cooling surfaces retain their efficiency, and there is no necessity to interrupt the process to thaw any deposited ice. In the second apparatus, as the greater part of the water has been removed by cooling, a relatively small quantity of calcium chloride solution is required to complete the desiccation.—W. H. C.

Concentrating apparatus [for muddy liquids]. E. Vial. Fr. Pat. 358,998, Oct. 30, 1905.

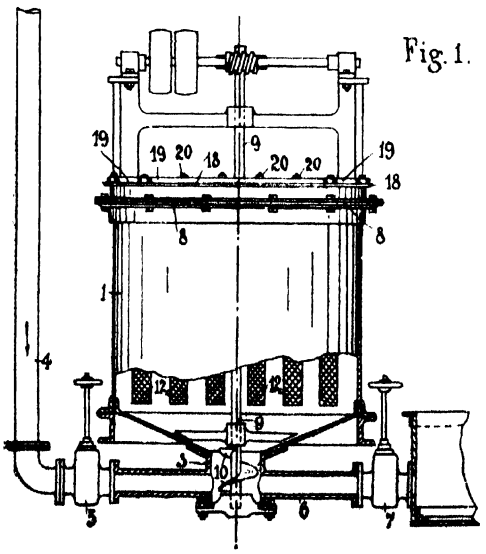


Fig. 1.

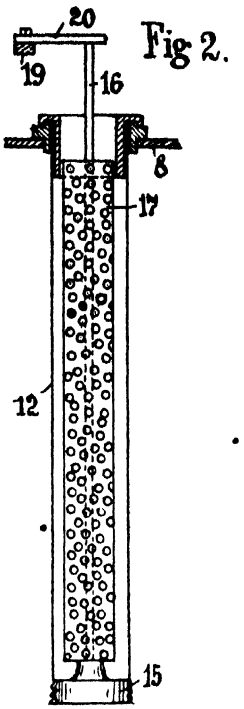


Fig. 2.

THE muddy liquid enters the apparatus from a reservoir, placed at a higher level, through the pipe, 4, and the valve, 5, and passes through the opening, 3, into the cylinder, 1. This latter has a cover, 8, provided with a rim, 18, the cover being perforated with round holes through which a number of filter tubes, 12, hang down into the cylinder. The liquid rises through the tubes by its own pressure, and collects in the open tray formed by the rim, 18, from which it is run off to a reservoir, whilst the solid matter in suspension collects in the lower part of the cylinder, 1, and on the exterior of the tubes, 12. When the liquid is sufficiently concentrated, the supply is shut off by closing the valve, 5, and the concentrated liquid is run out by the pipe, 6, and the valve, 7, which is opened only during the discharge. An agitator, 10, worked by the rod, 9, is used to assist in discharging the contents of the vessel, 1.

The filter-tube is shown on a larger scale in Fig. 2. It consists of a cylinder of porous material, 12, closed at the bottom by the plate, 15, and prevented from collapsing by the inner perforated cylinder, 17. The tubes are kept in position by the bent rods, 16, 20, attached to the bottom of the tubes and fastened to bars, 19, which are placed across the rim, 18. When it is desired to wash the filters, the rod, 20, is loosened and the tubes are plunged alternately up and down in the vessel, 1, whereby the deposit is washed off by the concentrated liquid.—W. H. C.

Gases; Process of compressing ——. G. Meyersberg. Fr. Pat. 359,003, Oct. 30, 1905.

THE claim is for a process of compressing air or gases which consists in passing the gas through a series of vessels in which it is heated. The heat energy is stated to be converted into kinetic energy which is applied to cause the gas to leave the apparatus at a higher pressure than that at which it enters.—W. H. C.

Machines for aspirating air laden with earthy or dusty matter; System of filtration for protecting ——. G. Todeschini. Fr. Pat. 359,054, Nov. 2, 1905. Under Int. Conv., Nov. 3, 1904.

IN order to protect the moving parts of the air-pump

from the abrasive action of the dusty matter in the air, the latter is drawn through a washer. The washer consists of a vessel, partly filled with water. The air enters by a pipe opening below the surface of the liquid, at one end of the vessel, and passes to the air-pump through another pipe, above the surface of the liquid at the other end. As the air thus traverses the whole length of the vessel, any bubbles formed will be broken before they reach the outlet. To diminish the size of the bubbles, the liquid is rendered milky, dense and soapy by the addition of calcium carbonate, soft soap and "creoline."
—W. H. C.

GERMAN PATENT.

Heat-insulating composition for steam-pipes and the like. V. Holczabek. Ger. Pat. 165,342, Feb. 20, 1904.

THE seed-pods of the cotton plant are mixed with a binding agent and incorporated with other insulating substances, such as kieselguhr, asbestos, tar and asphaltum. For example, 80 kilos. of the cotton-seed pods are mixed with about 20 litres of water, about 15 kilos. of a binding agent, such as clay, are gradually added, and then 12—20 kilos. of kieselguhr.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 258.)

Cyanogen in coal gas. A. Samtleben. J. Gasbeleucht., 1906, **49**, 205—209.

THE author's experiments were carried out at the Bernburg gas works where no cyanogen extractor is in use. The gas at the inlet and outlet of the purifier boxes contained, on the average, 213·4 and 18·0 grms. of hydrogen cyanide per 100 cb. m. respectively. The average test of the town gas was 16·4 grms. of hydrogen cyanide per 100 cb. m., the water in the holder containing 13·5 grms. per 1 cb. m., which acted on the paint of the holder causing blue stains. The composition of the purifying material after one year's working was: Prussian blue, 3·65 per cent.; thiocyanate, 0·27 per cent.; sulphur, 35·51 per cent.; sulphuric acid, 1·35 per cent.; ammonia, 0·59 per cent.; water, 8·32 per cent. Calculated from the amount of hydrogen cyanide removed from the gas, the purifying material should have contained 6·3 per cent. of Prussian blue. The difference is attributed to the action of oxygen, 2 per cent. of air having been admixed with the gas.

The rate of formation of cyanogen in the retort during one carbonising period was ascertained with Zwickau (Saxon) and Yorkshire silkstone coal at temperatures of about 950° and 1050° C. Two curve-diagrams are given showing grms. of hydrogen cyanide per 100 cb.m. of gas as ordinates with hours of carbonisation as abscissæ. The maximum was reached in the different cases somewhere after the second hour.—R. L.

Carbon monoxide; Difficulties in the determination of —— in gaseous mixtures. A. Gautier and Clausmann. XXIII., page 337.

Fuel trade of France. Mining World, March 10, 1906.

IMPORTS in 1905 were somewhat less than in 1904, but exports showed an increase. Business has been transacted principally with Great Britain and Belgium, although Germany has sent more coke to France than any other country.

The foreign trade in the past year was as follows in metric tons:—

	Imports	Exports.
Coal	10,513,920	1,658,680
Coke	1,632,710	242,040
Briquettes	399,390	88,940
Total	12,546,020	1,989,660

Changes in 1905 from 1904 were:—Coal imports, decrease of 370,948 tons; exports, increase, 538,533 tons. Coke, imports, decrease, 23,654 tons; exports, increase, 81,450 tons. Briquettes, imports, decrease, 128,717 tons; exports, increase, 22,152 tons. Imports, as a whole, show a falling off from 1904 of 523,319 tons; exports an increase of 642,138 tons; a balance in favour of exports of 118,819 tons.

Of the imports in 1905 Great Britain furnished 5,759,010 tons of coal (5,797,316 tons in 1904); Belgium, 3,460,430 tons of coal (3,855,547 tons in 1904), and 500,690 tons of coke (527,948 tons in 1904); Germany, 850,490 tons of coal (888,455 tons in 1904), and 1,114,850 tons of coke (1,112,650 tons in 1904); while the remainder was contributed by various other countries. Of the exports Belgium received 1,148,000 tons of coal (663,700 tons in 1904), and 69,550 tons of coke (44,824 tons in 1904); Switzerland, 210,050 tons of coal (168,524 tons in 1904), and 44,070 tons of coke (36,562 tons in 1904); French and foreign vessels, 132,940 tons of coal (137,033 tons in 1904), and 32,470 tons of briquettes (50,531 tons in 1904); whilst the balance was for various countries. [T.R.]

ENGLISH PATENTS.

Peat fuel; Manufacture of ——. Central Torfkohlen Ges.m.b.H., Berlin. Eng. Pat. 27,397, Dec. 15, 1904. Under Int. Conv., Dec. 17, 1903.

SEE Fr. Pat. 349,139 of 1904; this J., 1905, 612.—T. F. B.

Fuel, Artificial ——. P. Grayson, London. Eng. Pat. 10,866, May 24, 1905.

COAL (about 2 lb.) reduced to the form of impalpable dust is mixed thoroughly with plaster of Paris (about 3 oz.) or cement, or both; from 6 to 18 oz. of water are added, and the mixture is compressed into any desired shape. Other binding and combustible materials may also be incorporated.—H. B.

Gas furnaces for charcoal and like kilns. J. Buchanan, Liverpool. Eng. Pat. 4921, March 9, 1905.

THE claim is for a furnace for heating animal charcoal kilns in which the gas passes from a gas chamber to a mixing chamber, provided with air-inlets spaced alternately with the inlets for gas and the outlets through which the mixture escapes to a combustion chamber. To avoid long tongues of flame and to get a better distribution of the heat, perforated blocks of metal or of refractory material are placed over the gas outlets, or the whole of the interior of the heating chamber may be packed with such blocks or with bricks. The lower heated parts of the kiln are surrounded by a casing, and the air is circulated through the chamber so formed, to pre-heat it and to cool the contents of the kiln. The air may be further heated before it reaches the mixing chamber, by passing it through flues formed in the brickwork of the combustion chamber, and the heating effect of the gaseous fuel may be increased by injecting compressed air, with or without oil spray, into the mixing chamber.—W. H. C.

Gas; Furnaces and retorts for the manufacture of ——. A. Rummens, Kockelberg, Belgium. Eng. Pat. 9151, May 1, 1905.

SEE Fr. Pat. 353,865 of 1905; this J., 1905, 1057.—T. F. B.

Kilns for generation of gas, roasting and the like; Rotary ——. S. E. Sieurin, Hoganas, Sweden. Eng. Pat. 15,838, Aug. 2, 1905.

SEE Fr. Pat. 356,615 of 1905; this J., 1906, 11.—T. F. B.

Retorts for the destructive distillation of coal; Vertical ——. H. W. Woodall, Wimborne, and A. McD. Duckham, Upper Parkstone, Dorset. Eng. Pat. 21,447, Oct. 21, 1905.

THE claim relates to the method of removing the coke from vertical retorts (described in Eng. Pat. 16,497 of 1903; this J., 1904, 744), and consists in arranging a horizontal plate underneath the lower end of each retort, but above the level of the water-seal. The coke rests on this plate instead of in the water of the seal, and is not damaged by too long contact with the water. A water-cooled pusher or rake, operated from without the casing, pushes the coke, at intervals, from the plates on to a belt conveyor which carries it away through the water-

seal. By regulating the rate at which the pusher works, the feed of coal into the retorts, and the degree of carbonisation is adjusted.—W. H. C.

Gas for illuminating and heating purposes, and apparatus therefor. A. H. Arzt and S. Baron, London. Eng. Pat. 24,242, Nov. 9, 1904.

AIR is blown simultaneously into a gas-holder and into a carburetter, encountering, in the latter, a finely divided supply of liquid hydrocarbon which trickles down through a mass of porous material capable of yielding silicon hydride. The porous material may be made by mixing powdered magnesia, silica, and a saturated solution of sodium chloride into a stiff paste, moulding, drying and baking the product, and impregnating it with triethyl silico-formate, $SiH(OC_2H_5)_3$. This material is said to evolve silicon hydride, SiH_4, which is immediately decomposed, the silicon being oxidised whilst the hydrogen unites, in the cold state, with the vapour in the carburetter, the gas produced being conducted into the gas-holder and mixed with the air therein.—H. B.

Combustion gases under pressure; Apparatus for producing —— for use as motive power for driving turbines and the like, and means in combination therewith for producing a liquid jet. A. Vogt, London. Eng. Pat. 26,178, Dec. 1, 1904.

AIR and combustible gas (or sprayed liquid fuel) are admitted continuously under pressure into a strong steel cylinder, wherein they burn, with the production of hot gases under high pressure, which are led out at high velocity through a discharge nozzle at the end of the cylinder to the apparatus in which the motive power is to be developed. Within the outer cylinder is a series of concentric cylindrical casings, of thin sheet nickel or the like, one within the other. The compressed air supply is obliged to pass consecutively up and down the annular spaces between the cylindrical casings, before it encounters the gas supply on entering the innermost casing. In this way the air is preheated, and loss of heat by radiation is minimised. The discharge nozzle may be surrounded by another, supplied with liquid, whereby, owing to the injector action, a jet of liquid at high velocity may be formed.—H. B.

Suction-Gas producer plant. C. Whitfield, Kettering. Eng. Pat. 4917, March 9, 1905.

THE gas-outlet pipe from a producer passes vertically downwards, and opens into the top of an enclosed tank let into the ground; the scrubber rises vertically above the same tank, which is long enough to extend beneath the open ends of both the pipe and the scrubber, and leave a portion open at the top to the atmosphere. A flange, depending from the top of the tank into the water therein, seals off the open part from that through which the gas flows on its way from the pipe to the foot of the scrubber, and permits the water level to rise and fall, in the part below the pipe and scrubber, at each suction stroke. The vertical portion of the gas-outlet pipe is grooved spirally on its exterior and is enclosed in an open-ended concentric sleeve from which a branch pipe leads to the generating chamber of the producer; water is allowed to flow down the spiral grooves and is vaporised by the heat derived from the out-flowing gas; and the mixture of air and steam is aspirated, at each stroke, into the producer from the annular space between the grooved pipe and the sleeve.—H. B.

Gas producers; Impts. in ——. Tangyes, Ltd., Soho, Staffs., and J. Robson, jun., Handsworth, Staffs. Eng. Pat. 8534, April 20, 1905.

THE gas producer, which is designed for use with bituminous coal, and more particularly as a suction producer, is provided at the lower part of the combustion chamber with an annular water-vaporising chamber, through which the air supply is led before passing to the upper part of the combustion chamber. Whilst gas is being produced, the air and vapour are led only in a downward direction through the fuel; hence the tarry matters given off by the fresh fuel, which is charged into the producer from above, have to pass downwards through the incandescent zone, becoming completely gasified. A blower and suitably valved pipes are provided, whereby, in starting the combustion, air can be blown either upwards or downwards through the fuel. If an additional supply of steam is required, the hot gases are led through a tubular interchanger containing water, over which an additional air current is drawn.—H. B.

Gas producers; Construction and method of operation of ——. H. Lane, Manchester. Eng. Pat. 10,496, May 19, 1905.

THE producer is of the intermittent type, and during the steaming period the steam is introduced above and below the fuel so as to traverse the same, partly in an upward direction and partly downward. The gas is collected in an annular conduit, in the thickness of the brickwork shell of the producer, about midway in the height of the column of fuel, and communicating with the generating chamber by radial apertures or perforations. —C. S.

Electric glow lamps; Process of making a metallic connection between the light-emitting bodies and the supply conductors of ——. H. Kuzel, Baden, Austria. Eng. Pat. 15,462, July 27, 1905.

A METALLIC connection, between the light-emitting body and its supply conductors, is made by applying to the joints a metal of high melting point whilst such metal is in a colloidal or pasty condition, as described in Eng. Pat. 28,154 of 1904 (this J., 1906, 115), drying the pasty substance, and heating the joints gradually to a white heat in a neutral atmosphere.—H. B.

UNITED STATES PATENTS.

Gas-producers; Process of operating ——. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York. U.S. Pat. 813,628, Feb. 27, 1906.

THE process of operating a gas producer consists in cooling, purifying and compressing products of combustion, and feeding these compressed gases, admixed with air, into the producer in the form of a high-pressure jet, through an unsealed passage way, containing a similar mixture, whereby the feed will respond to the pressure in the producer.—W. C. H.

Gas-producer. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 813,629, Feb. 27, 1906.

THIS patent covers an arrangement of a gas making and using plant, which forms an almost closed system. The gas supplied by the producer is used in heating a furnace, and the products of combustion, low in carbon dioxide or containing an excess of oxygen, escape to the stack. The stack is tapped by a pipe through which a portion of the products of combustion are withdrawn. This pipe is surrounded by a casing, provided with an inlet for air, for the purpose of cooling the products of combustion in the pipe; and the air thus heated is used as the supporter of combustion in the furnace, the movement of the air being effected by a fan, on the pressure side of which an excess-outlet is arranged, *i.e.*, between the fan and the furnace. The products of combustion are drawn from the stack, through the cooling apparatus, and delivered to the gas producing zone of the producer by means of a fan. There is a valved air-inlet on the pipe on the suction side of the fan, by which air is mixed with the products of combustion introduced into the producer, and a valved waste-outlet on the pipe connecting the fan with the producer.—W. C. H.

Gas; Apparatus for producing ——. C. Ellis, White Plains, N.Y. U.S. Pat. 814,279, March 6, 1906.

THE gas-producing plant described comprises a fuel-burning furnace, provided with a chimney stack, from which hot products of combustion are drawn through a gas-washer, by means of a fan, and forced, when washed, into a producer, the pipe connections being also provided with means for admixing regulated amounts of air with the washed gases before entering the producer. (See also preceding abstract.)—W. C. H.

Gas; Process of generating ——. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 814,001, Feb. 27, 1906.

In the generation of gas in a gas producer, an endothermic body consisting of mixed products of combustion from different sources, is supplied to the draught current, whereby the temperature of this endothermic body may be regulated to any desired degree. The mixture may consist of the products of combustion from a furnace treating ore and of those from a boiler furnace.—R. L.

Gas-producer. J. H. Swindell, Pittsburg, Pa. U.S. Pat. 814,249, March 6, 1906.

In the producer described, a combustion chamber, a cooler, a scrubber, and a purifier chamber are all included in the same casing, and suitably connected. The combustion chamber is provided with a water-seal ash-pit, and at the bottom of the cooler is a water-seal tar-receiving pan, which extends beyond the casing, to allow of the removal of tar, without interrupting the working of the apparatus. Air and steam are introduced into the space beneath the grate, the steam being supplied from a tank or boiler which surrounds a portion of the combustion chamber, and the air through a draught pipe, into which steam from the boiler is directed. The steam pipe is provided with a valve, and the draught-pipe with a damper, both of which are automatically controlled by the pressure of the gas issuing from the apparatus; the suction of the gas affects a diaphragm which is connected with a walking-beam connected with the valve and damper.—W. C. H.

FRENCH PATENTS.

Briquettes; Lignite or peat ——. C. F. M. Guirouvet. Fr. Pat. 350,424, Dec. 24, 1904.

Peat or lignite is distilled in a retort, and the residual coke is pulverised and incorporated with tar and a small quantity of saltpetre, the whole being compressed in moulds, then dried, and reheated in an oven until the liberation of fumes has ceased.—C. S.

Peat; Process for desiccating and preparing ——, *for utilisation as fuel or litter.* D. R. O'Sullivan-Beare. Fr. Pat. 358,699, Oct. 20, 1905.

After pressing out the greater part of the "free" water by mechanical means, the "latent" water in the peat is liberated by the application of heat in a suitable manner, so as to soften the fibre. The softened peat is next treated in a special filter-press, so as to break the fibres and express the contained water, the residue being put through a felting process and pressed into solid briquettes in suitable moulds.—C. S.

Combustible; Artificial ——, *and process for its manufacture.* A. Engle. Fr. Pat. 358,831, Oct. 24, 1905.

Night-soil and similar matters are mixed with quicklime, which absorbs water and also renders them inodorous. The resulting mass is mixed with twice its bulk of powdered coal and is made into a mass with tar or oil residues and briquetted.—W. H. C.

Coal and similar combustibles; Compound for assisting the combustion of ——, *and for preventing the clinkering and destruction of the fire-bars.* J. A. Fravel. Fr. Pat. 358,807, Oct. 24, 1905.

A solution of alkali nitrates, holding in suspension a small proportion of ferrous oxide, is sprinkled over the coal or other combustible before the latter is charged into the furnace, or it may be sprayed over the fire itself. The nitrates are decomposed by the heat and liberate oxygen which assists the combustion, whilst the bases present combine with any silica in the fuel to form an ash which does not produce clinker on the bars.—W. H. C.

Gaseous mixture; Apparatus for determining the proportions of a ——. P. de Bruyn, G.m.b.H. Fr. Pat. 358,515, Oct. 14, 1905.

The gas to be examined is admitted at the enclosed base of a chimney which surrounds another chimney, of much smaller diameter, in which a flame is burning. The diameter of the inner chimney diminishes towards the top, and a long flame is produced within it. The gas under examination partly enters the lower end of the inner chimney, thus furnishing the oxygen required by the flame, and partly flows up outside it, escaping at the top into the atmosphere. According as the gas contains less or more oxygen, the flame lengthens or shortens proportionately, and by observing the length of the flame by means of a scale behind it, the composition of the gas is determined.—H. B.

Water-gas; Device for introducing ——, *into coal-gas retorts.* J. E. Goldschmid. Fr. Pat. 358,562, Oct. 16, 1905. Under Int. Conv., Oct. 17, 1904.

The elbow pipe through which the water-gas is led into the gas retort is provided at the angle with a perforated plug and a lateral screw stopper so arranged that, by removing the plug or the stopper, access can readily be had to either limb of the elbow pipe.—H. B.

Gas generator in direct connection with a burner. L. Koester. Fr. Pat. 358,632, Oct. 18, 1905.

The generator chamber, containing the fuel, is placed in direct communication with the boiler or other apparatus to be heated, and streams of air are admitted both above and below the opening in the masonry through which the generator gas enters the combustion chamber of the apparatus in question, these air streams serving to keep the masonry cool by flowing over its outer surfaces before entering the combustion chamber.—H. B.

Contact material [for gas mixtures]; Support for——. Soc. Française d'Incandescence par le Gaz (Système Auer). Fr. Pat. 358,808, Oct. 24, 1905.

In the production of illuminating or heating gas by catalytic processes, notably in the reduction of carbon monoxide with hydrogen, the temperature of reaction may be considerably reduced and, incidentally, the catalytic power of the contact material strengthened, by employing a fibrous substance or filaments as support for the latter. For instance, fibrous asbestos may be impregnated with a solution of a salt of iron, nickel, cobalt or copper, which latter is then transformed into the oxide and subsequently reduced to the metal.—R. L.

Gaseous medium for carrying the vapours of volatile combustible liquids; Process for producing a non-oxidising ——. C. Martini and H. Huneke. Fr. Pat. 359,018, Oct. 31, 1905. Under Int. Conv., May 15, 1905.

A combustible gas, such as coal gas, is mixed with the quantity of air necessary for its complete combustion, and the mixture is burned continuously in a closed chamber, in the absence of air. The gaseous products of the combustion are led through a cooling device into a carburetter, containing gasolene or the like, for the production of carburetted gas. It is claimed that this non-oxidising vehicle for the combustible vapour is safer than air or the exhaust gases from gas engines, boiler furnaces, &c., whilst being cheaper than carbon dioxide. —H. B.

Electric incandescence lamps; Process of making luminous bodies for ——. H. Kuzel. Fr. Pat. 359,025, Jan. 9, 1905.

See Eng. Pat. 28,154 of 1904; this J., 1906, 115.—T.F.B.

Carbon filaments for incandescence lamps, and process for making the same. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 358,921, Sept. 5, 1905

See Eng. Pat. 6959A of 1904; this J., 1905, 721.—T.F.B.

Incandescence electric lamps with filaments of tungsten, molybdenum, or similar metals; Process of manufacturing ——. Siemens and Halske, A.-G. Fr. Pat. 359,010, Oct. 31, 1905. Under Int. Conv., Nov. 15, 1904.

See Eng. Pat. 23,098 of 1905; this J., 1906, 115.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 258.)

Petroleum products. U.S. Customs Decision, Jan. 10, 1906.

THE United States Circuit Court of Appeals, decided that the provision in paragraph 626 of the tariff, "that if there be imported into the United States crude petroleum or the products of crude petroleum produced in any country which imposes a duty on crude petroleum or its products exported from the United States, there shall in such cases be levied, paid and collected a duty upon said crude petroleum or its products so imported, equal to the duty imposed by such country," means that when crude petroleum is imported into the United States it shall pay whatever duty is laid upon it by the country where it is produced. Further, when any product of crude petroleum is so imported it shall pay the duty imposed upon such product by the country where such product is produced. If, however, the country making the product imposes no duty on similar products from the United States, the product shall have free entry into the United States even though the crude petroleum from which the product is made be produced by a country imposing a duty on the crude petroleum of the United States. Thus Russia and Germany each impose a duty on crude petroleum and its products imported from the United States, while Belgium does not. Hence paraffin oil manufactured in Germany from Russian petroleum is subject to the rates levied by Germany on American paraffin oil, while paraffin oil manufactured in Belgium from Russian petroleum is free of duty when imported into the United States. The Court further held by a majority-opinion that the provision of paragraph 633 for the free entry of paraffin does not operate to exclude it from the provision for products of crude petroleum as above given; also that the same provision includes the more valuable petroleum products, but not the less valuable ones, such as *paraffinum molle* composed of paraffin oil and ceresin, the latter of principal value. [T.R.] R. W. M.

UNITED STATES PATENTS.

Distilling wood and obtaining therefrom the different by-products; Apparatus for ——. W. W. and T. L. James, Rawles Springs, Miss. U.S. Pat. 813,302, Feb. 20, 1906.

A RECTANGULAR, box-shaped retort is mounted, by diagonally opposite corners, on standards of equal height, and is fitted with internal steam coils arranged along the vertical sides of the retort, so as to leave a central space for the charge of wood to be distilled. Steam supply and discharge pipes are provided, the latter containing a "puppet valve"; and charging and discharging doors are carried by the vertically opposite upper and lower corners of the retort.—C. S.

Coke Oven. G. Pierboni and P. Bufano, Connellsville, Pa. U.S. Pat. 814,621, March 6, 1906.

THE oven is of ovoid form and is provided with an arched roof, constructed of bricks of keystone form laid in tiers, the ends of each tier being closed with a horizontally tapered key brick, and the centre of the arch being closed with an approximately ovoid brick forming the vent of the oven. The oven is provided with a door or opening, the wall adjacent to the same being concaved or arched horizontally.—C. S

FRENCH PATENTS.

Coke ovens; Horizontal ——, *with gas circulating alternately in opposite directions.* W. Klönne. Fr. Pat. 358,624, Oct. 18, 1905.

TWO gas mains are provided at each end of the oven, to work alternately, each of them delivering the gas into one of two parallel, longitudinal channels, situated in juxtaposition underneath the sole of the series of flues in each moiety of the oven, so that when the one gas main is working, the gas passes through one of these channels into certain of the flues, whilst the waste gases are utilised in heating one of a pair of recuperators, the hot air for the combustion of the gas being supplied by the second regenerator and delivered into the oven through the second channel. When the second gas main is working, the functions of the channels are reversed, and the second recuperator is heated, the hot air being supplied from the first one.—C.S.

Paint or composition; Non-corrosive and antiseptic —— F. E. Dunnet. Fr. Pat. 358,592, Oct. 17, 1905. XIIIA., page 325.

Hydrocarbons; Process of rendering volatile —— *uninflammable such as petroleum spirit (benzine).* A. Boerner and J. Fluss. Fr. Pat. 359,044, Oct. 31, 1905.

To render volatile hydrocarbons uninflammable, and prepare an incombustible solvent for fats, one part of carbon chloride or tetrachloride and two parts of "heavy benzine" are mixed with varying quantities of turpentine spirit, resin, or solutions of resin and heavy hydrocarbons that will dissolve fats. In the product, the "heavy benzine" may be replaced by petroleum, for the purpose of utilising it as an addition to imperfectly refined petroleum, in order to raise the flashing point and specific gravity of the latter according to requirements (see this J., 1905, 962; Eng. Pat. 16, 756).—C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 261.)

1.4-*Anthraquinone.* H. Dienel. Ber., 1906, **39**, 926—938.

WHEN an alcoholic solution of α-anthrol is boiled in a reflux apparatus for 6—7 hours with sodium nitrite and zinc chloride, in concentrated aqueous solution, two isomeric nitroso compounds, 2.1- and 1.4- nitrosoanthrol, are obtained, which are easily separated by the greater solubility of the zinc salt of the 1.4-derivative. The former crystallises from alcohol in brownish-red or orange needles, decomposing at 200° C., whilst the latter forms glistening, light-brown needles darkening at 205° C., and melting and decomposing at 233° C. On reduction, the corresponding amino compounds are obtained, which, when subjected to oxidation, yield 1.2- and 1.4- anthraquinone. The latter crystallises from alcohol in long yellow needles melting at 206° C. Reduction, acetylation and oxidation led to the formation of quinizarin, which possesses only weak mordant-dyeing properties.—D. B.

ENGLISH PATENTS.

Sulphur colouring matters [Sulphide dyestuffs]; Manufacture of ——. A. Meyenberg, J. T. Alpass and The Clayton Aniline Co., Manchester. Eng. Pat. 11,066, May 26, 1905.

PARA-TOLUYLENEDIAMINE (NH_2:CH_3:NH_2,1:3:4) is heated with twice its weight of sulphur in an oil-bath, to a temperature of 210°—240° C., until the evolution of sulphuretted hydrogen ceases. The melt obtained is insoluble in dilute solutions of sodium sulphide, but if it be heated with caustic alkali or a similar compound to about 140° C., it gives a soluble substance which dyes cotton a yellowish-brown shade from a sodium sulphide bath. By exposure to the air, this is converted into a good olive-green, which is made brighter by treatment with hydrogen peroxide and is darkened by metallic salts.

If the para-toluylenediamine be heated with twice its weight of 40 per cent. formic acid, a compound is obtained which melts at 138°—140° C., and gives a good yellow dyestuff on heating to 240° C. with twice its weight of sulphur. By heating the formic acid derivative with sulphur and sodium sulphide, a brown sulphide dyestuff is formed.—A. B. S.

Lakes [from azo dyestuffs]; Manufacture of new colour ——. C. D. Abel. From Act.-Ges. f. Anilinfabr. Eng. Pat. 15,170, July 24, 1905. XIII*A*., page 325.

UNITED STATES PATENT.

Anthraquinone compound [Anthracene dyestuff] and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 814,137, March 6, 1906.

SEE Fr. Pat. 357,138 of 1905; this J., 1906, 66.—T. F. B.

FRENCH PATENT.

Tanning and colouring materials; Automatic extractor for ——. L. F. Jury. Fr. Pat. 358,783, Oct. 7, 1905, XIV., page 327.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 263.)

Cotton dyed with sulphide blacks; Some remarks concerning Pilling's paper on ——. A. Kertesz. J. Soc. Dyers and Col., 1906, 22, 93—94.

THE author confirms most of Pilling's results (this J., 1906, 216), but, opposed to the latter, states that after-treatment with potassium bichromate and acetic acid, has no perceptible effect in preventing the tendering of cotton dyed with sulphide blacks. He points out that the tendering can always be prevented, as was shown some years ago (see U.S. Pat. 693,653 of 1902; this J., 1902, 471), by arranging that the final treatment of the goods after dyeing is always an alkaline one.—A. S.

Cotton and linen; Test to differentiate ——. A. Herzog. XXIII., page 338.

ENGLISH PATENTS.

Cellulose [Viscose]; Apparatus for filtering and pumping or regulating the flow of solutions of — —. C. F. Topham. Eng. Pat. 5766, March 18, 1905. XIX., page 333.

Wool lubricant soluble in water. J. W. Riep and G. H. Bauer, Dusseldorf, Germany. Eng. Pat. 7231, April 5, 1905.

100 KILOS. of castor oil are mixed with a solution of 50 kilos. of caustic potash of 50° B. in 50 litres of water, and heated to 99° C. Then 40 litres of water are added slowly so as to prevent the temperature falling appreciably. When the liquid begins to rise in the vessel, another 40 litres of water are added so as to keep the temperature steady (because a rise might cause complete saponification) until the whole mass becomes a thin and clear liquid; this is diluted with water in the proportion of 1 to 5, and is then ready for use.

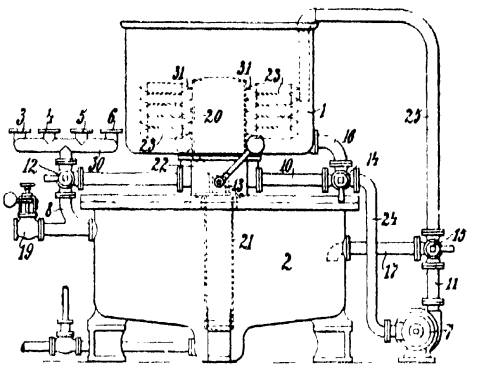
Only a portion of the oil is saponified, and the remainder is dissolved in the soap formed and the excess of alkali. —A. B. S.

Flax, hemp, jute, tow and similar fibres; Spinning of —— *by the wet process.* P. Heyndrick, A. Delerue, J. Dantzer and E. Mongy, Lille, France. Eng. Pat. 21,922, Oct. 27, 1905.

IN order to soften the gummy matters which are usually present in the "slivers" of the above materials, they are passed through a vessel of water containing zinc chloride, and heated to from 25°—30° C. before going through the process of drawing. The usual amount of zinc chloride employed is 2—3 grms. of the anhydrous salt per litre of water, but the proportion can be varied according to the nature of the textile material.—A. B. S.

Dyeing, mordanting and bleaching of loose materials, spun threads, cops, knitted goods, &c.; Apparatus for ——. O. Venter. Chemnitz, Germany. Eng. Pat. 15,532, July 28, 1905.

THE invention relates to an apparatus in which the dye-liquor, &c., can traverse fabric to be dyed in either direction without reversing the pump, and the apparatus can also be connected with suction or pressure pipes for the purpose of sucking or forcing the liquid through the material to be treated.



The figure shows one form of machine. 1 is the dye-vat proper, which contains the material to be treated (in this case cops) and is open at the top; 2 is the closed dye tank, which is connected with 1 by means of the perforated pipe, 21, the three-way cock, 13, and the vessel, 20, to which are attached the perforated spindles, 23, for holding the cops. 3, 4, 5 and 6 are connections for steam, compressed air, vacuum and water respectively. 12, 14, and 15 are three-way cocks; 7, is a pump, and 19, a reducing value. The other connections are shown in the figure. When the material has been placed in 1, and the dye-liquor in 2, connection can be made between 30 and 8, and between 20 and 21, and by alternately connecting the pipe, 30, to the compressed air or vacuum, the liquid can be forced or sucked through the course, 30, 12, 8, 2, 21, 13, 20, 31, 23, and 1. If it be desired to use the pump the connections are made in the following order:—First 23, 31, 20, 22, 10, 14, 24, 7, 11, 15, 25, 1, whereby the liquor is forced through the material outwards, and then 1, 16, 14, 24, 7, 11, 15, 17, 2, 21, 13, 22, 20, 31, 23; the latter method forces the liquid through the material in the reverse direction to the first and without reversing the pump. By means of 19, a super-pressure of steam or compressed air may be kept up in 2.—A. B. S.

Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer; Impts. in ——. A. B. Lennox and T. Mackenzie. Eng. Pat. 7962, April 14, 1905. XVIII*B*., page 332.

UNITED STATES PATENTS.

Cotton or fibrous material for textile and like purposes; Apparatus for obtaining —— *from waste products.* C. Knopf, Hemelingen, Assignor to J. D. Barth, Bremen, and P. H. Minck, Hemelingen, Germany. U.S. Pat. 814,967, March 13, 1906.

SEE Eng. Pat. 12,650 of 1905; this J., 1906, 217.—T. F. B.

Fabrics; Apparatus for treating textile ——. O. Obermaier, Lambrecht, Germany. U.S. Pat. 815,306, March 13, 1906.

SEE Fr. Pat. 356,187 of 1905; this J., 1906, 17.—T. F. B.

Zinc formaldehyde hydrosulphite (S) : Process of making ——. E. A. Fourneaux, Assignor to H. A. Metz, New York. U.S. Pat. 814,031, March 6, 1906.

An acid is added so slowly to a mixture of zinc and an alkali formaldehyde bisulphite compound that no free acid forms in the mixture : a "basic zinc formaldehyde hydrosulphite (S)" is stated to be produced.—T. F. B.

Zinc formaldehyde hydrosulphite (S) ; Process of making basic ——. E. A. Fourneaux, Assignor to H. A. Metz, New York. U.S. Pat. 814,032, March 6, 1906.

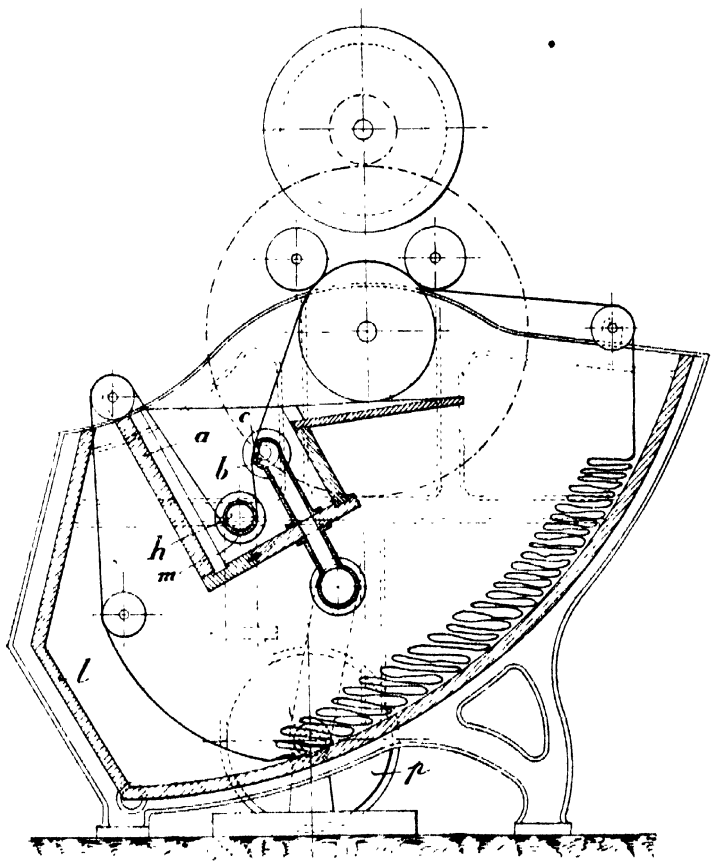
One molecular proportion of zinc is added to 2 mols. of sulphurous acid ; 2 mols. of formaldehyde are then added, and the mixture is reduced by the addition of a further mol. of zinc, whereby "basic zinc formaldehyde hydrosulphite (S)" is formed. (See also preceding abstract and U.S. Pat. 812,124 of 1906 ; this J., 1906, 217.)

—T. F. B.

French Patents.

Woollen tissues ; Machine for washing, scouring, &c., ——. N. Rousselle. Fr. Pat. 358,615, Oct. 18, 1905. Under Int. Conv., April 13, 1905.

Inside the trough, *a* (see Fig.), mounted within the vat, *l*, two tubes, *b* and *h*, are fixed horizontally and parallel to each other. These tubes are closed at one end and connected respectively with the liquor-suction and force pipes of a centrifugal pump, *p*. The tube, *b*, has extending along it a V-shaped slit, *c*, wider in the middle and narrower towards the ends. The other tube, *h*, has in it a narrow, longitudinal slit, *m*, and is provided internally with a removable filter for the interception of matters in suspension in the water and in the solutions employed in the washing and scouring operations. The woollen tissues to be scoured are sewn together end to end and are drawn through the trough at full width and in a continuous manner by means of squeezing rollers, passing successively, in contact with the two tubes, immediately in front of the slits. As the liquors are thus forced through the tissues, more thorough scouring than has hitherto been effected, is produced, whilst certain classes of tissues, *e.g.*, flannels, which are subsequently to have their surface "raised," are left in a condition very suitable for that process.—E. B.



Yarns in the form of bobbins; Apparatus for dyeing cross-wound ——. A. Sedeyn. Fr. Pat. 358,670, Oct. 19, 1905. Under Int. Conv., Sept. 25, 1905.

THE usual, intermediate, perforated tube upon which yarns

Fig. 1.

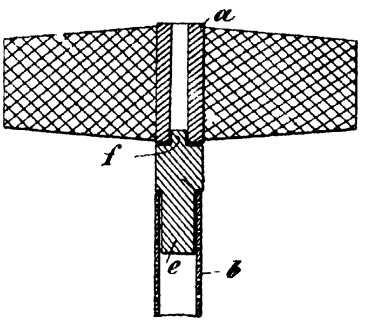


Fig. 2.

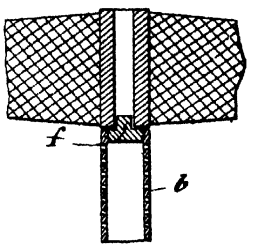


Fig. 3.

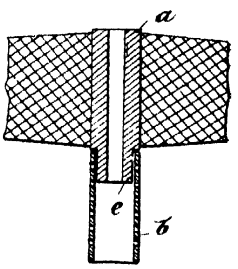


Fig. 6.

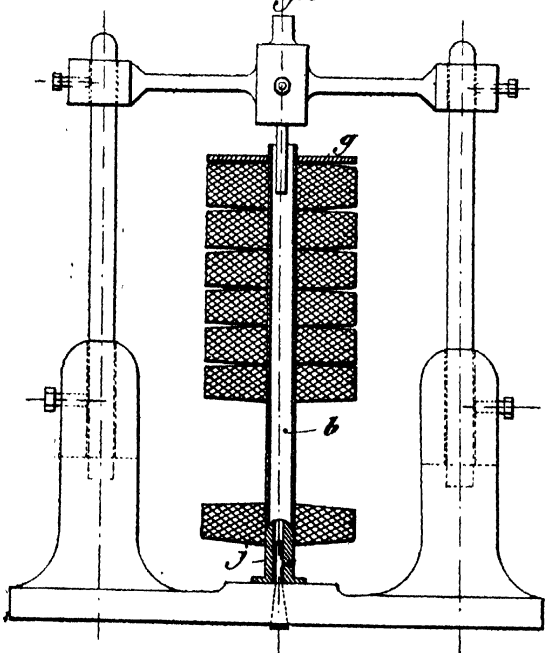


Fig. 5.

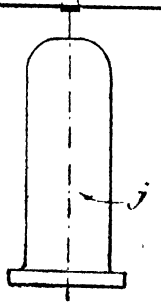
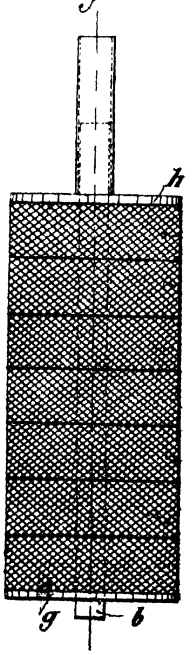


Fig. 4.



are wound in the form of "cheeses" or bobbins, before being placed upon the inner, perforated tube on which they are dyed, is dispensed with, the yarns being wound upon a tube, *a* (see figures), and forced from this, either directly (one end, *e*, of the tube being in this case made to fit into the dye-tube), or, indirectly (over a solid end-piece, *f*), on to the perforated pipe, *b*, of the dyeing apparatus. To the bottom of the latter pipe a plate, *g*, is attached (Fig. 4), above which the bobbins are placed successively in position. When almost the whole length of the pipe has been covered by the bobbins, a second plate, *h*, to which a sleeve-pipe is affixed, is fitted to the top. Pressure is applied to the upper plate to bring the two plates nearer together and so to compress the bobbins and cause them to form a compact mass around the central pipe. The dyeing is then performed in the usual manner by drawing or forcing dye-liquors alternately in opposite directions through the yarns. Afterwards the pipe with the yarns upon it is withdrawn from the dyeing apparatus, and, the cover plate being removed, is placed in an inverted position above a portable unwinding tube, *j*, upon which each bobbin is in turn received and from which the yarn composing it is unwound.—E. B.

Paintings; Producing —— fast to washing, on textile tissues, &c. E. Hottenroth, *née* Cloété-Brown. Fr. Pat. 358,554, Oct. 16, 1905.

PAINTINGS, fast to washing with water and to soaping, are produced upon tissues, &c., by means of mixtures containing, in addition to a pigment, an agglutinant, such as gum arabic, and a bichromate, *e.g.*, potassium bichromate. Each tint or layer of colour is separately applied, in dull daylight or non-actinic light, then exposed to light and the tissue, &c., washed and dried.—E. B.

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VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 263.)

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VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 265.)

Chamber process; Intensive working of the ——. M. Neumann. Z. angew. Chem., 1906, **19**, 474—481.

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THE results of further work on the alkali chromates are given (see this J., 1905, 1170, 1171). The tri- and tetra-chromates of sodium are soluble in water without decomposition. The solubility of the alkali mono- and bichromates in water is shown in the following table:—

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FIVE different potassium borates are obtainable, *viz.*, a monoborate, $K_2O,B_2O_3,3H_2O$, which crystallises only from alkaline solutions: its aqueous solutions dissociate, a diborate being obtained, *viz.*, $K_2O,2B_2O_3,4H_2O$. Two other diborates, crystallising with $5\frac{1}{2}$ and 6 mols. of water respectively, are obtained from aqueous solutions containing 1 mol. of potassium hydroxide to 2 of boric anhydride. A potassium pentaborate, $K_2O,5B_2O_3,8H_2O$, has been prepared by Laurent. Sodium monoborates containing $4\frac{1}{2}$, $5\frac{1}{2}$ and 8 mols. of water of crystallisation, were all obtained from solutions containing equal molecules of sodium hydroxide and boric anhydride. Sodium diborate crystallises with 5 and with 10 mols. of water; a sodium pentaborate, $Na_2O,5B_2O_3,10H_2O$, was also obtained the aqueous solutions of which partially dissociate. An ammonium diborate, $(NH_4)_2O,2B_2O_3,5H_2O$, and a pentaborate, $(NH_4)_2O,5B_2O_3,8H_2O$, are obtainable: the latter was prepared by adding ammonia to hot boric acid solution in the proportion of 1 mol. of ammonia to $3\frac{1}{2}$ of boric acid. In no case could triborates or tetraborates of the alkali metals or of ammonia be prepared. Barium forms two monoborates, crystallising with 2 and 4 mols. of water respectively, and a sesquiborate, $2BaO,3B_2O_3,7H_2O$; this last was obtained by adding boric acid solution to excess of baryta water; when heated with baryta water, this sesquiborate is converted into the monoborate crystallising with 2 mols. of water; that with 4 mols. of water is produced by heating boric acid for a long time with excess of baryta water.—T. F. B.

Magnesium permanganate as an oxidising agent. A. Michael and W. W. Garner. Amer. Chem. J., 1906, **35**, 267—271.

ANHYDROUS magnesium permanganate is a much more powerful oxidising agent than the potassium salt. It is best prepared by Mitscherlich's method: by the interaction of barium permanganate and magnesium sulphate. It was found to be insoluble in many organic solvents, forming stable solutions only in glacial acetic acid and in pyridine. It dissolves in methyl alcohol which is slowly oxidised, but ethyl and propyl alcohols are attacked at once. Methyl and ethyl acetates also dissolve it slightly, the solutions being tolerably stable. It is best used in glacial acetic acid, since pyridine has a remarkable inhibiting effect on its action. Propionic acid and its higher homologues and the hydroxy- and keto-acids are immediately destroyed by it. Aliphatic ketones are at once attacked, though potassium permanganate decomposes them with difficulty. Thus, a solution of potassium permanganate in acetone may be boiled without decomposition, but this solvent is at once oxidised by the magnesium salt. Even benzene, as well as its derivatives, may be oxidised completely to carbon dioxide and water, and the aliphatic hydrocarbons, from hexane upwards, give the same products.—F. SODN.

Lead chloride and lead acetate; Reactions between ——. J. White. Amer. Chem. J., 1906, **35**, 217—227.

THE author has studied the reactions determining the solubility of lead chloride in lead acetate solution, and

has succeeded in isolating two new crystalline salts, mixed chloro-acetates of lead, to one of which he assigns the formula $PbCl.C_2H_3O_2,C_2H_4O_2$, the other possibly containing the complex $PbCl.C_2H_3O_2,Pb(C_2H_3O_2)_2$. The former of these is produced when lead chloride is dissolved in a hot glacial acetic acid solution of lead acetate, and is decomposed by water. The latter crystallises from a solution of lead chloride in aqueous lead acetate. It is soluble in water, but decomposed by acetic acid. These compounds are analogous to those previously described with lead iodide (Amer. Chem. J., 1904, **31**, 1). But whereas lead chloride and alkali acetates undergo double decomposition, lead iodide forms compounds with these salts.—F. SODN.

Lead; Reactions during the formation of certain complex salts of ——. [*New iodoacetate of lead.*] J. White and J. M. Nelson. Amer. Chem. J., 1906, **35**, 227—235. (Compare previous abstract.)

A NEW iodoacetate of lead has been obtained $(PbI.C_2H_3O_2)_5\ Pb(C_2H_3O_2)_2$, by the interaction of methyl iodide and lead acetate in glacial acetic acid, a slight modification of Carius's method being adopted. A good result was obtained by heating a mixture of 6 grms. of methyl iodide, 10 grms. of lead acetate, 6 c.c. of acetic acid, and 2 c.c. of acetic anhydride, at 60°—70° C. for about 6 hours. The crystals resulting were washed with alcohol. The influence of temperature and of relative mass have been worked out, and the possible mechanism of the reaction is discussed in the paper.—F. SODN.

Platinum and iridium salts; Action of sulphuric acid on ——, *in presence of ammonium sulphate.* [*Detection of iridium in commercial platinum.*] M. Delépine. Comptes rend., 1906, **142**, 631—633.

As much as 2 grms. of platinum can be dissolved in 100 c.c. of concentrated sulphuric acid by prolonged boiling (40—50 hours). These solutions probably contain a platinosulphuric acid, much less easily reducible than chloroplatinic acid; for they deposit their platinum much less readily when heated with ammonium sulphate than with ammonium chloride.

Iridioplatinum containing 10 per cent. of iridium is attacked by sulphuric acid much less readily than platinum; but it dissolves as a whole, the undissolved portion still containing 10 per cent. of iridium. On heating with ammonium salts, the iridium remains dissolved, forming a green solution, which turns deep violet when boiled with a little nitric acid. This violet colour is so intense that it is possible by its means to detect iridium in many samples of commercial "pure platinum." The green solution contains the ammonium salt of iridiosulphuric acid. The author has distinguished three varieties of these iridiosulphates—(1) green, yielding a blue precipitate with barium or strontium salts, slowly decomposed by ammonia in the cold (described by Lecoq de Boisbaudran); (2) green, precipitated by barium salts from alkaline solutions only, as greenish-brown compound, and giving with ammonia an olive-brown solution; (3) olive-brown, not precipitated by barium salts unless ammonia is present.—J. T. D.

Metal-ammoniums; Nature of ——. O. Ruff and E. Geisel. Ber., 1906, **39**, 828—843.

THE authors find that the so-called alkali-metal-ammoniums are not compounds at all, but consist of a mixture of the metal with adhering saturated liquid solution of metal in liquid ammonia. They have determined the solubility at various temperatures of the alkali-metals in liquid ammonia, and find no other phase, either solid or liquid, than metal and saturated solution. The small amounts of heat which Joannis has found to be evolved during the solution of sodium or potassium in liquid ammonia, are probably attributable to the fact that the metals exist in solution not in the monatomic condition, but as Na_2 and K_2. Whether the alkaline-earth metal-ammoniums are of a similar nature is not yet established.—J. T. D.

Selenium dioxide. O. de Coninck. Comptes rend., 1906, **142**, 571—573.

THE paper contains determinations of the solubility of selenium dioxide in water, ethyl and methyl alcohols, acetone, and acetic acid, and also of the density of aqueous solutions, in addition to notes as to the reactions of selenium dioxide with acids, chlorides of phosphorus and hydrazine.—E. F. A.

Nitrogen peroxide; Reaction of ——, *on ammonia and ammonium salts.* Besson and Rossett. Comptes rend., 1906, **142**, 633—634.

LIQUID ammonia reacts violently on solid nitrogen peroxide; if ammonia gas be slowly brought into contact with the peroxide, the reaction proceeds more smoothly. Nitrogen peroxide also acts on ammonium salts, though heating to 100° C. in sealed tubes is then necessary to complete the reaction.—J. T. D.

Carbon dioxide; Liquefied —— *as a solvent.* E. H. Büchner Z. physik. Chem., 1906, **54**, 665—688.

A NUMBER of different inorganic and organic substances were examined as to their solubility in liquid carbon dioxide. *p*-Dichlorobenzene, acetic acid (?), camphor, ethyl alcohol (?), carbon bisulphide, ether, pentane, amylene, acetylene, benzene, and *p*-xylene are completely miscible, in the liquid condition, with liquid carbon dioxide, the solubility curve being throughout below the curve representing the critical temperature of solution. In other cases, the solubility curve cuts the critical temperature curve, *e.g.*, with naphthalene, phenanthrene, iodoform, *p*-dibromobenzene, borneol, substituted phenols (except nitrophenol), *p*-chloro-(or bromo-) nitrobenzene, 1.2.3- and 1.3.2- dichloronitrobenzene, phthalic anhydride, succinic anhydride, *a*-naphthylamine, urea, benzamide, and nearly all inorganic substances with the exception of gases. In still other instances, the substances in the liquid condition are partially soluble in liquid carbon dioxide, the solubility being increased on heating, in the case of bromoform and propyl, butyl and isobutyl alcohols; and diminished in the case of urethane, thymol, *o*-nitrophenol, nitrobenzene, the mono- and dichloro-nitrobenzenes not previously mentioned, and *o*-bromonitrobenzene.

Liquid carbon dioxide resembles liquid cyanogen in possessing only a small solvent power, and in this respect, differs sharply from liquefied sulphur dioxide and ammonia, which are good solvents for inorganic salts, and from liquefied hydrochloric, hydrobromic and hydriodic acids, and hydrogen sulphide, in which many organic substances are easily soluble.—A. S.

Chlorine gas; Use of —— *under moderate pressures in the chemical arts.* E. A. Ashcroft. Electrochem. and Met. Ind., 1906, **4**, 91—94.

THE use of chlorine under moderate pressures is possible only if the gas be perfectly dry, in which condition it does not attack any of the ordinary metals. For compressing the gas, the author obtained satisfactory results only by the use of ordinary metal reciprocating pumps with displacement plungers and oil-seals. The chlorine was dried by means of zinc chloride. For lubricating purposes and for the oil-seals, chlorine-proof whale oil was used, which was prepared in the following manner:—Good sperm whale oil was treated with chlorine until chemical action (indicated by rise of temperature) ceased, and was then treated with zinc oxide to neutralise acidity.

The author states that of many oils tried, the treated whale-oil was the only one to prove quite satisfactory.
—A. S.

Ozone; Conversion of oxygen into —— *at high temperatures; and oxidation of nitrogen.* F. Fischer and F. Braehmer. Ber., 1906, **39**, 940—968.

OZONE may be formed from oxygen at high temperatures. It has often been suspected, but never satisfactorily proved. Ozone being endothermic, should be more stable at high temperatures, and the great rapidity of its decomposition as the temperature falls, no doubt accounts for the fact of its formation never having been demonstrated. The authors have exposed oxygen and air to high temperatures, produced both by chemical and by electrical means, in the immediate presence of liquid air or oxygen, so as to

are wound in the form of "cheeses" or bobbins, before being placed upon the inner, perforated tube on which they are dyed, is dispensed with, the yarns being wound upon a tube, *a* (see figures), and forced from this, either directly (one end, *e*, of the tube being in this case made to fit into the dye-tube), or, indirectly (over a solid end-piece, *f*), on to the perforated pipe, *b*, of the dyeing apparatus. To the bottom of the latter pipe a plate, *g*, is attached (Fig. 4), above which the bobbins are placed successively in position. When almost the whole length of the pipe has been covered by the bobbins, a second plate, *h*, to which a sleeve-pipe is affixed, is fitted to the top. Pressure is applied to the upper plate to bring the two plates nearer together and so to compress the bobbins and cause them to form a compact mass around the central pipe. The dyeing is then performed in the usual manner by drawing or forcing dye-liquors alternately in opposite directions through the yarns. Afterwards the pipe with the yarns upon it is withdrawn from the dyeing apparatus, and, the cover plate being removed, is placed in an inverted position above a portable unwinding tube, *j*, upon which each bobbin is in turn received and from which the yarn composing it is unwound.—E. B.

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Lead chloride and lead acetate; Reactions between ——. J. White. Amer. Chem. J., 1906, **35**, 217—227.

THE author has studied the reactions determining the solubility of lead chloride in lead acetate solution, and

and dried, may be used in producing antimonial colours or may be reduced to metal. To separate arsenic from an antimonial solution containing it, freshly precipitated antimony sulphide is introduced into the solution, which is boiled, when the arsenic is precipitated as sulphide. —E. S.

Antimony oxides and other metallic oxides; Manufacture of ——. G. C. Genton. Fr. Pat. 359,075, Nov. 2, 1905.

The vapours and fumes from the roasting kiln are drawn through a series of vertical connected rectangular channels contained within a rectangular sheet iron vessel through which cold water continually flows. The channels communicate by arched continuations above, and open through the bottom of the vessel into a vacant closed compartment for each pair of the channels, so that the vapours are led successively down and up through the cooled channels, and at the end of the series of such channels into a condensing chamber, in which, it is stated, pure antimony trioxide, free from the insoluble oxide, collects.—E. S.

Arsenic sulphide; Method of utilising crude ——. F. Howles. Fr. Pat. 359,028, Oct. 31, 1905. Under Int. Conv., Nov. 8, 1904.

See Eng. Pat. 24,198 of 1904; this J., 1905, 1230.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 267.)

English Patent.

Pigments from glass; Manufacture of permanent ——. J. B. Bennett and J. Mastin. Eng. Pat. 15,398A, July 27, 1905. XIIIA., page 325.

United States Patent.

Glass; Manufacture of ——. F. L. O. Wadsworth, Morgantown, W. Va. U.S. Pat. 814,631, March 6, 1906.

The process described of forming glass sheets consists in rolling a mass of glass into sheets between non-absorbent surfaces, and interposing a gaseous fluid film, *e.g.*, of steam, between the glass and the forming surface, at the point of application of pressure, and discharging the gaseous fluid, as the sheet is formed. In the case of glass with a pattern-surface, the glass is spread over a pattern-forming surface, and comes into direct contact with it, only after the gaseous fluid has been discharged. The table on which the glass is spread, is provided with a channel in which a piston works, and as this moves along, it forces steam through openings in the forming surface, and the rear part of the piston draws off the fluid from the openings it has passed.—W. C. H.

French Patent.

Ceramic colours and fluxes; Preparation of —— by precipitation. H. Renoul. Fr. Pat. 358,988, Jan. 7, 1905.

The ceramic colours and fluxes are obtained in impalpable powders, by precipitating in aqueous solutions, silicates and borates of alkali, alkaline-earth or heavy metals. The claims also include the articles thus obtained, and their application in ceramic industries.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 267.)

Sand-lime brick. E. W. Lazell. Engineers' Club of Philadelphia, Nov. 4, 1905. Eng. and Mining J., 1906, 81, 374–376.

The author describes the manufacture, properties, uses and advantages of sand-lime bricks. A comparison of sand-lime brick with ordinary clay-brick and sandstone is given in the following table:—

Material.		Crushing strength, lb. per sq. in.	Absorption, per cent.	Crushing wet, after absorption, lb. per sq. in.	Freezing, percentage loss in weight.	Crushing after freezing, lb. per sq. in.
Sand-lime brick, common	Aver.	2718	15·07	1899	0·41	3023
	Max.	3035	—	1826	—	3067
	Min.	2136	—	1459	—	2956
Sand-lime brick, face		6025	12·87	3958	0·20	6765
Sand-lime brick, common	Aver.	3014	14·00	—	—	—
	Max.	4000	—	—	—	—
	Min.	2100	—	—	—	—
Clay-brick, common	Aver.	2325	16·65	1917	0·74	2216
	Max.	2587	—	2145	—	2550
	Min.	1891	—	1702	—	1875
Clay-brick, hard-burned	Aver.	4288	9·15	4693	0·18	4577
	Max.	4494	—	5564	—	4864
	Min.	3976	—	3975	—	4056
Clay-brick, repressed front	Aver.	4469	10·71	4431	0·22	4566
	Max.	5108	—	5103	—	4937
	Min.	3885	—	3807	—	4097
Indiana sandstone		4152	5·65	—	0·37	5561

—A. S.

Cement testing. O. H. Klein and S. F. Peckham. Report on Portland cements. J. C. Hertle and W. H. Black, July 27, 1905. XXIII., page 338.

English Patents.

Wood: Composition of matter for impregnating ——. K. H. Wolman, Idaweiche, Germany. Eng. Pat. 7043, April 3, 1905.

See Fr. Pat. 353,181 of 1905; this J., 1905, 971.—T.F.B.

Cement from furnace slag; Manufacture of ——. H. Colloseus, Berlin. Eng. Pat. 3619, Feb. 21, 1905. Under Int. Conv., Nov. 3, 1904.

See Fr. Pat. 356,276 of 1905; this J., 1905, 1307.—T.F.B.

Cements; Process for manufacturing hydraulic binding substances or ——. A. J. Boult, London. From M. Reiche, Paris. Eng. Pat. 4194, Feb. 28, 1905.

Calcium hydroxide is mixed with cement-forming oxides or hydroxides in the proportion of not more than 2 mols. to 1 mol. of silica, alumina or ferric oxide, and the mixture is heated with water under pressure or exposed to the action of superheated steam. The acid material must be very finely ground, leaving not more than 20 to 30 per cent. residue on a 4400-mesh sieve. Other oxides, *e.g.*, of chromium, manganese, zinc, copper, tin, antimony, may be used as the acid material if coloured cements are desired. Portland cement may be made by calcining a mixture of the proper ingredients after treating, as above, the whole or a part of the mixture. Artificial stone may be obtained by adding silicious sand to a mixture treated as above and again steaming.—A. G. L.

Cement; Manufacture of Portland ——. The Associated Portland Cement Manufacturers (1900), Ltd., H. K. G. Bamber and G. R. M. Layton, all of London. Eng. Pat. 5765, March 18, 1905.

The rotary cement kiln is made in two parts, which may

be revolved at different speeds if necessary. The raw materials are dried in the upper part and are prevented from falling directly into the lower part of the kiln by an annular diaphragm which, however, allows the passage of hot gases upwards. Instead, the dried raw materials fall through a series of apertures into a shoot leading to a grinding machine, being made to pass through a trap on their way in order to prevent hot gases from reaching the grinding machine, and are then raised and again introduced into the lower part of the kiln through a second series of apertures, the whole being done without sensible loss of heat.—A. G. L.

Clinker from refuse destructor furnaces; Treatment of ——. J. A. Brodie. Eng. Pat. 7521, April 10, 1905. XVIII*B.*, page 332.

Salt pans; Treatment of pan scale of ——, *and of its products and apparatus used.* F. Bale. Eng. Pat. 10,722, May 23, 1905. VII., page 315.

[*Cement*] *kilns; Rotary* ——. W. R. Warren, New York. Eng. Pat. 17,457, Aug. 29, 1905.

SEE Fr. Pat. 358,227 of 1905; this J., 1906, 182.—T.F.B.

UNITED STATES PATENTS.

Cement-kiln. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 813,490, Feb. 27, 1906.

THIS invention relates to kilns of the rotary type, and comprises a pair of cylindrical sections with abutting flanges, and a shoe to cover the flanges; the shoe consists of two sets of L-shaped sections, placed opposite to each other, and secured to the flanges by securing-flanges, and having bearing surfaces, the sections of one set being placed so as to "break joints" with the other set.—W. C. H.

Cement-burning process, and apparatus therefor. B. E. Eldred, Brookline, Mass., Assignor to Combustion Utilities Co., New York. U.S. Pat. 813,627, Feb. 27, 1906.

ACCORDING to this invention cement-forming material is fed into the upper end of a reverberative chamber, or rotary kiln. Adjacent to the lower end of the chamber is an external fuel bed, from which a calcining flame of low temperature is supplied. This flame is regulated by means of a gaseous diluent passed through the fuel from below upwards; the diluent suggested is a portion of the stack gases, which are drawn through a pipe from the stack, and introduced below the grate by means of a fan. To produce a local intensification of this flame to raise it to a clinkering temperature, a jet of air is introduced into the chamber, to intercept the flame or gas current, and is directed on to the material on the floor of the chamber; this jet commands the outlet end of the chamber. The external fire-box is separated from the burning chamber by a partition, arranged to form a number of openings in the chamber, one of which is commanded by the jet-nozzle, mounted on the partition.—W. C. H.

Cement-kilns; Heat-regulator for ——. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 813,630, Feb. 27, 1906.

THE apparatus described comprises a kiln, of the rotary type, and a regenerative chamber, for abstracting heat from the waste gases. The regenerator consists of a number of chambers lined with refractory materials, and between these chambers, others, provided with baffle-plates, for collecting dust. Means are provided for withdrawing a portion of the waste gases, after passing through the heater, and adding it to the heated air. The gas-exit end of the kiln is provided with a "housing" to which the chimney stack is also connected. Immediately below the chimney, and connected with the "housing," is a chamber of the regenerative air-heater, for abstracting a portion of the waste-gases from the "housing."—W. C. H.

Cement and cement construction; Method of treating ——. M. Toch, Assignor to H. M. Toch, New York. U.S. Pat. 813,841, Feb. 27, 1906.

THE method of treating Portland cement construction, to render it oil- and water-proof, consists in applying to the surface a suitable organic acid, such as an acid resin, or a compound such as calcium resinate; the solution may also contain a vegetable drying oil and a diluent. A mixture containing a dissolved resin and a pigment may be applied to the former layer.—W. C. H.

Binding agent and process of making same. L. Weiss, Budapest, Austria-Hungary. U.S. Pat. 814,490, March 6, 1906.

SEE Eng. Pat. 4939 of 1904; this J., 1904, 607.—T. F. B.

X.—METALLURGY.

(*Continued from page* 270.)

Cupriferous tailings; Cyanide treatment of —— *by the sulphuric acid process.* W. S. Brown. Inst. of Min. and Met., March 15, 1906. [Advance proof].

THE tailings were produced many years since at the Cobar-Chesney Mine, Cobar, N.S.W. Shallow rectangular wooden vats, each holding about 25 tons, were provided for the preliminary acid treatment. When loaded with ore, from 10 to 12 tons of dilute sulphuric acid were pumped on and then drained off slowly and intermittently through a launder. The first portion of this acid wash never showed any free acid, later portions were either made up with sulphuric acid for use with another charge or run to waste. Twenty-five tons of water were then run through as a wash, followed by a second wash of about half that quantity, the total treatment occupying 48 hours. All the solutions were passed through the precipitating boxes, which were loaded with scrap sheet iron. The washed ore from three acid vats, after being covered with 0·5—0·8 per cent. of lime, was run out and trucked to cyanide vats, each holding 75 tons of tailings. Fifteen tons of weak cyanide solution were first applied to displace the weak acid present. This was run to a special sump and subsequently used as a final wash. After draining off this weak solution, from 50 to 60 tons of 0·3 per cent. cyanide solution were pumped on and drained off in several separate portions; this was followed by 20 to 30 tons of weak solution, and finally by 15 tons of wash. Zinc-box precipitation was employed for the golds From the 1st to the 11th of October, 450 tons of tailing. were treated which yielded 167·7 oz. of gold. The average value of the tailings was 9 dwt. 4 grs., of which 81·1 per cent. was recovered. 20·1 lb. of 92 per cent. sulphuric acid were used per ton of tailings or 5·5 lb. in excess of the theoretical requirement; 7·1 lb. copper per ton were recovered. The cyanide consumption was 1·6 lb., the scrap iron used cost 1.5d., the lime cost 3s. 6d., and the zinc 2s. 0d. per ton of tailings. The working solutions seldom showed over 0·3 per cent. of copper, the shipments of precipitate averaged about 60 per cent of copper, the remainder consisting of iron and silica. The produce of the zinc boxes was extremely base, both copper and lead being present in notable proportions. After treatment with sulphuric acid, bullion 900 fine was produced.—J. H. C.

Alloy. U.S. Customs Decision, Jan. 16, 1906.

THE United States Circuit Court of Appeals held that an alloy composed of iron 62 per cent., manganese 6 per cent., and tin 32 per cent., and used in hardening bronze, is dutiable at 20 per cent. *ad valorem*, under paragraph 183 of the tariff, as a "metal unwrought." The claim of the importers that it was dutiable by similitude to ferro-manganese at 4 dols. per ton, under paragraph 122, was overruled. [T.R.] R. W. M.

Gold-zinc and gold-cadmium alloys. R. Vogel. Z. anorg. Chem., 1906, **48**, 319—346.

GOLD forms three chemical compounds with zinc, corresponding to the formulæ $AuZn$, Au_3Zn_8 and $AuZn_8$, and two with cadmium, represented by Au_4Cd_5 and $AuCd_3$.

Microphotographs are given showing the structure of certain metallic mixtures, and also the cooling curves of the gold-zinc and gold-cadmium mixtures.—T. F. B.

Silver-zinc alloys. G. I. Petrenko. Z. anorg. Chem., 1906, **48**, 347—363.

Conclusive evidence was obtained of the existence of four alloys of silver and zinc: these correspond to the formulæ Ag_3Zn_2, $AgZn$, Ag_2Zn_3, Ag_2Zn_5.—T. F. B.

Ferromagnetic alloys of non-magnetic metals; Heusler's ——. E. Haupt. Naturw. Rundsch., 1906, **21**, 69—71. Chem. Centr., 1906, **1**, 906. (See this J., 1904, 985; 1905, 850, 1237.)

At high temperatures all metals lose their magnetisability. For iron the transformation point is at about 800° C., and for nickel at about 400° C. In the case of manganese-aluminium bronzes, the transformation temperature rises as the proportion of manganese is increased, and also, if the percentage of manganese is kept constant, as the proportion of aluminium is increased. An alloy containing 61 per cent. of copper, 27 per cent. of manganese and 12 per cent. of aluminium, is still magnetisable at 310° C., but an alloy of 76 per cent. of copper, 16 per cent. of manganese and 8 per cent. of aluminium becomes non-magnetic at 160° C., and if contaminated with lead, at 60°—70° C. Stronger heating diminishes the magnetisability permanently. The maximum magnetisability is attained in the case of alloys containing manganese and aluminium in the proportions of their atomic weights. The analogy between the behaviour of the manganese-aluminium bronzes and the magnetisable manganese salts and their solutions is favourable to the assumption that these bronzes are solutions of manganese-aluminium compounds in copper. Manganese-aluminium bronzes remain ferromagnetic even on addition of other non-magnetic metals; lead, for example, increases the magnetisability appreciably.—A. S.

Bronzes; Malleable magnetic ——. F. Heusler. Sitzungsber. Ges. Beförd. ges. Naturwissenschaften zu Marburg, Nov., 1905, 98—99. Chem. Centr., 1906, **1**, 817.

After referring to previous work on the magnetic alloys free from iron, discovered by the author (see this J., 1904, 985; 1905, 850, 1237), attention is drawn to the important fact that certain manganese-aluminium bronzes rich in copper, which can be strongly magnetised, are capable of being forged. The forged alloys lose their magnetic properties when quenched in water, but become magnetisable again on keeping. (See preceding abstract.)—A. S.

Aluminium, copper and aluminium-bronze; Tensile overstrain and recovery of ——. A. Morley and G. A. Tomlinson. Phil. Mag., 1906, **11**, 380—392.

Ewing (Roy. Soc. Proc., 1895, **58**) has shown that the overstrained state, in the case of iron and steel, gradually disappears, and that the material approaches its original condition after a sufficient interval of time. Muir (Phil. Trans. Roy. Soc., 1899, **193**; this J., 1901, 254) found that this recovery is greatly accelerated by heating the metal to such moderate temperatures as 100° C. The authors have investigated the cases of overstrained aluminium, copper and an aluminium-bronze composed of aluminium, 10, and copper, 90 per cent. As with iron and steel, overstrained aluminium recovers its properties with rest, and more quickly by the application of heat. The recovery is nearly complete after 14 days, whilst Muir found that steel shows recovery to greater hardness than the original in 17 days. Copper is either not altered by overstrain, or if altered, it recovers its properties very rapidly. With overstrained aluminium-bronze the recovery with lapse of time is slow, but is very rapid under the influence of a moderate degree of heat. Mechanical vibration increases the injurious effects of overstraining and retards the recovery in the case of aluminium bronze, but has no appreciable influence on overstrained aluminium.—A. S.

Copper; Action of sulphuric acid on ——. C. H. Sluiter. Chem. Weekblad, 1906, **3**, 63—66. Chem. Centr., 1906, **1**, 903—904.

The author upholds the "reduction theory" of the action of sulphuric acid on copper and gives the following equations as representing the reactions:—

$Cu + H_2SO_4 = CuSO_4 + 2H$; $2H + H_2SO_4 = SO_2 + 2H_2O$.

It is stated that the only plausible explanation of the formation of copper sulphide is that the sulphur dioxide produced first, is further reduced to hydrogen sulphide by hydrogen. That hydrogen is present among the reaction products was proved by an experiment in which a nitrobenzene solution of sulphuric acid was heated with copper to 130° C., when it was found that aniline was formed. Nitrobenzene is not affected by heating with 96 per cent. sulphuric acid to 200° C., or by heating with water and copper to 100° C., and is not reduced by sulphur dioxide.—A. S.

Copper sulphate; Decomposition of the aqueous solution of —— *by aluminium alloys.* H. Pécheux. Comptes rend. 1906, **142**, 575—577.

The author's experiments show that magnesium-aluminium alloys acting on aqueous copper sulphate solution bring about a reduction of the water and evolution of hydrogen, solely due to the action of the magnesium; and a reduction of the copper sulphate with a deposition of red copper entirely due to the aluminium.

Tin-aluminium alloys cause a similar decomposition which, however, stops very soon, the alloy becoming coated with an insoluble surface film of alumina.—E. F. A.

Silicon chloride; Action of ——, *on cobalt.* E. Vigouroux. Comptes rend. 1906, **142**, 635—637.

At a high temperature, cobalt reacts on silicon chloride to form cobalt chloride and silicide; the action ceases when the silicon content of the residue (from which the cobalt chloride is separated by volatilisation) is 19—20 per cent., corresponding to the formula Co_2Si.—J. T. D.

Platinum and iridium salts; Action of sulphuric acid on —— *in presence of ammonium sulphate.* [*Detection of iridium in commercial platinum.*] M. Delépine. VII., page 314.

Mercury ores; Assay of —— . G. T. Holloway. XXIII., page 338.

Mineral production of Canada. Eng. and Mining J., March 17, 1906.

A preliminary report, issued by the Geological Survey of Canada, shows that the mineral production of the Dominion during the year 1905 was valued at 63,574,707 dols., as compared with 60,073,987 dols. in 1904. As an indication of the enormous increase in the mineral industry of Canada, it may be stated that the production in 1896 was 22,584,513 dols., and in 1886, 10,221,255 dols.

The following is a tabulated statement of last year's production:—

Mineral production of Canada in 1905.

Product.	Quantity.	Value.
		$
METALLIC.		
Copper ..... lb.	47,597,502	7,420,451
Gold ..... ,,	.....	14,486,833
Iron ore (exports, estimated).. ton	116,779	125,119
Pig iron from Canadian ore .. ,,	70,554	1,047,860
Lead..... lb.	55,961,000	2,634,084
Nickel .... ,,	18,876,315	7,550,526
Silver ... oz	5,974,875	3,605,957
Cobalt	.....	100,000
Other metallic products, including zinc	.....	180,000
Total metallic	.....	37,150,830
		$
NON-METALLIC.		
Asbestos ..... short ton	50,670	1,486,359
Asbestic ..... ,,	17,594	16,900
Chromite ..... ,,	8,575	93,301
Coal ..... ,,	8,775,933	17,658,615
Corundum ..... ,,	1,644	149,158
Felspar ..... ,,	11,700	23,400
Graphite ..... ,,	541	17,032
Grindstones..... ,,	5,172	57,200
Gypsum ..... ,,	435,089	581,543
Limestone for flux in iron furnaces ..... ,,	341,614	258,759

Product.	Quantity.	Value.
Manganese ore (exports) short ton	22	1,720
Mica „	.....	168,043
Mineral pigments—		
Barytes „	3,360	7,500
Ochres „	5,105	34,675
Mineral water	.....	100,000
Natural gas	.....	314,249
Petroleum bbl	634,095	849,687
Phosphate ton	1,300	8,425
Pyrites „	32,744	123 574
Salt „	45,370	310,858
Talc „	500	1,800
Tripolite „	200	3,600
Total non-metallic	.....	$22,266,303
STRUCTURAL MATERIALS AND CLAY PRODUCTS		$
Cement, natural rock bbl	14,184	10,274
„ Portland „	1,346,547	1,913,740
Flagstones	.....	7,650
Granite	.....	209,555
Sands and gravels (exports) tons	366,935	152,805
Sewer pipe	.....	382,000
Slate	.....	21,568
Terra-cotta, fire-proofing, &c.	.....	64,892
Building material, including bricks, building stone, lime, &c.	.....	6,095,000
Total structural materials and clay products	.....	$8,857,484
Estimated value of mineral products not returned	.....	300,000
Total, 1905	.....	$68,574,707

The exports of minerals from Canada in 1905 were as follow:—

Products	Quantity.	Value.
		$
Arsenic lb	108,000	5,400
Asbestos ton	47,631	1,386,115
Barytes cwt	34,488	14,343
Chromite ton	5,042	45,072
Coal „	1,635,287	4,029,457
Felspar „	9,161	27,660
Gold bearing quartz, dust, nuggets, &c	.....	13,706,960
Gypsum, crude ton	359,246	388,474
Copper, fine in ore, &c lb	40,470,879	5,401,400
„ black or coarse, and in pigs „	269,982	42,383
Lead in ore, &c „	40,350,792	1,011,655
„ pig, &c „	1,306,611	34,886
Nickel, in ore, &c „	17,318,059	1,569,693
Platinum, in ore concentrates, &c oz	15	283
Silver in ore, &c „	4,740,742	2,777,218
Mica lb.	1,087,781	170,049
Mineral pigments „	707,247	7,704
„ water gal	4,173	2,137
Oil—		
Crude „	35	2
Refined „	7,228	2,078
Ores—		
Antimony ton	525	27,118
Iron „	168 289	407,881
Manganese „	22	1,720
Other ores „	17,383	687,565
Phosphate „	40	1,253
Plumbago, crude cwt.	5,088	7,596
Pyrites ton	19,755	55,767
Salt lb.	1,447,728	6,112
Sand and gravel ton	306,935	152,805
Stone, ornamental „	2,878	898
„ building „	59,355	12,191
„ for manufacture of grindstones „	669	7,407
Other products of the mine	.....	71,331
Manufactures—		
Acid (sulphuric) lb.	232,203	2,718
Bricks M.	754	5,888
Aluminium in bars, &c. lb.	2,535,386	508,219
Aluminium, manufactured	.....	1,558
Cement	.....	3,143
Clay	.....	35
Coke ton	116,071	509,908
Grindstones, manufactured	.....	17,461
Gypsum, ground	.....	2,673
Iron and steel, value	.....	1,287,558
Lime	.....	85,723
Metals (n. o. p.)	.....	31,945
Plumbago, manufactures of	.....	518
Stone, ornamental	.....	3,107
„ building	.....	438

[T.R.]

ENGLISH PATENTS.

Steel; Impts. in the conversion of iron into ——. R. Simpson, Swansea. From D. I. R. Simpson, Johannesburg, Transvaal. Eng. Pat. 5817, March 20, 1905.

THE molten iron is run by means of a trough from a blast-furnace into a self-contained converter moving on rails to the desired point, and provided with tuyères, and with means for receiving and discharging the metal, or else the metal is run continuously through a shallow ladle provided with an overflow arrangement, a blast of air being forced through the metal during its passage through the ladle.—A. G. L.

Steel; Manufacture of a substance to be used for the improvement of inferior qualities of ——. G. L. Hoffmann, Berlin. Eng. Pat. 13,141, June 26, 1905.

SEE Fr. Pat. 355,786 of 1905; this J., 1905, 1239.—T.F.B.

Iron; Manufacture of foundry pig ——. C. Henning, Mannheim, Germany. Eng. Pat. 23,592, Nov. 16, 1905. Under Int. Conv., Nov. 17, 1904.

IN order to produce homogeneous low-carbon cast-iron from cast-iron and steel, the steel (40 per cent.) is first melted with cast-iron (60 per cent.) in a cupola furnace and the product cast into pigs (foundry pig iron) which can then be easily melted with a further quantity of pig-iron (60 to 70 per cent.).—A. G. L.

Gold; Apparatus for separating particles of —— or other more or less precious metals or substances from the gangue or material with which they are associated. G. Moore, London. Eng. Pat. 25,116, Nov. 18, 1904.

ON both sides of a long sloping framework are placed two endless belts of canvas, india-rubber, or similar material, which pass over suitably arranged pulleys and move from the lower end of the framework towards the upper. Each belt has continuous flanges on each side so as to form a kind of trough, down which slime, &c., and water run from the upper end to the lower. A number of water-proof aprons of oil-cloth or india-rubber are arranged along the upper half of each belt, the lower ends of these aprons lying loosely on the belt, whilst the upper ends are fixed in position so as to force the fine material floating on the water into contact with the belts, which may be roughened, or have pieces of burlap, with or without wire-screens attached, fastened to them. Or, a second endless belt may lie loosely on the first one and travel with it, the second belt which consists of burlap and wire screen being longer than the first and passing over a separate drum at the upper end of the framework to admit of the surfaces of the two belts being cleaned separately. The returning (or under) part of each belt is raised considerably by being made to pass over a drum, covered with felt or other soft material, and placed near the centre of the frame.—A. G. L.

Zinc, nickel, cobalt and manganese oxides, and copper, arsenic, antimony, lead, bismuth, cadmium, and tin; Treatment of complex sulphide and oxidised ores for the recovery of ——. W. G. Rumbold, C. Patchin and J. W. Hughes. Eng. Pat. 2532, Feb. 8, 1905. XIIIA., page 325.

Metals; Extraction of —— from ores and waste materials. A. Gutensohn, London. Eng. Pat. 2619, Feb. 9, 1905.

THE powdered material, after roasting if necessary, is mixed with a flux consisting of a mixture of borate of manganese, carbon and fluorspar to which tar is sometimes added, and fused.—J. H. C.

Cupola furnaces. A. Baillot, Haybes, France. Eng. Pat. 10,312, May 16, 1905. Under Int. Conv., Dec 5, 1904.

SEE Fr. Pat. 349,036 of 1904; this J., 1905, 624.—T. F. B.

Blast-furnaces; Impt. in ——. Frodingham Iron and Steel Co., Ltd., and M. Mannaberg, both of Frodingham, Lincs. Eng. Pat 26,263, Dec. 16, 1905.

IN addition to the ordinary tuyères blowing into the

hearth of the furnace, one or more tuyères are provided and arranged so as to direct a blast against the bosh walls in order to burn away any deposited matter which might form a "scaffold."—A. G. L.

Ores; Process for treating finely granulated or pulverised ——. H. J. Haddan, London. From Fellner und Ziegler, Frankfort-on-Maine, Germany. Eng. Pat. 12,200, June 10, 1905.

See U.S. Pat. 801,144 of 1905; this J., 1905, 1113.—T. F. B.

Slag; Apparatus for pulverising blast-furnace ——. H. Colloseus, Berlin. Eng. Pat. 14,329, July 11, 1905.

See Fr. Pat. 356,379 of 1905; this J., 1906, 26.—T. F. B.

Metals; Separation of — from their ores. R. E. Saunders, and The S.O.S. Synd., Ltd., both of London. Eng. Pat. 21,839, Oct. 26, 1905.

Essentially the invention consists in allowing the powdered ore to fall vertically whilst subjecting it to the action of a horizontal current of air, the lighter gangue particles being thus separated from the heavier particles of ore. The current of air may be conveniently furnished by an exhaust fan working at the back of a casing open at the front. The ore falls from a hopper, placed on top and near the front of the casing, on to a number of inclined baffle-plates or on to a number of endless horizontal travelling bands arranged below each other, so that the material falls from one to the next. The casing may be divided by means of a longitudinal partition so as to enable the strength of the air current in the two parts to be varied.—A. G. L.

United States Patents.

Iron and steel; Apparatus for the treatment of ore for the manufacture of — therefrom. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Vic. U.S. Pat. 814,557, March 6, 1906.

See Fr. Pat. 345,599 of 1904; this J., 1905, 32.—T. F. B.

Gold, silver, &c., Process of extracting ——. J. A. Comer, Los Angeles, Cal. U.S. Pat. 813,620, Feb. 27, 1906.

The crushed ore is treated with an alkaline solution of potassium cyanide, the solution is separated from the ore pulp and subjected to the action of compressed air, which is blown through it. After removing any sedimentary matter present in the solution, the gold, silver &c., are recovered electrolytically.—A. S.

Precious metals from ores, &c.; Process for the recovery of ——. J. A. Just, Pulaski, N. Y., Assignor to the Just Mining and Extraction Co., Syracuse, N. Y. U.S. Pat. 814,294, March 6, 1906.

The ores, especially silver and silver sulphide ores, are pulverised or granulated, then suspended in a solution containing an oxygen-yielding substance (nitre), treated with excess of sulphuric acid, and a current of air blown through. The mixture is heated until the solution is concentrated to one-half or less of its original volume, then diluted with acid or acidulated water to nearly its original volume, the acid solution separated from the sand and gangue, and the silver and gold separated from the acid solution, which latter is recovered for use over again.—A. S.

Metal-leaching process. T. B. Joseph, San Francisco, Cal. U.S. Pat. 814,452, March 6, 1906.

The invention relates to a process for the extraction of gold and silver, and consists in leaching the ore with an aqueous solution containing sodium cyanide, calcium hydroxide, barium dioxide, and ammonium bicarbonate, and simultaneously agitating the mixture with compressed air. —A. S.

Furnace; Roasting ——. T. F. Sheridan, Chicago, Ill., Assignor to Allis-Chalmers Co., Milwaukee, Wis. U.S. Pat. 814,238, March 6, 1906.

The invention relates to a roasting furnace with a hollow vertical shaft having hollow, horizontal "rake-arms" extending therefrom and communicating with the interior of the shaft. The hollow shaft and arms are filled with water, and a cooling medium is also circulated independently through pipes disposed in the hollow arms and communicating on the one hand with a supply-pipe in the shaft, and on the other, with the interior of the hollow shaft.—A. S.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 814,297, March 6, 1906.

The furnace comprises a number of hearths through which passes a rotating, vertical, hollow shaft, from which hollow arms extend into the several hearths. A cooling medium, such as water, is introduced near the middle of the shaft, and is caused to circulate through the shaft and arms "vertically in parallel and in series, and radially in multiple," finally leaving the shaft at the opposite ends thereof.—A. S.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 814,298, March 6, 1906.

The rotating, vertical, hollow shaft extending through the hearths of the furnace is divided longitudinally into a series of conduits, which, in turn, are divided by transverse partitions into compartments or chambers. From the shaft, hollow arms extend into the hearths. Cooling media are caused to circulate through the several conduits and the hollow arms attached thereto. (See preceding abstract).—A. S.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 814,299, March 6, 1906.

See preceding abstracts. The shaft is divided by transverse partitions into chambers closed at top and bottom. By means of a feed-pipe passing through the partitions separating the chambers, a cooling medium (water) is fed simultaneously into the several chambers of the shaft, and, after circulating through the hollow arms projecting from the shaft into the hearths of the furnace, is discharged through an exhaust pipe provided with intake openings in the spaces between consecutive chambers.—A. S.

Cupola. F. N. Cline, Chicago, Ill. U.S. Pat 814,769, March 13, 1906.

The furnace comprises a metal-melting chamber lined with fire-clay, and a crucible mounted in a second chamber at a lower level than the melting chamber, the bottom of the latter having, at one side, a throat or passage, lined with fire-clay, which extends over the upper edge of the crucible. Flame is led into the second chamber around the crucible, passes over the top of the crucible, and through the throat into the melting chamber, the products of combustion escaping through a gas-discharge pipe leading from the bottom of the melting chamber opposite the throat. The molten metal flows by gravity from the melting chamber through the throat into the crucible. —A. S.

Tin or tin and lead; Process of recovering ——. J. C. Taliaferro, Baltimore, Md., Assignor to Continental Can Co., New York. U.S. Pat. 814,334, March 6, 1906.

Tin or tin and lead are separated from iron or steel by fusing the first-mentioned metals, adding sufficient lead to cause the iron or steel to float to the top of the mixture, skimming off the iron or steel, and separating the tin and lead from the skimmings by melting on charcoal.—A. S.

Copper separation; Process of ——. A. Elliott, Little-rock, Cal. U.S. Pat. 814,836, March 13, 1906.

Oxidised copper ores containing basic gangue are leached with a hot, non-acid solution of ferrous sulphate, air being passed through the solution during the leaching operation. From the resulting solution the copper is precipitated by means of iron, ferrous sulphate being regenerated.—A. S.

Agitating device [for metallurgical apparatus]. W. B. Devereux, Glenwood Springs, Colo. U.S. Pat. 815,272, March 13, 1906.

In a tank provided with means for decanting the liquid

contained in the same, a number of vertical shafts are disposed, on each of which a propeller rotates at a substantial distance above the bottom of the tank, and above the level to which the solid material of the charge will settle when the propellers are at rest.—A. S.

FRENCH PATENTS.

Furnace; Calcining ——. H. Howard. Fr. Pat. 358,977, Oct. 30, 1905.

A DRYING or heating chamber is constructed over the arch of a circular reverberatory furnace, and the ores are fed into this chamber before they pass on to the furnace proper, so as to utilise a great part of the heat which would be otherwise lost. A stream of cold air is supplied to the chamber through a regulator, and revolving rabbles are provided to stir up the ore and force it into a tube which contains a screw propeller whereby it is regularly fed to the furnace below.—J. H. C.

Bronze; Process of making ——. G. E. Buttenshaw. Fr. Pat. 359,080, Nov. 3, 1905.

SEE Eng. Pat. 792 of 1905; this J., 1906, 184.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 272.)

(*A.*)—ELECTRO-CHEMISTRY.

ENGLISH PATENTS.

Accumulator plates; Manufacture of ——. A. G. Bloxam, London. From F. E. Polzeniusz and R. B. Goldschmidt, Brussels. Eng. Pat. 778, Jan. 14, 1905.

SEE Fr. Pat. 350,898 of 1905; this J., 1905, 805.—T. F. B.

Electric arcs or discharges; Deviating or drawing out ——, *applicable to apparatus for the chemical decomposition and combination of gases.* R. C. Gardner, London. From J. J. Thoresen, Christiania, and F. Tharaldsen, Meraker, Norway. Eng. Pat. 13,689, July 3, 1905.

SEE Fr. Pat. 352,556 of 1905; this J., 1905, 976.—T. F. B.

Electric glow lamps; Process of making a metallic connection between the light emitting bodies and the supply conductors of ——. H. Kuzel. Eng. Pat. 15,462, July 27, 1905. II., page 307.

UNITED STATES PATENTS.

Water; Process of decomposing —— by electrolysis. W. F. M. McCarty, Rocky Ridge, Md., Assignor to T. A. Darby, New York. U.S Pat. 813,105, Feb. 20, 1906.

METALLIC sodium or other alkali metal is added to water, which may have been previously acidified, the solution being subsequently electrolysed.—R. S. H.

Electrolytic apparatus. L. V. Scoyoc, Gilbert Station, Iowa. U.S. Pat. 813,844, Feb. 27, 1906.

THIS invention relates to an apparatus for the decomposition of water by electrolysis, and comprises a liquid-container and a liquid-supply for the same, together with a float valve, actuated by variations in the water level in the container, and supplying water to the latter so as to maintain a constant level. Receptacles for collecting the gases, with their open lower ends projecting below the water level in the container, have gas-bags arranged on their upper open ends. The receptacles for the gases have partitions provided with valve openings, and float valves in the receptacles acting in these valve openings regulate, by variations in the water levels, the discharge of the gases into the gas-bags. Electrodes are arranged in the container within the open lower ends of the gas-collectors. —B. N.

Decomposing water by electrolysis; Apparatus for ——. M. F. M. McCarty, Rocky Ridge, Md., Assignor to T. A. Darby, New York. U.S. Pat. 814,155, March 6, 1906.

THE electrolytic tank is divided from top to bottom by a partition into two chambers, the partition being provided near its lower end with a line of apertures, a glass tube being mounted in each aperture and extending into the respective chambers. An electrode is mounted in each chamber, and is connected with a suitable source of current supply, each electrode comprising a plate of suitable material extending approximately from side to side of the tank in order to present a large superficial area. Each electrode is bent inwards at its lower end, forming a terminal discharge portion extending at right angles to the body of the electrode, and located opposite and in line with all of the apertures and the ends of the glass tubes.—B. N.

Cells; Apparatus for feeding electrolytic ——. F. J. Briggs, Everett, Mass. U.S. Pat. 814,583, March 6, 1906.

THIS invention relates to a device for feeding cells in electrolytic apparatus, and comprises a tank of insulating material, divided by a central partition into two chambers on opposite sides of a standard which supports the tank on a pivot, the standard being in line with the partition. A spring is supported centrally by the standard, and extends longitudinally under the tank. Siphon pipes connect the interior of each chamber with the exterior, and are adapted to be connected with an outside cell. The tank supports a track which extends from one side of the pivot support to the other, this track consisting of two pairs of metallic rods, the rods in each pair being of unequal length, in line with each other and with their ends separated by small spaces. The longer rod in each pair is adjacent to the shorter, and overlaps the longer rod in the opposite pair. The supports for the outer ends of the rods are attached to the siphon pipes. A freely-moving ball on the track is adapted to roll from a position on one side of the pivot support to the other, and means are provided at opposite ends of the track for limiting the movement of the ball. A water supply is located directly over the central partition when the tank is level. The track forms a portion of an electrical circuit, containing a register, whereby, as the tank is tilted down in either direction, the supply of water enters the chamber which is tilted up, and the stream of water which is siphoning out through the opposite chamber is broken, thus breaking any electrical circuit which is passing through the stream. When the rolling ball passes over the centre of the track where the longer rods overlap, it completes the electrical circuit of which the rods form a part, and registers the emptying of one of the chambers.—B. N.

FRENCH PATENTS.

Hydrogen peroxide; Electrolytic preparation of ——. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 358,806, Oct. 24, 1905.

THIS invention relates to a process for the electrolytic preparation of hydrogen peroxide from persulphuric acid percarbonates, perborates or other analogous substances which may be easily obtained by electrolysis of pure solutions at an elevated temperature in the absence of catalytic agents, the platinum which passes into solution during the electrolysis being extracted by the use of a special cathode or by chemical means. The hydrogen peroxide is extracted from the electrolytic solution by solvents, such as ether or ethyl acetate, or by rapid distillation at a low temperature in a vacuum, the extracted solution being again submitted to electrolytic oxidation. —B. N.

Electric arcs; Process and apparatus for internally throwing up luminous —— especially for the treatment of gases or mixtures of gases by movable luminous electric arcs. A. J. Petersson. Fr. Pat. 359,113, Nov. 4, 1905. Under Int. Conv., Nov. 7, 1904.

THIS invention relates to a process of producing a luminous electric arc between electrodes placed in an electric

circuit, by closing the trajectory of discharge by means of an arc on another circuit, the latter arc being brought over the former by magnetic or electro-magnetic influence. The arcs are first established between the electrodes where the minimum separation is relatively small, and the deviation of these arcs is produced by electrodynamic forces, so as to bring them over the electrodes where the amount of minimum separation is relatively great. Several forms of laboratory furnaces are described, furnished with pairs of electrodes, one or more pairs of electrodes being separated to only a slight extent, and placed in a circuit or circuits so that the arcs are established by an expenditure of energy relatively small. Those arcs are deviated as before mentioned towards the pairs of electrodes which are separated to a greater extent, and which are placed in circuits in which the arcs are only established by expenditure of energy relatively great. —B. N.

(*B.*)—ELECTRO-METALLURGY.

Lithium; Preparation of metallic ——. O. Ruff and O. Johannsen. Z. Elektrochem., 1906, **12**, 186—188.

The authors electrolyse fused lithium bromide containing 10 to 15 per cent. of lithium chloride, and attain a yield of about 80 per cent. of the theoretical. The electrolytic vat is of the type designed by Muthmann, Hofer and Weiss (this J., 1902, 412—413), the salt being fused in a water-cooled metal receptacle by means of an arc and subsequently submitted to electrolysis in the same vessel. A current of 100 ampères at 10 volts is employed, the anode being a carbon rod, whilst the cathode consists of two iron rods of 4 mm. diameter. The metal, which separates at the cathode in the fused condition, is removed from time to time with a shallow iron spoon and poured off from the solidifying salt. The mixture of salts recommended has a good electrical conductivity and low fusing point (about 520° C.), and has proved the most suitable for the purpose. When it is desired to prepare pure metallic lithium, the addition of salts of the other alkali metals is not to be advised. Electrolysis of a mixture of lithium and potassium chlorides yielded a metal containing 5 per cent. of potassium, whereas the metal prepared as described above, contained only 0·17 per cent. of sodium. The melting point of lithium has been determined as 180° C.—R. S. H.

English Patents.

Copper electrotypes; Manufacture of —— and apparatus therefor. S. O. Cowper-Coles, London. Eng. Pat. 4668, March 6, 1905.

The frames containing the wax or other impressions to be electrotyped are mounted in a vat and serve as cathodes. The anodes are mounted on a central rotating frame, and are perforated to admit of circulation of the electrolyte. The latter is admitted at the bottom of the vat, and is projected by centrifugal force through the perforations over the surface of the cathode. In this way all air bubbles are removed and a deposit of copper free from pin-holes can be obtained at a rapid rate of deposition with a current density of from 500 to 1000 ampères per square foot. —R. S. H.

Electro-plating; Apparatus for ——. L. Potthoff, Brooklyn, New York. Eng. Pat. 6790A, March 30, 1905.

A tumbling barrel suitable for containing small articles to be plated, and provided with the necessary mechanism for rotation, is arranged in a vat. Anodes are provided both inside and outside the barrel, and cathodes lead the current to the work to be plated. The essential part of the process consists in the arrangement whereby, when the barrel is rotated in one direction, the articles are retained and submitted to the deposition, whereas, when the direction of rotation is reversed, they are discharged from the apparatus.—R. S. H.

Ore separators; Magnetic ——. C. Leon, London. From Maschinenbau Anstalt Humboldt, Kalk, Germany. Eng. Pat. 19,525, Sept. 27, 1905.

See Fr. Pat. 357,216 of 1905; this J., 1906, 80.—T. F. B.

United States Patents.

Electroplating Apparatus. L. Potthoff, Flushing, N.Y. U.S. Pat. 806,835, Dec. 12, 1905.

See Eng. Pat. 6790A of 1905; preceding these.—T. F. B.

Matte; [Electrolytic] Method of treating ——. W. M. Johnson, Hartford, Conn. U.S. Pat. 814,049, March 6, 1906.

The copper-nickel matte is subjected to the action of hot dilute sulphuric acid, whereby nickel is dissolved and sulphuretted hydrogen liberated, the latter being subsequently converted into sulphuric acid, whilst a residue consisting in part of copper sulphide is left. The nickel is recovered from the solution, the bath being maintained neutral by the addition of nickel hydroxide, which is added proportionately to the amount of metal separated at the cathode. The residue, consisting partly of copper sulphide, is roasted so as to form the oxide, which is then treated with sulphuric acid, and the solution of copper sulphate is electrolysed, using insoluble anodes of lead, in order to separate a portion of the copper, the gases from the roasting operation being simultaneously passed into the liquid. The solution is again used for extracting the roasted residue, and then again electrolysed until the presence of nickel interferes with the deposition of the copper. Further quantities of copper are afterwards obtained by deposition on rotary cathodes. The spent electrolyte is finally used for treating a fresh quantity of the matte.—B. N.

[Zinc] Smelting process; Electrical ——. W. M. Johnson, Iola, Kans. U.S. Pat. 814,050, March 6, 1906.

This invention relates to a smelting process for recovering volatile metals such as zinc, which consists in interposing between a relatively low-resistance charge, containing low-grade ore mixed with low-resistance carbon, and a furnace wall or hearth, a high-resistance charge containing high-grade ore mixed with high-resistance carbon, and also a layer of inert material, such as finely-divided carbon, acting as the electrodes. The furnace wall and hearth are thus protected from the low-grade ore during the passage of an electric current through the charges, the latter being so arranged as to secure a substantially even temperature within the furnace.—B. N.

Metallurgical process [Zinc]. F. T. Snyder, Oak Park, Ill. U.S. Pat. 814,810, March 13, 1906.

Zinc sulphide ore is mixed with carbon and slag-forming materials, and the mixture electrolysed in a bath of fused slag, in absence of air, at a temperature above the volatilising point of zinc, one of the electrodes being of carbon. Zinc and sulphur in the form of vapour are produced at the electrodes, and the sulphur combines with the carbon to form carbon bisulphide. The zinc vapour and carbon bisulphide are collected separately, the former being condensed, whilst the latter is conveyed to an engine where it is combined with oxygen in order to develop mechanical power which is used to drive an electric generator to supply current for the electrolysis.—A. S.

Amalgamating process [Electrical ——]. H. A. Thomas, Assignor to Dry Amalgamation Co., Chicago, Ill. U.S. Pat. 814,814, March 13, 1906.

A "thin continuous sheet or layer of pulverised ore" is fed through a body of insulated and electrostatically-charged mercury, whereby the precious metals are amalgamated and removed from the ore.—A. S.

Iron ore; Process of [electrically] smelting ——. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metall. Franç., Froges, Isère, France. U.S. Pat. 815,016, March 13, 1906.

The invention relates to a process of smelting iron ore by the aid of an electric current. Carbon is introduced at the base of the charge of ore in quantity sufficient to produce the chemical reactions necessary, and is protected from the action of the carbon dioxide generated during the smelting process. A mixture of carbon monoxide and carbon dioxide is formed, of gradually increasing

richness in carbon dioxide as the gases rise to the point at which the reduction of ore practically ceases. At this point oxygen is introduced, whereby the carbon monoxide is further oxidised, and the heating effect in the furnace increased.—A. S.

Iron ore ; Process for [electrically] smelting ——. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metall. Franç., Froges, Isère, France. U.S. Pat. 815,293, March 13, 1906.

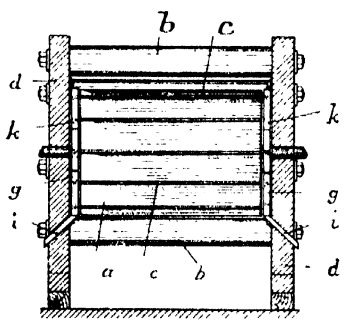
The invention relates to a process of electrically smelting iron ore. The ore is introduced at the top of the furnace, and means are provided for protecting the carbon from carbon dioxide generated during the smelting. The mixture of carbon monoxide and carbon dioxide produced, rises through the charge, and at a point above the level at which carbon monoxide is formed, nozzles are provided, through which oxygen is introduced in order to convert the carbon monoxide into carbon dioxide, and thus increase the heating effect in the furnace.—A. S.

Ore-separator ; Wet magnetic ——. F. J. Odling and W. Jamieson, Melbourne, Australia. U. S. Pat. 813,113, March 13, 1906.

The apparatus comprises a frame in which are mounted magnetic pole-pieces having V-shaped tips, and extending horizontally, but separated by an air-gap. A vibrating guiding-table or apron on to which a mixture of the ore and water is fed, extends through the air-gap between the poles, and an endless band of non-magnetic material travels longitudinally adjacent to the tip of the upper magnetic pole-piece. Means are provided for forming a film or coating of water on the travelling band. By the vibration of the table, the mixture of ore and water is caused to flow below the upper magnetic pole ; the magnetic particles are attracted by the latter and are retained by the "water web" produced by the co-operation of the film of water on the travelling band and the water mixed with the ore. This "water-web" carries the magnetic particles forward and delivers them at the side of the pole-pieces.—A. S.

French Patents.

Ores ; Electro-magnetic separator of ——. W. Wurmbach. Fr. Pat. 350,423, Dec. 24, 1904.



This invention relates to an electro-magnetic separator in which the chambers of separation are separated from rotating magnets by intermediate non-magnetic walls, *g*. The magnetic system consists of a series of horizontal cores, *b*, which may be excited magnetically, and these are disposed around the chambers of separation, *k*, the poles of the same sign being united at their ends by vertical polar pieces, *d*. The latter are made in the form of segments extending over three-fourths of a circle, so that there is an opening in which the magnetic field is not produced. An armature, *a*, with radial conducting plates, *c*, turns within the poles, *d*, and cores, *b*, and the armature is provided with a coil for exciting the magnets. The non-magnetic particles fall and are delivered through *i*, while the magnetic particles are carried round and expelled through the openings of the polar pieces, *d*, where the magnetic field is broken.—B. N.

Zinc and its alloys ; New process for electro deposition of ——. Dr. G. Langbein and Co. Fr. Pat. 358,622, Oct. 18, 1905.

The process of electro-deposition of zinc upon metallic objects is improved by the addition of urea to the bath. Double salts which are readily soluble are formed, and a high current density can be maintained without resulting in the production of a spongy deposit.—R. S. H.

Metallisation of articles of celluloid, horn, &c. ; [Electrical] Process of ——. L. Schwob and G. Hébert-Dilette. Fr. Pat. 359,001, Oct. 30, 1905.

This invention relates to a process of gilding or nickel-plating articles of celluloid, horn, &c., by plunging them into a bath of silver for about 1½ hours, the bath being made up as follows : 50 grms. of "Seignet salt" ("potassium tartrate") are dissolved in a litre of water ; 100 grms. of silver nitrate are dissolved in 55 grms. of ammonia, and added to 1 litre of water ; 50 grms. of each solution are added to 1 litre of water. The articles coated with silver are then placed in an ordinary gold or nickel-plating bath, and a current of electricity passed to deposit the metal.—B. N.

Furnace ; Electric ——, *for the reduction of metals and alloys and particularly of aluminium, silicon, magnesium, chromium, &c.* E. Viel. Fr. Pat. 359,042, Oct. 31, 1905.

The oxides to be treated are intimately mixed with a calculated amount of carbon or other reducing agent and passed in small quantities, but continuously, by means of a screw propeller, between two horizontal or conveniently inclined and highly excited electrodes contained within a crucible lined with carbon, whereby the metal or alloy is reduced and liberated, and falls upon an inclined bed, whence it may be removed as required.—J. H. C.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 273.)

Manihot Glaziovii ; Fatty oil of the seeds of ——. G. Fendler and O. Kuhn. Ber. Dtsch. pharm. Ges., 1905, **15**, 426—429. Chem. Centr., 1906, **1**, 768—769.

One hundred of the seeds of Manihot Glaziovii weigh 53 grms., of which 39·5 grms. consist of shells or husks, and 13·5 grms. of kernels. The kernels contain 5·18 per cent. of water and 35·20 per cent. of substances soluble in ether ; and the husks, 6·66 per cent. and 1·31 per cent. respectively ; the whole seeds contain 9·94 per cent. of fat. The oil examined was prepared from the whole seeds by percolation with ether. It was greenish-yellow in colour, had an odour resembling that of olive oil, and a somewhat bitter, acrid taste. It was soluble in ether, chloroform, benzene, carbon bisulphide, acetone and amyl alcohol, insoluble in absolute alcohol and glacial acetic acid ; with petroleum ether it gave a turbid solution. The oil became turbid at 4° C., but was not solid at —17°C. It had the sp. gr. 0·9258 at 15° C. ; acid value, 2·18 ; saponification value, 188·6 ; Reichert-Meissl value, 0·7 ; iodine value, 137·0 ; unsaponifiable matter, 0·9 per cent. ; glycerol, 10·6 per cent. ; refractometer reading at 40° C., 62·9. The fatty acids consisted of 89·03 per cent. of liquid, and 10·97 per cent. of solid acids. They had the following characters : Sp. gr. at 25° C. ; 0·8984 ; m. pt., 23·5° C. ; solidifying pt., 20·5 ; acid value, 197·6 ; saponification value, 200·1 ; mean molecular weight, 280·7 ; acetyl-acid value, 179·9 ; acetyl value, 20·7 ; iodine value, 143·1 ; iodine value of liquid fatty acids, 163·6 ; m. pt. of solid fatty acids, 54° C.—A. S.

Oleic acid series ; Some new acids of the ——. G. Ponzio. Gaz. chim. ital., 1906, **35**, 569—572.

From 100 grms. of stearic acid, 21 grms. of 2.3-oleic acid

(this J., 1904, 942), m. pt. 59° C., can be obtained. The latter acid, when allowed to stand for several days in contact with bromine, is converted into 2·3-dibromostearic acid, m. pt., 72° C. When heated in a sealed tube at 100° C. with hydrobromic acid in glacial acetic acid solution, β-bromostearic acid, m. pt. 54° C. is formed, which, on heating with alcoholic potassium hydroxide solution under an inverted condenser, yields β-hydroxystearic acid. $CH_3(CH_2)_{14}.CH(OH)CH_2.COOH$, m. pt. 89° C., moderately soluble in warm alcohol and chloroform, slightly soluble in petroleum ether and soluble in ether.

The 2.3-dihydroxystearic acid,

$$CH_3(CH_2)_{14}.CH(OH).CH(OH).COOH,$$

obtained by oxidising 2.3-oleic acid in dilute potassium hydroxide solution with the theoretical quantity of a 1 per cent. solution of potassium permanganate at 0° C., crystallises from ethyl acetate in prisms, m. pt. 126° C., soluble in most organic solvents, and also to some extent in warm water. On oxidising 2.3-oleic acid with twice the quantity of potassium permanganate mentioned above, and without cooling, palmitic acid is produced. (Compare this J., 1888, 442.)—A. S.

Chlorine gas; Use of —— under moderate pressures in the chemical arts. [*Chlorine-proof oil*]. E. A. Asheroft. VII., page 314.

Cocoa-nut fat in butter; Process for the detection of ——. H. P. Wijsman and J. J. Reijst. Z. Unters. Nahr. Genussm., 1906, **11**, 267–271.

THE authors propose a simple method for the detection of cocoa-nut fat in butter, based on Jensen's work as to the precipitation of certain of the volatile fatty acids by silver nitrate solution (this J., 1905, 1025). The sample of butter-fat is treated according to the usual method for the determination of the Reichert-Meissl value, and to the 110 c.c. of distillate, 40 c.c. of N/10-silver nitrate solution are added. After filtering, and washing the precipitate, the excess of silver nitrate is titrated with N/10-sodium chloride solution. The number of c.c. of N/10-silver nitrate solution used up in precipitating some of the volatile acids, is increased by one-tenth (correction for solubility of the silver salts) and is called the first "silver value." A second determination is then carried out in an exactly similar manner, except that 300 c.c. of distillate are collected, water being added to the distilling flask as required. The number of c.c. of N/10-silver nitrate used in this case, when increased by one-fifth, gives the second "silver value." In the case of mixtures containing cocoa-nut fat, the 110 c.c. of distillate in the first determination is not sufficient to hold the whole of the caprylic acid in solution, and some of the latter, therefore, escapes precipitation by the silver nitrate, whereas, in the second determination, the whole of the caprylic acid will be dissolved in the 300 c.c. of distillate, and a higher "silver value" will be obtained. In the case of pure butter-fat, on the other hand, less caprylic acid is present, and the "silver value" will be the same in the second determination as in the first, or even somewhat smaller, owing to the solubility of the silver precipitate in the larger volume of distillate. It was found that even with only 5 per cent. of cocoa-nut fat in a sample of butter, the second "silver value" was higher than the first, whilst in the case of pure butters, even two with abnormal Reichert-Meissl values, the second "silver value" was the same as or lower than the first.—A. S.

Fats; A reagent in the chemistry of ——. [*Naphthalene-stearosulphonic acid*]. F. Twitchell. J. Amer. Chem. Soc., 1906, **28**, 196—200.

THIS acid, the preparation of which has been described previously (this J., 1900, 254), may be used for the separation of stearic and palmitic acids from oleic and linolic acids in tallow and other fats. When a melted mass of mixed fatty acids is treated with a little naphthalene-stearosulphonic acid, the liquid fatty acids present, become slightly soluble, and by simply treating with water can be washed out of the mixture, partly in solution, but mainly as emulsion. Five grms. of the mixed fatty acids are treated with about 1 c.c. of a 10 per cent. aqueous solution of naphthalene-stearosulphonic acid and a little dilute sulphuric acid (containing about 1·25 per cent. of sulphuric acid). After thoroughly mixing the mass, a further 20 or 30 c.c. of the dilute acid are added and the mixture allowed to settle. The whole is then filtered, an oily layer rising to the surface being first brought on to the filter. The solid portion is washed with the sulphuric acid until the filtrate is no longer turbid. From 80 to 90 per cent. of the liquid fatty acids will have been removed by this treatment, and the remainder may be separated by repeating the process once or twice. The crystalline mass on the filter is finally washed with water and dried. It is important that the right quantity of sulphuric acid be used and the temperature during the separation should be a little above the melting point of oleic acid.

Naphthalene-stearosulphonic acid possesses catalytic properties and has the power of hydrolysing fats. Other fatty sulphonic acids, with the exception of stearosulphuric acid, also act as catalytic agents. The action of these sulphonic acids may be explained as follows:—They are soluble in water and their aqueous solutions dissolve fatty bodies, acting like soap solutions. At the same time they are acids which are electrolytically dissociated to a high degree, and the hydrogen ions set free, cause the hydrolysis of the portion of the fat dissolved.—W. P. S.

Linoleic Acid. U.S. Customs Decision, Feb. 20, 1906

LINOLEIC acid was held to be dutiable at 25 per cent. *ad valorem* under paragraph 1 of the tariff, as an "acid not specially provided for." The analysis showed the sample to be composed of 14·73 per cent. of linseed oil, and 85·27 per cent. of linoleic acid. The assessment of duty at 20 c. per gall. of 7½ lb. as "linseed oil" under paragraph 37 was overruled. [T.R.] R. W. M.

ENGLISH PATENTS.

Wool lubricant; A ——, soluble in water. J. W. Riep and G. H. Bauer. Eng. Pat. 7231, April 5, 1905. V., page 310.

Oils and fats; Apparatus for heating ——. F. P. y Garcia, Madrid. Eng. Pat. 12,784, June 20, 1905.

CLAIM is made for an apparatus for heating oil or fat by means of the heat produced by a chemical reaction. The apparatus, intended for use with a solid substance termed "Sosca" (a mixture of lime and sodium carbonate), consists of two cylinders the inner of which is perforated all over. The "Sosca" is placed in this vessel and is treated with water introduced from a separate chamber. There is also a lid in the form of a funnel screwed on to the top of the receptacle to carry off the vapours produced in the reaction. When the apparatus is charged, it is introduced into the vat containing the solidified fat.

— C. A. M.

Sewage and other similar sludges; Treatment of ——. [*Recovery of fatty substances*]. F. M. Spence, H. Spence, and P. Spence and Sons, Ltd., and R. Ockel. Eng. Pat. 8347, April 19, 1905. XVIII*B.*, page 333.

Soaps; Apparatus for the rapid cooling of fluid ——. R. W. James, London. From R. Roth, Mährisch-Ostrau, Austria. Eng. Pat. 3602, Feb. 21, 1905.

SEE Fr. Pat. 341,731 of 1904; this J., 1904,905.—T. F. B.

FRENCH PATENT.

Antiseptic soap; Manufacture of ——. M. Martens. Fr. Pat. 359,061, Nov. 2, 1905. XVIII*C.*, page 333.

GERMAN PATENT.

Disinfectant from chloronaphthalene and soap. L. Schwabe. Ger. Pat. 163,663, Oct. 13, 1903. XVIII*C.*, page 333.

richness in carbon dioxide as the gases rise to the point at which the reduction of ore practically ceases. At this point oxygen is introduced, whereby the carbon monoxide is further oxidised, and the heating effect in the furnace increased.—A. S.

Iron ore ; Process for [electrically] smelting ——. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metall. Franç., Froges, Isère, France. U.S. Pat. 815,293, March 13, 1906.

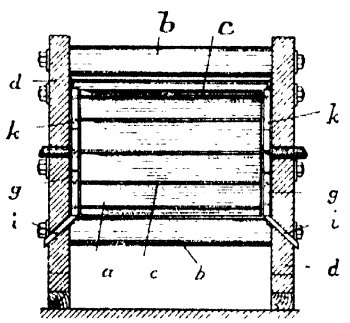
The invention relates to a process of electrically smelting iron ore. The ore is introduced at the top of the furnace, and means are provided for protecting the carbon from carbon dioxide generated during the smelting. The mixture of carbon monoxide and carbon dioxide produced, rises through the charge, and at a point above the level at which carbon monoxide is formed, nozzles are provided, through which oxygen is introduced in order to convert the carbon monoxide into carbon dioxide, and thus increase the heating effect in the furnace.—A. S.

Ore-separator ; Wet magnetic ——. F. J. Odling and W. Jamieson, Melbourne, Australia. U. S. Pat. 813,113, March 13, 1906.

The apparatus comprises a frame in which are mounted magnetic pole-pieces having V-shaped tips, and extending horizontally, but separated by an air-gap. A vibrating guiding-table or apron on to which a mixture of the ore and water is fed, extends through the air-gap between the poles, and an endless band of non-magnetic material travels longitudinally adjacent to the tip of the upper magnetic pole-piece. Means are provided for forming a film or coating of water on the travelling band. By the vibration of the table, the mixture of ore and water is caused to flow below the upper magnetic pole ; the magnetic particles are attracted by the latter and are retained by the "water web" produced by the co-operation of the film of water on the travelling band and the water mixed with the ore. This "water-web" carries the magnetic particles forward and delivers them at the side of the pole-pieces.—A. S.

French Patents.

Ores ; Electro-magnetic separator of ——. W. Wurmbach. Fr. Pat. 350,423, Dec. 24, 1904.



This invention relates to an electro-magnetic separator in which the chambers of separation are separated from rotating magnets by intermediate non-magnetic walls, *g*. The magnetic system consists of a series of horizontal cores, *b*, which may be excited magnetically, and these are disposed around the chambers of separation, *k*, the poles of the same sign being united at their ends by vertical polar pieces, *d*. The latter are made in the form of segments extending over three-fourths of a circle, so that there is an opening in which the magnetic field is not produced. An armature, *a*, with radial conducting plates, *c*, turns within the poles, *d*, and cores, *b*, and the armature is provided with a coil for exciting the magnets. The non-magnetic particles fall and are delivered through *i*, while the magnetic particles are carried round and expelled through the openings of the polar pieces, *d*, where the magnetic field is broken.—B. N.

Zinc and its alloys ; New process for electro deposition of ——. Dr. G. Langbein and Co. Fr. Pat. 358,622, Oct. 18, 1905.

The process of electro-deposition of zinc upon metallic objects is improved by the addition of urea to the bath. Double salts which are readily soluble are formed, and a high current density can be maintained without resulting in the production of a spongy deposit.—R. S. H.

Metallisation of articles of celluloid, horn, &c. ; [Electrical] Process of ——. L. Schwob and G. Hébert-Dilette. Fr. Pat. 359,001, Oct. 30, 1905.

This invention relates to a process of gilding or nickel-plating articles of celluloid, horn, &c., by plunging them into a bath of silver for about 1½ hours, the bath being made up as follows : 50 grms. of "Seignet salt" ("potassium tartrate") are dissolved in a litre of water ; 100 grms. of silver nitrate are dissolved in 55 grms. of ammonia, and added to 1 litre of water ; 50 grms. of each solution are added to 1 litre of water. The articles coated with silver are then placed in an ordinary gold or nickel-plating bath, and a current of electricity passed to deposit the metal.—B. N.

Furnace ; Electric ——, *for the reduction of metals and alloys and particularly of aluminium, silicon, magnesium, chromium, &c.* E. Viel. Fr. Pat. 359,042, Oct. 31, 1905.

The oxides to be treated are intimately mixed with a calculated amount of carbon or other reducing agent and passed in small quantities, but continuously, by means of a screw propeller, between two horizontal or conveniently inclined and highly excited electrodes contained within a crucible lined with carbon, whereby the metal or alloy is reduced and liberated, and falls upon an inclined bed, whence it may be removed as required.—J. H. C.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 273.)

Manihot Glaziovii ; Fatty oil of the seeds of ——. G. Fendler and O. Kuhn. Ber. Dtsch. pharm. Ges., 1905, **15**, 426—429. Chem. Centr., 1906, **1**, 768—769.

One hundred of the seeds of Manihot Glaziovii weigh 53 grms., of which 39·5 grms. consist of shells or husks, and 13·5 grms. of kernels. The kernels contain 5·18 per cent. of water and 35·20 per cent. of substances soluble in ether ; and the husks, 6·66 per cent. and 1·31 per cent. respectively ; the whole seeds contain 9·94 per cent. of fat. The oil examined was prepared from the whole seeds by percolation with ether. It was greenish-yellow in colour, had an odour resembling that of olive oil, and a somewhat bitter, acrid taste. It was soluble in ether, chloroform, benzene, carbon bisulphide, acetone and amyl alcohol, insoluble in absolute alcohol and glacial acetic acid ; with petroleum ether it gave a turbid solution. The oil became turbid at 4° C., but was not solid at —17°C. It had the sp. gr. 0·9258 at 15° C. ; acid value, 2·18 ; saponification value, 188·6 ; Reichert-Meissl value, 0·7 ; iodine value, 137·0 ; unsaponifiable matter, 0·9 per cent. ; glycerol, 10·6 per cent. ; refractometer reading at 40° C., 62·9. The fatty acids consisted of 89·03 per cent. of liquid, and 10·97 per cent. of solid acids. They had the following characters : Sp. gr. at 25° C. ; 0·8984 ; m. pt., 23·5° C. ; solidifying pt., 20·5 ; acid value, 197·6 ; saponification value, 200·1 ; mean molecular weight, 280·7 ; acetyl-acid value, 179·9 ; acetyl value, 20·7 ; iodine value, 143·1 ; iodine value of liquid fatty acids, 163·6 ; m. pt. of solid fatty acids, 54° C.—A. S.

Oleic acid series ; Some new acids of the ——. G. Ponzio. Gaz. chim. ital., 1906, **35**, 569—572.

From 100 grms. of stearic acid, 21 grms. of 2.3-oleic acid

(*B.*)—RESINS, VARNISHES.

Fir Balsam. U.S. Customs Decision, Feb. 27, 1906.

Fir or Canada balsam which has been strained to eliminate pieces of wood and bark, is free of duty as a "crude balsam," under paragraph 548 of the tariff. The assessment of duty at ¼ cent per lb. and 10 per cent. *ad valorem*, as a "drug advanced in value," under paragraph 20, was overruled on the ground that the straining was only to fit the drug for the usual market condition.

[T.R.] R. W. M.

English Patent.

Lacquers, varnishes, waterproofing and impregnating media; Solutions of organic compounds suitable as ——, and for the manufacture of films, filaments and insulating materials. L. Lederer, Sulzbach, Bavaria. Eng. Pat. 6751, March 30, 1905.

See Fr. Pat. 352,897 of 1905; this J., 1905, 978.—T. F. B.

(*C.*)—INDIA-RUBBER, Etc.

Quebrachite; Presence of —— in the latex of Hevea brasiliensis. A. W. K. de Jong. Rec. trav. chim. Pays-Bas, 1905, **25**, 48—49. Chem. Centr., 1906, **1**, 818.

The alcoholic solution obtained on coagulating the latex of *Hevea brasiliensis*, when evaporated on the water-bath, yields crystals of quebrachite, $C_6H_{11}O_5.OCH_3$, m. pt. 190°—191° C., easily soluble in alcohol, acetone and ether; $[\alpha]_D^{28°} = -80{\cdot}2°$. Quebrachite is a sugar which was first isolated from quebracho bark (*Aspidosperma quebracho*) by Tanret (this J., 1890, 202).—A. S.

India-rubber; Influence of chalk and of moisture on the vulcanisation of ——. R. Ditmar. Gummi-Zeit., 1905, **20**, 579—580.

Guayule rubber was vulcanised with 10 per cent. of sulphur and varying percentages of chalk for 50 minutes at 145° C., and the products tested mechanically. In one series of experiments all the materials were carefully dried, in a second series the rubber was allowed to retain its natural moisture, amounting to 14·5 per cent. In either case the breaking strength increased with the amount of chalk, up to 40 per cent. incorporated; the extensibility showed a maximum at about 16 per cent of chalk in the experiments with dry rubber, whilst in those with moist rubber a maximum occurred at about 12 per cent., and another at about 24 per cent. It is proved experimentally that the chalk goes into perfect colloidal combination with the rubber and does not react with the sulphur. On vulcanisation with low percentages of chalk, the products are very porous, owing to the escape of steam; from this the author concludes that chalk acts as a binder of moisture in the process of vulcanisation.—W. A. C.

United States Patent.

Rubber; Method of extraction of pure raw — — from rubber plants. K. von Stechow, Wiesbaden, Germany. U.S. Pat. 814,407, March 6, 1906.

See Addition of July 10, 1905, to Fr. Pat. 355,611 of 1905; this J., 1905, 1014.—T. F. B.

French Patent.

Rubber; Process of devulcanising ——. M. Körner. Fr. Pat. 358,635, Oct. 18, 1905.

The rubber is heated for a considerable time at a high temperature (130°—150° C.) with benzene or other solvent, in presence of water or steam. In a modification of the process the extract obtained by heating with the solvent is heated along with water or steam, preferably under pressure.—C. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 275.)

Lime spots in vegetable-tanned coloured leather. W. Eitner. Gerber, 1906, **32**, 78—79.

The author has often been troubled, in the dyeing of kips, with the appearance of spots upon the grain. The cause appears to be due to the use of hard water. A similar defect is often met with in the case of glacé leather. In the latter leather the cause is that the free sulphuric acid of the alum, not having been washed out, acts on the lime from the hard water to form calcium sulphate, which is precipitated in the grain of the leather, thus preventing the dyestuff from penetrating readily. In the case of vegetable-tanned leather, the spots are formed in the "scudding process," by the calcareous water used, but they are not easily seen until the finished article is produced. Such lime deposits, which are unevenly distributed, are very difficult to remove, even by severe mechanical treatment.

For their removal an acid de-liming agent should be used, so as to convert the lime into a soluble form. The following acids are employed to this end:—Hydrochloric, lactic, acetic, and formic acids.

To remove lime stains from vegetable-tanned goods before dyeing, wash the tanned goods till soft, and then place in a bath of 2 per cent. hydrochloric acid and move for two hours. After this process the goods are to be well washed with water in the drum, and are then ready for dyeing.—H. Bn.

Lactic acid [Commercial]; Analysis of ——. M. Philip. XXIII., page 339.

Nutgall extract. U.S. Customs Decision.

The United States Circuit Court of Appeals, Jan. 25, 1906, decided that extract of nutgalls is not dutiable under paragraph 1 of the tariff, either directly or by similitude, as "tannin or tannic acid" at 50 c. per lb. This decision affirms one of the United States Circuit Court and reverses that of the Board of General Appraisers, whose latest decision held to the duty under paragraph 1. A previous decision of the Board made nutgall extract dutiable at ¼ c. per lb., and 10 per cent. *ad valorem*, as "nutgalls advanced in value or condition," under paragraph 20. The Court points to an unbroken line of Treasury Decisions for 26 years on nutgall extract, none of which considered the assessment of duty as "tannin," though tannin was especially named in all the tariff laws covering this period. The Treasury Department, Feb. 24, 1906, acquiesced in this decision on the advice of the Attorney-General, and directed the assessment of duty at ¼ c. per lb., and 10 per cent. *ad valorem*, under paragraph 20, as "nutgalls advanced in value or condition."

[T.R.] R. W. M.

English Patents.

Skins or hides; Process and apparatus for extracting grease and oil from ——. H. Brewer and J. T. Hardy, Bulwell, Notts. Eng. Pat. 10,437, May 18, 1905.

The wet skins, after liming and salting, are placed in heaps to press the superfluous moisture from them. They are then placed in a rotating drum or tumbler and subjected to the action of deodorised petroleum or other grease solvent and afterwards to the action of warm salt water to wash away the petroleum, grease, &c. The revolving drum has the shape of a double cone and is mounted on hollow spindles. One of the latter enters directly into the drum, whilst the other is closed to the interior of the drum except through a pipe which enters the middle or widest part of the vessel. This pipe is closed by a valve, which, when opened, allows the solvent to pass out of the drum into a collecting vat. The spindle opening into the drum allows the final salt wash to be injected. The drum is provided with a reversing gear, and is fitted with suitable openings. The treatment of the skins takes about four hours or longer.—W. P. S.

Hides; Process of treating ——. F. J. Oakes, New York. Eng. Pat. 24,487, Nov. 27, 1905. Under Int. Conv., Dec. 12, 1904.

See U.S. Pat. 798,293 of 1905: this J., 1905, 1023.—T.F.B.

Hides; Process of treating ——. F. J. Oakes, New York. Eng. Pat. 3516, Feb. 13, 1906. Under Int. Conv., March 31, 1905.

See U.S. Pat. 798,294 of 1905; this J., 1905, 1023.—T.F.B.

Plastic transparent product [from casein] for the manufacture of fibres, films, blocks or plates, and process of preparing the same. H. Cathelineau and A. Fleury, Paris. Eng. Pats. 12,277 and 12,278, June 13, 1905.

See Fr. Pat. 354,942 of 1905, and addition thereto; this J., 1905, 1169, 1226.—T. F. B.

French Patents.

Tanning and colouring materials; Automatic extractor for ——. L. F. Jury. Fr. Pat. 358,783, Oct. 7, 1905.

The material to be extracted is placed in a cylindrical vessel provided with suitable openings, a water-gauge, &c., and is there subjected to the action of water or of a weak extract resulting from a previous operation. The concentrated extract is pumped up to a receiver, and, when this is full, a ball-float diverts the current to a second receiver, where the subsequent weaker extracts are collected. The first receiver is divided into two similar compartments, so that they can be used alternately, and the second receiver into a number of compartments, each provided with a ball-float, which, when the compartment is full, causes the stream of liquid to be delivered into the next one, and so on. As the ball-floats rise they open valves at the bottom of the compartments and allow the weak extract to flow through the vessel containing the material. The liquid is heated on its way to the vessel by passing through a condenser into which the steam, arising from a concentrating apparatus, is conducted. The extract from the first receiver is further evaporated in this concentrator, in order to obtain a syrupy or dry product.—W. P. S.

Chrome leather; Process for waterproofing ——. A. Flöring and M. Lenneberg. Fr. Pat. 358,894, Oct. 27, 1905.

The dry leather is immersed for one hour in a bath of melted paraffin or ceresin containing from 5 to 30 per cent. of colophony, carnauba wax, beeswax, Japan wax or the like.—W P. S.

Leather; Process for the manufacture of artificial ——. J. B. Granjon and J. F. J. Berchet. Second Addition, dated Oct. 14, 1905, to Fr. Pat. 343,704, June 4, 1904 (this J., 1904, 1036).

If the leather be intended for use as machinery belts, the cardboard sheets described in the original patent are replaced by strips of strong canvas. Metallic threads or wires are placed between the strips, and to avoid fraying at the edges, the canvas may be made in the form of a tube (like a fire-hose) before treating with the asphalt, &c. It is finally rolled flat while still hot.—W. P. S.

Glue; Process for making ——. W. S. Sadikoff. Fr. Pat. 358,859, Oct. 25, 1905.

Fat and mineral matters are removed from the substances from which the glue is to be made, and the mass then treated with dilute sodium hydroxide solution (from 1 to 3 per cent. in strength). The still alkaline mass is now boiled for 10 minutes with a 1 per cent. aqueous solution of monochloracetic acid, filtered, and the glue precipitated from the solution by means of magnesium sulphate. The glue is finally washed with cold water as usual.
—W. P. S.

Metallisation of articles of celluloid, horn, &c.; [Electrical] Process of ——. L. Schwob and G. Hébert-Dilette. Fr. Pat. 359,001, Oct. 30, 1905. XIB., page 323.

Casein and similar substances; Conversion of ——, *into plastic products.* L. Collardon. Fr. Pat. 359,073, Nov. 2, 1905.

The casein is mixed with a 20 per cent. solution of viscose (in a suitable solvent) at a temperature of 60° C. Substances which harden the casein and decompose the viscose may be added during the operation. In place of viscose, other cellulose compounds may be employed.—W. P. S.

XV.—MANURES, Etc.

(*Continued from page 275.*)

Nitre; Analysis of ——. R. Bensemann. XXIII., page 337.

English Patents.

Fertilisers; Manufacture of —— *and apparatus therefor.* J. Crone, D. C. Taylor, and F. Williams, St. Helens, Lancs. Eng. Pat. 5618, March 17, 1905.

Waste animal substances, such as shoddy, hide and leather scraps, and the like, are delivered in a moist state, into a horizontal cylindrical vessel, adapted to be rotated on hollow trunnions, and enclosed within a chamber of refractory material, heated by a series of grates and flues. The trunnions are connected with fixed end boxes, having removable doors, through which the charge is introduced. A perforated pipe, supplying sulphuric acid of about 115° T., is led into the cylinder through the end boxes, and as far from the axis of rotation as convenient, so that the acid is sprayed evenly over the contents of the vessel as the latter rotates. Shoddy supplied to the apparatus should contain at least 40 per cent. of water. An exhausting fan is connected to the boxes, and delivers into a gas condensing tower. Pits are provided to receive the material when it it discharged. (Reference is made to Eng. Pat. 6101 of 1904, this J., 1905, 203.)—E. S.

Peat; Apparatus for treating ——, *particularly for making manure.* C. H. J. van Haeften, The Hague. Eng. Pat. 10,023, May 12, 1905.

Rapid disintegration of peat is effected by treating it with water containing ammonia, which also brings into solution constituents insoluble in water alone. The apparatus claimed for this process comprises a battery of closed vessels, in which the peat is lixiviated, reservoirs for water and for ammonia solution, with means for heating or cooling, and an air-pump which draws air through the reservoirs and the battery. The ammonia is drawn forward with the air, and when the water is saturated, the ammonia may be returned to its own reservoir by reversing the current.—C. A. M.

Yeast [Fodder or fertiliser]; Treating —— *to render it suitable for commercial purposes.* F. Gothard. Eng. Pat. 13,834, July 5, 1905. XVII., page 331.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page 277.*)

Diffusion waste-waters [beetroots]; Return of the —— *to the battery.* H. Claassen. Z. Ver. deut. Zuckerind., 1906, 260—278.

The author describes the advantages derived from working a diffusion battery by returning all the weak draining and pressing waters, usually run to waste, these waters taking the place of a corresponding quantity of fresh water in working the battery. By this means, the question of disposing of these waters, which are liable to become noxious, is removed, and a greater or smaller quantity of sugar can be left in the pressed slices according to fluctuations in the value of the sugar for fodder, or for recovery. These waters are not allowed to remain outside the battery for more than a few minutes, and are pumped back into the next diffuser, together with the necessary quantity of fresh water before they have had

time to cool. With rational working and with the extraction of the same amount of sugar as in the old process, it was found that the purity of the juice was slightly increased by the new process, because fresh water dissolves more non-sugar than the waste-waters. Thus the pressed slices not only contain all the extractive substances previously lost in the waste waters, but also a greater quantity of non-sugar. An advantage is only obtained by the new process if the whole of the waste waters be returned to the battery, and these wastes, *viz.*, drainage waters and press waters, should be mixed together and not passed in separately, according to the quantity of sugar present in the different fractions. If the temperature of the waste waters be maintained at the necessary high degree (75° C.), no deleterious changes need be feared in them. Lastly, if irregularities in extraction occur owing to abnormal beets or faulty supervision, no absolute loss can take place as in the old system, there is merely an alteration in the distribution of the sugar between the diffusion juice and the pressed fodder slices.—J. F. B.

Carbohydrates and organic acids and bases; Solubility and specific rotatory power of some —— in pyridine and other solvents. J. G. Holty. J. Physical Chem., 1905, **9**, 764—779. Chem. Centr., 1906, **1**, 917.

The solubility in pyridine at 26° C. of the substances examined is given in the following table:—

Substance.	Grms. in 100 parts of solution.	Substance.	Grms. in 100 parts of solution.
Levulose	18·49	Erythritol	2·50
Malonic acid	14·60	Lactose	2·18
Dextrose	7·62	Strychnine	1·23
Sucrose	6·45	Mannitol	0·47
Galactose	5·45	Propyl tartrate .	Soluble in all proportions.

The rotatory powers of the different solutions were compared with those of aqueous solutions of equal concentration. In the case of sucrose, dextrose, levulose and galactose, the specific rotation was greater in pyridine than in aqueous solution; with the other substances examined, the reverse was the case. The rotatory power of solutions of sucrose in pyridine was altered considerably by addition of benzene, carbon bisulphide, acetone, nitrobenzene or chloroform.—A. S.

Hydrazones and osazones of some α-diketones and reducing sugars; Thermochemistry of the ——. P. Landrieu. Comptes rend., 1906, **142**, 580—582.

The heats of combustion and of formation of the phenylhydrazones and phenylosazones derived from diacetyl, benzil, benzoin, and from the seven commoner reducing sugars, are given in tabular form, in addition to the heat disengaged in the preparation of these compounds from the corresponding diketones and sugars.—E. F. A.

Cane juice; Fermentation of ——. F. Watts and H. A. Tempany. XVII., page 329.

Cane molasses distillery; Chemical control of a ——. J. S. Gongora. XVII., page 330.

Levulose; Detection of —— in the presence of dextrose and dextrosamine. C. Neuberg. XXIII., page 338.

Quebrachite; Presence of —— in the latex of Hevea brasiliensis. A. W. K. de Jong. XIIIC., page 326.

Sugar production of Germany. Bd. of Trade J., March 22, 1906.

According to statistics published in the "Reichsanzeiger," the quantity of raw sugar produced in Germany during the period from 1st Sept., 1905, to Feb. 28 last, being the first six months of the 1905-6 sugar campaign, was 2,068,211 metric tons, as compared with 1,333,279 metric tons during the corresponding months of 1904-5. The quantity of refined sugar produced increased from 786,043 metric tons during the six months September, 1904, to February, 1905, to 903,019 metric tons during the six months September, 1905, to February, 1906. The total quantity of beets used during the first half of the present campaign was 15,726,425 metric tons, as compared with 10,071,211 metric tons during the corresponding months of 1904-5.

The total output of sugar (raw and refined) during the period September, 1905, to February, 1906, expressed in terms of raw sugar, was 2,295,349 metric tons, as compared with 1,510,461 metric tons in the corresponding months of 1904-5. [T.R.]

English Patent.

Lixiviating and washing sugar and other substances; Apparatus for ——. A. Hinze, Rositz, Germany. Eng. Pat. 5663, March 17, 1905.

See U.S. Pat. 793,133 of 1905; this J., 1905, 835.—T. F. B.

United States Patent

Carbonating apparatus for liquids. P. C. Haan, New Brunswick, N.J., Assignor to J. D. Pickard, East Orange, N.J. U.S. Pat. 813,883, Feb. 27, 1906.

The apparatus consists of a containing tank for the liquid and gas under pressure, and is provided with a float for governing the inlet of liquid, this float carrying a nozzle which sprays the liquid upwards through an atmosphere of compressed gas. The inlet for distributing and diffusing the gas comprises a vertical perforated spiral coil with spiral deflecting plates attached thereto; above the coil is placed a casing containing a series of corrugated deflecting plates surmounted by a stratum of porous material, to cause the union of liquid and gas held in the containing tank, by bringing them into intimate contact under pressure.—J. F. B.

French Patent.

Seaweed; Treatment of —— for the extraction of mineral and organic chemical substances. Mme. Laureau *née* J. H. Laureau. Third Addition, dated Oct. 14, 1905, to Fr. Pat. 352,069, March 6, 1905. VII., page 315.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 278.)

Barley; Relation between protein contents and condition of endosperm of ——, also method of testing barley. E. Jalowetz. Allg. Z. Bierbrau. u. Malzfab., 1906, **41**; Woch. f. Brau., 1906, **23**, 126—127.

The author proposes a new method for ascertaining rapidly whether a barley is rich or poor in protein according to the steeliness or mellowness of the endosperm. The barley is covered with a 40 per cent. solution of formaldehyde in a long-necked flask, nearly closed with a cork. The flask is heated in a boiling water-bath for 30 minutes; the grain is washed three or four times with cold water, pressed between blotting paper, and at once tested with the usual grain cutter. In all cases the cut surface possesses a gummy edge, inside which the section may show either a very strikingly chalky surface or a pronounced steely appearance. Between these two extremes, two or three intermediate conditions may be recognised, even by an inexperienced observer. The formaldehyde combines with the albuminoids of the grain, and the compound thus formed so influences the course of the reaction that the corns, rich in nitrogen, remain steely, whilst those poor in nitrogen are modified by the treatment and become mealy. This test distinctly reveals the fact, previously ascertained by analysis, that the corns in the lower part of the ear are less rich in nitrogen than those of the upper part of the same ear. It also eliminates the difficulty of distinguishing between "apparent" steeliness, which is harmless, and the permanent steeliness which is accom-

panied by a high protein content. The author has found in one case that the mealy corns contained 1·16 per cent. of nitrogen; the half-steely corns, 1·59 per cent.; and the steely corns, 1·70 per cent. If all the corns in a sample are mealy or almost mealy, the percentage of protein lies within the prescribed limits for a brewing barley; if all the corns are steely or half-steely, the barley is rich in protein. Mixed results indicate that the barley is not uniform as regards the protein contents, and is a mixture of two types, an observation which could not be made by a determination of the nitrogen on the whole sample in the usual way.—J. F. B.

Barley with abnormally high protein content; Malting of ——. T. Hajek. Z. ges. Brauw., 1906, **29**, 171—172

THE author conducted malting experiments with an abnormal barley having the following composition:—Moisture, 12·9; extract on air-dry grain, 62·9; and protein, 17·27 per cent. This barley was indistinguishable by external observations from normal brewing barley containing 10—11 per cent. of protein. The barley was steeped for 93 hours, being left six hours without water on the second and third days and three hours on the fourth day. The couch was piled 10 ins. high and was spread over the whole floor on the second day to a depth of about 5 ins. Germination was conducted in the cool as far as possible and lasted eight days. In spite of a somewhat restricted steeping and all possible precautions for cool germination, the temperature on the floor rose to 22·5° C., showing that barleys rich in protein have a natural tendency to get hot on the floor. The malt was divided into two portions, one being kilned on the Munich system and the other as in the preparation of Pilsener malt at a low temperature.

The malt possessed a low extract value corresponding to the high protein content. The enzyme contents were also high, as was shown by the fact that even the Munich malt required only ten minutes for complete saccharification, and by the high ratio of maltose to total extract. The proportion of soluble albuminoids was high, higher in the pale malt than in the dark, owing either to the coagulation of albumin or the destruction of proteolytic enzymes at the higher temperature of curing. The colour of the wort from the pale malt corresponded to one of the Vienna type, whereas an ordinary barley treated in the same way should have given a paler wort of the Pilsener type. This illustrates the function of the albuminoids in contributing to the colouring matters of malt. The modification of both malts was very bad, and was such as to make them quite unsuitable for brewing purposes. The author considers that these experiments fully confirm the current views as to the difficulty of producing good malts from barleys which are rich in protein.—J. F. B.

Malt [Distilleries and yeast factories]; Temperature necessary for the destruction of injurious organisms on ——. W. Henneberg. Z. Spiritusind., 1906, **29**, 93—94.

THE really injurious organisms in a distillery are the "wild" lactic acid bacteria, whilst in a yeast factory the mycoderma yeasts are also harmful. These organisms cause a large increase of acidity in the main mash, bad attenuation, bad yield of yeast and instability and flocculation of the yeast. In cases where malt is used cold, after the saccharification, in order to prevent foaming fermentation, there is very great danger of infection by the organisms occurring on the malt, unless these are first destroyed at a moderate heat. This destruction can be effected without crippling the diastase by heating the mash at 55° C. for 15 minutes. The author has found that this treatment is sufficient to prevent the subsequent development of all the non-sporulating organisms, amongst which the above-mentioned injurious species are included. The temperatures required to kill the principal organisms present in distillery mashes are as follow:—Mycoderma yeasts are killed in five minutes at 60° C., or in one minute at 65° C.; distillery yeasts lose their power of reproduction at 58° C., and are killed in one minute at 68°—70° C.; the acetifying *B. Xylinum* is killed in one minute at 50° C.; the cultivated lactic acid bacterium, *B. Delbrücki*, is killed in five minutes at 65° C., and in one minute at 72·5° C.; the "wild" lactic acid bacteria are killed in one minute at 66° C. It is quite unnecessary, even with the worst malts, to employ high temperatures for preventing infection. The injurious organisms both in the yeast mash and the main mash are killed during saccharification, and a re-heating at the saccharification temperature of 62° C. for half an hour after acidification of the yeast mash is sufficient to ensure the absence of these organisms. A higher temperature will cripple the diastase without producing a more efficient sterilisation, since the spore-bearing bacteria can withstand even a temperature of 100° C for a considerable time.

The main difficulty in sterilising mashes in the above manner on an industrial scale lies in the difficulty of ensuring that all the organisms are submitted to the desired temperature. Particles of the mash get splashed on the walls and edges of the tuns, and the organisms on these parts escape the action of the heat and are washed back afterwards into the mash.—J. F. B.

Diastatic enzymes; Influence of certain alkaloids and their salts on the activity of ——. H. E. Goebel. Z. Spiritusind., 1906, **29**, 85.

THE author has tested the influence of various alkaloids on the velocity of conversion of starch by Taka-diastase. The majority of the free alkaloids either retarded the conversion of starch into maltose or left it unaffected. The salts of the alkaloids retarded the diastatic action at the ordinary temperature, but accelerated it at 50° C. It is remarked, however, that neither the alkaloids nor their salts cause any alteration of the enzyme itself. Certain alkaloids, such as morphine and the hydrochlorides of atropine and pilocarpine, had a slight accelerating influence on diastatic action. Caffeïne, codeïne, atropine, nicotine, quinine and the hydrochlorides of codeïne and caffeïne had a slight retarding influence. Quinine hydrochloride, strychnine and its hydrochloride, veratrine and morphine hydrochloride had no influence at all.—J. F. B.

Yeasts; Part played by cysts of Glœosporium in the origin of ——. P. Viala and P. Paccotet. Comptes rend., 1906, **142**, 518—520. (See this J., 1906, 277.)

THE cysts of some species of *Glœosporium* form under certain conditions endogenous spores, which in favourable nutrient media, when freed from the cysts, develop to a mycelium of filaments and short elements with buds. These cysts bear the same relationship to the ordinary form of the fungi as the sporulating yeasts do to the budding forms.—E. F. A.

Yeast culture; New method for pure ——. H. Wickman and H. Zikes. Mitt. Oesterr. Versuchss. und Akad. f. Brauind., 1905; J. Inst. Brewing, 1906, **12**, 163—164.

A FILM of gelatin is spread with a glass rod on a cover glass divided up into squares of 2 mm., and is allowed to solidify under a watch glass. The yeast is suspended in beer wort at a suitable dilution, and a drop of the liquid is taken up in a sterile capillary tube, which is then lightly touched on the surface of the gelatin so as to leave a trace of the liquid on each of the squares. The plate thus prepared is placed in a Böttcher's chamber or on a hollowed microscope slide, and is fixed by vaseline. If the dilution has been properly chosen, each drop should contain one cell which can grow on the gelatin surface, and the new cells all lie in one plane. The individual cells are found as easily as with Lindner's droplet culture method; the new cells after 24 hours can readily be counted; the colonies can easily be re-inoculated and the cultures are very lasting.—J. F. B.

Cane juice; Fermentation of ——. F. Watts and H. A. Tempany. West Ind. Bull., 1906, **6**, 387—393.

WHEN cane juice is allowed to ferment spontaneously, the liquid becomes markedly acid and assumes a yellow colour, whilst a dark scum rises to the surface, the juice being said to sour; pronounced alcoholic fermentation with vigorous evolution of carbon dioxide then sets in, resulting in the production of over 8 per cent. by volume of alcohol in the liquid and the

deposition of a sediment of yeast. Finally in course of time, with free access of air, acetification of the alcohol takes place in the ordinary manner, the colour of the liquid changes to a clear, dark red, and the so-called "cane vinegar" is produced. The authors have found that the preliminary acidification ("souring") of the juice takes place equally well in absence as in presence of air. The disappearance of sugar and, presumably, the formation of alcohol proceed much more rapidly when air is allowed free access to the juice than when it is excluded. A study of the acidification of sugar solutions by inoculation of the dark scum from cane juice led to the conclusion that the acid is produced by the oxidation of the sugar by bacterial action at the expense of oxygen derived from the sugar itself, but no corresponding reduction product of the sugar could be identified, though traces of a body crystallising in prismatic needles and which may be mannitol (Marcano, Comptes rend., **108**, 955; this J., 1889, 561) were always found on evaporation. The ratio of volatile acid to fixed acid produced during this preliminary acidification was about 1:2. The organism which produces this acidity forms a felt-like growth in saccharine media, consisting of long threads which break up after 48 hours into short rod-like bacterial forms. The addition of 2 per cent. of phenol to the juice inhibits the acidification of the sugar.—J. F. B.

Colour; Formation of —— by bacteria in saccharine nutrient media. A. Kossowicz. Zeits. landw. Versuchsw. in Osterreich, 1904, 404; Zeits. ges. Brauw., 1906, **29**, 166.

THE author has examined the coloration produced by various bacteria in a solution containing 3 per cent. of raffinose or sucrose, 0·25 of potassium dihydrogen phosphate, 0·005 of tricalcium phosphate, 0·25 of magnesium sulphate, 0·25 of diammonium phosphate, and 0·2 of ammonium chloride.

B. prodigiosum produces a lemon-yellow colouring matter which appears after two or three weeks, and goes into solution. Red colouring matters are formed by *B. lactorubefaciens* and *micrococcus agilis*. *B. synxanthum* produces a reddish-brown substance, the appearance and intensity of which depend, as is also the case with the colouring matters formed by yeasts, on the proportion of magnesium sulphate present. *B. fluorescens liquefaciens* produces a characteristic yellow fluorescent substance, whilst with *B. fluorescens putidus* a white deposit is formed. A yellow colour is also obtained with *B. fluorescens aureus* and *Sarcina liquefaciens*. *B. cyaneofuscus* forms a greyish-brown colouring matter, and *B. mesentericus fuscus* a pale-brown deposit appearing after from two to four weeks. *B. butyricus Hueppe* produces a pale yellow coloration after three or four weeks and develops butyric acid. After six or eight weeks, *B. coli commune* forms a distinctly yellow colouring matter. With the following bacteria pure white cultures are obtained, even after about four months growth:—*Spirillum Finkler-Prior, Streptococcus pyogenes, Micrococcus flavescens, Tyrothrix distorta, B. Freudenreichii, B. aerogenes, B. lactis aerogenes* and the bacterium of stable manure. The last three bacteria and also *B. synxanthum* ferment raffinose vigorously.—T. H. P.

Fermenting vessels of cement. A. Weber. Woch. Brau., 1906, **23**, 95.

THE author recommends the use of fermenting vessels of wired glass, the joints being made with pure cement, coated with "brewers' pitch" ("Bierlack") at frequent intervals of time. The cement is not affected in any way, even the small particles of cement adhering to the glass being unchanged either by the beer or by brushing. In large vessels the attenuation is from 0·2° to 0·3° greater than in smaller ones, but the taste of the beer is the same in the two cases. The use of large vessels, up to 180 hectol. capacity, is recommended on grounds of economy.

The lager vessels used by the author are constructed on the Monier system, the walls and bottom being of cement fitted internally with wired glass. These give very satisfactory results and effect great economy, since they require only half the cellar room, whilst the cooling plant may be diminished, and the pitching of the vessels omitted.—T. H. P.

Wines made from vines attacked by mildew; Chemical character of ——. E. Manceau. Comptes rend., 1906, **142**, 589—590.

WINE made from grapes attacked by mildew contains less alcohol, more total acidity and a higher proportion of nitrogenous organic matter, also more mineral constituents and less free tartaric acid than wine from the same vines treated with sulphur. Such wines have an abnormal chemical composition which gives them a peculiar flavour and renders them more liable to oxidation and attack by disease germs.—F. F. A.

Apple marc; Study of ——. W. D. Bigelow and H. C. Gore. J. Amer. Chem. Soc., 1906, **28**, 200—207.

APPLE marc, or the insoluble matter of the flesh of the apple, is composed mainly of parenchymous tissue and about 40 per cent. of it is rendered soluble by boiling with water. This water extract consists of one complex carbohydrate, a galacto-araban. The must of apples, when treated with several volumes of alcohol, invariably gives a gummy precipitate. This precipitate contains complex carbohydrates which are richer in galactan, relative to the pentosan content, than the hot water extract of apple marc. The same is true of the alcohol precipitate given by "second pressing" ciders. The treatment with boiling water decreases the yield of crude fibre and cellulose and at the same time gives a purer fibre and a purer cellulose.—W. P. S.

"Quick" vinegar process; Bacteriological investigations on the ——. W. Henneberg, Deut. Essigind, 1905, **9**, 393—395, 403—405, 410—412; Chem. Centr., 1906, **1**, 613—614.

BACTERIOLOGICAL examination of vinegar and beechwood shavings, taken directly from an acetifying chamber working normally, showed that the vinegar itself was almost free from bacteria, whereas the shavings contained enormous quantities of acetifying bacteria. The vinegar from a chamber which is working defectively is characterised by the presence of a relatively large quantity of bacteria. In a normal chamber the disposition of the acetifying bacteria in the fibres of the wood and their relatively great power of coherence prevent them being washed off by the vinegar which flows over the shavings. Plate cultures on unhopped wort-agar showed the presence in the vinegar of mycoderma yeasts, yeasts capable of developing fruity ethers and only a few bacteria. Cultures from scrapings from the beechwood shavings showed growths of hay bacilli, spherical bacteria and large quantities of mucus-forming acetifying bacteria. Samples from a defective chamber gave growths of infusoria, dematium, mycoderma yeasts and *B. xylinum*. Since even the normal chambers contain large quantities of organisms quite unconnected with the acetifying process, it is difficult to determine the condition of a chamber by bacteriological analysis of the vinegar, although the number of foreign organisms in a defective chamber is greater. It was not possible to conduct experiments with pure cultures; the author could only obtain cultures of groups of organisms, concentrated as regards acetifying bacteria, by cultivation under certain conditions of nutrition, acidity and temperature. Suitable media for this purpose are diluted beer wort, beer, grain mash and vinegar mash. *B. xylinum* was present in all the vinegar chambers examined and had no deleterious influence on the work of the chambers.

Experiments in the laboratory with "quick" vinegar bacteria concentrated by natural selection, showed that the acetifying process can be effected quite as well in the laboratory as in a properly prepared vinegar chamber, a vinegar containing 10—11 per cent. of acetic acid being obtained under favourable conditions.—J. F. B.

Cane molasses distillery; Chemical control of a ——. J. S. Gongora. Bull. Assoc. Chim. Sucr. et Dist., 1906, **23**, 884—891.

FOR controlling the work of the distillery the density and

the acidity of the wash in each tun should be determined before fermentation. After fermentation, determinations should be made of the proportion of alcohol in the fermented wash, the density of the residue after elimination of the alcohol by distillation, the proportion of unfermented reducing sugars and the acidity. Records should be kept of the volume and strength of the alcohol obtained in the distillery from each tun and the quantity of alcohol lost in the vinasses. The difference between the sum of these two values and the quantity of alcohol calculated from the analysis of the fermented wash corresponds to undetermined losses, any sudden rise in which indicates a leakage at some stage of the distillation. The initial gravity of the wash gives the weight of molasses taken into work. The difference between the initial gravity and the final gravity after elimination of the alcohol gives the quantity of sugar fermented; this value, added to the quantity of unfermented sugar, gives the total sugar submitted to fermentation. The quantity of alcohol in the fermented wash, calculated as per cent. of sugar fermented, gives an idea of the purity of fermentation. The proportion of unfermented sugar per cent. of the total sugar indicates the physiological condition of the yeast. When a rise of this ratio occurs under constant conditions of work, it points to degeneration of the yeast or inhibition due to the presence of traces of anti-fermentative substances or to deficiency of yeast nutrients. The difference between the acidity before and after fermentation in well-conducted work, should not exceed 0·2 grm. per litre, calculated as sulphuric acid. When this number increases, the yield of alcohol per cent. of sugar will decrease, and it will be necessary to cleanse and disinfect the tuns. The time required for the wash in each tun to ferment should be recorded, as an indication of the activity of the yeast.—J. F. B.

Spirit monopoly; Russian state ——. Bd. of Trade J., March 29, 1906.

The spirit monopoly has been extended gradually, and by the middle of 1904 its operations covered all the Provinces of European Russia (Finland excepted) and Siberia. Comparing the yield of the beer and spirit excise before the introduction of the monopoly with that of the beer excise and the spirit monopoly after the introduction of the latter, the results are as follows: Before introduction, 30·7 millions sterling; after introduction, 42 millions. Allowing for extra expenditure in connection with control, &c., the result shows an increased revenue of 9·83 millions. In 1904, the population of the districts served by the monopoly was 127 millions. There were 2,368 distilleries, 335 bottling establishments, 28,209 establishments for sale. The amount of spirits sold was 189 million galls., or less than 1½ galls. per head. There was a slight reduction of the consumption as compared with the preceding year, owing to the comparatively poorer harvest, and the diminished purchasing power of the population. The gross yield in 1904 was 57 million sterling, and the expenditure 16·7 million, giving a net yield of 40·3, or 683,000*l.* less than the preceding year. The expenses of production were nearly 400,000*l.* more than in 1903. The movable and real property possessed by the Crown in connection with the monopoly was valued at 10·7 millions sterling.

The returns are satisfactory to the Government exchequer, as the yields are nearly 10,000,000*l.* superior to those derived by the State from the spirit and beer excise before the introduction of the spirit monopoly. The net revenue has, however, fallen off as compared with that of the year preceding the returns now published, which relate to 1904. This is attributable to the inferior harvest of 1903, which diminished the purchasing power of the population, and also to increased cost of production. The introduction of the spirit monopoly resulted in increasing the Government revenues at the expense of the resources of the local administrations, and the increased profit of the State implies the withdrawal of funds from the local bodies, which were generally employed for purposes of local improvement and education. [T.R.]

English Patents.

Yeast [Fodder or fertiliser]; Treating —— to render it suitable for commercial purposes. F. Gothard, Burton-on-Trent. Eng. Pat. 13,834, July 5, 1905.

Fresh brewers' yeast is pulverised or granulated by rubbing through a series of fine screens, and is then mixed in a machine with some perfectly dry, water-absorbent material suited for the purpose to which the product is to be applied. Suitable materials are dried, such as spent hops or hop meal, malt dust, brewers' grains, oat bran, powdered chalk, garden soil or sawdust. The mixture is quickly passed into a sterilising vessel in which it is heated, with agitation, and is finally reduced to a condition in which it contains not more than 12 per cent. of moisture, the product being used either as a fodder or fertiliser.—J. F. B.

Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer; Impts. in ——. A. B. Lenflox and T. Mackenzie. Eng. Pat. 7962, April 14, 1905. XVIII*B.*, page 332.

United States Patent.

Distilled liquids; Process for ascertaining the origin of colouring matters present in ——. C. T. Marsh, Assignor to L. H. Weissleder. U.S. Pat. 813,728, Feb. 27, 1906. XXIII., page 338.

German Patent.

Mashes in fermentation industries; Material for use in facilitating the drawing-off of ——. D. Ernst. Ger. Pat. 163,801, Jan. 14, 1905.

In the manufacture of spirit and pressed yeast, malt germs, oat husks, chopped straw, chaff, &c., are added to the mashes to facilitate the drawing-off of the wort. The patentee claims the use of the threads (of the beard) of the maize-cob in place of the materials named.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 280.)

(*A.*)—FOODS.

Milk treated with hydrogen peroxide; Note on ——. P. Adam. J. Pharm. Chim., 1906, **23**, 273—277.

Fresh and unboiled milk which has not been treated with hydrogen peroxide gives, in the presence of hydrogen peroxide, a red coloration with guaiacol solution and a blue coloration with *p*-phenylenediamine, and decolorises the Methylene Blue of Schardinger's reagent (this J., 1905, 47). The same milk, previously treated with hydrogen peroxide, gives colorations with guaiacol and *p*-phenylenediamine, but does not change the colour of Schardinger's reagent. If this treated milk be kept until the hydrogen peroxide has disappeared, it will still give, in the presence of hydrogen peroxide, the reactions with guaiacol and *p*-phenylenediamine, but no longer decolorises Schardinger's reagent, differing in the latter respect from fresh milk. From the above facts, the author concludes that the reducing enzyme present in milk is alone destroyed by hydrogen peroxide, and that the oxidising enzyme (not to be confounded with the oxydase) withstands the action of the peroxide for a considerable time.—W. P. S.

Cocoa-nut fat in butter; Process for the detection of ——. H. P. Wijsman and J. J. Reijst. XXIII., page 338.

Cocoa and chocolate; Detection of foreign substances in ——. F. Bordas and Touplain. XXIII., page 338.

ENGLISH PATENTS.

Animal tissues and mixtures of such tissues with other substances, and the products obtained thereby; Process of preserving ——. J. R. Hatmaker, Paris. Eng. Pat. 4351, March 2, 1905.

THE substances, such as fish, oysters, beef, and all kinds of animal tissue, either alone or mixed with other substances, are reduced to a pulpy condition, with the addition of water if necessary. The pulp is then exposed in the form of a thin layer or film upon a suitable surface heated to a temperature above 212° F. (see Eng. Pat. 25,563, of 1904; this J., 1905, 1249), and removed before it is injured by over-heating. The substances may be cooked, digested or seasoned before drying.—W. P. S.

Yeast [*Fodder or fertiliser*]; *Treating —— to render it suitable for commercial purposes.* F. Gothard. Eng. Pat. 13,834, July 5, 1905. XVII., page 331.

[*Milk*] *Separators; Impts. in centrifugal* ——. H. H. Lake, London. From Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 19,209, Sept. 22, 1905.

THE invention relates to separators which are driven by a steam turbine. A regulating cover, or a separate chamber communicating with the separator, is connected by a float or an arrangement of balanced levers with the steam valve. When the level of the milk in the separator sinks, the supply of steam is cut off, but a by-pass allows sufficient steam to pass to keep the separator running at a low speed when it is empty.—W. H. C.

Fruit syrups or fruit extracts; Process for making concentrated ——. O. Volz, Berlin. Eng. Pat. 612, Jan. 9, 1906. Under Int. Conv., Jan. 10, 1905.

FRUIT juice of any kind is treated with chloroform, benzene, carbon tetrachloride, ether, carbon bisulphide or similar solvent, and the latter then separated. The chloroform extract is evaporated at a low temperature under reduced pressure, the residue is dissolved in alcohol, the solution cooled, filtered to remove vegetable fats and waxes, and the alcohol again distilled off under reduced pressure. The residue of aromatic substances obtained may be added to the extracted juice after the latter has been evaporated under reduced pressure to about one-twentieth of its volume. The original juice may be obtained from fruit which has been preserved by the addition of alcohol or by pasteurising.—W. P. S.

UNITED STATES PATENT.

Casein; Process of precipitating and preserving ——. H. V. Dunham, Bellows Falls, Vt., Assignor to Casein Co. of America, New Jersey. U. S. Pat. 814,594, March 6, 1906.

A SMALL percentage of boric acid is added to the acid used for precipitating the casein.—W. P. S.

FRENCH PATENTS.

Lupins; Preparation of meal from ——, *for food.* A. de Sousa Reis. Fr. Pat. 358,713, Oct. 21, 1905. Under Int. Conv., Dec. 1, 1904.

LUPINS contain a large proportion (about 50 per cent.) of albuminoids but their utilisation as a foodstuff is hindered by the presence of a bitter principle. According to the present patent the lupins are boiled in a solution of acetic acid and common salt, and then purified by systematic extraction with water until the bitter substance is removed. The seeds are finally decorticated, dried and ground to meal.—J. F. B.

Whey from skimmed milk; Preparation of ——. Deutsche Milchwerke. Fr. Pat. 358,965, Oct. 28, 1905.

Two hundred litres of skimmed milk are mixed with 20 litres of full milk and heated to a temperature of 80° C for 45 minutes. The milk is then cooled to about 25° C., mixed with 6·6 litres of a culture of lactic acid bacteria, and the whole kept at this temperature until the acidity rises to 3·5 or 3·6°. The mixture is now rapidly cooled to about 14° C., and kept at this temperature for a further three or four hours. It is then ready for use as a beverage. —W. P. S.

Alimentary materials; Preservation of ——, *by means of ozone.* H. J. Wessels de Frise. Fr. Pat. 359,037, Oct. 31, 1905.

THE articles, such as meat, eggs, fruits, beverages, &c., to be preserved, are placed in a chamber from which the air is withdrawn by means of a pump, a pipe being provided at the top of the chamber for this purpose. The air withdrawn is passed successively through a cooling and drying chamber, an ozonising apparatus and a sterilising chamber and is then returned to the bottom of the chamber containing the foods. A portion of the ozonised air may be forced by a pump through jets directly on to the joints of meat or into the latter. The chamber is hermetically closed, but suitable openings are provided for removing the articles of food as required.—W. P. S.

GERMAN PATENT.

Proteins; Process for the separation of true ——, *from their solutions, and from salts, extractive matters, albumoses and peptones.* Farbw. vorm. Meister, Lucius und Brüning. Ger. Pat. 164,762, March 4, 1905.

ALBUMINOUS solutions are treated with a small quantity of alcohol, insufficient to produce a precipitate or turbidity, and the proteins are then separated by addition of an excess of acid or alkali. Or, the albuminous solutions are treated with an alcoholic solution of caustic soda or caustic potash, without producing a precipitate, and the proteins are then separated from the alkaline solution by the addition of acid.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

ENGLISH PATENTS.

Clinker from refuse destructor furnaces; Treatment of ——. J. A. Brodie, Liverpool. Eng. Pat. 7521, April 10, 1905.

THE clinker is removed from the destructor furnace and at once introduced into a blast-furnace situated adjacent to the destructor. If needed, fuel may be added and also from 5 to 10 per cent. of lime or other flux. The products of combustion of the blast-furnace are led into the flue of the destructor or into a steam generating furnace. The material after treatment in the blast-furnace is suitable for road foundations, concrete or paving blocks.—W. P. S.

Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same; the evaporator being also applicable as a smoke washer; Impts. in ——. A. B. Lennox, Newcastle-on-Tyne, and T. Mackenzie, Glasgow. Eng. Pat. 7962, April 14, 1905. (See also Eng. Pats. 13,227 and 18,488 of 1904; this J., 1905, 811, 982.)

THE evaporator consists of a series of chambers, with openings in the baffle—or partition—walls between them, the whole being provided with a floor slanting upwards, and communicating at one end with a flue from a boiler, by way of an opening that can be closed by a damper, and at the other end with a chimney. The liquid to be evaporated is sprayed into the chambers, and any portion of the liquid that remains unevaporated drains away, together with any solid matter in the flue gases, through openings in the bottom of each partition, and runs down over the damper into a tank fitted with a strainer or filter to clarify the liquid, which can then be returned to the spraying devices. The communicating openings in the baffle-walls are of chequered brick or iron work, with an open area equal to that of the flue, and may be arranged at different levels so as to distribute the hot gases in passing from one chamber to another. The sloping arrangement of the apparatus enables a fan to be dispensed with when the chimney draught is good, but a fan may be provided in the chamber next the chimney, if necessary.—C. S.

Sewage and other similar sludges; Treatment of ——. [*Recovery of fatty substances*]. F. M. Spence, H. Spence and P. Spence and Sons, Ltd., Manchester and R. Ockel, Lower Walton, Cheshire. Eng. Pat. 8347, April 19, 1905.

THE nearly or completely solidified sludge cake, yielded by curdling or otherwise treating the sewage, is subjected to the action of a sufficient quantity of mineral acid, preferably sulphuric acid, to liberate the fatty acids from the mineral matters present. The amount of acid to be added is ascertained by a preliminary experiment on a small quantity of the sludge cake. Sufficient acid must be added to give a yield of fatty acids free from iron, alumina or other soaps. The acidified cake is then prepared for treatment with suitable solvents. (See also Eng. Pat. 23,640 of 1904; this J., 1905, 1080.)—W. P. S.

Water-purifying apparatus. J. J. Krüger, Copenhagen. Eng. Pat. 24,435, Nov. 25, 1905.

THE water to be purified is forced by suitable means through a water motor or turbine and is then conducted by a pipe to a measuring device, such as a tipping bowl, or paddle-wheel, situated at the top of a tank. The latter is provided with an outlet for the purified water and with a sludge cock. A reagent tank is placed at the bottom of the tank on the outside, and is provided with a stirrer and a pump, both worked by the water-motor. The pump raises the chemical solution up to a small receiver adjacent to the tipping device. This receiver is provided with an overflow and an arrangement, such as a movable pipe or valve actuated by levers from the tipping vessel or water-wheel, so that predetermined quantities of the chemical solution are delivered to the water before it enters the main tank.
—W. P. S.

UNITED STATES PATENT.

Water-purification system. J. F. Wixford, St. Louis, Mo. U.S. Pat. 814,634, March 6, 1906.

THE plant consists of a settling-basin and a delivery-well connected by a conduit near the bottom of the well. A pipe delivers a supply of reagent from a tank into a conduit entering the top of the well and a second pipe delivers lime-water from a lime tank into the conduit at a point nearer the well. Both pipes enter the conduit at such a distance from the well that the chemicals may be thoroughly mixed with the water before it enters the well. The reagent and lime tanks are provided with a supply of water.—W. P. S.

FRENCH PATENT.

Boiler water; Apparatus for the chemical examination of —— while the boiler is in operation. A. Schmitz. Fr. Pat. 359,046, Nov. 2, 1905. Under Int. Conv., Nov. 3, 1904.

SEE Eng. Pat. 22,621 of 1905; this J., 1906, 195.—T. F. B.

(*C.*)—DISINFECTANTS.

FRENCH PATENT.

Antiseptic soap; Manufacture of ——. M. Martens. Fr. Pat. 359,061, Nov. 2, 1905. Under Int. Conv., Nov, 14, 1904.

A SOAP containing "lysol" is claimed, and is obtained by adding a certain quantity of cresol to the alkali used in making the soap.—W. P. S.

GERMAN PATENTS.

Disinfectant from chloronaphthalene and soap; Process of preparing a ——. L. Schwabe. Ger. Pat. 163,663, Oct. 13, 1903.

OLEIC ACID is treated with dry chlorine until an increase of about 50 per cent. in weight is attained; 100 parts of the product are dissolved in 223 parts of 30 per cent. caustic potash solution, and heated until it is soluble in water. In this solution is dissolved 124 parts of the product obtained by chlorinating naphthalene with dry chlorine until it has increased 40—50 per cent. in weight, and removing the hydrochloric acid formed. The final product is stated to be soluble in water, and to contain 70 per cent. of chloronaphthalene calculated on the weight of oleic acid used. (Compare Eng. Pat. 4950 of 1893; this J., 1894, 271.)—T. F. B.

Disinfectant fluids; Process of preparing ——. L. Schachtel. Ger. Pat. 164,793, Feb. 25, 1904.

SOLUTIONS possessing considerable disinfectant properties are obtained by dissolving α- or β-naphthol, or a mixture of the two, in alkali carbonate solutions. The disinfectants may also be prepared in solid form by simply mixing the components. The best proportions are equal weights of naphthol and alkali carbonate: increase of the latter increases the solubility of the product, but diminishes its antiseptic properties. Such disinfectants are stated to be more effective than those prepared from naphthols and alkali hydroxides, and possess the advantage over other phenolic disinfectants of being non-poisonous and odourless.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 280.)

Apple marc; Study of ——. W. D. Bigelow and H. C. Gore. XVII., page 330.

ENGLISH PATENTS.

Paper making apparatus; Impts. in —— for effecting the separation of sand, metal and other impurities from the pulp. J. Macnaughton, Edinburgh. Eng. Pat. 23,399, Nov. 14, 1905.

SEE U.S. Pat. 813,984 of 1906; following these.—T. F. B.

Cellulose [*Viscose*]; *Apparatus for filtering and pumping or regulating the flow of solutions of* ——. C. F. Topham, Kew Gardens. Eng. Pat. 5766, March 18, 1905.

THE apparatus consists of a support connected with the main viscose supply, and provided with pivot joints maintaining in position the filter, the pump and the nozzle arm, all being clamped together and bored internally so that there is a direct passage from the viscose main to the squirting nozzle. The filter consits of two plates clamped together and provided on their internal faces with projections between which the filtering medium is firmly held, passages being provided for the viscose to pass between the projections. On the discharge side of the filter the supporting plate has a hole covered with an elastic diaphragm, which is distended by the pressure of the filtered viscose when the filter is working freely, but which collapses when the filter fails to pass more viscose than the pump is drawing away. The filtered viscose is drawn away by a plunger pump constructed without an inlet valve, a recess being provided beneath the plunger in which the viscose is trapped by the plunger. At the bottom of the recess is the delivery valve, closed by a spring, which requires a higher pressure to open it than the pressure of the viscose entering the pump. The difference in pressure is overcome by the work of the plunger on the column of viscose above the valve. The delivery valve can either be wholly removed for cleaning or can be loosened to such an extent that a rush of viscose sweeps any accumulated dirt through a passage to the outside, opened by the operation of loosening the valve. After passing the delivery valve the viscose is delivered to the nozzle arm, an air chamber in the form of a bottle being clamped against an opening in the side of the delivery tube to equalise the flow.—J. F. B.

Collodions and cellulose solutions; Pumps for supplying —— to filters and drawing apparatus. L. Desmarais, G. Morane, and M. J. A. Denis, Reims, France. Eng. Pat. 6783, March 30, 1905. Under Int. Conv., April 26, 1904.

SEE Fr. Pat. 342,655 of 1904; this J., 1904, 933.—T. F. B.

Cellulose product and process of manufacturing the same. Soc. Franç. de la Viscose, Paris. Eng. Pat. 1182, Jan. 16, 1906. Under Int. Conv., Jan. 28, 1905.

See Fr. Pat. 351,089 of 1905 ; this J., 1905, 855.—T. F. B.

United States Patent.

Paper-making apparatus for separating sand, metal and other impurities from pulp. J. Macnaughton, Edinburgh. U.S. Pat. 813,984, Feb. 27, 1906.

The pulp on its way to the breast of the paper machine is passed through a conical casing with a box or receptacle at the bottom, in which the heavy impurities are collected, and an adjustable outlet for lighter impurities at the top. The inlet for the pulp passes tangentially into the casing, and the purified pulp is discharged through a central outlet.—J. F. B.

French Patents.

Seaweed ; Treatment of —— for the extraction of mineral and organic chemical substances. Mme. Laureau *née* J. H. Laureau. Third Addition, dated Oct. 14, 1905, to Fr. Pat. 352,069, March 6, 1905. VII., page 315.

Metallisation of articles of celluloid, horn, &c. ; [Electrical] Process of ——. L. Schwob and G. Hébert-Dilette. Fr. Pat. 359,001, Oct. 30, 1905 XI*B*., page 323.

Casein and similar substances ; Conversion of —— into plastic products. L. Collardon. Fr. Pat. 359,073, Nov. 2, 1905. XIV., page 327.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

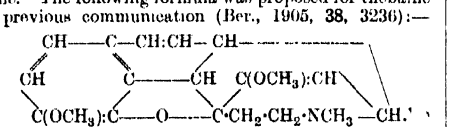
(*Continued from page* 284.)

Cinchona bark [and kola nuts] ; Cause of the red coloration of ——. A. Tschirch. Schweiz. Woch. f. Chem. u. Pharm., 1905, **43**, 125—126.

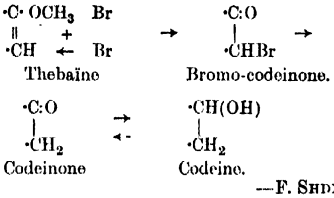
It has been noted that when fresh kola nuts are sliced, the cut surfaces turn red ; but if the seeds are previously kept in water at 60°—80° C. for a short period, no red colouring follows on cutting them. The formation of "kola-red" is, therefore, attributed to the presence of a hydrolytic ferment or an oxydase. The author observed, when in Java, that freshly removed cinchona bark is free from red colour when first stripped from the tree, but after 65 seconds exposure to the air, the surface turns red. It was found, however, that no red colour appeared when the cut branches were immersed for 30 minutes in water at 80° C., or when they were exposed to steam at the same temperature for a like period. When twigs of the living tree were bent down into a vessel of water at 80° C., and kept immersed for half an hour, again no reddening of the bark occurred when it was removed. If, however, the twigs, instead of being heated in water, were exposed to dry heat at 80° or 100° C. in an oven, reddening subsequently took place. The red colour would, therefore, appear to be due to the action of an enzyme on a glucotannoid, by which either "cinchona-red" itself, or a body which is converted into "cinchona red," is formed.—J. O. B.

Thebaine. M. Freund. Ber. 1906, **39**, 844—850.

The author has succeeded in converting thebaine into codeine. The following formula was proposed for thebaine in a previous communication (Ber., 1905, **38**, 3236):—



On treating thebaïne in chloroform or glacial acetic acid with bromine, the hydrobromide of a monobrom-addition product is obtained, and this, after recrystallising from dilute alcohol, yields fine leaflets melting at 197°—198° C. are obtained. This substance is the hydrobromide of bromo-codeinone, $C_{18}H_{18}BrNO_3$, HBr, H_2O. It contains one methoxyl group, and one methyl group attached to the nitrogen atom. If the hot alcoholic solution of this substance be treated with ammonia, the free base separates in clusters of needles melting at 156°—157° C., with decomposition. The base does not form a methiodide and is readily soluble in chloroform, but insoluble in water and caustic alkali. The bromine probably adds itself to the bridged ring, where it splits the methyl from the methoxyl group. The free base forms an oxime, $C_{18}H_{18}(OH)NO_2(:N.OH)$, which is free from bromine and soluble in dilute alkali. After recrystallising from alcohol, it melts at 272°—273° C. On reducing bromo-codeinone with iron filings and dilute sulphuric acid, codeinone, melting at 185° C., is produced, and this codeinone is identical with the codeinone obtained from codeine.



—F. Shdn.

Piperazine benzoate and salicylate. A. Astruc. Bull. Soc. Chim., 1906, **35**, 169—171.

The benzoate and salicylate of piperazine are obtained as crystalline precipitates on mixing 2 mols. of the acid with 1 mol. of the base in alcoholic solution. Piperazine benzoate, $C_4H_{10}N_2(C_6H_5.COOH)_2$, is a white anhydrous salt, crystallising in glistening plates, which volatilise without melting at 120° C. At 15° C. it dissolves in 15 parts of water, 16·3 parts of 90 per cent. alcohol, and 46·4 parts of absolute alcohol. It is acid to phenolphthalein. Piperazine salicylate, $C_4H_{10}N_2(C_6H_4.OH.COOH)_2$, separates in the form of fine white needles, which volatilise at 160° C. without fusion. At 15° C. it dissolves in 90 parts of distilled water, 200 parts of 90 per cent. alcohol, and 450 parts of absolute alcohol. It is acid to phenolphthalein.—F. Shdn.

"Pois de Java" ; Chemical investigation of ——. E. Kohn-Abrest. Comptes rend., 1906, **142**, 586—589

The grains from "Pois de Java" a species of *Phaseolus lunatus* (see Dunstan and Henry ; this J., 1903, 1255), yield hydrogen cyanide on maceration with water. The author has determined quantitatively the amount of hydrogen cyanide liberated after maceration with water, and subsequent boiling with hydrochloric acid in eight varieties. The amounts vary from 0·528 to 1·638 grms. per kilo. Cold dilute hydrochloric acid only liberates very small quantities of hydrogen cyanide—E. F. A.

Nerol ; Preparation of pure ——. H. von Soden and W. Treff. Ber., 1906, **39**, 906—914.

Crude nerol obtained from oil of petitgrain, purified by calcium chloride, was converted into the diphenylurethane. This was fractionally recrystallised from light petroleum or methyl alcohol. The geranyl-diphenylurethane separates first, melting at 81°—82° C., and from the mother liquors, neryl-diphenylurethane is obtained, melting at 52°—53° C. From 100 parts of crude urethane, 63 parts of pure neryl-diphenylurethane were separated. From this, pure nerol, $C_{10}H_{18}O$, was obtained. It is a colourless oil, possessing a delicate, fresh rose smell. The sp. gr. at 15° C. is 0·8813 ; b. pt. at 755 mm. 224°—225° C. ; at 25 mm. 125° C. Optical rotation, *nil*. A crystalline tetrabromide of nerol, $C_{10}H_{18}OBr_4$, is obtained by adding the calculated amount of bromine to a carefully cooled solution of nerol in chloroform. On evaporating, and recrystallising the residue from ethyl acetate and light petroleum, long silky needles, melting at 118°—119° C., are obtained. Geranyl-diphenylurethane gives pure geraniol, with the following constants :—Sp. gr. at 15° C., 0·8825 ; optical rotation, *nil* ; b. pt. at 3 mm., 94° C., at

25 mm. 129°—130° C.; at ordinary pressure, 229°—230° C. The tetrabromide after recrystallising from ether and light petroleum, melts at 70°—71° C.—F. Shdn.

Coumarin from m-cresol. K. Fries and W. Klostermann. Ber., 1906, **39**, 871—875.

Homologues of coumarin were produced by the Pechmann method from *m*-cresol, the methyl group in the meta position favouring the reaction. 4-*Methylcoumarin*, $C_{10}H_8O_2$, was prepared by heating *m*-cresol and malic acid with concentrated sulphuric acid. On crystallising from dilute alcohol, white needles or tablets melting at 128° C. are obtained. The compound smells strongly of coumarin, and is soluble in most organic solvents. It dissolves in aqueous sodium hydroxide on boiling, from which the greater part of the coumarin is precipitated by carbon dioxide. 2.4-*Dimethylcoumarin*, $C_{11}H_{10}O_2$, is obtained from *m*-cresol and acetoacetic ester. On crystallising from alcohol, short white needles melting at 132° C. are obtained. It is soluble in most organic solvents and in a boiling solution of caustic alkali. 1.2.4-*Trimethylcoumarin*, $C_{12}H_{12}O_2$, is obtained from *m*-cresol and methylacetoacetic ester. After crystallising from alcohol, the product has the form of fine glistening needles, melting at 114° C. It possesses no coumarin-like odour, and is readily soluble in most organic solvents. It is only slowly dissolved by hot caustic alkali solution.—F. Shdn.

Calcium and strontium iodomercurates. A. Duboin. Comptes rend., 1906, **142**, 573—574. (See this J., 1906, 283.)

The author has obtained the compounds, $CaI_2,HgI_2,8H_2O$; $SrI_2,5HgI_2,8H_2O$; and $SrI_2,HgI_2,8H_2O$ crystallising in transparent needles.—E. F. A.

Antimony tartrate. J. Bougault. Comptes rend., 1906, **142**, 585—586.

The author prepared a well characterised antimony tartrate, $C_4H_3O_6Sb$, by precipitation with acetone from a solution of antimony oxide in excess of tartaric acid. The compounds, $C_4H_7O_5Sb$, previously described by Guntz, and prepared, by using alcohol as a precipitant, are probably mixtures of antimony tartrate and its ester.
—E. F. A.

Diastatic enzymes; Influence of certain alkaloids and their salts on the activity of ——. H. E. Goebel. XVII., page 329.

Carbohydrates and organic acids and bases; Solubility and specefic rotatory power of some ——, *in pyridine and other solvents.* J. G. Holty. XVI., page 328.

Lactic acid [Commercial]; Analysis of ——. M. Philip. XXIII., page 339.

Acetylsalicylic acid. U.S. Customs Decision, Jan. 10, 1906.

Acetylsalicylic acid is dutiable at 25 per cent. *ad valorem*, as a "medicinal preparation not containing alcohol, nor made with the use of alcohol," under paragraph 68 of the tariff. The claim of the importer for assessment of duty at 10 c. per lb., under paragraph 1, as "salicylic acid," was overruled. [T.R.] R. W. M.

English Patents.

Camphor [from Isoborneol]; Manufacture of ——. O. Imray, London. From Soc. Chem. Industry, Basle, Switzerland. Eng. Pat. 2520, Feb. 1, 1906.

The process claimed for the manufacture of camphor, is by treating isoborneol suspended in water with a hypochlorite, in the presence or absence of a small proportion of an oxygen carrier. (See Fr. Pat. 352,888 of 1905; this J., 1905, 985.)—F. Shdn.

Ortho-toluene sulpho-chloride. O. Oberländer, Manchester, and the Alliance Chemical Co. Ltd., Bury, Lancs. Eng. Pat. 2304, Feb. 6, 1905.

Ortho-toluene-sulphonic acid crystals obtained by the precipitation of their solution in sulphuric acid with water as described in Eng. Pat. 14,390 of 1901 (this J., 1902, 1024) are treated with chlorosulphonic acid at the ordinary temperature. After standing for several hours, the mixture is poured into ice water and ortho-toluene-sulphochloride is thereby obtained. (Reference is made to Eng. Pats. 11,676 of 1900, and 6537 of 1901; this J., 1901, 504 and 746.)—F. Shdn.

Benzoyl-salicylic acid. J. Wetter, London. From F. Hoffmann-la Roche and Co., Bâle, Switzerland. Eng. Pat. 10,093, May 13, 1905.

True benzoyl-salicylic acid, $C_6H_4(O.CO.C_6H_5)COOH$, is produced when disodium salicylate is allowed to act on benzoyl chloride diluted with ether or light petroleum, provided the benzoyl chloride is employed in molecular quantity or slight excess, and high temperatures are avoided. Benzoyl-salicylic acid is sparingly soluble in water, easily in ether, alcohol and chloroform, and after recrystallising from alcohol melts at 132° C. On boiling with alkalis, it splits up into benzoic and salicylic acids.
—F. Shdn.

Para-aminobenzoic ether [ester]; Manufacture of new salts of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,292, June 13, 1905.

See Fr. Pat. 355,193 of 1905; this J., 1905, 1189.—T. F. B.

Aminoalcohols; Manufacture of new esters of ——, *of salts thereof and of new intermediate products for use therein.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,843, June 21, 1905.

See Fr. Pat. 355,367 of 1905; this J., 1905, 1189.—T. F. B.

Guaiacol sulphonic acids and salts thereof. R. E. Ellis, London. From Chem. Fabr. von Heyden, Akt.-Ges., Radebeul, Germany. Eng. Pat. 16,723, Aug. 7, 1905.

The mixture left after sulphonating guaiacol is treated with excess of chalk in the usual way. To the clear filtrate half a molecule of lime, or other alkaline-earth or oxide of a heavy metal, is then added. This precipitates the para acid as an insoluble basic salt, leaving the ortho acid in solution. Pure para-guaiacol sulphonic acid gives a precipitate with an ammoniacal calcium or barium chloride solution. The potassium salt, when treated with concentrated nitric acid, gives a yellow precipitate of dinitro-guaiacol. Pure ortho-guaiacol sulphonic acid gives no precipitate when treated with the same reagents.
—F. Shdn.

Therapeutical compound [Glycol monosalicylic ester]; Manufacture of a ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 80, Jan. 1, 1906.

The monosalicylic ester of glycol is prepared by heating together salicylic acid (75 parts) and an ethylene halohydrin (*e.g.*, ethylene chlorhydrin, 45 parts) for a few hours at 140°—150° C. The product is poured into water, made alkaline with sodium carbonate, extracted with ether and the ethereal extract distilled *in vacuo*. The resulting pure ester boils at 169°—170° C. (12 mm.) and melts at 37° C. It is stated to be of value in therapeutics as a substitute for salicylic acid.—T. F. B.

United States Patent.

Alcohols; Process of producing aromatic ——. C. Mettler, Munich, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 815,193, March 13, 1906.

See Eng. Pat. 18,674 of 1905; this J., 1905, 1188.—T. F. B.

French Patents.

Menthylsalicylic ether; Process of making ——. R. Scheuble and B. Bibus. Fr. Pat. 358,948, Oct. 28, 1905.

See Eng. Pat. 8544 of 1905; this J., 1906, 233.—T. F. B.

Cholic acid; Process of making mercury salts of ——. J. D. Riedel, Akt.-Ges. Fr. Pat. 359,069, Nov. 2, 1905.

See Eng. Pat. 11,180 of 1905; this J., 1905, 939.—T. F. B

Antimony lactate; Manufacture of double salts of ——. Chem. Fabr. von Heyden, Akt.-Ges. Fr. Pat. 359,084, Nov. 3, 1905.

See Eng. Pat. 21,751 of 1905; this J., 1906, 134.—T. F. B.

Hydrogen peroxide; Electrolytic preparation of ——. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 358,806, Oct. 24, 1905. XII., page 321.

Phosphorescent substances in the form of powder or stone; Process for the manufacture of ——. L. Vanino and R. Lambrecht. Fr. Pat. 359,038, Oct. 31, 1905.

It is known that the phosphorescence of alkaline-earth sulphides is considerably increased by the addition of very small quantities of bismuth salts. The patentees find that a still greater effect is produced by the addition of small quantities of thorium or thallium, or, especially lithium salts. In order to obtain the phosphorescent material in the form of stone, it is introduced into a fused substance. For example, potassium nitrate is fused and the powdered phosphorescent substance is introduced. On cooling, the mass sets hard.—A. S.

German Patents.

Eucalyptol-formaldehyde compound; Process of preparing a ——. F. Henschke. Ger. Pat. 164,884, Nov. 20, 1904.

Condensation products may be obtained from eucalyptol and formaldehyde by their interaction in presence of a condensing agent, such as an alkali hydroxide or an acid. The resulting compound is very easily resolved into its components.—T. F. B.

Hexamethylenetetramine; Process of preparing ammonium compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 164,510, May 14, 1904.

"Ammonium compounds" are obtained by the action of hexamethylenetetramine on halogenalkylimides of aromatic acids, either in benzene or chloroform solution, or by heating the components together *in vacuo*: from bromethylphthalimide, a compound of the constitution, $C_6H_4(CO)_2{:}N.C_2H_4.N(Br)$: $C_6H_{12}N_2$, is obtained. —T. F. B.

C-C-Dialkylbarbituric acids; Process of preparing ——. E. Merck. Ger. Pat. 165,225, July 20, 1904. Addition to Ger. Pat. 162,280, Jan. 9, 1904.

Cyanodialkylacetylureas are converted directly into *C-C*-dialkylbarbituric acids by heating with concentrated mineral acids for a longer time than is necessary for their conversion into dialkylmalonuric amides, internal condensation of the latter taking place.—T. F. B.

C-C-Dialkylbarbituric acids; Process of preparing ——. A. Einhorn. Ger. Pat. 165,649, Nov. 24, 1904.

Dialkylthiobarbituric acids are converted into dialkylbarbituric acids by heating with a mineral acid which has no oxidising action (*e.g.*, phosphoric acid, hydrochloric acid, sulphurous acid). The reaction may be accelerated by the addition of alcohol. (Compare Eng. Pat. 22,967 of 1903; this J., 1904, 76.)—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 284.)

United States Patent.

Photography; Trichromatic ——. B. Jumeaux and W. N. L. Davidson, Brighton. U.S. Pat. 814,215, March 6, 1906.

See Eng. Pat. 3780 of 1903; this J., 1904, 337.—T. F. B.

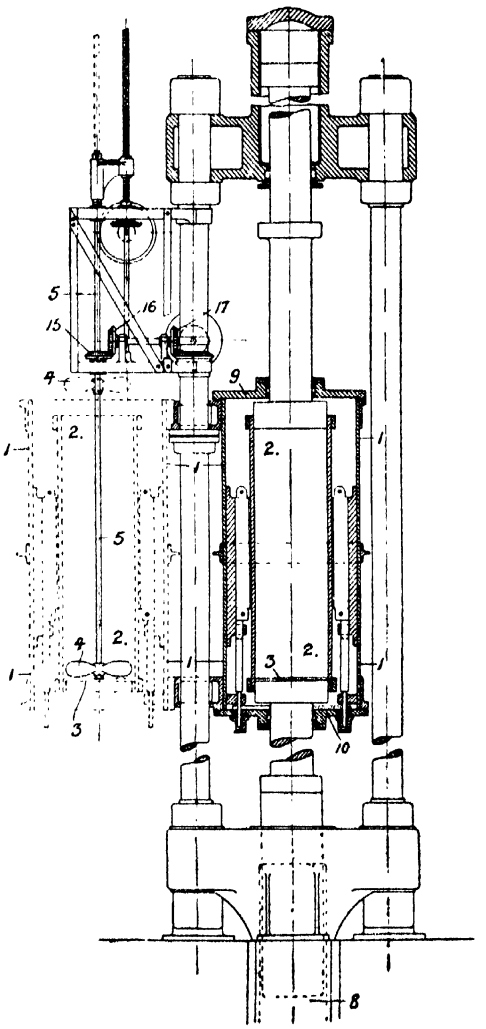
XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 285.)

English Patents.

Guncotton blocks; Manufacture of pressed or solidified ——, *from the loose or open state.* A. Musker, Bootle, Lancs. Eng. Pat. 3725, Feb. 23, 1905.

The invention consists in the use of an apparatus for mixing guncotton with water which is attached to a hydraulic press, so that the vessel containing the guncotton can readily be swung into position for compressing the pulp into blocks. In the attached drawings the container, 2, held by means of a cylinder, 1, attached to one of the columns of the press, is shown to the left, in dotted lines. At the bottom of the container is a plate, 3, on which the charge rests. Before charging, the blades, 4, of the revolving stirrer, 5, are arranged in position at the bottom of the container, and as the charge is introduced, it is thoroughly stirred, the stirrer being gradually raised by means of the gear fixed above (16 and 17) until the blades are in the position shown by the dotted lines, 4. The container, and cylinder are then swung into position



between the rams of the press, the covers, 9, and 10, are slipped on and bolted tight, and the contents are compressed. The expressed water flows away through perforations in the container, 2, which extend between the edges of the jacket, a layer of filter paper being introduced to prevent the loss of solid guncotton. When the guncotton has been sufficiently compressed, the cylinder can be swung back into its former position, the container removed, and a fresh one substituted for repeating the operation.—B. J. S.

Explosives containing nitroglycerine. J. Wetter, London. From Westfälisch-Anhaltische Sprengstoff A.-G., Berlin. Eng. Pat. 4057, Feb. 27, 1905.

See Fr. Pat. 351,805 of 1905; this J., 1905, 903.—T.F.B.

Explosives. E. Louis, Houilles, France. Eng. Pat. 4372, March 2, 1905. Under Int. Conv., March 2, 1904.

See Fr. Pat. 340,913 of 1904; this J., 1904, 837.—T. F. B.

Smokeless powders; Impts. in ——. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 12,892, June 22, 1905.

FIG. 1.



FIG. 2.

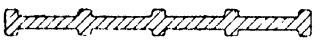


FIG. 3.

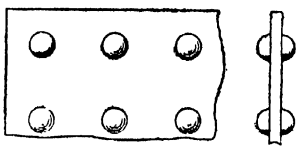


FIG. 4.

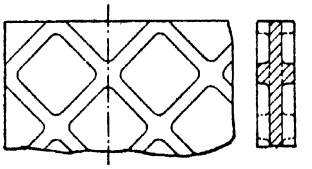
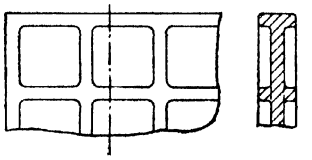


FIG. 5.



Irregularity in rate of burning occurs with all the known forms in which propellants are used. With the cord form the surface exposed, diminishes as the material burns; the flat surfaces of strip or flake powders adhere, whilst tubular powder is apt to split longitudinally; in each case a variation of pressure is produced. The inventors use a modification of the strip or ribbon form with ribs to prevent contact of the flat surfaces. These ribs may be used as shown in section in Figs. 1 and 2, in the form of studs as in Fig. 3, or as a network as in Figs. 4 and 5. The strips may be cut into flakes if desired.

—B. J. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 287.)

INORGANIC—QUALITATIVE.

Platinum and iridium salts; Action of sulphuric acid on ——, in presence of ammonium sulphate. [Detection of iridium in commercial platinum.] M. Delépine. VII., page 314.

INORGANIC—QUANTITATIVE.

Carbon monoxide; Difficulties in the determination of —— in gaseous mixtures. A. Gautier and Clausmann. Comptes rend., 1906, **142**, 485—491.

In determining carbon monoxide, when present to the extent of several cubic centimetres in gaseous mixtures, the author finds that after the gas has been washed with potassium hydroxide, bromine water and pyrogallol, the cuprous chloride solution, even when present in considerable excess, does not absorb all the carbon monoxide present. Further, carbon monoxide diluted with an inert gas is not burnt completely, even when exploded in presence of excess of oxygen, owing to its resistance to oxidation in presence of other combustible gases. The author recommends that the residual gases, either after absorption with cuprous chloride or explosion with oxygen, be caused to pass over iodic anhydride heated to 70° C. which oxidises the last traces of carbon monoxide.

—E. F. A.

Nitre; Analysis of ——. R. Bensemann. Z. angew. Chem., 1906, **19**, 471—473.

The author's process (this J., 1905, 691), needs modification for potassium nitrate, or for sodium nitrate containing notable amounts of the potassium salt. The solution of the salt (100 c.c.) is evaporated to dryness with 16 grms. of oxalic acid, then mixed to a thin paste with water and a further 8 grms. of oxalic acid, evaporated to dryness again, mixed again with water and 8 grms. more of oxalic acid and evaporated a third time. It is now wetted with water and evaporated five times, brought into a platinum dish, which is covered and placed in a porcelain basin 22 cm. in diameter and 6 cm. high, where it is cautiously heated till acid fumes are no longer evolved. It is then gradually heated over a powerful burner to bright redness till perfectly white, which requires about an hour. The cooled substance is then treated exactly as sodium nitrate.

Instead of this method, the following is often more convenient: (*a*) The chloride is determined in 50 c.c. of the solution. (*b*) 50 c.c. diluted to 500 c.c. are evaporated to dryness with 50 c.c. of concentrated hydrochloric acid; this is repeated five times, then the mass is five times wetted with water and evaporated to dryness, and the chloride in the residue determined. This gives chloride equivalent to chloride + chlorate + nitrate in the original substance. (*c*) The salt is ignited, and the chloride in the residue determined, which is equivalent to chloride + chlorate + perchlorate in the original. (*d*) The salt after ignition is treated as in (*b*) which gives chloride equivalent to chloride + chlorate + perchlorate + nitrate. The mode of calculating from these four results, the amounts of each of the four separate salts is obvious.

This latter "chloride method" is much less laborious than the first, or "carbonate method," but always gives higher nitrate figures. The author has not yet discovered the reason of this, nor which figure is nearer the truth.

—J. T. D.

Iron; Determination of —— by bichromate, using diphenylcarbohydrazide [diphenylcarbazide] as indicator. L. Brandt. Z. anal. Chem., 1906, **45**, 95—99.

In the determination of iron by titration with bichromate solution, diphenylcarbohydrazide (see this J., 1900, 1007, 1040) has the advantage over other indicators of being used in the titrating vessel, and not outside it. The method is as follows:—To about 1½ litres of water in a capacious dish are added 60—80 c.c. of dilute hydrochloric acid (sp. gr. 1·12) and 100 c.c. of a solution containing 10 grms. of manganese sulphate, 55 c.c. of dilute sulphuric acid, 1:3, and 5 c.c. of phosphoric acid of sp. gr. 1·7. The iron solution, which should contain 0·2—0·5 grm. of iron, and 5 c.c. of a 0·1 per cent. solution of the indicator are further added, and the titration with bichromate performed. There is, at first, a bright red-violet colour which finally changes sharply to the green of chromic chloride.

The indicator may also be employed in the determination of chromic acid, an excess of standard ferrous ammonium

sulphate solution being added, and the process completed as above described.

The solution of the indicator in acetic acid should be prepared fresh every few days.—F. SODN.

Ferric chloride; Reduction of —— by zinc. D. L. Randall Z. anorg. Chem., 1906, **48**, 389—392.

AMALGAMATED zinc has generally been considered applicable only to the reduction of sulphuric acid solutions of iron for its determination by permanganate. It is found, however, that it can be applied equally well to ferric chloride, provided that the titration is carried out in presence of manganous sulphate and with sufficiently dilute solutions. Under these conditions, excess of hydrochloric acid is no disadvantage; thus 25 c.c. of the acid may be present if the solution of about 0·5 grm. of iron be diluted to 1 litre.—T. F. B.

Silver and gold; Determination of ——. C. Goldschmidt. Z. anal. Chem. 1906, **45**, 87.

METALLIC silver is precipitated as a black powder from solutions containing it when boiled with sheet cobalt. In like manner sheet nickel, dipped into boiling solutions of gold salts, precipitates the metal as a brown powder. The reactions may be used quantitatively, the precipitates being weighed.—F. SODN.

Tungsten and tin; Separation of ——. E. Donath. Z. angew. Chem., 1906, **19**, 473—474.

THE mixed tungstic and stannic oxides are heated in a covered porcelain crucible with zinc dust or zinc filings, for a quarter of an hour, and after cooling, the mass is heated with 1:2 hydrochloric acid till no more hydrogen is evolved, and all the metallic tin is, therefore, dissolved. To the cooled liquid, potassium chlorate is cautiously added till the blue colour has entirely disappeared, and the tungsten is entirely in the form of dioxide. The liquid is now diluted with at least one and a half times its volume of water, and allowed to stand for 24 hours, when the whole of the tungstic oxide is deposited. It is filtered off, washed first with water containing nitric acid, and finally with a hot dilute solution of ammonium nitrate, dried, ignited, and weighed. In the filtrate the tin is precipitated as sulphide.—J. T. D.

Cement testing. O. H. Klein and S. F. Peckham. Report on Portland cements. J. C. Hertle and W. H. Black. July 27, 1905.

THIS report on cement testing was prepared for the Commissioners of Accounts of the City of New York, and is a discussion on "the determination of a method for a comparative analytical examination of cements, cement mortars and concretes, corelative with their properties as revealed by physical tests."

The method includes the following determinations (1) matter volatile at a red heat; (2) matter insoluble in 10 per cent. hydrochloric acid; (3) soluble silica; (4) alumina and ferric oxide; (5) lime; (6) magnesia; (7) sulphuric acid. For the analysis of 5 grms. of cement, or 10 grms. of mortar are taken. The filtrate and washings from the silica are made up to 1 litre, and the iron and alumina determined in 100 c.c. of this by double precipitation with ammonium hydroxide. The lime is precipitated in the filtrate from the iron and alumina by ammonium oxalate, and ignited with the aid of the blowpipe for 15 minutes. The filtrate from the lime is rendered acid with hydrochloric acid, evaporated to about 150 c.c. and 30 c.c. of a saturated solution of microcosmic salt added. The solution is boiled and cooled, and then ammonia is added with constant stirring, avoiding more than a slight excess until the precipitate begins to form. The sulphuric acid is determined as barium sulphate in 100 c.c. of the solution left in the litre flask.—W. C. H.

Mercury ores; Assay of ——. G. T. Holloway. Analyst, 1906, **31**, 66—71.

THE author describes a modified apparatus for carrying out Eschka's method of determining small quantities of mercury (Z. anal. Chem., **2**, 334). In this method the ore is heated with iron filings in a crucible covered with a weighed gold disc hollowed out into the form of a cup, in which water is placed; the mercury condenses on the gold and is weighed. R. E. Chism (this J., 1898, 1183) replaced the gold cup by silver foil, but the author states that difficulty is experienced in fitting either the gold cup or silver foil "mercury-tight" to the crucible. He proposes a cover consisting of a flat disc of "fine" silver, free from pin-holes, on which is placed a copper box provided with inlet and outlet tubes for a current of cold water.—A. S.

ORGANIC—QUALITATIVE.

Cotton and linen; Test to differentiate ——. A. Herzog. Rev. Intern. Falsific., through Apoth.-Zeit., 1905, **20**, 891.

A SMALL piece of the material is macerated in a tepid alcoholic solution of Cyanine, washed free from excess of the dyestuff with water, then immersed in dilute sulphuric acid. Cotton is completely decolorised by this treatment, but the linen fibres retain the blue tint. If the material be then washed with water, and immersed in solution of ammonia, the colour of the flax fibres is intensified.—J. O. B.

Levulose; Detection of ——, in the presence of dextrose and dextrosamine. C. Neuberg. Z. physiol. Chem., 1905, **45**, 500; J. Pharm. Chim., 1906, **23**, 302—303.

LEVULOSE, when heated with *a*-methylphenylhydrazine acetate, gives an osazone, whilst dextrose, similarly treated, yields the corresponding hydrazone. The osazone is readily detected by its colour and is separated from the hydrazone by means of the usual solvents. The mixture of sugars and *a*-methylphenylhydrazine acetate should be heated on the water-bath for five minutes, and then allowed to cool to the ordinary temperature. Dextrosamine hydrochloride yields no trace of osazone when treated with *a*-methylphenylhydrazine acetate, and may also be distinguished from levulose by means of phenyl isocyanate (Stendal's method), or by oxidation into isosaccharic acid.—W. P. S.

Cocoa-nut fat in butter; Process for the detection of ——. H. P. Wijsman and J. J. Reijst. XII., page 324.

Cocoa and chocolate; Detection of foreign substances in ——. F. Bordas and Touplain. Comptes rend., 1906, **142**, 639—641.

THE cocoa, from which fat and matters soluble in water have been removed, is treated by flotation in a series of liquids (mixtures of carbon tetrachloride and benzene) of densities 1·440, 1·500, 1·530, 1·600. The flotation separations are rendered quicker and more certain by the use of a centrifugal machine, and thus earthnut husks and cocoa seeds, pure cocoa, cocoa husks, potato starch, and mineral matter are successively separated. The method is applicable to other powdered aliments.—J. T. D.

UNITED STATES PATENT.

Distilled liquids; Process for ascertaining the origin of colouring matters present in ——. C. T. Marsh, Assignor to L. H. Weissleder, Cincinnati, Ohio. U.S. Pat. 813,728, Feb. 27, 1906.

FOR testing the nature of the colouring matter of whiskey, amyl alcohol is distilled in presence of a caustic alkali and the clear distillate is mixed with water and with the whiskey to be tested. When the mixture is allowed to stand at rest, it separates into an upper alcoholic layer and a lower aqueous layer. If the whiskey contain artificial colouring matters, the aqueous layer is coloured by them, whilst, if the colouring matters be such as are acquired by the process of ageing, the aqueous layer remains clear.—J. F. B.

ORGANIC—QUANTITATIVE.

Fats; A reagent in the chemistry of ——. [*Naphthalene-stearosulphonic acid.*] E. Twitchell. XII., page 324.

Lactic acid [Commercial]; Analysis of ——. M. Philip. Collegium, 1906, 88—90.

THE presence of anhydride in commercial lactic acid renders the determination of the latter by direct titration untrustworthy. The following method is, therefore, proposed:—About 5 grms. or 5 c.c. of the sample are diluted with water and titrated with N/1 sodium hydroxide solution, using phenolphthalein as indicator. A measured excess of the alkali solution is then added, the mixture boiled, and the excess of alkali titrated back. The first titration gives the amount of actual lactic acid, and the quantity of alkali used in the second corresponds with the amount of anhydride present. One c.c. of N/1 alkali corresponds to 0·09 grm. of lactic acid and with 0·162 grm. of the anhydride. Sulphuric acid should always be tested for in the sample, and, if present, must be determined and allowed for in the foregoing titrations.
—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Jewels; Coloration of —— by radium rays. A. Miethe. Ann. der Physik, No. 3, 1906; Electrician, 1906, **56**, 887.

ON exposure to a "preparation of 60 mgrms. of radium bromide," a colourless diamond from Borneo, was coloured a light yellow after eight days, and a decided lemon-yellow after a further eight days. On heating to 250° C. the yellow coloration was diminished, but the colour was not entirely destroyed even on heating to redness. A colourless Brazil diamond was not coloured by exposure to the radium rays. On exposing a light blue sapphire from Ceylon to radium rays, after two hours the colour changed to green, then to light yellow, and, after a few more hours, to reddish-yellow; after a fortnight the colour was dark yellow or nearly chestnut. The colour disappeared on heating the sapphire, but the light yellow tint was always regained on cooling. Ruby, amethyst, blue topaz and chrysoberyl were not affected by radium rays. Tinted tourmaline was not changed to any considerable extent, but a stone having a pink colour at one end acquired a red colour, and a tourmaline having a green end acquired a green colour at any section by exposure to radium rays.—A. S.

Trade Report.

ARGENTINA; TRADE OF —— IN 1905.
Bd. of Trade J., March 15, 1906.

The following table shows the value of certain articles imported during the years 1904 and 1905:—

Articles imported.	1904.	1905.
	$	$
Textiles	56,819,229	46,218,951
Stoneware, glass and ceramic goods	15,905,293	17,466,903
Wines, spirits, &c	7,790,815	9,167,842
Chemicals and pharmaceutical products	6,014,344	6,275,786
Oils	6,205,756	5,556,067
Paper and manufactures of paper	4,023,720	4,133,842
Leather and manufactures of leather	1,410,017	1,796,844
Colours and dyes	1,154,439	1,441,726

The values of certain exports from Argentina during the past two years were as follows:—

Exports.	1904.	1905.
	$	$
Wool in the grease	48,355,002	64,312,927
Hides and skins	24,539,712	30,509,533
Linseed	28,359,923	26,233,851
Quebracho extract	2,011,130	2,427,772

NOTE.—The dollar referred to is the gold dollar, worth about 4s.

New Books.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES FOR 1904. Part II. Statistics. Wyman and Sons, Fetter Lane, E.C. [Cd. 2484.] Price 7d.

THIS second part of the Annual Report of the Work of the Factory Department contains statistics as to the staffs of the various factories, surgeons' reports, poisoning cases, accidents, and prosecutions, together with a classification of the non-textile industries. Returns of employment are also given in detail.

GAS UNDERTAKINGS. Return relating to all authorised Gas Undertakings in the United Kingdom other than those of Local Authorities, for the year ended Dec. 31, 1904 (in continuation of Parliamentary Paper, No. 331 of 1904). 320. Price 10d.

GAS UNDERTAKINGS (LOCAL AUTHORITIES). Returns relating to all authorised Gas Undertakings in the United Kingdom belonging to Local Authorities, for the year ended March 25, 1905 (in continuation of Parliamentary Paper No. 332 of 1904). 321. Price 5½d.

ACCORDING to these Returns, which have been prepared in the Board of Trade by order of the House of Commons, there were in 1904, 469 authorised gas undertakings in the United Kingdom, other than those belonging to local authorities, as compared with 459 in 1903. The number of such undertakings belonging to local authorities in the year 1904-5 was 265, as compared with 260 in the year 1903-4.

NEW CUSTOMS TARIFF OF RUSSIA AS MODIFIED BY COMMERCIAL TREATIES WITH GERMANY AND FRANCE. Wyman and Sons, Fetter Lane, E.C. [Cd. 2857.] Price 9d.

THE present tariff came into force on March 1, 1906. The following are among the classes dealt with under "Import duties" (the numbers referring to those in the tariff):—40—56, Animal products; 65—72, Building materials, stone, &c; 73—76, Earthenware and porcelain; 77—8, Glass; 79, Coal; 80—87, Tar, pitch, gums and resins; 88, India-rubber and manufactures thereof; 89—123, Chemical and pharmaceutical products; 124—137, Dyeing and tanning materials and colours; 138—166, Metals and manufactures thereof; 176—178, Paper and wares thereof; The return also contains a list of substances of which importation is prohibited, and a tariff of export duties.

BULGARIA: NEW CUSTOMS TARIFF OF ——. [Cd. 2862.] Price 6d. Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C.

THIS translation of the Bulgarian customs tariff has just been published by the Board of Trade, and includes the modifications made by the conventions concluded with the United Kingdom, France, Germany and Italy. The tariff came into force on Jan. 14th last.

ANNUAL STATEMENT OF THE TRADE OF THE UNITED KINGDOM, 1904. Supplement to Volumes I. and II. [Cd. 2668.] Price 5s. 10d.

THIS return contains abstract and detailed tables showing the countries of consignment of imports and countries of ultimate destination of exports. In Volumes I. and II. of the "Annual Statement of Trade" imports are generally classified as received from the countries whence they were shipped direct to the United Kingdom, and exports to countries possessing no seaboard are credited to the country in which the port of discharge is situated. The present volume also contains statements of the consignments from each country retained for consumption in the United Kingdom, or the "special" imports from each country into the United Kingdom.

A Treatise on Producer-Gas and Gas-Producers. By Samuel S. Wyer, M.E., Member of the American Institute of Mining Engineers. Engineering and Mining Journal. 505, Pearl Street, New York, 1906. Price, 4 dols., post paid. 20, Bucklersbury, London.

8vo. volume, containing 276 pages of subject matter, with 113 illustrations, followed by a bibliography of works, &c., on Gas-Producers, filling 14 pages, and the alphabetical index. The text is sub-divided as follows:—I. Fundamental Physical Laws and Definitions. II. Fundamental Chemical Laws and Definitions. III. Thermal and Physical Calculations. IV. Commercial Gases. V. Status of Producer-Gas. VI. Classification of Gas-Producers. VII. Manufacture and Use of Producer-Gas. VIII. Use of Steam in Gas-Producers. IX. Carbon Dioxide in Producer-Gas. X. Efficiency of Gas-Producers. XI. Heat Balance of the Gas-Producer. XII. Fuel. XIII. Requirements. XIV. History of Gas-Producers. XV. American Pressure Producers. XVI. American Suction Gas-Producers. XVII. Gas-Cleaning. XVIII. By-Product Gas-Producers. XIX. By-Product Coke Oven Gas-Producers. XX. Producer-Gas for Firing Ceramic Kilns. XXI. For Firing Steam Boilers. XXII. Wood Gas-Producers. XXIII. Removal of Tar from Gas. XXIV. Gas-Producer Power Plants. XXV. Operation of Gas-Producers XXVI. Testing Gas-Producers. XXVII. Future of the Gas-Producer. XXVIII. Gas Poisoning.

Jahrbuch der Oesterreichischen Chemischen Industrie (Chemische Industrie, Gummi, Gaswerke, Petroleum, Kerzen und Seifen). Herausgegeben von Rudolf Hanel. Jahrgang 1906. Alfred Hölder, K.U.K. Hof. und Universitäts-Buchhändler, Wien, 1906. Price K.3.80. "Compassverlag," Maria Theresienstr. 32. Vienna. I.

This volume, of small 8vo size, is a directory of the Austrian Chemical Industrial firms, and the contents fill 300 pages, and besides the mere addresses of firms and proprietors, it gives also dates as to year of foundation, number of workpeople; horse-power; kind of motive power; telegraphic addresses; various statistics; prices, &c.

Das neue Technisch-Chemische Institut der Königlichen Technischen Hochschule zu Berlin und die Feier seiner Eröffnung am 25, November, 1905. Von dem Direktor des Instituts, Dr. Otto N. Witt, Geheimer Regierungsrat und Profesor. Weidmannsche Buchhandlung, 94 Zimmerstr. Berlin S.W. 12. 1906. Price, M.12.

This large 8vo pamphlet contains a full report of the Royal Technical High School of Berlin, of which Professor Otto N. Witt is the Director. The Report fills 16 pages and is beautifully illustrated both in the text, and by means of photo-lithographic plates. As an illustration of the work done in the Electro-Chemical Laboratory, the working out of Frank's electro-chemical method of utilising the nitrogen of the air is cited (Prof. Frank having carried out a portion of his investigations here), his investigations, with those of others, leading up to the system and method now adopted at Notodden, in Norway, of which the localities, works, and apparatus are fully illustrated. The Report as a whole is a reprint in separate form of the article appearing in the *Chemische Industrie*, 1905, 28, 699—707. (This J., 1906, 27.)

Chemie der Organischen Farbstoffe. von Dr. Rudolf Nietzki, o. Professor an der Universität zu Basel. 5ᵉumgearbeitete Auflage. Julius Springer's Verlag. Monbijouplatz 3. Berlin. Price, M.8.

8vo. volume, containing 355 pages of subject matter, and the alphabetical index. The text is sub-divided as follows:—Introduction: Causes of Colouring Power. Chromphors: Chromogens; the dyeing process. Dyeing on Mordants. Constitution of Chromogens, &c. I. Nitro Compounds. II. Azo-dyestuffs. III. Hydrazone-, Pyrazolone-dyestuffs and Formazyls. IV. Azomethins and Stilbene dyestuffs. V. Hydroxyquinones and Quinone-oximes, (Anthracene dyestuffs). VI. Diphenyl- and Triphenylmethane Dyestuffs. VII. Imido-quinone Dyestuffs. VIII. Aniline Black. IX. Quinoline- and Acridine Dyestuffs. X. Thiazol- and Sulphide Dyestuffs. XI. Hydroxyketone Dyestuffs: Xanthone, Flavone; Cumarin and Indone. XII. Dyestuffs of the Indigo Group. XIII. Appendix with Orseille, Litmus, Canarin and Murexide.

Methods of Organic Analysis. By Henry C. Sherman, Ph.D., Adj. Professor of Analytical Chemistry in Columbia University. The Macmillan Company, New York. Macmillan and Co., Ltd., London, 1905. Price, 7s. 6d.

Large 8vo. volume, containing 237 pages of subject matter, and an alphabetical Index. The subject matter is classified as follows:- I. Introduction: Organic Analysis, &c. II. Nitrogen, Sulphur, and Phosphorus. III. Alcohols and Glycerol. IV. Aldehydes. V., VI., and VII. Carbohydrates. General Methods and Special Methods. VIII. Acids. IX. Oils, Fats, and Waxes. General Methods. X. Fatty Oils, Special Methods. XI. Butter. XII. Soaps and Lubricants. XIII. Proteids and Cereals. XIV. Milk.

The Polariscope in the Chemical Laboratory. An Introduction to Polarimetry and Related Methods. By George Wm. Rolfe, A.M., Instructor in Sugar Analysis in the Massachusetts Institute of Technology. The Macmillan Company, New York. Macmillan and Co., Ltd., London, 1905. Price, 8s. net.

Small 8vo. volume, containing 277 pages of subject matter, with 38 illustrations, five pages of Bibliography, 30 pages of tables, and an Alphabetical Index.

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A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications received, the Treasurer is requested to receive [illegible]

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Death.

Griffith, R. W. S., of Eyeworth Lodge, Lyndhurst, Hants. March 29.

Patent List.

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Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 7878. Bottman, Miller and Diller. Apparatus for the mechanical classification of [illegible]. [illegible] 1908. Convention Germany, April 3, [illegible]

[A.] 8165. Rappold. Kilns or furnaces with travelling hearths. April 4.

„ 8278. British Thomson-Houston Co., Ltd. (General Electric Co.). Vessels used in chemical operations. April 5.

„ 8323. Bornett. Apparatus for filtering gases or liquors. April 6.

„ 8374. Harrison. Filter presses. April 7.

„ 8744. Brewis and Allen. Extraction with volatile solvents. April 11.

„ 8812. Hargreaves. Furnaces. April 12.

„ 8911. Pritchard, and The United Alkali Co., Ltd. Apparatus for evaporating solutions. April 12.

„ 8947. James. Method of producing liquid air or other gases. April 14.

[C.S.] 9056 (1905). Burdon (Soc. Anon. des Procédés Maslin-Theryc). Furnaces. April 11.

„ 9264 (1905). Joyce. Kiln for drying hops and the like. April 19.

„ 9441 (1905). Dolhotel. Recovery of volatile solvents. April 19.

„ 9464 (1905). Craig, Craig and Craig. Apparatus for filtering liquids containing fine coal or the like. April 11.

„ 9548 (1905). Kestner. *See under* II.

„ 10,817 (1905). Morison. Apparatus for heating and evaporating liquids by means of steam. April 19.

„ 22,816 (1905). Lorimer. Drying and conditioning machines. April 11.

„ 23,378 (1905). Thwaite. *See under* II.

II.—FUEL, GAS, AND LIGHT.

[A.] 8017. Lee. Manufacture of metallic filaments for incandescent electric lamps. April 3.

„ 8030. Rothberg. Coke ovens. [U.S. Appl., April 8, 1905.]* April 3.

„ 8057 Kuzel. Manufacture of incandescence bodies of difficultly fusible conductive materials with the use of colloidal oxides and hydroxides of difficultly fusible metals. [Ger. Appl., Aug. 3, 1905.]* April 3.

„ 8067. Act.-Ges. f. Selasbeleuchtung. Apparatus for mixing gas and air for illuminating purposes. [Ger Appl., April 4, 1905.]* April 3.

„ 8119. Wright and Westwood. Purifiers of coal-gas plant. April 4.

„ 8154. Terneden and Muller. Manufacture of water gas.* April 4.

„ 8256. Bloxam. (Watergas Maatschappy System Drs. Kramers and Aarts). Manufacture of water gas.* April 5.

„ 8276. Bauke. Suction gas producers.* April 5.

„ 8293. Gardner, Manners, Fairweather and Warnock. Manufacture of gas and apparatus therefor. April 6.

„ 8362. Bellowitsch. *See under* VII.

„ 8433. Jerratsch. Gas retorts.* April 7.

„ 8462. Grove. Petroleum or heavy oil carburettors. April 9.

„ 8486. Gore. Apparatus for enriching and compressing coal gas. April 9.

„ 8521. Allport. Coke oven plant. April 9.

„ 8670. Bauke. Production of gas.* April 10.

„ 8705. Lynde. Production of gas from hydrocarbons. April 11.

„ 8746. Hischemöller. Fuel. April 11.

„ 8752. Taylor, Russell and Haight. Incandescence gas mantles. April 11.

„ 8778. Bauke. Suction gas generators.* April 11.

„ 8782. Burge. Production of acetylene. April 11.

[A.] 8840. Imray (Siemens und Halske A.-G.). Manufacture of incandescence bodies for electric lighting.* April 12.

„ 8866. Page (Doherty). Gas calorimeters.* April 12.

„ 9020. Bloxam (Lux). Manufacture of filaments of tungsten or molybdenum for electric incandescence lamps. April 14.

[C.S.] 7904 (1905). Thwaite. Apparatus for automatically sustaining the suction influence in suction gas producers. April 19.

„ 9548 (1905). Kestner. Removal of dust and other suspended matter from furnace and other gases. April 11.

„ 10,699 (1905). Collin. Coke ovens with regenerator action. April 11.

„ 23,351 (1905). Fraser and Fraser. Burners for liquid fuel. April 19.

„ 23,378 (1905). Thwaite. Separation of dust from gases. April 11.

„ 995 (1906). Gautreau and Gautreau. Vaporisers for combustible liquids. April 19.

„ 1295 (1906). Maschinenfabrik und Mühlenbauanstalt G. Luther, A.-G. Gas producers. April 19.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 7934. Hesse. Purifying pitch oils and other ethereal oils obtained by destructive distillation of resinous substances April 2.

„ 8757. Pagès and Camus. Manufacture of acetone. [Fr. Appl., April 14, 1905.]* April 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 8066. Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of new sulphur dyestuff compounds. [Ger. Appl., Feb. 26, 1906.]* April 3.

„ 8077. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new derivatives of certain polychloranilines.* April 3.

„ 8490. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new mono-azo dyestuffs. April 9.

[C.S.] 7838. (1905). Oehler and Oehler. Production of indophenol sulphonic acids. April 11.

„ 12,756 (1905). Cooper (Bayer und Co.). Manufacture of new anthraquinone dyestuffs April 11.

„ 15,763 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of intermediate compounds and of colouring matters containing sulphur. April 11.

„ 19,186 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. April 11.

„ 1954 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of Indigo paste. April 11.

„ 4687 (1906). Imray (Soc Chem. Industry in Basle). Manufacture of a red vat dyeing dyestuff. April 11.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 8045. Soc. Franç. de la Viscose. Spinning viscose. [Fr. Appl., April 3, 1905.]* April 3.

„ 8137. Grosvenor and Mackay. Yarn dyeing machines. April 4.

„ 8167. Trocquenet. Non-inflammable material containing cellulose.* April 4.

[A.] 8313. Frankenberg. Manufacture of waterproof materials. [Ger. Appl., Sept. 18, 1905.]* April 6.

„ 8435. Ringenbac. Bleaching textile fabrics.* April 7.

„ 8461. Pickles and Pickles. Finishing fabrics. April 9.

„ 8597. Fuchs. Mordants for cotton and other materials. April 10.

[C.S.] 4746 (1905). Linkmeyer. Manufacture of artificial threads. April 19.

„ 17,241 (1905). Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on the fibre, with or without white or coloured discharge effects. April 19.

„ 4073 (1906). Meister, Lucius und Brüning. Manufacture of ketone sulphoxylates. April 11.

VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

[A.] 8230. Dick. Process for colouring or staining ivory, bone, horn, celluloid, and the like. April 5.

VII. ACIDS, ALKALIS, AND SALTS.

[A.] 7856. Lester. Lime briquettes. April 2.

„ 7870. Pauling. Production of nitric acid or nitric oxide from air.* April 2.

„ 7871. Pauling. Production of pure nitric acid.* April 2.

„ 8362. Bellowitsch. Manufacture of ferrocyanides from gas purifying masses or other ferrocyaniferous masses.* April 6.

„ 8364. Lee. Process and apparatus for making barium cyanide. April 6.

„ 8495. Kusel, and Deutsche Solvay-Werke A.-G. *See under* XI.

„ 8910. Lecoeur. Purification of solutions of ammonia of copper. April 12.

[C.S.] 6798 (1905). Garroway. Recovery of magnesium sulphate obtained in the production of acetic acid from magnesium acetate. April 11.

„ 7916. (1905) Driffield, and United Alkali Co., Ltd. Purification of sulphuric acid. April 19.

„ 16,929 (1905). Raschen, Wareing, and United Alkali Co. Separation of arsenic from arsenical sulphuric acid and obtainment of arsenious chloride. April 11.

„ 16,930 (1905). Raschen, Wareing, and United Alkali Co. Production of arsenious acid from arsenious chloride. April 11.

„ 17,887 (1905). Raschen, Conroy, Wareing, and United Alkali Co. Production of arsenious acid from arsenious chloride. April 11.

„ 22,225 (1905). Feldkamp. *See under* XX.

„ 24,733 (1905). Roberts. Manufacture of hydrochloric acid. April 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 8888. Marks (Theisen et Cie.). Method of obtaining moiré effects on glass.* April 12.

[C.S.] 6816 (1905). Carl. Glass substitute. April 11.

„ 10,833 (1905). Heller, and Porzellanfabr. Ph. Rosenthal und Co., A.-G., Filiale Kronach Ceramic ware. April 19.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 7927. Gordon. Manufacture of bricks. [U.S. Appl., May 4, 1905.]* April 2.

[A.] 8545. Rümp. Manufacture of artificial stone. April 9.

„ 8627. Crowley and Payne. Fireproof or heat resisting surfacing composition or cement.* April 10.

„ 8995. Ford. Manufacture of artificial stone. April 14.

[C.S.] 6536 (1905) Ross. Imitation marble. April 11.

„ 14,709 (1905). Walden. Asphaltic cement. April 11.

„ 1111 (1906). Pirsoul. Manufacture of tiles. April 11.

„ 1325 (1906). Poulsen. Preservation of wood. April 11.

X.—METALLURGY.

[A.] 7876. Bagley, and The South Durham Steel and Iron Co., Ltd. Open hearth furnaces. April 2.

„ 7892. Picaud. Manufacture of steel.* April 2.

„ 8084. Valentine and Betts. *See under* XI.

„ 8141. Abelspies. Ore separating tables. April 4.

„ 8507. Hunter. Conversion of iron into steel or malleable iron.* April 9.

„ 8648. Timm. Reduction of iron ores. [Ger. Appl., April 10, 1905.]* April 10.

„ 8667. Coslett. Treatment of metallic surfaces for preventing oxidation or rusting.* April 10.

„ 8894. Dammert. Production of metallic alloys.* April 12.

„ 8939. Cowper-Coles. Production of non-tarnishable silver. April 14.

„ 8983. Simm and Simm. Treatment of spelter or other substances containing zinc and apparatus therefor. April 14.

[C.S.] 28,992 (1904). Atkinson. Preliminary treatment of refractory ores. April 11.

„ 28,992A (1904). Atkinson. Collection of arsenic in the treatment of refractory ores. April 11.

„ 1916 (1905). Hendryx. Process for treating ores. April 11.

„ 1928 (1905). Hendryx. Apparatus for treating ores. April 11.

„ 8307 (1905). Schaap. Brazing metals. April 19.

„ 9249 (1905). Ridley. Treatment of slag. April 11.

„ 19,638 (1905). Borchers, Günther and Franke. *See under* XI.

„ 24,486 (1905). Hybinette. Process of refining copper nickel matte. April 19.

„ 3252 (1906). Callmann and Bormann. Process of refining zinc and other metals. April 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 7869. Pauling. Production of voltaic strong-current arcs.* April 2.

„ 8039. Rambaldini. Continuous electrolysis. [Ital. Appl., April 3, 1905.]* April 3.

„ 8084. Valentine and Betts. Electrolytic smelting of lead sulphide ores. April 4.

„ 8452. Pauling. Production of voltaic strong-current arcs.* April 9.

„ 8495. Küsel, and Deutsche Solvaywerke A.-G. Electrolytic manufacture of salts of oxy-acids of the halogens. April 9.

„ 8924. Cowper-Coles. Electrodeposition of copper and other metals April 12.

[C.S.] 19,638 (1905). Borchers, Günther and Franke. Electrolytic production of copper. April 11.

„ 24,538 (1905). Howorth (Kellner). Electrodes for electrolytic apparatus. April 11.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 7901. Böhm. Production of odourless fish oil. April 2.

[C.S.] 18,666 (1905). Jürgens. Process and apparatus for cooling soap solutions. April 11.

„ 23,670 (1905). Kremer and Ges. f. Abwasserklärung. Apparatus for the recovery of fats and the like. April 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A.)—PIGMENTS, PAINTS.

[A.] 8513. Hall. Distemper paints. April 9.

[C.S.] 9480 (1905). Herisson. Manufacture of oil colours. April 11.

(B.) RESINS, VARNISHES.

[A.] 7934. Hesse. *See under* III.

„ 8599. Shaw. Machinery for printing the pattern on linoleum, oilcloth and the like. April 10.

„ 8884. Sommer. Manufacture of mono-coloured linoleum. [Ger. Appl., May 19, 1905.]* April 12.

C.S.] 14,402 (1905). Bigland. *See under* XIV.

(C.)—INDIA-RUBBER.

[A.] 8953. Boresin. Process of manufacturing artificial india-rubber.* April 14.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 8508. Thompson (Kelk). Tanning. April 9.

[C.S.] 14,402 (1905). Bigland. Manufacture of size from resin and other materials and by-products, and apparatus therefor. April 19.

„ 21,267 (1905). Soc. Civile d'Etudes de l'Indéchirable Grimson. Material suitable for driving belts and similar purposes. April 11.

XV.—MANURES, ETC.

[A.] 8727. Stringfellow. *See under* XVIII*B*.

XVI.—SUGAR, STARCH, GUM, ETC.

[C.S.] 5323 (1906). De Vecchis and Sani. Complete extraction of inulin from the tubercles containing it. April 19.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

[A.] 7936. Soc. "Le Lait." Preservation of liquid foods. [Fr. Appl., April 3, 1905.]* April 2.

[A.] 8329. Boult (Chem. Ind. A.-G. St. Margrethen). Manufacture of lemonade powder or tablets.* April 6.

„ 8677. Badoud. Preservation of alimentary products. [Fr. Appl., Sept. 28, 1905.]* April 10.

„ 8789. Alliance Chemical Co., Ltd., and Krupp. Manufacture of food preparations. April 11.

„ 8859. Héritte. Alimentary extracts of blood. April 12.

„ 8988. Carey and Lawrence. Purifying and pasteurising milk and other liquids. April 14.

[C.S.] 29,543 (1904). Hemming. Sterilising, preserving and aerating foods, &c. April 11.

„ 15,079 (1905). Brodrick. Compounds for making non-alcoholic drinks. April 11.

„ 5195 (1906). Hansteen. Production of an aliment from cetraria. April 11.

(B.)—SANITATION; WATER PURIFICATION.

[A.] 8396. Desrumaux. Purification of water.* April 7.

„ 8558. Hope. Method of disinfecting and precipitating sewage. April 10.

„ 8559. Brooke. Method of disposing of, utilising, or rendering innocuous trade or other liquid effluents. April 10.

„ 8727. Stringfellow. Sanitation and manure production. April 11.

[C.S.] 24,322 (1905). Bordigoni. Apparatus for the bacterial treatment of sewage and for the purification of effluent or residual liquids. April 19.

(C.)—DISINFECTANTS.

[A.] 8839. Taylor. Disinfectant or preservative. April 12.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 8045. Soc. Franç. de la Viscose. *See under* V.

[C.S.] 6926 (1905). Claviez. Manufacture of paper threads. April 11.

„ 21,505 (1905). Horteloup. Utilisation of ulex europeus celluloses for manufacturing artificial silk, celluloid, guncotton, &c. April 11.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 7934. Hesse. *See under* III.

„ 8260. Dubosc. Manufacture of synthetic camphor. April 5.

„ 8266. Weizmann, and The Clayton Aniline Co., Ltd. Manufacture of isobornyl esters and camphor. April 5.

„ 8356. Dubosc. Manufacture of synthetic camphor. [Fr. Appl., April 6, 1905.]* April 6.

„ 8407. Newton (Bayer und Co.). Manufacture of new pharmaceutical compounds. April 7.

„ 8527. Johnson (Verein. Chininfabrik Zimmer und Co.). Manufacture of quinine oxymagnesium halcid compounds and of quinine esters therefrom. April 9.

„ 9008. Nitritfabrik G.m.b.H. Process for the production of formates. [Ger. Appl., April 15, 1905.]* April 14.

[C.S.] 22,225 (1905). Feldkamp. Manufacture of oxalates and oxalic acid. April 19.

„ 6606 (1906). Johnson (Badische Anilin und Soda Fabrik). Production of borneol esters and isoborneol esters. April 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 7935. Bloxam (Neue Photographische Ges.). Reproducing pictures by imprinting an original picture that has been treated with hydrogen peroxide.* April 2.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 8604. Robrecht. Manufacture of smokeless gunpowder.* April 10.

[C.S.] 14,958 (1905). Deutsche Sprengstoff Act.-Ges. Manufacture of nitroglycerine explosives. April 11.

„ 15,564 (1905). Cocking, and Kynoch, Ltd. Smokeless powders. April 19.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 8301. Bliss. Apparatus for determining and recording the percentage of carbon dioxide in gases. April 6.

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R. S. Hutton, D.Sc.	XI.
R. Lessing, Ph.D., II., III., VII.	
H. Levinstein, Ph.D., M.Sc.	(IV., V., VI., XX.
A. G. Levy, B.Sc.	VIII., IX.
E. W. Lewis	XIII.
G. W. Macdonald, M.Sc.	XXII.
N. H. J. Miller, Ph.D.	XV.
C. A. Mitchell, B.A.	XII., XXII.
R. W. Moore	Trade Report.
Barker North	V., XI.
T. H. Pope, B.Sc.	(XVI., XVII., XX., XXI.
Chas. Salter	(II., III., IX., XVI., XVII.
M. J. Salter	XIII.
F. Sheddon	XX.
A. Shonk	III., VII., X., XI.
W. P. Skertchley	(XII., XVIII.
B. J. Smart	(IV., XI., XX., XXII.
E. Sonstadt	III., VII., X., XV.
F. Southerden, B.Sc.	IX., XX.
A. B. Steven, B.Sc.	IV., V.
L. J. de Whalley, B.Sc.	XVI.

Birmingham Section.

Chairman: Percy F. Frankland

Vice-Chairmen:
W. Waters Butler, Frank E. Lott, Alex. E. Tucker.

Committee:

F. H. Alcock	Henry L. Heathcote.	T. Slater Price.
Robt. B. Batty.	Edward Jackson.	Walter Rosenhain.
Wm. B. Davidson.	Thos. Lawton.	Harry Silvester.
Alex. Findlay.	Frank Platten.	Thos. Turner.

Hon. Local Secretary and Treasurer:
F. R. O'Shaughnessy, Tyburn, nr. Birmingham.

Canadian Section.

Chairman: F. J. Smale.

Vice-Chairmen:
W. H. Ellis, A. McGill, *B. J. Harrington.*

Committee:

J. H. Bowman.	Chas. H. Heys.	*M. J. Taylor.*
Jeffrey H. Burland.	W. R. Lang.	Harold Van der Linde.
Thos. Davies.	W. Lash Miller.	W. H. Van Winkel.
Milton L. Hersey.	Jas. P. Murray.	

Hon. Treasurer: J. W. Bain, 90, Charles Street, Toronto.

Hon. Local Secretary:
Alfred Burton, 44, York Street, Toronto.

Liverpool Section.

Chairman : Eustace Carey
Vice-Chairman : Frank Tate

Committee :

T. Lewis Bailey	*J T Conroy*	C Longuet Higgins.
J. Campbell Brown	H E Davies	*E L Peck*
Arthur Carey	*A Foden*	W. Collingwood
G C Clayton	G Watson Gray.	Williams.

Hon Treasurer W P. Thompson

Hon Local Secretary :
W R. Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

The following take office after the Annual General Meeting :—*Chairman :* J T Conroy. *Vice-Chairman* Eustace Carey. *Committee* : J G Donnan Max Mosquett R J L Rawlins, and Alex Watt.

London Section.

Chairman A. Gordon Salamon
Vice-Chairman R J Friswell

Committee

E J Bevan	*D Ll Howard*	*Egerton Redwood*
H G Colman	G C Jones	Walter F Reid
J N Connah	A R Ling	F Napier Sutton.
M O Forster	B E R Newlands	*Chas Wightman*
Oscar Guttmann	Wm Pearce	

Hon Local Secretary
Julian L Baker, Staunesbury Holt, Kingston Road, Staines

The following take office after the Annual General Meeting :—*Chairman* R J Friswell. *Committee* : C A Keane J Lewkowitsch, G T Morgan A Gordon Salamon and P Schuhkowitz.

Manchester Section.

Chairman : G H. Bailey
Vice Chairman : *F Scudder*

Committee :

J Barnes	*B Hart*	*J H Lester*
J. Burge	W B Hart	H Porter
W. R. Coleman	R S Hutton	T Stenhouse
J. Grossmann	W L Kay	H *Thomson*

Hon Local Secretary
Julius Hübner, Ash Villa, Cheadle Hulme, Cheshire

The following take office after the Annual General Meeting :—*Vice Chairman* R E Markel. *Committee* H Bentley H Lewinstein, H Morris and W J Pope.

Newcastle Section.

Chairman H Louis
Vice-Chairman : J T Dunn

Committee :

P. P Bedson.	John Pattinson	Harry Smith
H. S Collins	*W W Proctor*	A Spiller
Ellwood Holmes	H *L Reynoldson*	*J F Stead*
N. H. Martin	Geo Sisson	C. E Stuart.

Hon. Local Secretary and Treasurer
F. C. Garrett, Armstrong College Newcastle-on Tyne

The following take office after the Annual General Meeting :—*Committee* W M. H Hutchings, C. L Potter, J Ap. Smyth and W H Sodeau.

New England Section.

Chairman Henry Howard.
Vice-Chairman : F. E Atteaux.

Committee :

C. R Borland	J W. Loveland	Charles R. Sanger
Godfrey L Cabot	L A Olney.	F H. Thorp.
W. A. Gallup.	Edw D Pearce.	W. H. Walker
A. F Hobbs	F C Robinson.	W J. Webber
Lawrence S James		

Hon. Local Treasurer : Robert W Neff 22, India Square, Boston, Mass., U S A.

Hon Local Secretary
A A. Claflin, Box 1189, Boston, Mass U S A.

New York Section.

Chairman : Russell W. Moore
Vice-Chairman : Geo. C. Stone.

Committee :

C Baskerville	A C. Humphreys.	*Wm H Nichols.*
Chas F. Chandler	E G Love.	T. J. Parker.
V Coblentz	*Wm McMurtrie.*	G. A Prochazka
A H Elliott	E. H Miller.	W. E Rowley.
De Laguel Haigh		

Hon Local Secretary :
H Schweitzer, 128, Duane Street, New York, U S A

The following take office after the Annual General Meeting :—*Chairman* Geo C Stone. *Committee :* Howard B Bishop, J B F Herreshoff, Geo F Kunz R W Moore, Albert Plaut, and Maximilian Toch.

Nottingham Section.

Chairman J. M C Paton
Vice-Chairman. J T Wood

Committee

L Archbutt	H S Garry	J O'Sullivan
S F Burford	J Goldings	G. J. Ward.
F J R Carulla	F Stanley Kipping	J White.
R. M Caven	O Quibell	

Hon Treasurer S J Pentecost Sherwood Rise, Nottingham

Hon Local Secretary
S B Trotman, King's Walk Chambers, Parliament Street, Nottingham

Scottish Section.

Chairman David Perry.
Vice-Chairman J S Macarthur

Committee

R M. Clark	Jno S Ford	*Jas Hope*
W S Curphey.	*W Frew.*	J Falconer King
L Dobbin	R Hamilton	Jas McLeod
Thos Ewan	G G Henderson.	T L Patterson.
C E Fawsitt	*Jas Hendrick*	D J. Playfair.
J Arnold Fleming		

Hon Secretary and Treasurer :
Thomas Gray c/o Gourlay and Deas, 124, St. Vincent Street, Glasgow

The following take office in Sept. next :—*Chairman* : John S Macarthur. *Vice-Chairman* Thos Gray. *Committee* Jas Faill, David Perry R T. Thomson and Chas. W. Townsend.

Hon Sec and Treasurer :
Chas E Fawsitt.

Sydney, N.S.W., Section.

Chairman A Liversidge.

Committee :

W A Dixon	Jas M Petrie	R Greig Smith
V Elliott	A. A Ramsay	H G. Smith
G C Joplin	J A Schofield	T. Steel.
J Morison		

Hon Local Secretary
T U Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S W.

Yorkshire Section.

Chairman . H. R Procter
Vice-Chairman : Thorp Whitaker.

Committee :

J. E Bedford	*W M Gardner.*	G. E. Scott-Smith
F. Branson	H. R. Hirst	A. Smithells
B. A. Burrell.	W. McD. Mackey.	*Geo Ward*
S. H Davies.	*F W. Richardson.*	

Hon Local Secretary and Treasurer .
T Farley, 17, East Parade, Leeds.

The following take office after the Annual General Meeting :—*Chairman :* F W. Branson *Committee :* E M Chaplin, J. Garfield, B. North, H R. Procter, and G. W. Slatter.

N.B.—The names in *italics* are those of members of Committee who retire from their respective offices at the end of the current session.

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Eustace Carey has been nominated to the office of President under Rule 8; Dr. E. G. Love, Mr. A. Gordon Salamon, and Mr. Chas. Wightman have been nominated Vice-Presidents under Rule 8; and Dr. E. Divers, F.R.S., has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's office, at least one month before the date of the Annual General Meeting, at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

ALTERATION OF BY-LAWS.

With a view to facilitate the voting of members residing abroad, notice is hereby given, in accordance with Rule 35 of the By-laws, that the Council will propose to the forthcoming Annual General Meeting the amendment of the Society's By-laws as follows:

1. Rule 18. (*a*) That the words "At least two months before the date of each Annual General Meeting," in the first and second lines thereof, be replaced by the words, "In the second issue of the Society's Journal for the month of April in each year."

(*b*) That the words "date of that meeting," in the fourth line thereof, be replaced by the words "Annual Meeting next ensuing."

(*c*) That the words "At least one month before the date of;" in the sixth line from the end thereof, be replaced by the words "not later than the last day of May prior to."

2. Rule 19. That the words "at least five days before the commencement of the said meeting,' in the two last lines thereof, be replaced by the words, "in the second issue of the Society's Journal for the month of May."

Death.

Griffith, R. W. S., of Eyeworth Lodge, Lyndhurst, Hants. March 29.

PROCEEDINGS

OF THE

EXTRAORDINARY GENERAL MEETING,

MARCH 27TH, 1906.

An extraordinary general meeting of the Society was held on Tuesday, March 27th, 1906, at the house of the Society of Arts, John Street, Adelphi. Dr. E. Divers, F.R.S., President, took the chair at 3.30 p.m.

Mr. C. G. Cresswell (Secretary) read the notice convening the meeting as follows:—

"Notice is hereby given that an Extraordinary General Meeting of the Society will be held at 3.30 o'clock, precisely, in the afternoon of Tuesday, the twenty-seventh day of March, 1906, at the House of the Society of Arts, John Street, Adelphi, W.C., by kind permission of the Council of that Society, with the object of considering and adopting the resolution mentioned in the Requisition hereinafter set forth:—

"To the President and Council of the Society of Chemical Industry."

We, the undersigned Members of the Society of Chemical Industry, hereby request that, in accordance with By-Law 40, you will convene an Extraordinary General Meeting of the Society with the object of considering and, if approved by the said Extraordinary Meeting, of adopting the following resolution (that is to say)—

Resolution.

"That it is desirable that the Society of Chemical Industry as now existing should be incorporated under and subject to the grant of a Royal Charter and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation.

Dated this twenty-second day of December, 1905."

The Chairman. The business before us to-day need take but very little time, and the sparse attendance may be regarded as evidence that the members are in accord with those who have signed the requisition for this meeting. In order to shorten the business, and to put us in order, I will ask Sir Boverton Redwood to formally propose the resolution. Sir Boverton Redwood has been acting as the Chairman of a Committee appointed some considerable time ago to consider the expediency of obtaining a Royal Charter, so that he is particularly well fitted to move the resolution.

Sir Boverton Redwood. As you, sir, have already indicated in your opening remarks, this question of obtaining a Charter of Incorporation for the Society of Chemical Industry has received the attention of the Council of the Society from time to time during, I think, the past three years, and a Special Committee was appointed for the purpose of studying the subject in all its aspects, with the help of our hon. counsel, Mr. C. C. Hutchinson, to whom I would like to take this opportunity of saying we owe very much in this matter, and under the experienced guidance of our legal adviser, Mr. Markby, whom I am happy to see with us to-day. It surely is scarcely necessary for me to say very much in respect to the advantages which would result to the Society from obtaining a Charter of Incorporation. At the present time we are but an aggregation or association of persons having like objects in view, but without legal existence as a corporate body. Consequently in making representations to the Government, or in taking in point of fact any action such as is ordinarily taken by corporate bodies, we have to act simply as an assemblage of individuals with all the obvious disadvantages attendant upon such informal constitution. There can be, I think, no question that if we were to obtain this proposed charter the Society would be placed on a far higher plane in public estimation, lustre would be added to its name, and we should be in an infinitely better position to carry out the important duties with which we are charged. We should also incidentally place ourselves in a position similar to that of the other learned Societies, and it seems to be obvious that in such a position we should be far better able to advance the interests of manufactures and science.

The supremely important question of the possible effect which incorporation might have upon the status of members beyond the seas has been attentively discussed by the Committee, and I may say at once that no action would have been proposed which, in the opinion of the Committee, was in the slightest degree likely to place those members in a less advantageous position, or in any way to weaken the ties which so happily bind us together.

But on that point we are quite satisfied. We have received the most positive assurances from our competent legal advisers that under a charter the Society would be no less broadly Anglo-Saxon and cosmopolitan than it is at present, and that nothing would occur in connection with the incorporation to modify the existing constitution of the Society, so as to impair its usefulness. In these circumstances it scarcely seems that there can be room for doubt as to the advisability of passing the resolution which is before the meeting, but, as you will have gathered from what has taken place, the Council has, doubtless in the exercise of a wise discretion, preserved a passive attitude in this matter, and has not taken action until it was called upon and compelled to do so by the receipt of the requisition which has been read to the meeting. That requisition, as you will have seen, bears the signatures of representatives of all ranks and various sections of the Society; past and present officers, and many distinguished Canadian and United States members of the Society, but I should like to state that by some mischance one of the sheets bearing signatures from New York went astray. Through Dr. Power we are in receipt of a letter from Mr. Parker explaining that the signatures which I am about to give you were affixed to the requisition in his presence, and it is strongly desired that those signatures should be recorded with his own, that is, with Mr. Parker's as advocating the Charter. The signatures in question include those of the two American Past Presidents, Prof. C. F. Chandler (of Columbia University), and Dr. W. H. Nichols; the Hon. Local Secretary, Dr. H. Schweitzer; the Hon. Treasurer, Mr. R. C. Woodcock; Mr. T. J. Parker, Dr. R. W. Moore, Dr. E. G. Love, and Dr. Leo Backeland.

We have thus, besides the signatures received from Canada through Mr. E. Grant Hooper, signatures received through Dr. Power, from New York, New England, Philadelphia, Washington, Baltimore and St. Louis. On receipt of the requisition the Council called this meeting, and, although it was recognised that members not resident in the United Kingdom could hardly be expected to attend, time has been afforded for the receipt of written expressions of any views that might be entertained. As bearing upon the question of the New York signatures, and as indicating the opportunity there has been afforded for the conveyance of expressions of opinion, I may, perhaps, be allowed to read this very brief letter, dated March 6th last, from Mr. Parker to Dr. Power:—

"I am glad to receive your valued letter of the 23rd ult., and to learn that there is a prospect of the names sent you as advocating the acquisition of a Royal Charter for the Society of Chemical Industry being added to your list. I know this would be pleasing to both Mr. William H. Nichols and Prof. Chandler, as I spoke to both these gentlemen personally about it, and they were both very much in favour of it. I shall be glad to learn that Sir Boverton Redwood has appended the names to the list. Please let me hear from you.

"Yours very truly,
"(Signed) T. J. PARKER."

Perhaps it may be anticipated that before resuming my seat I should say a few words as to the prospects of success in the event of the resolution being carried. Obviously nothing like an assurance can be given on such a question, but I think I am justified in stating that the results of confidential inquiries have been such as to give us the most hopeful anticipations of success. I have only further to say that if there are any points that I have not covered in these remarks, on which any member of the Society here present would like to have additional information which it is within my power to give, I hope he will address himself to the Chair on those points, and I have only now in conclusion to formally move the adoption of the resolution which is incorporated in the notice convening the meeting which has been read by the Secretary.

Mr. A. GORDON SALAMON: I have been asked to second the resolution which has been so well described to you by Sir Boverton Redwood, and have very great pleasure in doing so. No one who has served on the Committee, and who has studied this question, can have the slightest doubt that the obtaining of a Charter of Incorporation must react for the benefit of the Society as a whole, and must tend to consolidate those sections beyond the seas with our sections at home. If this be so, it will have the ultimate effect of rendering our Society the most powerful of its kind, and of making it represent fully and completely the chemical industries so far as they are controlled by English speaking chemists.

The CHAIRMAN: I invite discussion on this motion before putting it formally to the vote. Whilst as Chairman of this meeting I wish to preserve an impartial attitude, I believe I may as an individual, without overstepping my position as Chairman, say that I am very strongly in favour of getting this Charter. As you know, this Society has grown very large, and, in consequence of its numbers and importance, it has ventured in recent years to make itself heard on questions of public importance in relation to chemical industry. Now, if any case of strenuous opposition—such as might be offered by vested interests in such a case as is now before a Royal Commission, that of the utilisation of the canals and waterways of this country—to what would be an advancement of chemical industry, I think the Society would feel much greater confidence in combating this opposition, if it knew that it had behind it the position given by the possession of a Royal Charter. At any rate, it would not have to vindicate its right to be heard. Again, were any movement intended on the part of the Government to advance scientific interests, and those societies representing them, we should, if we were a chartered Society, have a much better claim to receive consideration than we have at present. Some 50 years or more ago this question did arise, when the Government, which had already given accommodation to the Royal Society at Somerset House, decided to give further housing accommodation to this and other scientific societies, it limited the housing to those only which had a Charter. If, therefore, we had been then in existence we should have received no consideration whatever from the Government. No doubt other cases may turn up in which we may find the advantage of the consideration which would be given to us from our possession of a Charter. I now invite remarks for or against this motion.

Mr. R. J. FRISWELL: I gather from a remark which fell from Sir Boverton Redwood that the Council adopts a passive attitude in this matter. We have heard most eloquently from him, from Mr. Salamon, and from the Chairman, the advantages which would accrue from the possession of a Charter, but there are a certain number of disadvantages which also accompany it, and I think it is right that those also should be borne in mind. After all unless we act upon the theory that silence gives consent, the signatures to the requisition, and the members present do not amount to much more than 1 per cent. of the Society, so that it appears that there are a considerable number who maintain silence, which may be that of consent, of simple neutrality, or of want of information. Now I happen to be one of the survivors of a very embittered discussion which in the years 1874, 1875 and 1876 shook the Chemical Society very nearly to disintegration. It arose from the fact that numerous persons without any pretence to a knowledge of chemistry were making use of the letters "F.C.S." in order to advertise themselves as competent chemists, and to obtain practice on that ground. Amongst the members most prominent in the discussion were the late Dr. Wright, Prof. Hartley, and Mr. C. T. Kingzett, and several others, including myself. We appealed to the Chemical Society to know whether it was possible that some evidence of qualification for membership of the Society could be required. At first the Society was extremely averse from giving any reply at all; but at last, after a deal of discussion, they agreed to refer the matter to counsel. Counsel referred to the Charter, and advised them that under the Charter it was absolutely impossible for the Chemical Society to require from candidates any knowledge of chemistry—it was simply necessary for a person to be recommended by a certain number of Fellows and to declare that he took an interest in chemistry, and if he were elected and able to pay the fees he became

a Fellow of the Society. Finding it impossible to carry this point, we went further and asked the Society to see whether, under the Charter, they could amend their rules and get a separate class of Fellows established. That proposal I believe arose on the motion of the late Sir Edward Frankland. The matter was referred to counsel again, and again to the Charter, and again it was announced that they had no power whatever to effect any alteration, and that, moreover, any attempt to alter the Charter would rouse opposition, and in addition to being very costly financially might possibly cause other injury to the Society. The result, as we all know, was the formation of a separate body, the Institute of Chemistry. Later on, when I was a member of the Council of the Chemical Society, it was proposed to admit ladies. The Council debated the matter several times, and there was a strong feeling on the part of a majority that ladies should be admitted to the privilege of Fellowship, but again the Charter was referred to, and again it was found impossible. I have referred to these matters simply because the possession of a Charter, like other questions, has two sides to it. Although it undoubtedly, as the proposer and the seconder have stated, confers considerable powers on the Society, enables it to own property, and to do many acts which it otherwise could not do, and also confers prestige, yet it undoubtedly seriously hampers every Society, because I am informed, and I had a great deal to do with the question of the Charter that the Institute of Chemistry obtained, that when a Charter is once granted you are not in the position that you are in under the ordinary law—where you may do that which is not forbidden. When you are under a Charter you may not do that which is not forbidden, you may only do that which is expressly permitted in the Charter. Therefore, unless we are to become to some extent stereotyped or fossilised, it will be necessary for the proposed Charter to be drawn with the most extreme care if future expansions and alterations of the Society may be permitted without having recourse to that tribunal which both the Chemical Society and the Institute of Chemistry have looked upon with considerable alarm, that is the Privy Council, for an amendment of the Charter. As to the possibility of the Society being granted a house, because it is a Chartered Society, I do not think there is much force in that. When a house was granted to six learned societies there were, I believe, but six. Now there are numbers of societies—there are Chartered Accountants, Chartered Patent Agents, the Institute of Chemistry, and various other Chartered Societies, and I do not think it is in the least likely that public money will ever be expended on granting houses to any of those bodies which are to some extent, as we are, of the nature of professional or trade societies.

Gentlemen, I have only made these remarks because I felt it my duty to do so. I have seen during 27 years past the very great difficulty which the existence of a Charter places in the way of a Society which is a living and expanding body. It is all very well for the Chemical Society to have its Charter, but in my opinion it has stereotyped a great many points which could be very well improved. It is all very well, also, for the Institute of Chemistry, which is an examining and qualifying body, but in a body such as ours I feel sure there are likely to arise occasions when it will be desirable to go outside the Charter, however well it may be drawn. We cannot foresee what changes may arise in a few, even 20 years' time. You may say, sufficient unto the day is the evil thereof, and draw our Charter as well as you can, but I hope, as the Council of the Society have taken a passive attitude in this matter, they will at any rate carefully consider what may arise in the way that I have mentioned before proceeding to take a step which, it seems to me, must tend to stereotype our Constitution for, at any rate, a great number of years to come.

Mr. T. Tyrer: I do not propose to follow Mr. Friswell in his rather alarmist speech. I have inquired into the points mentioned by him and may say, for his comfort, that the answers to questions put to the solicitor of the Committee have completely removed my own doubts and fears. May I remind you that the Society's Constitution is extremely broad and wide. The objects of the Society are not such as in any way to be taken as quasi professional, nor can membership be regarded as in any degree a qualification. It may be that the value of membership of the Society of Chemical Industry, apart from its Journal, is that it is a Society of good fellowship, and that wherever a member of the Society meets another there is at once instituted a bond of friendliness and friendship which goes far to justify the application for this Charter. It must not be taken, I think, that the use of the word "passive" as regards the Council is in any way to be regarded as implying dissent. The passivity of the Council is an obligation, as well as a wise action on their behalf. This question was raised some time ago, and has been referred to more than once. I retired from the Council last year, and up to that time the attitude, though passive, was entirely friendly and satisfactory. From time to time to my knowledge, by definite reports, the Committee told the Council what was going on. Most careful questions as to the existing by-laws, based on the fact that this is a Society of wide membership, extending over all parts of the world, questions as to nationality and government and proceedings of various sections have been put—most trying and most interesting questions have been put—to the legal advisers, and I have heard satisfactory replies. But these thoughts were not in my mind until Mr. Friswell spoke. What I really rose to say was this. In addition to the names which have been added, and to which Sir Boverton Redwood referred, there is this great fact, that in one's visits to America within the three years referred to, there were no objections, there was no "passive" resistance, there was no criticism; everybody was pleased, particularly when answers were given by those who knew the spirit in which this movement was commenced. During the meeting which took place last year, the expressions of confidence in the Council, and hopes for the future of the Society, and belief in its great mission, were very numerous and hearty. Out of the very large number of letters I have received, in a majority of them reference was made to the coming action, and hopes expressed that whatever steps might be taken by the Council would be for the good of the whole Society, coupled with the assurance that they were quite convinced that such a Council as we possess could do nothing which was very far wrong. I simply want to emphasise the fact that we need have no fear as to the paucity of members attending now being used as an argument against us at any time. Members could have written, they have had plenty of opportunity, and if there had been any opposition we might have been flooded with telegrams from various parts of the world, especially from America, where they are not shy in expressing opinion. That has not happened and is, therefore, a very happy augury for the future.

Mr. Julian L. Baker asked, in the event of a Charter being obtained, if it would be possible at any future time to raise the annual subscription to the Society?

Sir Boverton Redwood: On that point the solicitor has explained to me that it is not intended to specify the subscription in the Charter, and therefore it can be fixed from time to time as the Council may think fit.

Mr. E. Grant Hooper thought that both Mr. Baker's question and the remarks of Mr. Friswell pointed not so much to the disadvantage of a Charter as to the necessity of securing broad powers. That, he felt, was really the purport of the remarks Mr. Friswell had made.

Mr. Friswell: Certainly.

Mr. E. Grant Hooper: With that view he was sure they were all in sympathy. They did not desire to bind themselves in any narrow groove; and he himself felt that every effort should be made to obtain a Charter of as wide a character as possible. It was impossible to forecast the future of a Society such as this, and just as the various developments which had occurred in the course of its existence could scarcely have been foreseen at its foundation, so was it undesirable that they should limit themselves in any avoidable manner as regards the future. That there might be some limitation, even

after every care was taken, was, he thought, only to say that this, like most other propositions, was not absolutely free from disadvantages. They could hardly hope to escape that, but what had to be considered was whether or not the balance of advantage was in favour of the direction in which they were proposing to proceed. On that point he thought that the comparative smallness of the meeting was evidence of a general feeling on the part of the Society as a whole that they were moving in the right direction.

Mr. DAVID HOWARD: I am not a lawyer; but may I suggest that even as an incorporated body under a somewhat cumbersome Act, we are still limited in our powers. We cannot go beyond our memorandum. If we wished to make some fundamental alteration we should have a process almost as cumbersome as obtaining a Charter to go through, and is there not an advantage in having clearly defined objects and sticking to them? I am old enough to remember the whole history of the discussions at the Chemical Society about practising Fellows. I was an enthusiast at that time in favour of it, and I am bound to say I think it was one of the best things that ever happened that we had a Charter to prevent our making a mistake. It has been much better that the Institute of Chemistry should do the work, and not act as a mere adjunct to a learned Society which had nothing to do with professional work as such. Therefore I think that is one thing distinctly in favour of a Royal Charter. Again, with regard to the admission of ladies, I do not think that the injury to the Society has been so serious as to justify that being claimed as an objection to a Charter; and we can put in words which will prevent our excluding ladies. Then, with regard to the Institute of Chemistry, I do not know of a single point in which the Charter has done us any harm, and I know many in which it has done us good. The very fact that it has kept us on strictly defined lines—not too strictly—has been a great benefit to the Institute. I have heard some wild suggestions, and there is no more delicate way of suggesting to a man that he cannot have what he wants, than to say that it is not in the Charter; it is so much more considerate to put it in that way than to say "you know it *is* very stupid"; and very often that would be the only alternative. I have had a pretty long experience as a Fellow of two Chartered Societies, and have found it an unmixed blessing. After all, it ever so fundamental a change was proposed as to go outside a carefully-drawn Charter, I think it is very well to make it extremely difficult, and make it require very careful and serious consideration before you do it. We have a certain check on us now, and if the other check is somewhat more severe, is it unwise to have that check? Is it unwise to prevent some rash action which would do away with the useful work of many years? For it is far from certain that progress is always in the right direction. When I was young I learnt Latin, which I believe now is objectionable in a chemist, and I was taught a certain line about an extremely easy descent to a place which we do not mention. Therefore progress may be in a wrong direction. On the other hand, a difficulty in making fundamental changes is an unmixed good.

Mr. P. MACEWAN: If this resolution is passed, will it be final? I ask that because I notice that the British Medical Association are also going to apply for a Royal Charter, and the first thing that Association seems to have done was to submit to its members the draft of the Charter. From that I learn—and the thing is brought to my mind by Mr. Baker's question—that their subscription is the same as ours, but in the Charter they say that the subscription shall not exceed 60s. a year. My question is, will the members of this Society not have an opportunity of reading the draft Charter before it is applied for? If it were published in the Society's Journal, some suggestions might be put forward by members who took care to read it.

Sir BOVERTON REDWOOD: The answer is that all that this meeting would commit the Society to is indicated by the resolution; and with respect to further action, the course which would be taken would be to submit the byelaws, which in effect would indicate the nature of the Charter to the members of the Society, at a subsequent date, for their consideration and approval; when further opportunity, of course, would be afforded for discussion of the subject.

Mr. MACEWAN: Before, or after the Charter is obtained?

Sir BOVERTON REDWOOD: Subsequent to the granting of the Charter. What this Society would be committed to is indicated by the resolution; namely, that the Council is authorised—assuming this resolution to be passed—to take all necessary steps to procure the granting of a Royal Charter of Incorporation. The Council, in pursuance of that authorisation, would proceed to take those steps. Assuming that they meet with success, and obtain the Charter, it would then be necessary to draw up a series of byelaws, which, as I have said, would be submitted to the Society in due course for their consideration and approval.

Mr. MACEWAN: Why should not we have the same advantage as in the case of the British Medical Association, where the proposed Charter is submitted to all the members and published in the Society's Journal? I simply throw that out as a suggestion; I do not press it, but it struck me as being an exceedingly good idea to let members see what is exactly being asked for.

Sir BOVERTON REDWOOD: I take it, Mr. President, we are perfectly safe in acting as I have indicated. We are acting under the advice, and with the experienced assistance of Mr. C. C. Hutchinson and of Mr. Markby; and I may further point out that it would not be, as I understand, the constitutional method of procedure to discuss the terms of a Charter which we may never obtain. We have first of all to procure the Royal recognition, which is indicated by the granting of a Charter. It is possible we might not get precisely such a form of Charter as we might have in our minds as the outcome of discussing the particulars of the Charter by a meeting.

The CHAIRMAN: Are there any other remarks to be made? If not, I will ask Sir Boverton Redwood to reply to the comments which have been made, in so far as necessary.

Sir BOVERTON REDWOOD: I have only to say that I think we are indebted to Mr. Friswell for his attendance here, and for the remarks he has made; first, because it is always well to hear both sides of a question, and I may say that one admires a man who has the courage to express himself in a sense which may perhaps be different to that of the majority of those among whom he finds himself for the time being. But especially I think we are indebted to Mr. Friswell because his remarks have had the effect of eliciting speeches in support of this motion which perhaps otherwise we might not have had. There is, I think, in all that Mr. Friswell has said, only one point for me to comment upon. Mr. Friswell has alluded to the size of this meeting, on which I have nothing further to say beyond what the Chairman has already remarked; but I ought to refer in connection with that to the comparatively small number of signatures to this requisition. Coupling the paucity of this attendance with the small number of signatories, Mr. Friswell pointed out that, collectively, it represented but a small fraction of the total membership of the Society. It is only right for me to say that with respect to the signatures for this requisition, all that was aimed at was to comply with byelaw 40, under which the requisition was sent in and this meeting has been called, which byelaw requires that there shall be at least thirty signatures. It was, in fact, rather by accident than by intention that we exceeded the requisite number. It was in point of fact in taking steps to obtain only the requisite number of signatures that something like double that number came in. But I know that there would be no difficulty in indefinitely, within the limits of the membership of the Society, extending the list, and, therefore, it must not be taken that the number of signatures has any kind of bearing whatever on the attitude of the members of the Society in relation to the proposition which has been put before you.

The CHAIRMAN: I most cordially endorse the words of Sir Boverton Redwood in thanking Mr. Friswell for expressing some words of warning to us as to the steps that we are proposing to take. It is very important for this meeting to consider both sides of the matter, so that we may not be deciding without having considered the consequences. Mr. Howard has treated the matter so thoroughly from the point of view I take myself, that it is unnecessary to enlarge upon what he has said. I may mention that I also was in the fight at the Chemical Society to which Mr. Friswell referred, and which led to the foundation of the Institute of Chemistry. Similarly, some remarks made at a meeting of the Chemical Society in the discussion of an important paper by Mr. Deacon, led, indirectly, to the foundation of the Society of Chemical Industry. A wish was then expressed to enlarge the scope of the Chemical Society's operations, so that industrial chemical papers might be read there as well as purely scientific ones. I am sure that on these two occasions the Chemical Society found such shelter as its Charter afforded rather helpful, for it was felt by many of its Fellows that such great undertakings would prove to be beyond the ability of the Society to carry through. As was mentioned by Mr. Howard, a Charter is really very useful at times in this way. If we find out after we have got the Charter any sufficient reason for wishing to extend or modify our powers, it will probably not be difficult or expensive to get a modification of it, or a supplemental Charter. I think, therefore, that we should not be frightened by the dangers which Mr. Friswell has brought before us, although it is important that they should be taken into consideration. I do not think it is amiss for me to express the hope that Mr. Friswell will hold up his hand in favour of applying for the Charter, although, very properly indeed, he has thought it well to point out the objections there may be to doing so without due precautions.

Dr. POWER: Before you put the motion, Mr. Chairman, I should like to say a word. It seems to me that in connection with the record of the proceedings of this meeting it is desirable that there should be some expression of sentiment with regard to the bearing of the Charter on the *status* of the members of the Society across the seas. I naturally have, so far as the United States members are concerned, a feeling of deep interest with regard to this matter, and I think I may say that this movement has received the unqualified support, and the deep sympathy of the more influential members in the United States. The only hesitation that seems to have been expressed in connection with this matter, is as to whether the *status* or the relations of the members in the United States would in any way be prejudiced or altered by the granting of a Royal Charter to this Society. They have received definite personal assurances that such would not be the case, and, if I remember rightly, Sir Boverton Redwood has referred to this in the course of his remarks. I think we may take it for granted that the Charter, if secured, will be drawn on such broad lines as to guarantee the equal rights and privileges of every member of the Society in any part of the world.

The CHAIRMAN: I am sure we are much obliged to Dr. Power for what he has said.

Mr. S. HALL: One thing has occurred to my mind which may induce Mr. Friswell to think of altering his view, though I do not know which way he is going to vote. He has very wisely made us think how to keep the Charter as wide and broad as possible, because Charters no doubt do have the effect of limitation in certain cases; but would it not be the same thing if, having the probability of obtaining a Charter, we limited ourselves and so did not obtain those advantages which Mr. Friswell himself thinks would accrue from it? We should be depriving ourselves of the opportunity of getting them if we did not accept or take the Charter.

The CHAIRMAN: There is one point I forgot to mention just now, and that was with regard to the question raised by Mr. MacEwan. I should like it to be clearly understood that, in applying for a Charter, we are not applying for any modification of the laws and constitution of the Society. As it has been explained by Sir Boverton Redwood, the byelaws will need some revision when we have got the Charter. Any changes will have to be authorised by the vote of a General Meeting of the Society.

I will now put the matter to the vote. Those in favour will please signify the same in the usual way.

It is carried unanimously.

The CHAIRMAN: It only remains to thank you for your attendance to-day.

Mr. S. HALL: Allow me a moment. I am sure that all those who have had anything to do with this matter during the years it has been under consideration must wish to thank Sir Boverton Redwood for the very great care he has exercised, for getting the very best information for us, for calling us together, and consulting us, not only the Committee but the Council, about it. I therefore propose a vote of thanks to Sir Boverton Redwood.

Mr. WALTER REID: This is a resolution which probably everybody in the room would like to second, and if I may claim the privilege of doing so, I would like to, knowing as I do the large amount of work Sir Boverton Redwood has done. This matter has been before us about three years, and during those three years, although it has not been published generally to the Society, the Council have had many reports on the matter, and nothing could equal the clear method with which Sir Boverton Redwood has treated the subject. I do not think one false step has been made from the beginning. When difficulties presented themselves, they were met, and the result is highly satisfactory, and we are much indebted to Sir Boverton Redwood.

The CHAIRMAN: Again, if I may exceed my duties, I should like to take sides and strongly support this resolution, because I feel that nothing that has been said by the proposer and seconder has gone beyond the facts of the case.

The resolution was put and carried unanimously.

Mr. DAVID HOWARD: There is another resolution I should like to move. Our President is only our Chairman to-day, and the Chairman may have a vote of thanks. We the more welcome the opportunity of thanking him, because, as President, we have so much less opportunity of doing so, although, whether as President or Chairman, we are glad to be presided over by him.

Mr. GRANT HOOPER: I beg to second that.

The resolution was put by Mr. Howard and carried unanimously.

Sir BOVERTON REDWOOD: Before the Chairman rises to respond to the vote proposed by Mr. David Howard, may I say that while I am deeply grateful to the Hon. Treasurer of the Society, Mr. Samuel Hall, and to my friend, Mr. Reid, for the very kind words which have fallen from them, and to my friend, Dr. Divers, for supporting the motion, I nevertheless feel that I am placed in a somewhat uncomfortable position. I recognise that we are very far as yet from having achieved the object we have in view, and I cannot help thinking that if, in the end, we should chance to be unsuccessful—I do not anticipate we shall be, but these things do occur—I should deserve your execration rather than your praise. Therefore I cannot divest myself of the idea that perhaps in a sense this motion is a little premature. Let us wait, please, until we have accomplished that which we have in view, and then if you think the work has been well done, I shall be only too glad to hear it.

The CHAIRMAN: I thank you for the kind way in which you have passed the vote of thanks to myself, for your attendance here, and for having done a public duty to the Society. If everybody had stayed away, satisfied that even in their absence the matter would be determined as they wished, nothing could have been done till another meeting had been called.

Birmingham Section.

Meeting held at Birmingham, on Thursday, March 15th, 1906.

PROF. FRANKLAND IN THE CHAIR.

NOTE ON A SIMPLE METHOD OF CHECKING THE EFFICIENCY OF A SEWAGE PURIFICATION WORKS.

BY F. R. O'SHAUGHNESSY, A.R.C.SC., F.I.C.

It is always desirable, and in most cases it is necessary, to have some working standard for guidance in the construction and manipulation of plant to be used for purifying sewage. The moment one attempts to fix definite limits, however, one is met by a number of not inconsiderable difficulties; and at least any arbitrary figures which may be adopted can have only a local and special value, which, if rigidly adhered to, must often give rise to grave anomalies. It is, however, not merely a matter of considerable interest, but it is of the utmost importance to know what may be considered a reasonable degree of purification in any given sewage. For the grosser impurities are usually eliminated with comparative ease, but as the liquor gets purer, it becomes more and more difficult, and consequently more and more expensive, to remove a given increment of impurity. When the process of purification has reached the stage when the purity of the liquor approximates to that at which it is usually considered wise to fix a standard figure, a slight increase in the stringency of the standard will entail an enormous, and often an altogether disproportionate increase in the cost of the sewage works. Taking this fact into account, and remembering also that our ideas on some of the important aspects of this question are necessarily tentative, it behoves us to avoid the besetting sin of dogmatism. The promised land of finality is not for this generation of sewage experts, and it is manifestly absurd to spend large sums of money in effecting what may be an unnecessary degree of purification. It is not my intention in this brief note to discuss at length this vexed question of standards, but my own experience would suggest an elastic rather than a rigid standard, as being the more reasonable.

The object of this communication is to bring forward my deductions from some of my observations on the effect of sewage effluents on the water of the river into which they are discharged. A reasonable condition, as will be generally admitted, is, that the effluent shall *at least* not cause the water of the stream to deteriorate. This condition seems so obvious, that it is often and easily quoted as an axiom. But be it noted that, while it is easy to quote an aphorism, it is somewhat difficult to devise a ready working means of checking this condition The method I am about to explain is as simple and obvious as the axiom. It consists in determining the tendency of the river water to putrefy above and below the given sewage works. As a control, isolated comparisons are of little value, as the river water in populous districts is so extremely variable in composition.

In my own experiments, the observations were made almost daily, and in the table the results are given for a whole year.

AVERAGE analysis of the Rivers Tame and Rea in dry weather.

Results expressed in parts per 100,000.

Sample.	Albuminoid ammonia.	Oxygen absorbed in four hours.
River Rea (above works) ...	0·102	0 913
River Tame (above works)..	0·114	1·172
River Tame(Sweetmore Bridge) (Rea and Tame combined below works).....	0·121	1·233

Also for comparison I give the average analysis of the river water in dry weather, both above and below the works.

The tendency of any particular sample to putrefy was determined by the well-known "oxygen absorbed in three minutes" test, applied before and after incubation for five or six days.

The point to be noted is, that though the water tends to putrefy below as well as above the works, the number of samples showing putrefactive tendencies is less, in this case, below the works than above. This, therefore, may be considered satisfactory, and the works in question, from the point of view of this condition alone, are working efficiently. If the samples showing putrefactive tendencies were more numerous below than above, then the reverse would be the case. This condition is an extremely important one, and anyone familiar with the great difficulties to be surmounted in the treatment of enormous volumes of impure liquid will realise how severe is a control such as this.

Nevertheless, that such a standard can be maintained, the figures amply demonstrate. Further, the observations have that superlative advantage from the point of view of the layman in that they are on a practical and not on a laboratory scale. This method should form, therefore, a very good working test.

DISCUSSION.

The CHAIRMAN said, as Mr O'Shaughnessy had remarked, the tendency now-a-days was more and more to do away with hard and fast standards of sewage purification and to consider local circumstances. It was obvious that to purify sewage which was to be discharged into a foul stream and to purify sewage which would pass into a stream afterwards used as drinking water were two very different matters and it would be unreasonable to employ the same standard for both. This test, which Mr. O'Shaughnessy had introduced, was a very luminous one. The layman could easily understand it. It was based wholly upon practical results. It did not deal with the amount of organic matter—albuminoid ammonia, or anything of that kind, but simply with the question of whether the water putrefied or not after incubation in a closed bottle at a certain temperature for a certain length of time. It would have been advantageous if Mr O'Shaughnessy had stated the amount of nitrates at the three places in question—the Rea, and the Tame at Saltley above the works, and the Tame at Sweetmore Bridge below the works—this diminution in the putrescibility of the water below the influx of the sewage effluent was no doubt to be attributed to the nitrates present

STATEMENT of the condition of the Rivers Tame and Rea at Saltley (above Drainage Board's works) and river Tame at Sweetmore Bridge (below Drainage Board's outfall).

Percentage of samples analysed which showed signs of putrefaction.

Sample.	Oct., 1904.	Nov., 1904.	Dec., 1904.	Jan., 1905.	Feb., 1905.	March, 1905.	April, 1905.	May, 1905.	June, 1905.	July, 1905.	Aug., 1905.	Sept., 1905.	Average percentage.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
River Rea (above works)	68·2	55·5	52·9	60	50	45·5	61·5	44	60	23·8	*88·5	47·6	50·2
River Tame (above works)	52·6	38·8	35·2	42·1	15	31·9	66·7	71	70	23·8	53·8	47·6	49·5
River Tame (Sweetmore Bridge) (Rea and Tame combined below works).	47·4	38·8	35·5	40	22·2	40·9	55·6	59	60	19	38·5	47·6	42·1

in the sewage effluent. There was only one point to guard against, *viz.*, the effect of any other stream entering the Tame.

If Mr. O'Shaughnessy said there was no further tributary between the entry of the Birmingham effluent and the spot where his samples had been taken below, then these figures clearly showed that the character of the water was *chemically* inferior after the introduction of the sewage effluent. The albuminoid ammonia had gone up; the oxygen absorbed had also gone up, but in view of the very considerable proportion of nitrates introduced into the stream in the effluent, the purification of this organic matter which had been introduced, took place because the oxidation of this organic matter was effected at the expense of the nitrates. It was very convenient when one had to discharge a sewage effluent into a foul river like the Tame and Rea and not into a pure stream, because it was comparatively easy, by means of a sewage effluent, to purify a foul river like the Tame than to do the same in the case of a beautiful upland stream.

A similar case occurred to him at Manchester, where the effluent from the sewage works was discharged into the Manchester Ship Canal, which he supposed was about the foulest water that could be found in the United Kingdom, and it was an easy matter there to discharge an effluent which could be shown to purify the Manchester Ship Canal rather than pollute it.

Dr. A. Findlay criticised the method adopted in taking the average for the whole year, as the variations in the different months were so great; could not one, perhaps, get a better idea of these results by plotting in a curve—putting each month by itself? He did not care for the idea of lumping all the figures together for the year, because the irregularities were so great in the different months.

Mr. A. E. Tucker asked whether the very marked difference in the putrefaction figures attributed to June and July could be attributed to climatic influences—whether June was cold and July hot—or how otherwise they could be accounted for.

He also asked for further details as to the actual method. The time for the permanganate test was given, but not the time for the subsequent incubation.

Mr. H. Silvester said the question was a very important one for a densely populated district like the Midlands. Frequently it was very little credited in rural districts. He believed the County Council of Derbyshire had a fixed standard of 0·1 albuminoid ammonia and 1·0 of oxygen absorbed in parts per 100,000. That was very well for Derbyshire, where there were no very large works, but in the Midlands, where a number of manufacturing industries were pouring their waste products in the sewage, it was difficult to get the effluent at the outfall works to comply with these figures; then the incubation test, which he believed was used by the Chairman in his Manchester experiments, supplied a want. If in a polluted stream like the Rea and Tame an effluent could be turned out that would not putrefy and would admit of coarse fish living, that was all that could be reasonably expected. He took it that that was the object of the figures which Mr. O'Shaughnessy had put on the board, showing that good work was being done by the Tame and Rea Drainage Board.

The Chairman said he was not the originator of the process; it was due to Mr. Scudder.

Mr. Clifford asked whether the three minutes' oxygen absorption test, before and after incubation, did measure putrescibility. In carrying out similar tests at Manchester some difficulty was experienced in deciding whether a particular sample was putrescent or not when it was on the border line of putrescibility. Some samples would be slightly putrescent, but the oxygen absorption showed no increase; others would remain practically odourless, yet showed a slight increase in the oxygen absorption. No mention was made as to the indefiniteness of the test. Had Mr. O'Shaughnessy tried the dissolved oxygen method as a measure of putrescibility? Some work had been done at Manchester by that method. Known quantities of effluent and aërated tap water were mixed and incubated, and the dissolved oxygen determined. There was one other point not mentioned, namely, the possible effects of certain tar products on the three minutes' oxygen absorption test.

Dr. T. S. Price suggested, in connection with Dr. Findlay's remarks, that, in taking an average, it would be better if the relative volumes of water contributed by the Rea and the Tame were taken into consideration. It would thus be possible to obtain a better average to compare with the results that were obtained below the sewage works.

Mr. A. H. Hiorns said the results applied specially to Birmingham, of course, and he could not see how they could be compared with other towns. How far would the acid liquors, waste pickle and so on, which must go into the sewage in enormous quantities, operate in the putrefaction? A lot of acid, he believed, also came through the special method of purification. If that method were not adopted, the same results would not occur in other districts; therefore, he thought these results were applicable to Birmingham only and could not be compared with those of other districts.

Mr. W. W. Butler asked whether it was correct to assume that the quantity of albuminoid ammonia could be ignored so long as the effluent was not putrescent. It seemed to him a remarkable statement. If he had a manufactory and wanted to make use of the stream water referred to, he would naturally look upon that indication of albuminoid ammonia as very dangerous from his own point of view. Would Mr. O'Shaughnessy say that, as the water was not putrescent, he had a good defence against the charge of contamination?

Mr. O'Shaughnessy, in reply, said his was essentially not a paper dealing with details, but with the effect, in the broadest possible way, of the sewage effluent on the stream. The questions which different speakers had raised were mainly questions of detail. As Prof. Frankland surmised, there was an increase in the amount of nitrate in the river water after receiving the effluent, but even so, if the test for putrefaction was not applied directly, there was no guarantee that the water of the stream did not possess a greater tendency to putrefy after reception of the purified sewage. After all, their deductions, however obtained, must ultimately be submitted to a number of laymen for consideration, and he had found by experience that such people did not care to be troubled with a lot of figures which they only very partially understood. The *raison d'être* of the method and the test was to supply information which could be put into plain English, and readily grasped by the average layman. It was quite true that the albuminoid ammonia and oxygen absorbed showed an increase, but that increase was very slight, and he need hardly point out that to remove this slight increment from, say, 25,000,000 galls. of water per day would entail an enormous expense. Moreover—and Mr. Butler had referred to this point—since the tendency of the river water to putrefy was lessened, they might anticipate that, with free access of air and all the purifying agencies of the stream at work, the river water would improve as it flowed along. This he actually found to be the case, and the rate of improvement was astonishing.

With respect to Mr. Tucker's query. The test consisted in observing the amount of oxygen absorbed by a given volume of the sample from acid permanganate, in three minutes, both before and after the sample had been incubated in a closed bottle for five or six days at 80° F. With regard to the months of June and July, Mr. Tucker was correct in his surmise—one was very wet and the other a dry month.

Mr. Clifford had remarked on the indefiniteness of the test, and it *was* indefinite with respect to the *amount* of putrescibility. He had, however, used the term "putrefactive tendencies" advisedly, for, although a sample might not have quite enough available oxygen to remain non-putrescent in a closed bottle, still only under very exceptional circumstances would the same water putrefy when exposed in the river. The method was not empirical

with the behaviour of any given sample, but with the general conditions obtaining over prolonged periods.

With respect to the method for determining the rate of absorption of dissolved oxygen, he had made a large number of observations, and was convinced that in experienced hands it was capable of giving very valuable information with respect to the behaviour of the dissolved contents of water. Tar products were not present in sufficient quantity to interfere here, but when present were likely to produce confusingly curious results. He agreed with Dr. Findlay's objection and with Dr. Price's remark.

Acid discharges were certainly inimical to biological treatment, if present in sufficient quantity. It was necessary, in fact, to exercise considerable care from that point of view, and at times some difficulty had been experienced owing to those waste liquors. At one time, it was thought that Birmingham sewage could not be successfully treated otherwise than chemically, but during the last five or six years the opposite had been demonstrated.

The CHAIRMAN said those results might be produced in another way. If the sewage were treated with a large proportion of antiseptic chemicals, then the number of samples putrefying below the point of ingress might be less than that of those putrefying above. Of course, that would not be a desirable state of things, because on further dilution, putrefaction would ensue. But if, as Mr. O'Shaughnessy assured them, the nitrates have gone up, then it was obvious that the smaller putrescibility of the samples below the works was due to the presence of nitrates and not to the presence of antiseptic chemicals.

Mr. O'SHAUGHNESSY said that the chemicals, in the original sewage, practically did not affect the nature of the effluent going out, because it first of all had to go through septic tanks where it was well mixed, and every drop of water to which those figures applied had to filter through an average of 4 ft. 6 in. of soil before it reached the river, so that the chemicals could not have much effect on the final effluent.

London Section.

Meeting held at Burlington House, on Monday, April 2nd, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

The CHAIRMAN said he had a very pleasant duty to perform, namely, to inform the members that their American brethren whom they had the pleasure of welcoming last summer, had sent a very charming recognition of their reception in the form of an engraved tablet, which they desired should be kept as a permanent record of the pleasure which their visit had given them. The wording was as follows:—

"The American members of the Society of Chemical Industry who were present at the Annual Meeting in London, 1905, and participated in the many splendid tours, receptions and entertainments forming the great programme provided by the London and Provincial Sections of the Society, desire to place on record in an enduring form their deep appreciation of the delightful hospitality and attention extended to them by their British fellow members.

"In expressing their thanks and gratitude the American members feel that the new and more intimate relations established with our brothers across the sea by the meeting of 1905, have broadened and strengthened the bonds of love and friendship already so firmly established between the two great English-speaking countries."

The Committee, in accepting this memento, had instructed their Hon. Secretary to write to the Chairman of the Visiting Committee in New York, saying how much they appreciated this token from their fellow members across the sea, and it was also their intention to ask the Council to allow it to be hung in their Council Room at Westminster. He trusted that would meet with the approval of the meeting.

ROPINESS IN FLOUR AND BREAD AND ITS DETECTION AND PREVENTION.

BY E. J. WATKINS.

During the hot autumnal months, bakers are frequently confronted with the outbreak of a serious disease in the bread called "rope." The disease generally declares itself within 12 to 48 hours, after the loaf has left the oven. At first, the bread acquires a faint, sickly odour, and, upon cutting open, the crumb of the loaf is found to be infected with brownish spots, larger and more numerous at the centre of the loaf. With the progress of the disease, the spots gradually expand until the centre of the loaf becomes moist and sticky. The infected portions can be drawn into long, gummy threads, hence the name of the disease. If conditions are favourable, the whole of the crumb finally becomes reduced to a slimy, brownish mass, and presents the appearance of having been saturated with molasses, emitting a strong valerian-like odour. Bread which contains bran, such as wholemeal, Graham bread, rye bread and patent bread which contains more or less of the germ and husk, is much more frequently attacked by the disease, than is bread made entirely from white flour, but the disease is not uncommon in white bread. The straight grade flours, *i.e.*, those made from the flour obtained on the break rolls, and hence more or less contaminated with the dust and bran fragments, appear to be more liable to attack than the patent grades, made from the fine clean semolina, obtained from the heart of the endosperm.

All modern writers agree in ascribing this disease to bacterial activity, but a wide difference of opinion appears to exist, in this country, as to the nature of the specific bacillus. Ropiness in liquids has been exhaustively studied by many workers, and English writers upon bread have generally attributed to organisms isolated from such solutions, the power to also produce ropiness in bread thus:—

W. Jago ("Science and Art of Breadmaking," 1895) quotes Morris and Moritz as having traced ropiness in beer to *Pediococcus Cerevisiæ*, and considers that the ropiness of bread is probably due to similar origin.

P. Schutzenberger ("Fermentation," 4th Edition, 1886) devotes a chapter to viscous fermentations and quotes observations of Pasteur, who found small globular organisms 0·0012 to 0·0014 mm. in size, which grew at 30° C. in solutions containing sugar.

The products of the organism per 100 grms. of sugar, are stated to be mannite 51·09, gum 45·5, carbon dioxide 6·18.

These observations have been largely used by writers upon breadmaking in explaining the causes of ropiness in bread and the products resulting from it.

Resulting from a comprehensive investigation of 16 samples of ropy bread found in Germany, *J. Vogel* ("Zeits. f. Hygiene und Infektions Krankheiten," **26**, 393) isolated two species of bacteria which he identified as being members of the group of potato bacilli, and which he named *B. Panis Viscosus I.* and *B. Panis Viscosus II.* respectively. *Jackenack* ("Z. Anal. Chem.," **39**, 73) found a similar organism in a black bread which he investigated.

The finding of potato bacilli in bread has also been reported by other workers, among whom, Uffelmann, Emil Laurent, Kratschmer, and Niemilowicz should be mentioned.

So far as I am aware, however, no investigation of the organism to be found in ropy bread, occurring in this country, has hitherto been published, I therefore take the opportunity of recording the following observations:—A brown loaf was taken from a batch of bread which had gone very ropy, portions of the sticky material from the centre of the loaf were removed with a sterile platinum

[illegible] with sterilised water. Portions [illegible] with traces of the resulting [illegible] at 37° C. in the incubator. Growth occurred in 36 hours upon all the media, viz., nutrient gelatin, agar, sterilised bread, and in peptonised wort. A microscopic examination showed all these cultures to consist of a short motile bacillus. By repeated sub-culturing in peptone wort a practically pure culture was obtained. These pure cultures in wort were then used in the following experiments upon the production of ropiness in bread made with a known sound flour.

I. Sound loaves two days' old were taken, and cut into two with a sterilised knife. One half was then infected with three loopsful of a wort culture, at the centre of the crumb, and afterwards placed in a moist chamber at a constant temperature of 28° C; in each case the second half which had not been infected, being placed side by side with the test so as to form a check. The results from four of these tests are given in Table I.,

in [illegible] one loaf of about 400 grms.

Doughs were [illegible] ture, [illegible] two hours, then moulded, proved [illegible] for 40 minutes at an oven temperature of [illegible] A series of seven tests was made, and in each proportion of water increasing from 1 to 5 c.c. was [illegible] from the mixing water required for dough [illegible] replaced by an equivalent volume of a peptone wort culture of the bacillus. The fermentation of these doughs was quite normal, the dough presenting no [illegible] of the effect of bacterial activity when moulded and proved. The resulting bread was light and bulky, with a [illegible] normal odour, flavour, and appearance when it [illegible] oven. These loaves were cut into two with a [illegible] knife, and one half was placed in the incubator at a [illegible]

Table I.—Inoculated Bread.

No.	Loaves kept in moist chamber at constant temperature.		
	½ Loaf inoculated with 3 loopsful of wort culture.	Temperature of incubator.	½ Loaf not inoculated kept as check.
1	Small brown patch in 12 hours, gradually extending until ¼ of crumb had been destroyed in 14 days.	30° C.	Remained perfectly sound during 14 days. Some of mould about 15th day.
2	Ropiness appeared in 14 hours, very gradual increase during 7-day test.	28° C.	Free from ropiness during 7-day test. Mould appeared at 12th day.
3	Crumb completely destroyed in 10 days and reduced to pasty mass.	35° C.	Remained quite sound and free from ropiness.
4	1 c.c. wort culture inoculated. Large central patch in 8 days.	30° C.	Kept in dry air at 15° C. Quite sound and without any sign of rope during test of 8 days.

In each of the tests, ropiness was found to develop in the inoculated portion of the loaf to such an extent in 12 hours, as to be unmistakably recognised. The rapidity with which it spread throughout the mass depended upon the temperature. The higher temperatures (35° C.—40° C.) greatly accelerating it. In no case did the uninfected portion develop ropiness, though the test was continued until moulds (chiefly penicillium) made their appearance.

A number of baking tests were next made, a patent flour being selected for the purpose which had been previously tested and found to yield perfectly sound bread.

Note.—Patent flours are produced entirely from the centre of the endosperm.

The doughs were made with distilled water in a porcelain trough, compressed yeast being used for fermenting.

The proportion of materials used was similar to that

temperature and in moist air, whilst the check [illegible] were kept at room temperature for seven days [illegible] further four days at room temperature (about 15° [illegible] in a moist atmosphere, the object being to ascertain [illegible] effect of low temperature alone as compared [illegible] temperature and moisture.

In Table II. will be found the results obtained [illegible] this series of tests. Photograph I. illustrates [illegible] appearance of test 9. In no case did any of the bread made from these doughs, inoculated with [illegible] of the bacillus, develop ropiness, providing the [illegible] ture at which the loaf was kept did not exceed 15° C. Presence of moisture was without effect at such [illegible] tures. On the other hand, every portion, [illegible] of the quantity of culture added, became [illegible] tures between 25°—30° C. in a moist [illegible] presence of the disease could be detected by [illegible] istic odour accompanying its development, long [illegible]

Table II.— Temperature and Moisture.

No.	Brand of flour used.	Amount of wort culture added to dough.	½ Loaf kept in moist chamber.				Temp. of chamber.	½ Loaf kept in dry chamber at temperature 15°—16° C.			
			1 day.	2 days.	3 days.	4 days.		2 days.	4 days.	7 days.	9 days.
5	Patent grade	1 c.c.	Ropy smell	Crumb discoloured	Large central patch	—	30° C.	Quite sound	Quite sound	Quite sound	Quite sound
6	,,	2 c.c.	,, ,,	,,	Whole crumb pink	Brown and sticky	28° C.	,,	,,	,,	,,
7	,,	3 c.c.	,, ,,	Slightly moist in centre	Centre quite moist and sticky	Brown	,,	,,	,,	,,	,,
8	,,	4 c.c.	,, ,,	Crumb coloured pinkish	Becoming damp	Quite sticky	26° C.	,,	,,	,,	,,
9	,,	5 c.c.	Very strong ropy smell	Crumb discoloured and damp in 30 hours	Wet	Wet and pasty	25° C.	,,	,,	,,	,,
10	,,	5 c.c.	,, ,,	,,	,,	,,	,,	,,	,,	,,	,,
11	,,	5 c.c.	,, ,,	,,	,,	,,	,,	,,	,,	,,	,,
12	Suspected flour	None	Slight ropy smell	Spots [illegible] mould	Whole crumb [illegible]	,,	,,	,,	,,	,,	,,

any obvious changes in the bread had made their appearance. After a variable period the peculiar browning and softening of the crumb made its appearance which is indicative of the advanced stages of the disease.

In order to further test the influence of atmospheric conditions, a sound loaf was taken, cut into two and each half treated with 1 c.c. of a wort culture. One of these sections was kept at 28° C. in the moist chamber, and the other at 16° C. in a dry cupboard, the crumb being kept moist with sterilised water. The portion in the moist chamber became quite ropy in 24 hours, whilst the other half did not show any sign of the disease at the end of 28 days though still quite moist. Fig. II. shows the condition of these two pieces.

Elevated temperature would thus appear to be absolutely necessary to the development of ropiness in bread, even when the bacillus is present in large numbers, moisture alone when temperature is low, being incapable of causing its appearance.

In the course of experimenting with cultures in various media it was found that acidity either checked, or altogether stopped the growth of the organism, according to the degree of acidity present.

Thus flasks of peptone wort containing 0·1 per cent. acetic acid were inoculated with three loopsful of a young agar culture, and incubated at 28° C. Controls with peptone wort containing no acetic acid being run at the same time. In the acid flasks no growth was obtained, but the neutral flask developed a good culture. In a further experiment 0·06 per cent. acetic acid yielded similar results. When lactic acid was substituted for acetic acid it was found that alcoholic fermentation occurred in one of the flasks, but the rope bacillus could not be detected either by the growth in the medium or by microscopic examination, whilst in the other flasks results similar to those produced by acetic acid were obtained.

It appeared to be probable, therefore, that if slight acidity of the medium prevented the growth of the bacillus in liquid cultures, it should be possible to entirely suppress the disease in breads if the doughs were made slightly acid. A series of loaves was accordingly made, the doughs of which were rendered slightly acid with varying proportions of acetic and lactic acids. A relatively large amount of wort culture was added to each dough. The quality of acid used in these doughs has been calculated into pounds of real acid per sack of flour, as this is most convenient for baking purposes. The quantities used, with results obtained, will be found in Table III.

Photograph III. shows the results obtained from a parallel experiment. Both these loaves were made from the same flour, yeast, &c., and each dough was mixed with 5 c.c. of the same wort culture of the bacillus. To one of the doughs was then added 0·3 of acetic acid, whilst the second dough was left in the natural condition. Fermentation and baking were precisely similar for both loaves. After baking they were both kept in the moist chamber at 27° C. The loaf marked, A, which contained no added acid, became distinctly ropy in 24 hours, the disease progressing rapidly during the remainder of the test. Loaf, B, which contained acid, was perfectly sound at the end of five days when the photograph was taken.

These acid loaves were generally of good bulk and sweet and, with exception of experiment 13, they did not betray any sign of acidity to the taste or smell. On account of the rapidity with which the acids used affect the gluten, it was always necessary to see that the fermentation was not prolonged unduly, but, it was never found to be difficult to control this action, so long as the acid did not exceed about 1 lb. per sack of flour.

In experiment 13, mentioned above, the acid did break down the elasticity of the gluten and the resulting bread was heavy, close and damp, a condition presumably favourable to the bacillus, but it will be noted that the disease did not manifest itself.

A consideration of all the results obtained leads to the conclusion that the addition of a small quantity of acetic acid to the dough will effectually prevent the appearance of ropiness in the resulting bread during much longer period than bread is usually kept. The minimum quantity of acid appears to be about 0·3 lbs. per sack of flour, whilst a maximum of 0·7 lbs. should not be exceeded on account of its softening action upon the gluten.

When lactic acid is employed as a preventive, the minimum quantity is greater; below 0·6 lbs. per sack its action is somewhat uncertain. The greater softening action of this acid upon gluten must not be lost sight of when considering the quantity to use.

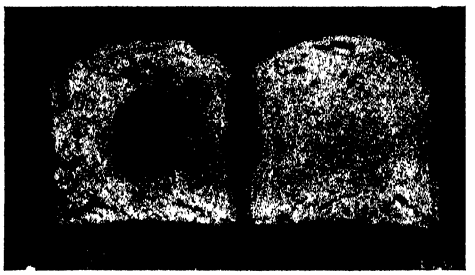
The resistance of the bacillus, or its spores, to heat is very great indeed, as was shown by the following experiments:—A peptone wort culture was immersed in a

Table III.—Acid Breads.

No.	Brand of flour used in making dough.	Acid used per sack of flour.	No. of c.cm. peptone wort culture added to dough	Kept in moist chamber at a constant temperature of 28° C. for				
				3 days	5 days	7 days	10 days	14 days.
14	Patent grade	lbs. Acetic 1·06	c.c. 5	—	—	—	—	Quite sound
16	"	0·5	5	—	—	—	—	"
15	"	0·4	5	—	—	—	Mould appears but no sign of rope	Quite free from rope
16	"	0·3	10	—	—	—	—	"
17	"	0·25	10	Sound	Faint ropy odour	Slight discoloration	Moist"	Quite ropy but development slow
18	Baker's grade containing rope bacillus	0·3	none	—	—	—	No sign of rope	Mould appeared, no sign of ropiness
19	"	0·3	none	—	—	—	"	Quite free from ropiness
20	Patent grade	Lactic 0·8	5	—	—	—	Mould appeared	No sign of ropiness
21	"	0·6	5	—	—	—	"	"
22	"	0·5	5	—	—	Slightly ropy	Crumb discoloured	Rope developing slowly
23	"	0·5	5	—	—	—	Slight indication of ropiness.	"
24	Baker's grade containing rope bacillus	1·0	none	—	—	—	—	Perfectly sound and free from ropiness
25	"	0·4	none	—	—	—	Mould appeared	"
26	"	0·3	none	—	—	—	"	"
27	Patent grade	Acetic 0·2	20	—	—	—	—	Quite free from ropiness



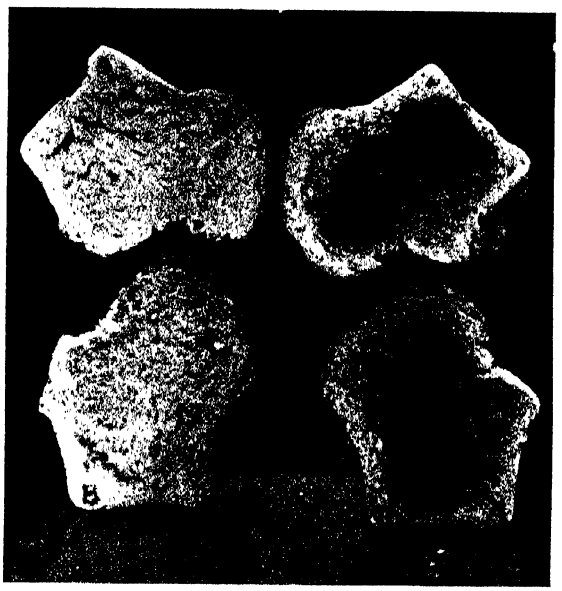
ROPE EXPERIMENT 9.—Dough made with 5 c.c. wort culture. Appearance after 7 days. — *a*) Half kept at 30° C. in moist air. *(b)* Half kept at 18° C. in dry air.



a Loaf infected with 1 c.c. of pure culture in peptonised wort, after eight days' incubating at 30° C. in moist air.

b Check half of same loaf. Not infected, kept at 15° C. in dry air.

III.



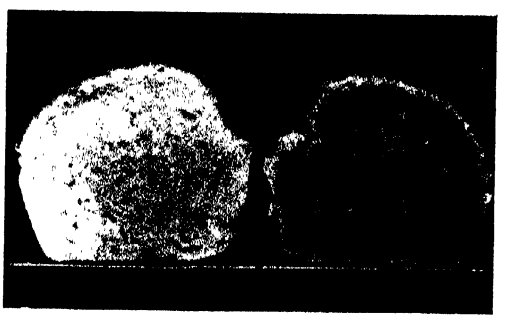
ROPE EXPERIMENTS. Both loaves made of same flour and contain 5 c.c. wort culture of rope bacillus. — *a*) Containing no acid. *(b.* Containing 0·3 acetic acid after five days' incubation.

IV



X 500.
Preparation from ropy loaf made from patent flour and inoculated with 5 c.c. peptone wort culture obtained from flour.

V.



ROPE EXPERIMENTS.—Loaf made with patent flour, and raised with baking powder, 5 c.c. wort culture of bacillus added to dough.

boiling water-bath for 30 minutes on three successive days. Streak cultures on agar were made after each boiling and incubated at 28° C. All the cultures yielded vigorous growths, and bread tubes inoculated from the thrice-boiled wort became typically ropy. Microscopic examination of the cultures also revealed the same organism as was originally isolated.

Two doughs were next inoculated with portions of this boiled culture, fermented and baked as before. The results will be found in Table IV.

or flour store; dirt accumulating in false bottoms and crevices of troughs, &c., have each in turn been advanced as the cause of the sudden appearance of this disease, and elaborate methods for purifying and sterilising all apparatus have been devised, as the best means of eradicating it when it has once revealed its presence.

Such methods have frequently proved totally inadequate to accomplish the desired end, even when carried to the extent of putting in a complete new set of utensils and reconstructing the bakehouse.

Table IV.—Boiled Culture.

No.	Flour used	Amount of boiled wort culture added in the dough	½ Loaf kept in moist chamber at 28° C.				½ Loaf kept at 16° C. in dry cupboard for 7 days.
			12 hours.	24 hours	48 hours.	72 hours.	
28	Patent grade	c.c. 0·5	Ropy smell	Crumb dark in colour	Damp and quite ropy	Whole crumb sticky and brown coloured	Quite sound
29	„	1·0	„	Ropy smell	Crumb darkened in colour	Centre quite sticky and brown coloured	Quite sound

The noteworthy feature of these tests was that, after three boilings of 30 minutes and one baking of 40 minutes, the organism was not only alive but extremely active, the disease appearing somewhat earlier and spreading with greater rapidity. This test also shows how hopeless a task the baker is recommended to undertake, when he is told to give bread liable to rope an extra long baking, in order to prevent the disease appearing.

The morphological and cultural characteristics of the organism isolated from the bread and from the various media, are as follows:—A short rod with rounded ends, frequently united in pairs, seldom in chains of more than three. It readily forms ovoid spores which almost entirely fill the cell. In length, it is from 1· 1·25 μ; in breadth, 0·75 μ.

The micro-photo of the organism, Fig. IV., is taken from one of the loaves inoculated with a peptone wort culture of the bacillus, which had been started from flour.

In hanging drop.—Sluggishly motile, organism surrounded by a translucent capsule.

Staining.—Good by Gram, Carbol Fuchsin, Methylene Blue. Spore staining very difficult, usually only successful by Müller's method. Grows best at temperatures between 25°—40° C., stagnates at 15° C.

Agar.—Smeary white growth, brownish on looking through the medium, edges of growth irregular. Whitish film on water of condensation.

Gelatin.—Shining, barely visible, filmy growth, very slowly liquefying the medium.

Wort gelatin.—White crinkled growth, slowly liquefying medium.

Peptonised wort.—Rapid growth, rendering liquid turbid, and forming a slimy gelatinous film on the sides of flask and surface of liquid. The wort acquires a faintly urinous odour.

Sterilised bread.—Becomes brownish, as if saturated with syrup, and is gradually converted into a moist viscous mass, emitting a strong valerian-like odour.

Milk is coagulated, clot partially redissolving upon long action.

Potato.—Quickly becomes covered with a white crinkling growth which turns brown with age. A peculiar burnt, musty odour is evolved.

The foregoing characteristics leave little doubt as to the identity of the organism with *bacillus mesentericus fuscus* (Flügge. Lehmann and Neumann's "Atlas of Bacteriology," page 326, Plate 43).

The bacillus is a frequent inhabitant of soil, vegetables, &c., and doubtless also of the cereals.

Perhaps the most important question, from the practical baker's point of view, is, how and when the bacillus gains access to his doughs. It would appear from a perusal of the methods generally advocated for the prevention or cure of rope, that the bakers are to be held almost entirely to blame for its appearance in the bakery.

Dampness and insufficient ventilation of the bakehouse

It has been noticed, however, in more than one case that a complete change of flour was accompanied by a disappearance of the disease equally as sudden as its onset. The suggestion that the flour was the real medium conveying the bacillus, or its spores, has been vigorously combatted by millers, but positive and conclusive evidence, either for or against this view, does not appear to have been available hitherto.

During the autumn of 1905, a large firm of bakers in the North had the misfortune to find their bread suddenly attacked by this disease. They dealt promptly with the matter by discarding all flour in stock and replacing it with fresh flour from a totally different source. As a result, the trouble immediately disappeared. A series of careful baking tests of each of the brands of flour forming the old stock was then undertaken, with the result that all but one brand were found to be perfectly sound. Every blended flour into which this particular brand entered was also found to yield bread which became ropy. The evidence was conclusive that this flour carried the bacillus and had been the means of introducing rope into the bakery. At my request the firm kindly furnished me with some of this flour for investigation. It was an ordinary bakers' grade, somewhat soft and of low water absorbing capacity. It contained 10·45 per cent. dry gluten grey and rather short in texture, the soluble matter was 4·46 per cent. and the reaction was slightly acid (0·132 acetic acid per 100 grms).

A series of cultures upon various media was started, using a very thin paste of the flour made by thoroughly triturating 1 grm. of flour with 100 c.c. sterile distilled water, the medium being inoculated with 1 loopful of the well stirred emulsion. Upon cultivation, growths were obtained identical with those previously isolated from ropy bread.

Sterilised bread was rapidly turned completely ropy by one loopful of the flour mixture; check tubes ran concurrently remaining unchanged.

From each of these cultures stained preparations were made which upon microscopic examination revealed short sporing bacillus, similar to the *B. Mesentericus* previously isolated from bread. Fresh subcultures in peptone wort were started and baking tests afterwards made with them using the patent flour employed previously.

The whole series amounting to 10 loaves became ropy within 48 hours.

A set of loaves was made from the suspected flour alone, without addition of any culture. On testing these in a similar manner to those recorded in Table II., it was found that all the half loaves kept at 26°—30° C. in moist air became thoroughly ropy, whilst the check portions maintained at low temperatures 14°—16° C. remained sound during testing periods of 14 days.

A repetition of the acid experiments yielded results in conformity with those in Table III. Portions of the

suspected flour made into bread with addition of acid did not go ropy during the usual testing period (see Table III., Nos. 18, 19, 24, 25, 26).

The above series of tests having shown that the bacillus was, undoubtedly, present in this sample of flour, an attempt was made to see whether yeast was in any way essential to the development of the organism in bread. Accordingly some loaves were made without yeast, a commercial baking powder in the proportion of 10 grms. in 280 grms. flour being substituted as the aërating agent.

In all five tests were made, and a reference to Table V., Photo V., will show that ropiness appeared in the usual time in each case, demonstrating that the development of the disease is independent of the presence of yeast.

at 28° C. In the bakery, the prover would be found equally efficient, or the neighbourhood of the oven, provided suitable means be taken to protect the tubes from dust and accident.

At the expiration of 24 hours the tubes should be examined, both for appearance of the bread and also by smell for indications of ropiness. If *B. Mesentericus* be present, the whole of the tubes containing the flour solution will generally exhibit positive indications of ropiness, the check tubes remaining unchanged. The experiment should be continued a further period of 24 hours, with examinations at intervals, for confirmation, by noting the rate of increase of the disease, which is usually rapid.

If a portion only of the inoculated tubes shows signs of

Table V.—Baking Powder.

No.	Brand of flour used for making dough	No. of c.c. peptone wort culture of bacillus added	½ Loaf kept in moist chamber	Temp. °C.	½ Loaf kept at room temperature.	Temp. °C.
30	Suspected flour entirely	None	Ropy in 24 hours	27	--	--
31	Patent grade	2 c.c.	Ropy in 36 hours but not very pronounced	30	Quite sound and apparently sweet at expiration of 4 days, kept dry	16
32	" "	5 c.c.	Ropy in 36 hours, large central patch in 4 days	28	Surface kept moist by distilled water Quite sound for 96 hours	18
33	25 per cent suspected flour 75 per cent patents	None	Apparently sound for 30 hours Slight ropy odour in 48 hours Crumb coloured pink in 60 hours	28	Perfectly sound at end of 48 hours	18
34	Patent grade	5 c.c.	Ropy in 30 hours, entire crumb discoloured in 72 hours	26	Sound at end of 96 hours	16

In this case the evidence establishes beyond doubt the existence of the bacillus in the flour, but there is reason for the view that, in modern practice, flour is the only material responsible for the appearance of this disease.

It must be mentioned that, in the past, the introduction of rope bacillus may occasionally have been due to the use of potato ferments. The use of potatoes is now almost obsolete, certainly among progressive bakers, and the fact that *B. Mesentericus* is known to commonly exist upon potatoes should furnish a strong additional reason for the abandonment of their use in bread-making.

The loss and anxiety entailed when goods became attacked by rope, renders a reliable and rapid test for the presence of *B. Mesentericus* very desirable.

I find that the following test satisfies all the requirements of the practical baker, it is very delicate, a positive result being readily obtained from 0·02 grms. of a ropy flour. On the other hand, there is no fear that genuinely sound flours will fail to pass the test, because they do not yield appearances which resemble ropiness in the time proposed as a limit. Ten large test tubes (6 in. by 1 in.) are thoroughly boiled in water for one hour, washed and drained. When drained place in the oven and bake at 232° C. (450° F.) for three hours to completely sterilise them. Cool and then place into each tube a finger of bread 3 in. by ½ in. by ½ in., cut from the centre of the same 2-day old loaf. (The average weight of each piece is 5 grms.) Moisten each piece with 5 c.c. of recently boiled distilled water, then plug all tubes with cotton wool and sterilise by immersion in boiling water for one hour on three successive days. These tubes are conveniently prepared in batches a few days previous to being required.

In order to test a flour, 2 grms. are taken from sample and well mixed with 100 c.c. of distilled water. The beaker containing the mixture is placed in a boiling water bath for 30 minutes, in order to destroy all organisms except spore formers like *B. Mesentericus*, &c.

To the series of 10 prepared tubes add successively 1 to 7 c.c. of the boiled flour mixture, leaving the three remaining tubes to serve as checks. Number the tubes in rotation. The precaution of having three check tubes is necessary in view of the known vitality of the mesentericus group, and no test should be considered satisfactory unless all three check tubes remain quite sound.

Immediately the tubes have been inoculated, the wool plugs are replaced, and the 10 tubes put into an incubator

ropiness, it is better to repeat the experiment before condemning the flour; when the bacillus is present in dangerous number, indications can usually be found in every tube inoculated, though frequently not yielding a growth proportional to the amount of flour solution added.

If the tubes reveal no indication of ropiness in 48 hours, the flour may be passed as sound. It is not practicable to prolong the experiment beyond 48 hours on account of the development of other organisms, moulds, &c. When *B. Mesentericus* is present, its existence is always manifested within 36 hours of starting the test.

Summary.

Ropiness in bread is produced by varieties of *Bacillus Mesentericus* (Flugge). The bacillus is introduced into the dough through the flour, in which material it sometimes occurs in large numbers, possibly coming from the bran coats. Breads containing bran and straight grade white flours are most prone to develop ropiness.

The bacillus is a prolific spore former, the spores being capable of resisting high temperatures for prolonged periods.

Once present in the dough, development of the bacillus, after bread has been made, depends partly upon the reaction of the bread and partly upon atmospheric conditions.

Bread is only faintly acid in reaction and always insufficiently so to naturally prevent the development and spread of ropiness, but if the acidity be increased by addition of small quantities of acetic acid to the dough, development can be prevented.

Low temperature and dryness of the bread store tend to suppress development, but the maximum temperature of 18° C. (65° F.) cannot be exceeded without great risk.

When a batch of bread is found to be ropy, all flour in stock should be at once tested, so as to locate the infected stock and in the meantime fresh supplies of flour from a different source should be laid in.

When the infected batch of flour has been discovered, it should be isolated, so that it can be worked up under those conditions which are most unfavourable to the development of the bacillus, *i.e.*, the doughs being made slightly acid and the bread being quickly cooled and kept at low temperature during storage. Such flour might advantageously be kept until the colder months, when the prospects of development are at a minimum.

During the summer months the danger of purchasing ropy flour may be entirely obviated by the application of the bread tube test to a sample of the flour before buying.

Discussion.

The Chairman said he had been much interested in a suggestion of the author as to the use of acid in preventing this contamination of flour, for they would all agree that the evil resided substantially in the flour itself, and not to any appreciable extent in outside substances which were likely to be used. The author recommended the employment of lactic and acetic acids as deterrents, but he asked if the proportion in which he suggested their use would not have a deleterious effect on the bread produced. The sample exhibited at the close of the paper smelt very strongly of acetic acid, which would certainly be objectionable. He did not know whether he had found that with lactic acid he could prepare a bread with no injurious properties. He would also call attention to a matter which had been in the minds of many, namely, the employment of nitrogen peroxide with a view to producing a bleaching effect on flour. That had been quite recently the subject of litigation, and it had been stated by a number of experienced millers that the use of nitrogen peroxide in traces, in addition to the effect of bleaching, brought about an improvement in the flour itself. Now, if acidity were requisite for the prevention of the work of this bacillus, it would be interesting to know whether the same effect would be produced by employing traces of the much more potent nitrogen peroxide. He noticed that the author said that when he replaced the yeast by baking powder he did not get such objectionable results as regarded ropiness, and it would be of interest to know whether that was due to any particular ingredient of the baking powder, or whether he had examined the yeast employed for bacterial impurities. The author further told them that when he used bran in the flour there was more likelihood of this "rope" being developed than when it was not present, and he asked whether, in his opinion, there was any constituent in the bran itself which encouraged the growth; otherwise it was rather difficult to understand how the mere presence of the bran, unless associated with bacteria, would have this effect. It appeared that the "rope" flour and bread had been submitted to a temperature at which the spores were not destroyed, but he would like to ask if the author had examined the dough, and if he could tell them at what stage the spore development commenced and was at its maximum, and what was the condition of the dough with regard to the appearance of the *B. Mesentericus fuscus* in it. In what respect did this *B. Mesentericus fuscus* differ from the *B. Mesentericus vulgatus* described by Loffler, which produced similar ropiness in milk? That was the so-called potato bacillus, and he asked whether these were varieties of the same species or essentially different, or whether they were both common to the so-called peptone bacilli.

Mr. W. Jago asked the author whether he had tried either of the odourless mineral acids, such as sulphuric or phosphoric acid instead of acetic acid, because, with regard to the diseases of bread, the baker placed that of sour bread as the first and foremost, and he was afraid that if it was suggested to the average baker that in order to get rid of ropiness he should get his bread charged with acetic acid, he would be inclined to regard the remedy as worse than the disease. He noticed the remark that ordinary bread was only very faintly acid, and, as a matter of fact, it was but faintly acid to all ordinary tests; but notwithstanding that, a number of samples of sour bread contained acetic and butyric acid in quite sufficient quantity to render them objectionable in flavour and character. One point which struck him was the references to the baker's ordinary remedy for ropiness, namely, baking his bread as thoroughly as possible. This, as the author had indicated, meant drier bread, and there was less chance of the development of the ropy organism. The breads which were going to become ropy were usually those in which there was the presence of dextrinous, or gummy bodies—not merely dextrin, but also bodies of the soluble proteid type. It was probably known to many that, in order to overcome the dryness of breads produced by modern methods, in which the bran and everything associated with it was as far as possible removed, and potatoes were no longer used, it had become customary to boil starch in some form and add the gelatinised starch to the bread in the making. Now breads containing this gelatinised starch became ropy much more readily than those from which such starch was absent. This only pointed to the fact that certain forms of bread, and bread possessing certain characteristics, were better media of growth than others. He congratulated the author on the simplicity of the method suggested for determining whether any particular flour was the source of ropiness. Ropiness he regarded as being introduced by the flour, because of certain organisms, germs, and spores residing on the outer coating of the bran. Having once come into the flour, and through the flour into the bread, there was no doubt of the fact that the greatest possible cleanliness in troughs and in utensils was a means, if not of prevention certainly of cure. But having once got a growth of this kind into a bakery the re-infection would be continual. One of the methods of re-infection that had occurred in his experience had been in the bread cooling rooms themselves, where by successive elimination of the various defective materials, the yeast, the potatoes, the flour, and gradual working at each until the original source was removed, there yet remained the room in which the bread was stored, the loaves remaining from one batch apparently had affected the successive batches, and after everything else had been got rid of, this source of infection remained. Again the question of thorough sterilisation by every possible means of utensils, the rooms, the delivery vans and even the clothing worn by the men delivering the bread, was of importance.

Mr. E. Grant Hooper said that he had no experience of any such extreme degree of ropiness as was represented by the bread placed before them that evening. It must be apparent to all, on looking at the samples, that it was in the centre of the bread, the moister part, that this development had occurred, whilst the outer or drier portion presented no abnormal feature. This made him inclined to suggest that the baking was in many cases at fault where the evil appeared, whether it was of an extreme character, or a much less pronounced case where the bread was merely sour. No doubt this infection would spread where a decided development of the ropy organisms occurred in a bakery; but he would like to ask the author whether he had any experience of the general bacteriological examination of flours. He was of opinion that where flour was badly treated, where it was allowed to get or to remain damp, that sort of development was likely to occur, and he would suggest that the particular organism and others akin to it were much more widely spread than was commonly supposed. If flour were kept dry the development of such organisms to any serious extent appeared to be infrequent, but, in such samples as had come before him, he had always observed that it was ill-baked, moist bread of which complaint was made. Such bread, if kept for, say, a fortnight, would almost always become mouldy, indicating that it was more damp than ordinary, good sound bread. He agreed with the Chairman in thinking that the addition of acetic acid would probably prove highly objectionable to consumers, for he certainly thought that the samples passed round were much too acid to be accepted as satisfactory bread.

Mr. A. E. Humphries asked whether the abnormal proportion of yeast used had anything to do with the extreme cases of ropiness which were produced. He found that an addition of 0·25 per cent. of lactic acid absolutely spoilt the bread for commercial purposes. Frichot, who claimed to hold the master patent for bleaching flour, had stated that his object was not to make the flour whiter, but to sterilise it. The author had told them indirectly that the bacillus survived the oven, and he traced it back to the flour. As a miller he was anxious to know how the flour picked it up, and where it came

[illegible] Was it claimed that the trouble arose from the flour always, or only that it did so in the case particularly referred to in the paper?

Mr. Lawrence Briant said when bread became ropy, which was a somewhat rare occurrence, it occurred generally in breads which were peculiarly moist. When materials were used in baking, such as malt extract, which increased the moisture, and partially dextrinised the starch, the resulting bread was known to be more prone to become ropy than in other cases, and it therefore seemed as though the percentage of moisture in the bread had a good deal to do, not with the presence, but with the activity of the particular bacillus. It was interesting to know that this bacillus was in the flour, and was not due to dirt or carelessness in the management of the bakery, although it was easy to understand that carelessness would perpetuate its growth. Some years ago Mr. Jago and himself, independently working on the causes of sourness in bread, came to the conclusion that it was due in most cases to bacteria present in the flour, and not, as was previously imagined, to contamination in the bakery, although no doubt that was responsible for a good deal of sour bread. It also seemed clear that ropiness occurred, or was likely to occur, in an underbaked loaf more than in one thoroughly baked. The temperature in the interior of the loaf was not 400° F., for a number of observations of temperature were made by Mr. Jago, and some by himself years ago, and it was then observed that the temperature seldom rose above 205°; 98°—203° F. was the usual temperature in the interior. Possibly, had the temperature been higher, the bacteria, if not destroyed, would at any rate have become less active. With regard to the addition of acid to dough, that would surely be inadmissible from many points of view. Amongst others, when bread was acid it became peculiarly chaffy in character, a condition much objected to by the public, and for that reason alone the use of acid should be condemned.

Mr. Julian L. Baker referred to the treatment of flours by bleaching agents, one of which was nitrogen peroxide. It seemed to him that such treatment might seriously modify certain conditions in bread making, because the natural flour contained active diastase. That diastase would, of course, act on the wheat starch during the making of the dough, during its fermentation, and in a measure during the baking. It was probable that quite a different set of carbohydrate constituents would be found in the ultimate loaf if the diastase were destroyed.

Dr. S. Rideal said in regard to the acid treatment, he thought both acetic acid and lactic acid were unsuitable for preventing ropiness. The experiment with baking powder suggested that possibly alum or tartaric acid were preventatives, and he would suggest that the author try bisulphate of soda, which he had found an excellent germicide, in the place of free acids in the sterilisation of water.

Dr. E. Frankland Armstrong said the author had identified this bacillus with the *B. Mesentericus*, but he had omitted to say whether he had tried a pure culture of *B. Mesentericus* in bread to ascertain whether similar ropiness was produced. It seemed to him that was a point of considerable interest. He did not quite gather whether, in sterilising flour, the infusion which Mr. Watkins told them was swarming with this bacillus, he sterilised for once only, or say for 40 minutes, on a particular day, keeping the infusion at a temperature of about 95° for another day, and then again sterilised it in the same way as one was accustomed to sterilise water. If that particular bacillus were capable of forming spores resistant to heat under such very drastic conditions, it would be a very remarkable one. Interesting and convincing as the experiments were, it did seem to him that the author had at times worked under unusual conditions in taking such a large quantity of yeast—5 lb. to the sack, as had been pointed out, was altogether abnormal. A considerable quantity of the nitrogenous substances derived from the yeast, many of them not only injurious in themselves, but containing food substances very favourable for the development of bacteria, were thus introduced into the bread. Yeast, as it came into the hands of the baker, was of course full of bacterial impurities of all kinds. It was only owing to its excessive activity, and the fact that the primary fermentation came to an end before these subsidiary disease germs were able to develop, that the immunity of the baker from much more serious evils than ropiness was to be attributed. He should also like to ask if the author had tried the effect of minute traces of alkalinity on this particular bacillus.

Mr. A. C. Chapman asked if the author had made any experiments to ascertain whether it was possible for the bacillus in question to communicate ropiness to other materials than bread, such as beer, wine, wort, milk, &c., all of which were well known at times to exhibit the phenomenon of ropiness. He had been particularly struck with the singularly successful manner in which the author had always been able to reproduce ropiness with the organism he had isolated. It was the experience of those who had investigated this subject in reference to other substances that ropiness was a very capricious phenomenon. An organism isolated from a ropy liquid was sometimes found to induce ropiness in other liquids quite readily, whereas at other times no such result could be obtained. He (Mr. Chapman) had often observed this in the course of his own work.

Dr. P. Schidrowitz said ropiness occurred in many liquids like beer and wine, and a number of organisms had been isolated, but they always appeared to be different. There was the *B. Gummosus* of Happ, the bacillus found by Laborde, and the bacillus described by Gayon and Dubourg, which all produced ropiness and the concomitants of ropiness, such as mannitol, and he should like to know if, in his experiments, mannitol was isolated?

Mr. Watkins said perhaps he had not been sufficiently explicit as to the use of baking powder in the bread, because several speakers had taken it that he then got better results; as a matter of fact, reference to the tables would show that he got equally bad results, and it struck him that was proof that the yeast was not in fault. Reference had been made to the claim that bleaching the flour also had the effect of sterilising it. His results did not support the theory, as one of the flours that yielded ropy bread had been bleached by the well-known process referred to by the Chairman, in which nitrogen peroxide was used. The question had been asked how the bacillus got into the flour? He should be inclined to say it got in on the bran coating, and was derived directly from the land upon which the wheat was grown, because, as he pointed out, the breads most liable to it were those which contained either bran, or were low-grade white flours containing much bran and offal. Further, the disease appeared to be much more common in Germany, where black bread was largely used. The fact that so much white bread was used here was probably the explanation why ropiness was uncommon. Under modern conditions of breadmaking it was probable that flour was the sole cause of ropiness. The use of mineral acids had been advocated, but he hardly thought these could be justified as substitutes for organic acids in an article of diet. The same objection must also apply to alum, against the use of which many reasons could be urged. He was not sure that the use of acetic acid was so deleterious as some of the speakers seemed to think. Many people took far more acetic acid than he advocated in the form of vinegar. He had calculated that if the minimum quantity of 0·3 lb. per sack were used, it only increased the percentage of acid in the bread by 0·0708 per cent. With regard to the odour of the loaves exhibited, he might say that when they left the oven they did not smell markedly acid to him. The odour which they now possessed was a close odour, and was the natural effect of being kept from five to seven days in a closed incubator at a high temperature and in a moist atmosphere. A good, sweet loaf could be obtained with 0·27 lb. of acid per sack.

Some bread had been mentioned, and it must be admitted that appreciable quantities of acetic and lactic acids were found in such bread, but it should be pointed out, that, so far as the evidence went, the tasting of the

bread was not always proportional to its "sourness," so that those terms were not synonymous. In his experiments, pure acids had been used, and it was not found that the bread, even when it contained as much as 1 lb. of acid per sack of flour was "sour," though it certainly possessed the odour of acetic acid.

Bread, containing gelatinised starch and other hydroscopic substance, undoubtedly furnished a better culture medium to the bacillus which, in his opinion, was largely due to the superior moisture-retaining properties of such breads.

It was difficult to understand how the loaves from one batch could affect succeeding batches by simple external contact in the cooling room. In every case coming within the author's knowledge, ropiness developed first at the centre of the loaf and only after a long time did it extend to the crust. Even then the crust was never penetrated. It would, therefore, appear that the outer portions of the loaf were sterilised, but that towards the centre the spores survived the baking process, and afterwards developed, if conditions proved suitable.

Dryness of the flour, whilst undoubtedly an essential in making a good keeping flour, could hardly help much in the suppression of rope, for the reason just stated, as it was the spores which had to be feared rather than the bacilli. Such drying as would be accomplished by the miller would probably have the effect of causing spore formation.

It was, perhaps, hardly necessary to justify the use of 5 lb. of yeast per sack, in view of the fact that ropy flour made with baking powder produced ropy bread under suitable climatic conditions. Briefly, the reason was that by this means a quick fermentation could be attained, thus preventing any undue development of bacteria in the dough stage. When the small amounts of yeast mentioned by some speakers were used it must be remembered that the fermentations were much more prolonged than was necessary with large quantities of yeast, consequently the danger of bacterial development was greater. Long fermentations were admittedly favourable to bacterial activity, whilst short, vigorous fermentations were distinctly inimical to bacterial growth.

New England Section.

Meeting held at Boston, on Friday, March 2nd, 1905.

VICE CHAIRMAN IN THE CHAIR.

ANTIMONY COMPOUNDS AS FIXING AGENTS FOR TANNIC ACID.

BY W. S. WILLIAMS.

Of the different bodies available as fixing agents for tannic acid on the vegetable fibres, the antimony compounds are by far the most important. The choice of the best salt of antimony to use for a particular class of work is a more difficult matter, and depends on several different factors. The most suitable form for yarn may not answer as well for piece goods, the best fixing agent for cloth mordanted with tannic acid by steeping, is not necessarily as well adapted to precipitate the tannic acid applied by padding, or again, the antimony compound giving the most satisfactory results in piece dyeing may fail to answer as a fixing agent for printed goods.

A perusal of the literature of the subject will leave one even more at sea. All kinds of impossible claims are made by the advocates of the various compounds, and these improbable statements are so interwoven with the facts of the case, that it becomes extremely difficult to sift the evidence. Most of the experiments are made on yarn mordanted with tannin by steeping, and the results taken as conclusive for all forms of fibre and methods of operation.

The statement that a compound containing only 15 per cent. of antimony oxide will replace, weight for weight, one containing 40 per cent. or more is improbable, to say the least, and is not borne out either by theory or practice. The weaker compound may, however, possess other properties which will for certain work more than counterbalance the difference in strength. In many cases where tests are given, one of the antimony compounds is present in large excess, so that the weaker compound, taken in equal quantity, is still able to fix all the tannic acid on the fibre. The only test at all conclusive is one which takes into account both the antimony combined with the tannic acid in the fibre and that left in the bath, and still capable of reacting with more tannic acid. The experiments, to which I call your attention, are chosen from a long series undertaken to determine the relative values of the different antimony compounds under specific conditions. That is, the fixing in a continuous machine of cotton piece goods which had been padded with tannin liquor and dried. The factors considered are cost and resulting shade.

The first attempts were made by taking swatches from the cloth from time to time and samples from the bath for analysis. The results were hardly satisfactory. Differences were found in the weight of the pieces of cloth, and consequently in the amount of tannic acid taken up. The variation in depth of shade, due to this cause, was found in most cases to be greater than that produced by the different conditions of the antimony bath. The analysis of the weak antimony solution was difficult and tedious, and offered no method of separating the available oxide of antimony from that already combined with tannin, but left in the bath. To supplement these, I finally resorted to laboratory trials which I have found to give the most comprehensive comparison of the relative values. The method consists of the progressive exhaustion of an antimony bath by the successive introduction of patches of tannin prepared cloth, and the subsequent dyeing of all the patches with an excess of basic dyestuff. The mode of operation may be briefly outlined as follows:

Separate baths are prepared of the various antimony compounds in 750 c.c. water, and so calculated as to contain the same quantities of antimony. The bath is maintained at 49° C., while introducing successive 10 grm. patches of mordanted cloth. Each swatch is worked for 10 minutes, wrung out, and another lent introduced. As soon as removed from the fixing bath, each patch is rinsed in cold water. After all the patches had been fixed (four or five in each bath are all that are required), they are well washed and dyed together in a bath containing an excess of Methylene Blue or some other basic dyestuff. For cloth padded with a liquor containing 2 oz. of dry tannin per gallon, the bath should contain 0·10 - 0·12 grm. of 75 per cent. antimony fluoride, and the other compounds in proportion. For comparison, a patch of the same cloth is worked $\frac{1}{10}$ minutes in distilled water, rinsed, and dyed with the others.

The first table gives the more common antimony compounds with their relative strength. The first eight given are the compounds used for the trials shown in the second table. The percentages given were determined volumetrically with iodine solution. With the exception of the lactates, the titration may be performed without starch solution, the iodine serving as its own indicator. The results obtained by this method, although not as strictly accurate as those determined gravimetrically with hydrogen sulphide, have been found correct enough for all industrial purposes.

The second table gives the compounds used for a characteristic trial and the results obtained. The results have been proved by repeated trials with the same compounds. The amount of each compound and the relative cost per unit of antimony oxide is figured with the 75 per cent. salt as a standard. These cost values will, of course, vary from time to time, and will differ according to locality.

It will be seen that the first patch in each bath is completely fixed, the patches from the Frochch's "patent antimony salts," the "antimonine," and the lactates being slightly brighter than the others. The second patches from these three baths show a full shade, while the swatches from other compounds which do not dissociate as readily

Relative strength of Antimony Compounds.

Antimony Compound.	Formula.	Theoretical percentage Sb_2O_3.	Actual percentage H_2O_3.
Double Fluoride of Antimony ("75 per cent Antimony Salt")	$NaF.xSb.F_3$.	75	73·0
Tartar Emetic	$K(SbO)C_4H_4O_6+\frac{1}{2}H_2O$	43·4	42·75
Sodium Antimony Tartrate	$Na(SbO)C_4H_4O_6+\frac{1}{2}H_2O$	45·6	44·4
Froelich's Patent Antimony Salts (1)	$SbF_3Na_5(SbO)(C_2O_4)_3+xH_2O$	41·0	37·1
Antimony Lactate (2)	Acid Sodium Salt of Antimonyl-Lactic Acid	—	13·0
Liquid Antimony Lactate (3)	Acid Sodium Salt of Antimonyl-Lactic Acid	—	12·5
Antimonine (4)	$[(SbO)(C_3H_5O_3)]_2(C_3H_5O_3)_4.2C_3H_6O_3$	26·2	13·0
Potassium Antimony Oxalate (5)	$Sb(C_2O_4K)_3+6H_2O$	23·7	(6) 28·6
Antimony Trichloride	$SbCl_3$	63·6	—
Antimony Trifluoride	SbF_3	80·4	—
De Haën's Antimony Salt	$SbF_3(NH_4)_2SO_4$	47·0	—
Double Fluoride of Antimony ("66 per cent Antimony Salt")	SbF_3NaF.	66·0	64·8

(1) Dr. Oscar Froelich.
(2) C. N. Waite, U.S. Pat. 341,294.
(3) A. A. Claflin.
(4) Böhringer.-Lauter-Praktisches Hb.d Zeugdrucks II., p 93.
(5) Lauter Prak Hb.d Zeugdrucks II., p 92
(6) Dry Salt Theoretical, 28·75 per cent. Sb_2O_3

Results of successive Exhaustion Experiments.

Antimony Compound.	Parts used to give same quantity of Sb_2O_3.	Relative cost per unit Sb_2O_3.	First patch.	Second patch	Third patch	Fourth patch.
75 per cent. Antimony Fluoride	100	1	Full shade	Nearly full	½ shade	Trace
Tartar Emetic	175	2·9	" "	¾ shade	½ "	"
Sodium Antimony Tartrate	175	—	" "	½ "	½ "	"
Froelich's Patent Antimony Salt	200	2·1	Full shade a trifle brighter than above.	Full shade	Trace	No T A. fixed
Solid Antimony Lactate	575	5·7	" "	" "	"	" " "
Liquid " "	575	5·4	" "	" "	"	" " "
Antimonine	575	5·7	" "	" "	"	" " "
Antimony Potassium Oxalate	325	—	Full shade	Nearly full	½ shade	" Trace "
Blank (Distilled water)	—	—	No T.A. fixed	—	—	—

are dyed somewhat lighter. In the third set, the baths of these same three compounds are found to be practically exhausted, while the others, which have given up their antimony more slowly still, have enough to fix about one half the tannin present. The fourth set of patches shows all the baths exhausted. None of the baths gave any precipitate with hydrogen sulphide, showing that all the antimony had united with the tannin, even in the case of the compounds most difficult to dissociate.

It will be seen that the claim for the lactates of easy dissociation and complete exhaustion of the antimony is maintained. On the other hand, the remaining compounds, although acting more slowly, have likewise given up all their antimony.

From the trials we are justified in drawing the following conclusions for this class of work:—

With the antimony compounds tested, the fixing power is in proportion to the amount of oxide of antimony they contain.

"Antimonine" and the lactates are the compounds most easily dissociated, and, in this respect, are nearly equalled by the double salt of antimony fluoride and antimony oxalate. Tartar emetic and the corresponding sodium salt give up their antimony most slowly. In practice, for continuous baths, the slightly brighter shade obtained with the lactic compounds is not usually advantage enough to overcome their much higher cost when compared with the fluoride.

These laboratory trials and later experiments carried out in practice do not show any deleterious effects due to liberated acid even from the fluorides. In the latter case I have always used a small quantity of soda, but cannot find that this addition has any influence on the ultimate fixing value of the salt. These results do not agree with those of other writers, notably the experiments described by During (Färber-Zeitung, 1900, page 319). I attribute this discrepancy to difference in strength of antimony solutions, to the time allowed for action (Düring allows the samples to remain in the bath one hour at 60° C.), and, in some cases, to the fact that the mordanted fibre has not been dried before introducing into the fixing bath as in my work.

To further test this action of the acid liberated from the fluorides, the following trials were made, combining practical running and the successive exhaustion test: 30,000 yards of a cloth 10·79 yards to the pound were padded in a liquor containing 4 oz. tannin per gallon, dried and fixed in a continuous machine. The box containing the antimony solution was filled at the beginning of the run with a fresh bath of the usual amount of 75 per cent. antimony fluoride and soda, and maintained throughout the day at the same volume by a continuous stream of fresh solution of the original strength. Nothing was removed from the bath during the run of eight hours except what was carried away by the cloth itself. It will be seen that every possible opportunity was offered for the acid to collect. Samples were taken from the bath at the beginning of the run and every two hours during the day. The original sample was then reduced so as to contain 0·12 grm. of antimony oxide per litre, and all the other samples were reduced in the same volumetric proportion without determining the antimony they contained. The successive exhaustion tests were then made in 750 c.c. of these reduced baths according to the method already described. These results showed no appreciable difference in the fixing value of the baths or the brightness of the shade produced. The last baths were slightly stronger than those at the commencement of the run, but this would be due to the fact that more antimony was added during the day than was used up in fixing the tannin.

From these results it would seem that the action of the liberated acids in stripping the tannin from the fibre and in retarding the action between antimony compounds and tannic acid have been greatly exaggerated. In the case of very light, bright shades, or in the presence of a large excess of acid antimony compounds, this factor might become appreciable, but in the ordinary run of practical work the danger is negligible.

The final test in all cases, however, must be a practical one. Only by such a trial is it possible to determine if an antimony compound will produce the desired results under the conditions existing in the works.

Discussion.

Mr. A. A. Claflin said that the correctness of Mr. Williams' conclusions might be somewhat questioned. The object of printing or dyeing a cotton fabric was to produce a colour, and, in the case of the basic dyestuffs, three factors enter into this colour: tannic acid, antimony compound and dyestuff. Economy could only be considered in one of these factors in relation to its effect on the other two. For example, the cheapest source of tannic acid was mangrove extract, but this could not be used in calico printing because it possessed a colour of its own which would absolutely prevent the production of suitable shades, hence recourse was had to nearly pure tannic acids costing eight times as much. In the case of antimony compounds, it was very easy to show that the fluoride containing 73 per cent. was cheaper than the lactate as a source of antimony. The whole question then was whether, with the fluoride, the final colour was obtained more cheaply and better than with the lactate. The author admitted that the shade produced by the lactate was superior to that produced by the fluoride. That superiority of shade was due, as was pointed out by During, to the fact that the lactic acid had much less solvent effect on the fixed colour than had the hydrofluoric acid. His criticism on the author's work was, that his experiments were not carried on under conditions suitable for determining that loss. It was well known in testing dyestuffs that unless comparative trials were made with very light shades, large differences were imperceptible, because the excess of colour obscured the comparison. The dyestuff was always the most expensive factor in the final colour, and, in the experience of the speaker, the saving of the dyestuff effected by using a lactate instead of a fluoride would more than repay an excess of cost of the lactate. In some recent experiments in a large print works it was found possible to reduce the amount of Methylene Blue in the colour paste 20 per cent., when using antimony lactate, and to still obtain as full a shade as with the larger percentage of dyestuff, using antimony fluoride for fixing.

The author spoke of the addition of soda; chalk was also frequently added to the fixing bath to neutralise the acid, both of these compounds precipitating antimony oxide, and, while freshly precipitated oxide of antimony possessed a certain amount of mordanting power, much valuable oxide was lost by subsidence, and the colours themselves were very liable to rub. Another point was that the price of antimony oxide had nearly trebled in the last two years, and this had the effect of making the relative difference of cost of the antimony lactate and antimony fluoride not so great.

Mr. Williams, in reply, said he thought Mr. Claflin had well presented the other side of the question, and, as he stated in the conclusion of his paper, the final test was that of practical result under actual working conditions.

Nottingham Section.

Meeting held at Nottingham on Wednesday, March 28th, 1905.

Mr. J. M. C. Paton in the Chair.

THE DEPRECIATION OF PLANT AND MACHINERY

By H. Stanley Garry, C.A.

The subject of depreciation is one to which increasing attention is now being paid, and there is, perhaps, no class to whom it appeals more forcibly than those connected with chemical industries. It is a subject moreover which, while generally accepted in principle, has given rise to great divergence of opinion in details. Some considerable confusion exists, however, through a want of clearness in definition, and it will be well, therefore, in bringing this subject before you for discussion to clearly define, in the first place, what is intended to be covered by the word "Depreciation."

It is now generally recognised that the wastage of capital invested in plant and machinery is as much a working expense as the labour which operates it, and forms an equally definite part of the cost of production. It is also recognised that this wastage proceeds from a variety of causes differing in effect. We may enumerate these as follows:

Wastage by deterioration.—While a machine or plant may be renewed and repaired in part, and may be made practically efficient in working, there is a slow but inevitable depreciation taking place, which sooner or later extinguishes its capital value.

Wastage by obsolescence.—Under this head, the plant or machinery may be rendered obsolete by reason of its being superseded by an improved type of machine, or partially by reduction in the price after purchase, or by scientific discovery which may render the whole, or any part of a plant obsolete, owing to the changes in process or manufacture.

These divisions are practically final in their effect.

The term "depreciation" is also used to cover an annual provision in anticipation of the expense of the renewal of the machinery and plant at some future period. Some authorities would carry the matter still further, and include under the head of depreciation a provision against the possible diminished value of the plant and machinery which may occur by reason of the changes in markets and trade. In some cases, the life of machinery and plant may be dependent on the period of a patent. These, however, are matters which are, perhaps, more properly dealt with in the light of reserves, to be provided for before distribution of profits, and are not risks which affect solely the plant, but also the other items of a balance sheet.

We have, therefore, to consider an annual charge for depreciation to provide for:—1, deterioration; 2, renewals; 3, obsolescence. I purpose dealing here with the subject of depreciation under these heads as affecting —1, cost of production; 2, income tax; 3, fire insurance.

With regard to the two primary heads of deterioration and obsolescence, we may describe the effect of these on the life of the plant, as deterioration or death from natural causes, and obsolescence as accidental death.

This illustration is, perhaps, homely, but if you will consider it in the light of insurance, you will more readily appreciate the difference in the risks and the annual premium involved therein.

Residual value.—In dealing with the estimated life of plant and machinery, we have to take into account the residual value of the machinery or plant when its period of usefulness has expired, and in dealing with plant of a special nature, it may be generally assumed that, in proportion to its special character, its residual value will be low. In plant of a general character, as engines, boilers, shafting, pulleys, &c., in the event of displacement, its residual value will be high.

Method.—In like manner when we come to deal with the plant as a whole for the purpose of assessing the annual provision for depreciation, we find that the considerations affecting deterioration, renewals, and obsolescence differ greatly according to the character of the plant.

There are two extreme methods of valuation:—

1. The method of assuming an average per centage rate covering the whole plant of, say, 5 to 7½ per cent. on the book value.

2. The individual valuation of each machine, and the writing off of the detailed differences.

Both these methods are faulty. In the first method, the result is hazardous, as the percentage may be assumed on a proportion of general and special plant which may vary considerably afterwards. In the second place, the detail is very considerable. It has to be done at a time of pressure, and if left to other hands than that of a principal, the results are generally too favourable.

In arriving at a basis, therefore, for the settlement of a depreciation charge, it will be found generally desirable to classify the plant, and by taking the plant and machinery in each department and abstracting the items of each under five or six classes, we shall get, in the first place, a departmental separation, and, secondly, a classification under each department of, say:—

Motive power.—Boiler, engines, &c.

Prime movers.—Shafting, pulleys and transmitters.

Process plant.—Fixed, wearable, loose.

Accessory.—Railway trucks, weighing machines, travellers, cranes and the like.

By leaving space in each department inventory, we can provide for additions, and by having loose sheets with columns for abstracting, we can economise in re-writing.

Having obtained our totals thus, we can then apply to each department and sub-division a separate rate in respect of deterioration, obsolescence and renewals, based on our experience. The particulars thus obtained will also afford a basis for the charges in our cost sheets, as we shall thus obtain a departmental depreciation charge. We can then adopt a fixed rate.

Diminishing value.—Before we can proceed to establish a percentage rate on these classes of plant, we must settle the basis on which the rates are to be calculated.

For some years, the basis of the diminished value obtained by the writing off of the annual depreciation charge has been generally adopted, but during the last few years, there has been a tendency to revert to the basis of original cost. For instance, a rate of 10 per cent. on the original cost will exhaust the value in 10 annual instalments, but a rate of about 16½ per cent. would be required to exhaust the value in the 10 years if calculated on the diminishing value remaining after the deduction of depreciation in each year.

The argument in favour of basing the calculation on the diminishing value, is that the sums written off in the earlier years were greater when the repairs were small, and that thus tended to equalise matters. Too often, however, the two factors of rate and basis have not been settled together, and in consequence, the adoption of the basis of diminishing value has had the effect of leaving a considerable value in the books when the plant has disappeared.

For instance, a 5 per cent. rate generally carries the impression of a 20 years' life, yet taking £100 as cost and writing off on the diminishing value, the balance left at the end of the twentieth year is £37 14s. We cannot assume that the residual value in the plant, after 20 years' service, would be a third of the value, and it will be seen that there is room here for considerable error. Not only so, but if we adopt original cost the position is much clearer for any revision of the rate at any subsequent period.

Depreciation rates.—Dealing with these sub-divisions of the plant in order, we have:—

Motive power, boilers, engines, &c.—Some authorities place the depreciation on engines as high as 12½ per cent. and boilers at 10 to 15 per cent. Much depends on the stress of working and the water. Matheson places the life of a boiler at 15 years, with renewal of the furnace at the end of 10 years, and recommends a rate of 7½ per cent. per annum on the diminishing value on this class; no provision being made for obsolescence. This is, however, an extreme view.

Prime movers.—Shafting, pulleys and the plant under this head have, as a rule, a high residual value even if displaced, and probably a rate of 5 per cent. will be sufficient provision. Belting should be classified as loose tools. In this class, authorities would recommend the adoption of a rate of 5 per cent., which may be divided into 3 per cent. for deterioration and a renewal rate of 2 per. cent. No provision for obsolescence is made herein.

Process plant fixed.—Under this head we would place all heavy process plant, the wearable and renewal portions of which are classified under their separate heading. The deterioration would then be met by a rate of 2½ per cent., the renewal rate at 2½ per cent. An obsolescence rate dependent on the nature of the processes.

Process plant wearable.—Under our classification we have already dealt with the exteriors of this plant and we have, therefore, to provide a heavy renewal rate. By the dissection of this plant under the shop totals we shall have already secured the separation of the different process plants and can readily apply to each shop total a distinctive rate for renewals applicable to its character and requirements. This will be readily based on experience.

Process plant loose.—In the case of loose tools, the valuation yearly gives the most reliable results. In some cases there is an annual increase in this class, but this should verify itself. It is to be remembered that at a going-concern valuation this cannot, in the nature of the plant, work out at much more than half the original cost value.

Accessory plant.—In this case we have a high residual value due to general utility and consequently a rate for deterioration of 2½ per cent., and a renewal rate of 2½ per cent. should suffice.

Horses, carts, harness, &c.—The risks and depreciation on this class are too great to include in any average rate. The treatment accorded to loose tools of revaluation annually gives, probably, the best results.

Depreciation and income tax.—In order to avoid repetition and as the problems in connection with income tax and fire insurance are mainly connected with the rate of depreciation, it will be well to deal, at this stage, with these aspects of the subject. It is to be noted, in the first place, that from the very earliest periods of income tax assessment, the law has always dragged far behind its administration in regard to the allowance of depreciation.

The Report of the Departmental Committee on Income Tax, issued in June, 1905, states that the Committee are of opinion that no substantial change is called for in respect to the allowances for depreciation, a conclusion which could only be expected from the official character of the Committee, and which is further evidenced by their opinion that the income tax, as a whole, is levied with a minimum of friction and a maximum of result. The labours of the Committee have, however, provided evidence of the sharp contrast with which this subject is viewed from the official and commercial standpoints. The official standpoint is summed up by an official witness in the statement that the income tax is a tax on income and not on profits. The commercial standpoint, on the other hand, is summed up by a commercial witness in the statement that income tax should be levied only on profits distributed in dividends as the basis of actual income.

The rate of depreciation allowed under the Income Tax Acts differs considerably in different localities, a result which is stated to be due to a want of knowledge on the part of manufacturers as to their rights. It would certainly appear that there is considerable scope on the part of some body representative of the chemical industries to take up the question of depreciation and to obtain the most-favoured-nation clause in the assessments with regard to this.

For instance, the rate of depreciation allowed to engineers in Leicester is 7½ per cent. on the full value, while in Cardiff the rate is only 5 per cent. on the diminished value. Hosiery machinery in Leicester obtains 7½ per cent. as against 5 per cent. on lace machinery in Nottingham. Dyers' machinery in Leicester can get 10½ per cent. if justified on enquiry. Generally speaking, a distinction is made between motive power and process plant, and the general practice assumes 5 per cent. on motive power and 7½ per cent. to 10 per cent. on process plant. The foregoing allowances are, however, in respect of our two headings of deterioration and renewals.

With regard to obsolescence, there appears to be no annual allowance at present possible in respect of this, but where claims are made specifically under this head, an allowance is made from the assessment for plant which is scrapped to the full amount at which the same stood in the books at the previous stocktaking.

With regard to horses, no allowance is made for these, but the full cost of replacement is to be charged as they occur.

Fixtures.—No allowance is made for depreciation on fixtures, unless these are included under the head of

plant. Any replacements are allowed in full against the year's working.

It is to be noted, as evidence of the interest now taken in securing the allowances for depreciation, that whereas in the year 1893–4 the depreciation allowances were only £4,109,207, they have steadily increased until in 1902–3 they have reached £12,707,580.

The arguments used in connection with depreciation as regards income tax may be regarded somewhat as special pleading, but it may be of interest to summarise the grounds specified by the Associated Chambers of Commerce in 1897, for an increase in the rate of allowance.

1. That machines become obsolete much more quickly to-day than formerly.

2. That the value of machines diminishes more rapidly.

3. That the first purchasers pay a heavy premium on new machines, and, after a year or two, could purchase superior machines at half original price.

4. That machinery is worked at higher speed, wears out sooner, and is more rapidly depreciated to-day than formerly.

With regard to the basis of diminishing value, it is to be noted that the Inland Revenue authorities have now reverted in a number of cases to the basis of original cost, and that where, say, 5 per cent. is allowed on original cost, there is often an alternative rate of 7½ per cent. allowed on the diminishing value.

Renewals.—The practice adopted by the Income Tax authorities provides for the charging up of renewals to capital account where depreciation is allowed, and they usually decline to allow both renewals and depreciation as a charge against the year's profits. The result is to treat renewals as capital expenditure, which in turn are subject to depreciation at the rate agreed on. If we take Mathieson's example of the life of a boiler at 15 years, at the end of 10 years, of which we have to renew the furnaces, it will be seen that by charging renewals to capital, we can only provide for 25 per cent. of the cost of the renewal before the expiration of the life period. Therefore, if we are to charge renewals to capital, it is evident that in our calculation of the rate of depreciation we must include the provision for renewals along with deterioration.

The tendency to-day is to separate renewals from depreciation and to provide a fixed sum annually against renewals and repairs, charging the outlay each year under both these heads against the sum thus accumulated, and leaving depreciation to include deterioration and obsolescence only.

Fire insurance and depreciation. The point has been mentioned that in the case of writing down machinery and plant by an increased rate of depreciation, the value in the case of a fire would be affected in the claim for replacement.

Upon enquiry, I am informed that it is usual, in some offices, to append a declaration on the face of the policy that the depreciation written off in the books of the business shall not be taken for the purpose of assessing a fire loss. I am also informed that the assured is covered for the value of the plant at the time of the fire, and that the original cost of the plant, less depreciation, is not necessarily the basis of the claim.

There does not appear to be any scale of depreciation in force for different kinds of plant recognised by the insurance companies, but as these losses are generally settled as between the assessors and surveyors, acting for both parties, or failing their agreement by arbitration, no special rates are applicable, but each case is settled on its merits. The principal factor appears to be the possession of definite and specific information on the value and cost of the plant, and so far as I have been able to gather, the rate of depreciation adopted by the insurer does not, in any way, govern the claim in case of fire.

It is to be noted that it is a general provision in fire insurances and policies that the company may elect to replace the plant. I have not been able to discover any instance where this has been done, and probably it was never intended as other than a protection to the company.

Turning back to the consideration of the subject generally, we have now dealt with the adoption of rates as regards cost purposes, we have compared the rates allowed for income tax purposes and we shall probably have arrived at the conclusion that the allowances for income tax are in no way to be regarded as a standard of the depreciation rates necessary for business purposes.

There exists some considerable controversy as to the proper authority to fix the rate of depreciation. One engineering author considers it unfortunate that the subject of depreciation is generally settled by the auditors, and claims that only an engineer can understand it. A similar claim is put forward by professional machinery valuers, on the ground of their independent position and general trade knowledge. The engineer is, no doubt, the best authority on deterioration. The chemist (as manager) is probably the best authority on renewals and probably both for obsolescence, while for financial considerations, the auditors take the first place.

In the evidence given by Mr. Arthur Chamberlain, of Birmingham, representing the Birmingham Chamber of Commerce, before the Income Tax Committee, he states, somewhat emphatically, that he would prefer to be guided by the financial expert on the subject of depreciation rather than by either his engineer or a professional machinery valuer, on the ground that the true test of the value of the plant is its earning power.

This brings us to the consideration of my last point:

Financial depreciation.—You will, perhaps, remember that in the opening remarks, we referred to the diminished value of machinery, due to the changes in markets and trade, which includes the action of foreign tariffs.

We have already dealt with deterioration, renewals and obsolescence, and we have still to take a general survey of the plant and machinery item with regard to its position from the point of view of earning power.

The argument put forward is that the plant and machinery asset tends to increase as time goes on, until it obtains an undue and predominating position, that as profits always tend to a minimum, the value of the plant and machinery item in all businesses requires to be steadily diminished if the ratio of profits to capital is to be maintained in future years.

From this point of view, the ideal condition would be, if we take the case of a new plant, that the capital account is to be closed immediately the installation is completed. After that, all additions, renewals and repairs are to be provided out of profits, and in addition, the value of the asset is to be written down annually.

The answer to this is, that if this ideal of depreciation were to be seriously proposed, it would be very few businesses which could be carried on. The reply is that in the history of the great number of businesses which have disappeared, their ruin began when the value of their plant, machinery and buildings steadily increased, even although their productive capacity followed. That the insufficient depreciation was a more potent factor in their downfall than either prices or markets. That prices and markets are dependent on new machinery, and that the obtaining of new machinery depends primarily on the sufficiency of the depreciation.

In this connection, the rates of depreciation in force in the United States would appear to be greater than in this country, and that there are not wanting prophets who trace the alleged falling off in the position of the English manufacturer in the world's market, due primarily to the insufficient depreciation of plant.

In conclusion, I have endeavoured to put before you in as brief a form as possible a summary of the opinion of authorities to-day on this subject. There is a tendency to-day to allow a larger provision for depreciation than was formerly deemed necessary, and to admit the importance of depreciation of plant and machinery in industrial economics to a degree never contemplated by a past generation.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 303.)

ENGLISH PATENTS.

Absorbents for gases or vapours and the application thereof for purifying or recovering gases or vapours, or like purposes; Improved — —. J. Dewar. Eng. Pat. 7808, 1905. VII., page 373.

Separators; Impts. in centrifugal hand — —. E. G. N. Salemius, Stockholm. Eng. Pat. 16,223, Aug. 9, 1905. Under Int. Conv., Oct. 31, 1904.

THE stand and the "houses" for the worm-wheels and spindles of the separator are arranged so that they are very compact and mutually strengthen each other, and are easy to cast. The covers to the houses are fastened by sliding spring-catches, and the crank is attached to the shaft by a sliding spring, cam and plate. The cam also serves as a check-nut for the worm-wheel which is driven on the conical end of the shaft.—W. H. C.

Oil in feed and other water; Impts. in and apparatus for determining the amount of — —. D. B. Morison, Hartlepool. Eng. Pat. 8031, April 14, 1905.

A SAMPLE of the water is collected in a cylindrical tube and its turbidity compared with a number of standards contained in similar tubes. These standards are prepared by emulsifying oil or other substances with water, each successive tube having a turbidity corresponding with an increased quantity of oil.—W. P. S.

Furnaces or apparatus for supplying heated air or gases for industrial purposes [Drying tea, &c.] P. D. G. Clark. Eng. Pat. 10,107, 1905. XVIII.I., page 387.

UNITED STATES PATENTS.

Composition of matter [for protecting packings from the action of lubricating oils]. L. S. van Westrum, Berlin, Germany. U.S. Pat. 814,750, March 13, 1906.

A COMPOSITION consisting of 5 parts of castor-oil, 3 to 4 parts of fine graphite, and 1 to 2 parts of caustic lime is claimed. It is used to prevent packings from being attacked and dissolved by petroleum or equivalent lubricants.—W. H. C.

Extraction vessel. C. M. Chamberlain, Lead, S. Dak. U.S. Pat. 814,940, March 13, 1906.

A LONG tank is supported in a horizontal position by trunnions, so that it can be inclined, and one or more trays, provided with filter beds, are fixed longitudinally within it. The tank has removable ends, one of which is provided with a discharge gate or gates, corresponding to and forming one end of the trays.—W. H. C.

Kiln. R. W. Stewart, Findlay, Ohio. U.S. Pat. 815,387, March 20, 1906.

THE claim is for a kiln chimney which has two separate flues—a "main or fire flue," which takes air from the exterior of the kiln, and a supplementary flue within and surrounded by the main flue and which communicates at its upper and lower ends with the interior of the kiln.—W. H. C.

Kiln. R. W. Stewart, Findlay, Ohio. U.S. Pat. 815,388, March 20, 1906.

THIS is a modification of the preceding patent, in which the supplementary flue surrounds the main flue on three sides.—W. H. C.

Distilling apparatus. G. F. Wentz, St. Louis, Mo. U.S. Pat. 815,392, March 20, 1906.

THE claim is for the combination of a steam generator with a condenser and a water reservoir. A water-supply pipe connects the lower portion of the condenser with the lower portion of the reservoir, and a water-return pipe connects the top of the former with the top of the latter. The steam generator is a cylindrical vessel, having a hand-opening above provided with a cap, from which a pipe leads the vapours to the condenser, and an inclined bottom, in which there is a tap for drawing off sediment. Water is supplied to the generator through a pipe connected to the water-return pipe, between the condenser and the reservoir, and which is controlled by a valve, operated by a crank attached to a float in the generator, and provided with a nozzle to direct the water with a gyratory motion on to the bottom of the generator.—W. H. C.

Filter [Iron-hydrogen alloy]. H. C. Gesner, New York, N.Y. U.S. Pat. 815,417, March 20, 1906.

THIS invention relates to a filter consisting of a porous coherent body of agglomerated particles of an alloy of iron and hydrogen made in the form of a rigid plate or tube.—B. N.

Filtering material. O. Löffler and W. Weidle, Vienna. U.S. Pat. 815,846, March 20, 1906.

SEE Eng. Pat. 6055 of 1905; this J., 1905, 937.—T. F. B.

FRENCH PATENTS.

Distillation of liquids, Process and apparatus for the continuous ——. J. Fischer. Fr. Pat. 359,533, June 22, 1905.

THE apparatus is shown in longitudinal vertical section in Fig. 1, in horizontal section on the line, *x*, *x'*, in Fig. 2, and in vertical cross section along the line, *y*, *y'*, in Fig. 3. The liquid to be distilled enters the apparatus by the pipe, *g*, into the bottom of the chamber, *c*, from which it flows through the chambers, *c*, formed by the partitions, *b*, being compelled to take a circuitous course by the vertical baffles, *j*. The vapours rise into the head, A, and escape by the opening, *a*, whilst the residual liquid collects in the chamber, *c'*, from which it flows to a second apparatus or to a tank, by the pipes, *h*. The gaseous heating medium enters through, *m*, into the chamber, *c'*, passes up the channels, *d*, over the baffle, *k*, and down the channels, *d'*, giving up its heat to the liquid in the chambers, *c*, passing finally into the chamber, C, from which it either goes to a second apparatus through the passage, *n*, controlled by the damper, *n'*, or by the passage, *o*, controlled by the damper, *o'*, to the flue. The apparatus is supported on a base, D, and the heating may be increased by injecting liquid fuel through *p*.

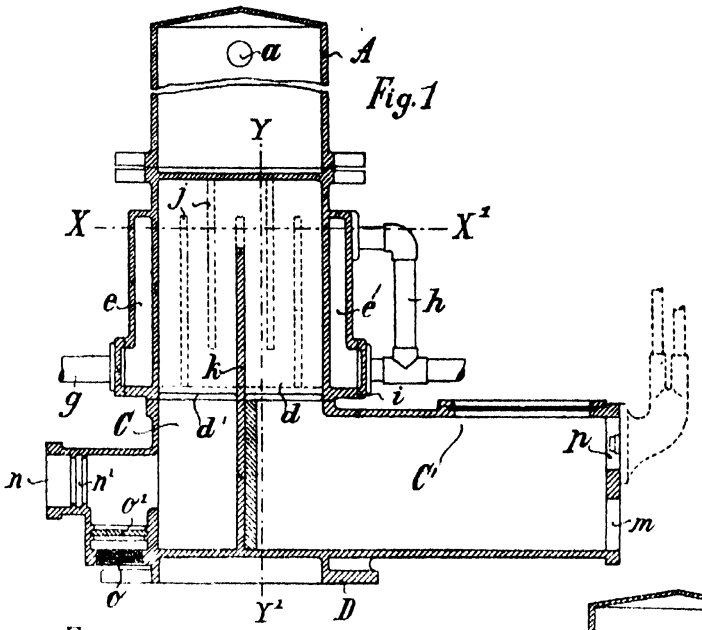


Fig. 1

Fig. 2

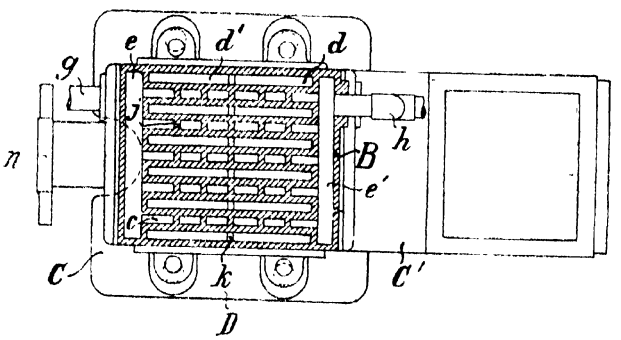
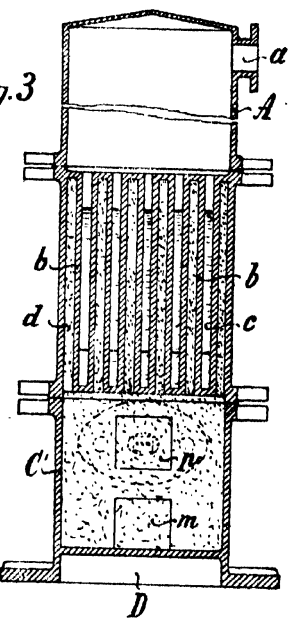


Fig. 3



Modifications of the apparatus are claimed, and it may either be used singly or several may be combined into a battery.—W. H. C.

Inflammable liquid, or liquids which give off inflammable vapours; Process for moving ——. C. Martini and H. Huncke. First Addition, dated Oct. 31, 1905, to Fr. Pat. 337,733, Feb. 28, 1903. (See Eng. Pat. 4233 of 1903; this J., 1904, 14.) Under Int. Conv., May 15, 1905.

The present Addition relates to the regulated addition of carbon dioxide or other inert gas to the exhaust gases from an explosion engine which are used to effect the movement of the fluids in question. The regulation is effected by a valve which is intermittently opened or shut by a lever attached to the shaft of the gas engine.

—W. H. C.

Drying; Process and apparatus for ——. A. H. Messinger and V. Popper. Fr. Pat. 359,594, Nov. 18, 1905.

See Eng. Pat. 25,871 of 1905; this J., 1906, 304.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 308.)

Calcium hydride; Industrial production of ——. G. F. Jaubert. Comptes rend., 1906, **142**, 788—789.

Metallic calcium is prepared by electrolysing the fused chloride, and is then heated for some hours to a high temperature in an atmosphere of hydrogen. The product is a white or grey, hard, porous solid, containing about 90 per cent. of the pure hydride. It is readily decomposed by water, 1 kilo. evolving nearly 1 cb. m. of hydrogen. It is proposed to use it in producing hydrogen for balloons.—J. T. D.

ENGLISH PATENTS.

Burners for liquid fuel. J. W. Morton, Carluke, N.B. Eng. Pat. 4933, March 9, 1905.

IN a burner for liquid fuel, operating by means of a steam-propelled spray, the spraying nozzle is fitted with a two-way connection, one branch of which leads to the boiler in which the burner is generating the steam, whilst the other is connected to a small independent boiler. On starting to use the burner, steam can be raised quickly in the small boiler, which is then kept in operation until a sufficient supply of steam is obtained from the large boiler, whereupon the valve connecting the small boiler is closed. (Reference is directed to Eng. Pats. 4046 of 1886 and 15,270 of 1904.)—H. B.

Gas-producing plants. [*Enriching producer gas*]. H. G. Hills, Romiley, Cheshire. Eng. Pat. 9171, May 2, 1905.

IN order to render producer-gas, generated in a suction producer, suitable for use in a gas engine which is designed for operating with ordinary coal-gas, the producer gas, in passing from the producer to the engine, is carburetted in the usual manner by drawing it through a vessel containing absorbent material, impregnated with benzol or the like. It is claimed that the calorific value of the gas is thus raised from 130—150 up to 500 B.T.U.
—H. B.

Gas calorimeter; Recording —. C. H. Beasley, Smethwick. Eng. Pat. 10,721, May 23, 1905.

A U-SHAPED tube, one limb of which is enclosed within a vertical chimney, is provided at the top of each limb with a small tank, and contains enough oil, or other suitable liquid, to fill the tube and partly fill the two tanks. The gas to be examined, is burned in an atmospheric burner at the bottom of the chimney, and the oil in the heated limb of the U-tube rises to a level above that in the other limb corresponding to the temperature attained. The difference in level is, therefore, a measure of the calorific value of the gas, and is recorded automatically by means of two floats situated in the tanks, and connected by threads or metal strips to two pulley-wheels arranged upon a horizontal spindle. The spindle rotates as the floats rise and fall respectively, and operates a lever carrying a marker, the latter tracing a diagram upon a moving band of paper, actuated by clockwork and ruled with a scale which indicates directly the calorific values.—H. B.

Minerals [*Coal*]; *Apparatus for cleaning and separating* —. G. F. Zimmer, London. Eng. Pat. 13,955, July 6, 1905.

THE crushed coal is made to pass along a vibrating conveyor trough, fitted with a corrugated bottom at the feed end and having a succession of false bottoms consisting of perforated plates, woven wire or grids, alternating with outlets for the removal of the waste. Adjustable weirs and apertures are also provided in the bottoms of the troughs, whereby the material is gradually sized and cleaned as it is carried along the trough.
—J. H. C.

Coal and other minerals; Apparatus for washing and separating —. D. Campbell, R. B. J. Binnie and W. Reid, Hamilton, Lanark. From J. Smith, Hatting Spruit, Natal. Eng. Pat. 26,556, Dec. 20, 1905.

IN jigging, a clearing arm or finger is provided which projects into the stone-trap. Arrangements are made for moving this arm at intervals so as to prevent the trap from becoming choked.—J. H. C.

Burning liquid fuel; Apparatus for —. J. W. Morton, Carluke, N.B. Eng. Pat. 4931, March 9, 1905.

THE liquid fuel is sprayed from a nozzle into a chamber having a tortuous passage in the form of a bend or spiral, which promotes the vaporisation of the fuel and its admixture with the air which enters the chamber along with the jet of fuel. A baffle-plate, of conical or other suitable form, is fixed above the outlet from the chamber, to render the combustion more perfect. The chamber is constructed of refractory material, such as fireclay.—H. B.

Gas; Process and apparatus for producing coal —. P. Busse, Crosta, Saxony. Eng. Pat. 4956, March 9, 1905.

SEE Addition of March 14, 1905, to Fr. Pat. 348,411 of 1904; this J., 1905, 1007.—T. F. B.

Gas-making plant; Impts. in connection with the hydraulic mains of — *for collecting pitch therefrom.* J. Y. Johnson, London. From Deutsche Continental Gas-Ges., Dessau, Germany. Eng. Pat. 17,464, Aug. 29, 1905.

WITHIN the hydraulic mains of gas-making plants, removable scoops or the like are arranged beneath the ends of the dip pipes, for collecting the pitch dropping therefrom, the scoops being withdrawn when filled, and replaced by empty ones. The arrangement is specially applicable to mains provided with a longitudinal inclined sealing partition, forming a separate longitudinal inclined chamber provided at the top with a series of apertures and covers; through these apertures the scoops can be inserted or withdrawn, without interrupting the gas manufacture.—H. B.

Gas engines; Process for the utilisation of the waste heat of marine — *for the production of steam from sea water for feeding gas generators.* E. Capitaine, Germany. Eng. Pat. 22,594, Nov. 4, 1905. Under Int Conv., Nov 5, 1904.

THE hot exhaust gases from the engine, or hot gases from the gas generator, are led down through the tubes of a boiler, or heat interchanger, producing steam from the sea-water contained therein. The steam is utilised in the gas generator. A constant flow of fresh sea-water takes place into the interior of the boiler through a tubular coil arranged within an annular jacket surrounding the boiler. A corresponding constant stream of the boiling, merely slightly concentrated, sea-water flows out from the top of the boiler into the said jacket, and, on its way to waste, parts with its heat to the fresh water flowing in through the coil.—H. B.

Coal gas and other gases, Process and apparatus for washing or purifying —. E. Ott, Zurich, Switzerland. Eng. Pat. 5773, March 18, 1905.

SEE Fr. Pat. 352,565 of 1905; this J., 1905, 961.—T. F. B.

Incandescent light; Process of generating —. R. Mewes, Berlin. Eng. Pat. 5265, March 13, 1905.

HYDROGEN, coal-gas, or other combustible gas, and oxygen, the air, or other gas used as supporter of combustion, are enriched by the addition of volatile, combustible or incombustible compounds, "such as calcium ethyl, calcium methyl, calcium ethylate, magnesium ethyl, silicium ethyl, silicium ethylate, borax ethyl, aluminium ethyl, aluminium ethylate," for the purpose of obtaining light by the incandescence of the liberated particles of metallic oxide, &c., without the intervention of a mantle. Burner jets, from which the enriched gas and air respectively issue, are arranged at suitable angles to each other. If desired, however, the flames may be directed upon the surface of a mantle or other suitable solid body.—H. B.

UNITED STATES PATENTS.

Gas producer. A. Cerasoli, Rome. U.S. Pat. 815,794, March 20, 1906.

SEE Eng. Pat. 20,678 of 1903; this J., 1904, 816.—T. F. B.

Gas producer. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 815,913, March 20, 1906.

A GAS producer is combined with a fuel-burning furnace by a pipe connecting the waste-gas outlet of the furnace with the producer. This pipe is provided with a valve-controlled air inlet, open to the atmosphere, and with an air injector between the inlet and the producer.—R. L.

Gas generator. J. Radcliffe, Elland. U.S. Pat. 816,123, March 27, 1906.

SEE Eng. Pat. 7592 of 1904; this J., 1905, 490.—T. F. B.

Gas-purifier. F. G. Hobart, Beloit, Wis., Assignor to Fairbanks, Morse and Co., Chicago, Ill. U.S. Pat. 814,698, March 13, 1906.

THE purifier described is for gas or liquid, and consists of a shell or casing, in which are a number of removable trays, closely fitted in the casing and dividing it into compartments. In each compartment, filtering material is placed on the trays. A pair of pipes rest on the bottom of the casing, and pass vertically upwards through the trays, which fit closely round the pipes. One of the pipes has inlet ports on one side of the trays, and the other outlet ports on the other side of the trays. The pipes pass through apertures in the cover at the top of the casing. —W. C. H.

Vacuum lamps; Method of producing —. D. M. Moore, Newark, N.J., Assignor to Moore Electrical Co., New York. U.S. Pat. 814,794, March 13, 1906.

IN the process described for manufacturing vacuum-tube electric lamps, the interior of the tube is coated with an organic substance, such as a hydrocarbon, which is electrolysed in order to form an adherent coating of "fixed solid residue," on the interior. While the electrolytic process is being carried on, the tube is exhausted and finally sealed off when the decomposition is practically complete.—W. C. H.

FRENCH PATENTS.

Fuel; Agglomeration of —. [*Utilisation of waste cellulose lyes.*] A. E. Tavernier and C. Oulman. Fr. Pat. 359,249, Nov. 8, 1905.

WASTE cellulose lyes from paper manufacture are treated with sulphuric acid and concentrated to a syrupy consistency, then well mixed with about 20 parts of the previously ground and sifted fuel. The mixture is heated for 10 minutes with direct steam, then formed into a paste and pressed in a briquette press under a pressure of 200 kilos. per sq. cm. The briquettes are dried in a chamber built of bricks and covered with red lead. Vapours of hydrochloric acid are passed through the chamber. By the action of the acid the cellulose is transformed into carbon and thus made insoluble. The hydrochloric acid vapours are received in water and used again.—R. L.

Burner; Liquid fuel —. C. Leistner. Fr. Pat. 359,355, Nov. 9, 1905. Under Int. Conv., Nov. 10, 1904.

SEE Eng. Pat. 24,372 of 1904; this J., 1906, 114.—T. F. B.

Gas generator. W. Towns. Fr. Pat. 359,203, Nov. 7, 1905. Under Int. Conv., July 8, 1905.

SEE Eng. Pat. 14,090 of 1905; this J., 1905, 1163.—T. F. B.

Gas-retort furnace. W. Bäcker. Fr. Pat. 359,255, Nov. 8, 1905.

THE furnace is circular in plan, and comprises a series of vertical retorts arranged like a ring in an annular chamber in the masonry. In the centre, and below the level of the retorts, are a number of generators, the gases from which are led through numerous flues into the annular retort-chamber, where they burn on encountering streams of preheated air. The chamber is sub-divided by partitions to cause the hot gases to pursue a zig-zag course round the retorts, and the waste gases finally pass off by a central chimney.—H. B.

Gas washer. Cie pour la Fabr. des Compteurs et Matérial d'Usines à Gaz. First Addition, dated Nov. 6, 1905, to Fr. Pat. 356,721, of Aug. 7, 1905 (this J., 1906, 11).

THE washing wheel referred to in the principal patent is here modified, by substituting discs of glass, arranged upon a rotary metal shaft and spaced apart by means of leather washers, for the sectors of glass, arranged radially round the shaft, as therein described. To prevent fracture of the glass discs by striking against the walls of the washing chamber as the shaft carrying the discs is lowered into or raised from it, each end of the shaft is provided with a vertical guide rod which sinks into a vertical pit or channel in the masonry, keeping the discs clear of the latter.—H. B.

Gas washing and purifying apparatus. Kirkham, Hulett and Chandler, Ltd., and S. Hersey. Fr. Pat. 359,276, Nov. 9, 1905. Under Int. Conv., Nov. 11, 1904.

SEE Eng. Pat. 24,467 of 1904; this J., 1905, 1056.—T. F. B.

Gases; Apparatus for [automatic] analysis of —. Monopol Betriebskontroll-Apparate K. Stembock. Fr. Pat. 359,352, Nov. 2, 1905. XXIII., page 395.

Filaments of iridium for incandescence lamps; Apparatus for baking —. R. J. Gulcher. Fr. Pat. 359,162, Nov. 4, 1905.

THE apparatus is designed for annealing iridium filaments, obtained by mixing finely-divided iridium with an organic agglutinant material, forming the mixture into filaments, drying the latter and reducing them in a current of hydrogen. An annular oxyhydrogen burner is suspended on a carrier between two vertical guides, and can be caused to ascend or descend between the guides by means of attached cords, working over pulleys at the top of the guides and connected to a winding spindle at the base of the apparatus. The burner consists of two concentric conical chambers, to one of which oxygen is led, to the other, hydrogen, by means of flexible tubing; an annular flame is thus produced, whilst the central space admits an upward current of air, and allows the iridium filament to pass through, as the burner rises or falls. The filament is suspended vertically from a thick platinum wire, so as to be in the centre of the flame, and the burner is raised and lowered as often as desired, to bake the filament throughout its length.—H. B.

Incandescence bodies for electric lighting; Process of making — by producing a metallic deposit on a metal core. Siemens und Halske Act.-Ges. Fr. Pat. 359,339, Nov. 11, 1905. Under Int. Conv., Nov. 15, 1904.

SEE Eng. Pat. 23,097 of 1905; this J., 1906, 115.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 309.)

Pine wood; Products of the distillation of —. W. H. Walker, E. W. Wiggins and E. C. Smith. J. Amer. Chem. Soc., 1906, 28 (Abstracts) 103—105.

THE distillation was effected in a retort made from a 12-in. wrought iron pipe surrounded by a 14-in. pipe serving as jacket. Superheated steam was passed through the jacket and the interior of the charge, the distillation being started at 175° C., whilst after the oil of turpentine and rosin oil had come over, the temperature was raised gradually to 400° C. It was found that heart-wood was of little value for the production of turpentine as compared with stump-wood. The turpentine obtained gave 80 per cent. of distillate below 163° C., had a sp. gr. of 0·865 to 0·867, and showed a specific rotatory power of +28·7°. It contained very little free acid and less than 1 per cent. of non-volatile matter. The crude rosin, after heating to 150° C. to expel moisture, solidified to a hard mass with clear vitreous fracture and of almost black colour. It was, therefore, converted into rosin oil, when the following products were obtained:—

	Per cent.	Sp. gr.
Acid liquor	15·34	—
Rosin spirit	4·20	0·930
Rosin oil	26·47	0·990
Blue oil	17·91	0·994
Green oil	16·62	1·030
Tar	4·62	—

In another series of experiments, the wood was subjected to dry distillation with the following results :—

	Weight of wood. Kilos.	Gas. Per cent.	Crude product. Per cent.	Tar. Per cent.	50 per cent acid Per cent	Oil Per cent.	Charcoal. Per cent.
I	2·2	43·0	34·2	19·5	1·18	3·0	23·9
II	2·0	28·7	46·9	25·9	1·70	2·5	24·5
III.	2·0	25·9	39·6	19·8	1·32	2·6	34·5
IV.	2·0	24·1	51·4	26·8	1·86	3·6	23·3

The first run was made at 300° C. for two hours, whilst in the last three runs, the retort was heated slowly to 175° C. for one hour, after which the temperature was raised to above 300° C. The following are the yields calculated on a cord of light wood of 6000 lb. :—

From steam distillation :

		Yield. Per cent.
Oil of turpentine	24·9 galls.	3·00
Yellow oil	4·4 ,,	0·56
Rosin	318 lb.	5·30

From dry distillation :—

		Yield. Per cent.
Gray acetate of lime	46·2 lb	—
Light oil	18·4 galls	2·31
Charcoal	1050 lb	17·50
Gas	3750 cb ft	2·00
Wood tar	1217 lb	20·28

—D. B.

Louisiana petroleum ; The series C_nH_{2n-2} in ——. C. E. Coates. J. Amer. Chem. Soc., 1906, **28**, 384—388.

JENNINGS oil furnished a small quantity of a fraction, $C_{11}H_{20}$, having an odour of turpentine, and ultimately, after repeated fractionation under a pressure of 21 mm. the following series was obtained :—

Probable formula.	Mol. wt.	C.	H.	Sp. gr.	B.P. at 760 mm C	n_D^{25}	Mol. refraction.
		per cent	per cent				
C_9H_{14}	111	—	—	$0{\cdot}774^{24}_{4}$	120·5	1·4260	—
C_9H_{16}	121	—	—	$0{\cdot}790^{23}_{4}$	145·7	1·4370	—
$C_{10}H_{18}$	138	86·81	13·01	$0{\cdot}814^{22}_{4}$	168–170	1·4460	44·96
$C_{11}H_{20}$	151	87·00	12·88	$0{\cdot}837^{20}_{4}$	198–200	1·4582	48·76
$C_{12}H_{22}$	167	86·68	13·43	$0{\cdot}851^{18}_{4}$	215–217	1·4640	53·48
$C_{13}H_{24}$	181	86·58	13·42	$0{\cdot}862^{22}_{4}$	235–238	1·4692	57·98

Despite the turpentine smell, all the above were optically inactive and gave no evidence of unsaturation under the usual tests. The properties of the hydrocarbon, $C_{10}H_{18}$, correspond with those of a methylbicyclononane, but the sp. gr. is too high. The hydrocarbon, $C_{13}H_{24}$, however, corresponds almost exactly with an isopropylmethylbicyclononane. The series appears to be a homologous bicyclic one beginning at least as low as $C_{10}H_{18}$ and having some connection with asphaltum, since a considerable portion of the oil was condensed to a semi-asphaltic mass on being passed through a red hot copper pipe and suddenly cooled.—C. S.

Dimethyl sulphate for determining tar oils in admixture with rosin and mineral oils, and its behaviour towards fatty oils, oil of turpentine and pinoline. E. Valenta. Chem.-Zeit., 1906, **30**, 266—267.

THE fraction from coal tar boiling at 240°—300° C. is often used to adulterate mineral oils and more frequently printers' ink. For its determination, dimethyl sulphate is recommended, which dissolves the hydrocarbons of the benzene series readily in the cold, but does not act on petroleum distillates and rosin oils. In the method described, a known volume of the oil under examination is added to a suitable volume of dimethyl sulphate (one and a half to two parts) in a stoppered glass cylinder of about 100 c.c. capacity, graduated so that each division equals 0·5 c.c. The contents are well shaken for about one minute and left to rest until the two layers have completely separated, when the increase in the volume of the lower layer indicates the quantity of coal-tar hydrocarbon oil taken up by the sulphate.

For the estimation of tar oils in printers' ink, the lampblack contained therein is separated in the usual manner. If the varnish contain saponifiable products, 25 c.c. are then evaporated to dryness on the water-bath with 125 c.c. of an alcoholic caustic soda solution (80 grms. in 1 litre of 95 per cent. alcohol). The residue is dissolved in 250 c.c. of hot water, the solution well shaken with 100 c.c. of ether, and this operation repeated two or three times. The ethereal solution containing the hydrocarbons is washed with water, the ether expelled by evaporation in a tared platinum dish, and the residue dried and weighed. A measured volume is then treated with dimethyl sulphate.

By the treatment of fatty oils, such, *e.g.*, as olive or almond oil, with dimethyl sulphate a diminution of the volume of the layer of dimethyl sulphate, as compared with the layer of the respective oil, is observed, whereas pinoline and oil of turpentine when shaken with an equal volume of dimethyl sulphate, cause an increase of volume of the latter, owing to solution of the substances named therein, to the extent of about 30 per cent [" Pinoline " is " German " or " Patent oil of turpentine " ; this J., 1898, 607.] The mixture obtained with pinoline has an orange colour, that with oil of turpentine is colourless but shows a considerable increase in temperature, a property, which it is thought might be applied with advantage to the determination of pinoline in oil of turpentine.—D. B.

ENGLISH PATENTS.

Kiln for the gasification or distillation of peat. M. Ziegler. Beuerberg, Germany. Eng. Pat. 18,174, Sept. 8, 1905.

THE kiln consists of a vertical shaft having one or more contractions extending all the way round ; the walls of the lower part of the shaft, in which the fire-grate and ash-pit are situated, being provided with numerous openings on all sides, both above and below the grate level, for the introduction of air. The kiln is always kept filled with peat, which is fed in from above through a hopper ; the gaseous products of the destructive distillation are led off at the top of the shaft ; whilst the residue is removed from the ash-pit by means of a screw conveyor. Preferably forced draught is used.—H. B.

Sulphate of ammonia ; Method of manufacturing ——. J. Grossmann, Manchester. Eng. Pat. 20,837, Oct. 14, 1905.

CRUDE ammonia liquor is distilled in the usual way, but without addition of lime, and the ammonia evolved is received in sulphuric acid in a saturator. The residual liquor in the still is concentrated, filtered, transferred to another still, and treated with an excess of sulphuric acid to expel, on heating, all the thiocyanic acid present, the

expulsion being aided by the injection of air. The ammonium sulphate solution thus obtained is then, after addition of sulphuric acid when necessary, used in the saturator to receive the ammonia evolved as first described. Or, the solution may be neutralised by ammonia and crystallised. When ferrocyanide is present in the crude ammonia liquor treated, the liquor may, at an intermediate stage of the process, be treated with an iron salt, and after removal of the precipitate formed, the cleared liquor is returned to the still in which thiocyanic acid is set free. If cyanide be present, an iron compound may be added to form ferrocyanide; or sulphur or a polysulphide is added to form a thiocyanate, with following treatment as described.—E. S.

United States Patents.

Wood-still. H. Copilovich, Hinckley, Minn., Assignor to Standard Turpentine Manufacturing Co., St. Paul, Minn. U.S. Pat. 814,901, March 13, 1906.

The metal still is cylindrical and has no bottom, but rests on the masonry foundation. There is an opening at the top for charging. The lighter products of distillation are led away by a pipe situated about halfway up the side of the still, and the tarry products are drawn off by a pipe running downwards from the floor.—C. E. F.

Coking; Process of ——. G. E. Merrill, Peace Dale, R.I. U.S. Pat. 815,453, March 20, 1906.

A horizontally moving layer of coal is subjected to successive degrees of heat, which may be regulated independently of each other, so that the different gases in the coal will be given off at determined points. The coal is, during its travel, protected from contact with the air. A spray of water plays on the heated mass of coal, and the steam generated thereby, together with any air which may be present, are removed by suction.—R. L.

German Patent.

Beech wood tar; Process for preparing an alkali-soluble product from —— which is solid at the ordinary temperature. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 163,446, June 18, 1903.

Air, oxygen or ozonised air is blown through crude beech wood tar heated to 120°–150° C., until the product is soluble in alkalis. When cold, the product is brittle, and completely soluble in alkali; it is said to resemble colophony in many respects. It has only a feeble odour, and is stated to be applicable to pharmaceutical purposes, and also in the production of colour lakes. Metallic salts can be obtained in the usual manner from the alkali solution.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

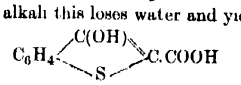
(*Continued from page* 310.)

Indigo group; Sulphur-containing analogues of the ——. P. Friedländer. Ber., 1906, **39**, 1060—1066.

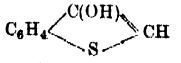
Thiosalicylic acid, obtained from *o*-thiocyanobenzoic acid and sodium sulphide, reacts readily and quantitatively with chloroacetic acid in presence of alkali, yielding phenylthioglycollic-*o*-carboxylic acid,

$C_6H_4(COOH)S.CH_2.COOH$, m. pt. 213° C. (uncorr.).

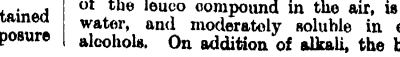
By the action of alkali this loses water and yields the acid



from which, on heating, carbon dioxide is disengaged, and *thioindoxyl* or *a-hydroxythionaphthene*



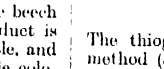
formed. The latter, when distilled with steam, is obtained in long colourless needles, melting at 71° C. On exposure to the air, thioindoxyl acquires a red colour, more rapidly in presence of alkali; and, on adding potassium ferricyanide to its solution in dilute caustic soda lye, red flocks of *thioindigo* separate,



Thioindigo sublimes in long needles and can be distilled in small quantities almost without decomposition. It is extremely resistant to oxidising agents, and is not acted upon by acids and alkalis, except fuming sulphuric acid, with which it yields a soluble red sulphonic acid. With alkaline reducing agents it yields a product soluble in alkalis, the solution of which, on exposure to air, becomes covered with a red bloom, and can be used for the dyeing of textile fibres, the shades produced being faster to light and oxidising agents than those yielded by indigo.

Thioindoxyl has properties quite analogous to those of indoxyl. With aromatic aldehydes, ketones and diketones, it yields "*thioindogenides*"; with isatin a *thioindirubin*; and with benzaldehyde and its derivatives, yellow crystalline compounds analogous to those obtained by Friedländer and Neudörfer (Ber., 1900, **80**, 1077; 1902, **32**, 1837) from ketocumaran, and erroneously believed to be flavone derivatives.

Arylthioglycollic acids to be used in the synthesis of thioindigo compounds, can be prepared from thioglycollic acid, $HS.CH_2.COOH$, from which by the action of aromatic diazo-compounds, products of the composition $X.N_2.S.CH_2.COOH$, are obtained, which on heating evolve nitrogen, with formation of the corresponding arylthioglycollic acids, $X.S.CH_2.COOH$. They can also be obtained in some cases by the action of nitro and halogen derivatives of aromatic compounds on thioglycollic acid in presence of alkali or an alkaline salt. For example, dinitrochlorobenzene and thioglycollic acid in presence of sodium acetate in alcoholic solution, yield *dinitrophenylthioglycollic acid*, $C_6H_3(NO_2)_2.S.CH_2.COOH$, m. pt. 167°–168° C., whilst *o*-nitrochlorobenzene or *o*-dinitrobenzene yields in a similar manner, in presence of potassium hydroxide, *o*-nitrophenylthioglycollic acid, $C_6H_4(NO_2).S.CH_2.COOH$, which, when reduced in acid solution, gives the inner anhydride of the amino-acid:



The thioglycollic acid is best prepared by Holmberg's method (*J. prakt. Chem.* [2], **71**, 264) from chloroacetic acid and potassium xanthate, the alkylxantho-acetic acid produced being decomposed by alkalis or ammonia.

The azo dyestuffs produced by the action of diazo compounds on thioindoxyl, give shades very similar to those produced by the *a*-naphthol-*o*-azo dyestuffs.—A. S.

Thiazines. R. Gnehm and F. Kaufler. Ber., 1906, **39**, 1016—1020.

The authors' experiments were made with the object of determining whether mercaptans and disulphides of the thiazine series possessed the characters of sulphide dyestuffs. As intermediate products, amino derivatives were prepared. By the action of alcoholic ammonia on Methylene Blue, one dimethylamino group is replaced by an amino group, an asymmetrical dimethylthionine being produced. Five grms. of Methylene Blue hydrochloride (free from zinc) were heated with 20—30 c.c. of a saturated alcoholic solution of ammonia for four hours in a sealed tube at 140°—150° C. The reaction product consisted of a brown crystalline mass, which, on opening the tube, rapidly turned blue. The pure compound was isolated, with suitable precautions to avoid contact with air, and was found to consist of the asymmetrical dimethylleucothionine:

The corresponding blue dyestuff, obtained by oxidation of the leuco compound in the air, is readily soluble in water, and moderately soluble in ethyl and methyl alcohols. On addition of alkali, the blue soution of the

dyestuff immediately turns red. By using benzylamine in place of ammonia, the reaction follows a different course, benzylaminotetramethylthionine being produced.

To prepare the mercaptan, Leuckardt's process (J. prakt. Chem., **41**, [2], 179; also this J., 1889, 187) was employed. Two grms. of dimethylthionine dissolved in 200 grms. of water were treated with 2·5 c.c. of concentrated hydrochloric acid and 0·5 grm. of sodium nitrite, dissolved in a small quantity of water, the mixture being cooled. After half-an-hour, a solution of 5 grms. of potassium xanthate in 300 c.c. of water was added and the mixture heated for four hours on the water-bath. The dark violet resin produced, consisting of the thiocarbonic acid ester of the thiazine-mercaptan, was filtered off, dried, and hydrolysed by sulphuric acid, when the thiazine-mercaptan was produced

$$R.S.CS.OC_2H_5 + H_2O = R.SH + COS + C_2H_5OH.$$

The authors have been unable to obtain the product in a pure state, but it possesses the characteristic properties of a sulphide dyestuff. It dissolves in sodium sulphide solution, with formation of a leuco-compound, and the solution dyes cotton a tolerably intense, somewhat dull blue, perfectly fast to washing.—A. S.

Methylene Green. R. Gnehm and E. Walder. Ber., 1906, **39**, 1020—1022.

By the action of nitrous acid on an acid solution of Methylene Blue, a bluish-green compound, Methylene Green, is formed, which has been generally regarded, although without any conclusive evidence, as nitro-Methylene Blue. The authors prepared the nitrate of Methylene Green by the action of sodium nitrite on a nitric acid solution of Methylene Blue. From the nitrate, the hydrobromide was obtained, and with this compound the amount of hydrogen taken up on reduction was determined. The results obtained prove that Methylene Green is the nitro derivative of Methylene Blue and not a nitroso compound.—A. S.

Dyestuff trade of Germany. For. Off. Ann. Series, No. 3544.

The export trade in dyestuffs continues to increase, the total shipments during 1905 exceeding those of 1904 by nearly 6000 tons; the total value of the exports during the last three years has been:—1903, £6,189,000; 1904, £6,255,650; 1905, £7,443,400. Of these totals, the exports of alizarin dyestuffs were valued at £754,550 in 1903, £741,950 in 1904, and £761,150 in 1905; and of Indigo, at £1,034,000 in 1903, £1,084,050 in 1904, and £1,384,450 in 1905.

The imports of dyestuffs into Germany were valued at £297,800 in 1903; £282,500 in 1904, and £309,350 in 1905. [T.R.]

Cyanines; Absorption and sensitising spectrum of the ——. A. von Hubl. XXI., page 393.

English Patents.

Colouring matters of the quinoline group [Cyanine dyestuffs]; Manufacture of blue —— and photographic surfaces sensitised therewith. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 16,227, Aug. 9, 1905.

Blue dyestuffs, which possess the property of rendering silver halide emulsions highly sensitive to red light rays, are obtained by the action of alkali on an alkyl halide of quinoline or quinaldine (or a mixture of these) in presence of formaldehyde, or a substance which easily generates formaldehyde. Twenty-five parts of quinoline-methyl chloride and 30 parts of *p*-toluquinaldine-ethyl iodide are dissolved in 500 parts of water, and boiled for a short time with 18 parts of 40 per cent. formaldehyde and 25 parts of a 16 per cent. sodium hydroxide solution. The dyestuffs are soluble in alcohol, and with difficulty in water. —T. F. B.

Moistening of substances [dyestuffs]; Process for facilitating the ——, and products made thereby. C. D. Abel, London. From Act. Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,955, June 22, 1905.

The process is described in Fr. Pat. 353,440 of 1905 (this J., 1905, 1102). The products claimed are mixtures of (*a*) Indigo and soap, (*b*) Sulphur Yellow R Extra and soap, each of which is very easily moistened.—T. F. B.

Anthracene series; Manufacture of new compounds of the —— and of new colouring matters therefrom, and their application in dyeing and printing [Anthracene dyestuffs]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 14,578, July 14, 1905.

See Fr. Pat. 357,239 of 1905; this J., 1906, 66.—T. F. B.

Methylanthraquinone; Manufacture of derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 16,632, Aug. 16, 1905.

β-Methylanthraquinone, or one of its negatively substituted derivatives, is converted by treatment with a halogen, into an ω-halogenated methylanthraquinone. The mono-, di- or tri-halogen derivatives may be obtained by using the necessary amount of halogen. The dihalogenated derivatives may be converted, by heating with concentrated sulphuric acid, with or without boric acid, into anthraquinone aldehydes.—T. F. B.

Dyestuffs; Manufacture of trisazo ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on the Maine, Germany. Eng. Pat. 14,787, July 18, 1905.

The dyestuffs prepared by combining diazo compounds with diammodiarylnaphthaldehydin-5-hydroxy-7-sulphonic acid (see U.S. Pat. 813,155 of 1906; this J., 1906, 260) are tetrazotised and combined with amines or phenols or their sulphonic acids. The resulting trisazo dyestuffs dye unmordanted cotton various bright shades of red, fast to washing and acids.—T. F. B.

Dyestuffs; Manufacture of Anthracene ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,196, Sept. 8, 1905.

See Addition of Sept. 7, 1905, to Fr. Pat. 343,608 of 1904; this J., 1906, 260.—T. F. B.

Dyes of the naphthalene series; Manufacture of o-oxymonoazo ——. W. and W. F. Kalle, Biebrich on Rhine, Germany. Eng. Pat. 23,034, Nov. 9, 1905. Under Int. Conv., Nov. 28, 1904.

The zinc salts of *o*-hydroxydiazonaphthalene compounds are readily formed by the action of a nitrite on the sulphonic acids of 1.2- or 2.1-aminonaphthol in presence of zinc oxide or zinc hydroxide, and zinc salts. These zinc compounds may be easily combined with resorcinol, dihydroxynaphthalenes, β-naphthol, naphtholsulphonic acids, &c.; the zinc compound of the *o*-hydroxyazo dyestuff is then decomposed by acid. Fifty-five kilos. of 1.2.4-aminonaphtholsulphonic acid are made into a paste with a solution of 60 kilos. of zinc sulphate in 70 kilos. of water, to which has been added 15 kilos. of 25 per cent. ammonia solution. A solution of 16 kilos. of sodium nitrite in 60 litres of water is then stirred in. Diazotisation is completed by heating for one to two hours at 40°—50° C. The product is neutralised by the addition of 60 kilos. of "calcined" soda, and mixed with a hot, saturated solution of 33·5 kilos. of β-naphthol. The combination is completed by heating, and the zinc lake is precipitated by addition of a solution of salt, and filtered. When boiled with dilute hydrochloric acid, the free acid is obtained, which dyes wool from an acid bath, bluish-red shades, converted by chroming into pure blue-black, and by treating with copper compounds into reddish-violet shades. (Compare Fr. Pat. 353,786 and U.S. Pat. 807,119 of 1905; this J., 1905, 1062 and 1906, 65.) —T. F. B.

French Patents.

Azo dyestuffs for wool; Production of ——. Soc. pour l'Ind. Chim. à Bale. Fr. Pat. 358,844, Jan. 3, 1905.

2.4-diamino-1-phenol is tetrazotised by means of a nitrite

in presence of a large excess of mineral acid, and preferably at a temperature below 0° C. A reddish-yellow solution of the corresponding tetrazo compound is so obtained and is combined with 1 mol. of an azo-component in acetic acid solution to form intermediate products. These intermediate products are then combined, in alkaline solution, with another mol., either of the same or of another azo-component to form dyestuffs of great fastness to fulling, light and washing, which vary in shade from Bordeaux red to violet. The shades produced are converted into violet-black to greenish-black shades by treatment with chromium salts, &c., on the fibre. For example, 10 kilos. of the hydrochloride of 2.4-diamino-1-phenol are dissolved in a little water and the solution cooled to −5° C., 25 kilos. of commercial hydrochloric acid are then added, and are followed gradually by a 10 per cent. solution of 7 kilos. of sodium nitrite. The solution of the tetrazo compound so produced is stable at ordinary temperatures. It is combined, in presence of an excess of sodium acetate, with 12·3 kilos. of the sodium salt of 1.4-naphthol-sulphonic acid. In a short time the formation of the red intermediate product is complete. This is then combined, either at once or after separation from the alkaline liquor by filtration, with 10 kilos. of sodium β-naphtholate in presence of excess of sodium carbonate in solution. It is best to gradually heat to 40° C. Finally, the whole is heated to 70°–80° C., and the finished dyestuff is salted out. It dyes wool from an acid bath in bright Bordeaux red shades, which are changed by subsequent chroming into violet-black shades, very fast to washing and to fulling. Dyestuffs with analogous properties are obtained if the 1.4-naphtholsulphonic acid is replaced by 1.5- or 2.6-naphtholsulphonic acids, and also if the β-naphthol is replaced by dihydroxynaphthalenes, such as 2.7-dihydroxynaphthalene.—E. F.

Dyestuff easily soluble in water, belonging to the naphthalene series; Production of an o-hydroxymonoazo ——. Fabr. de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 359,310, Jan. 17, 1905.

SEE Eng. Pat. 1368 of 1905; this J., 1905, 1061.—T. F. B.

Dyestuffs, Process of making blue —— by oxidation on the fibre. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 359,637, Jan. 28, 1905.

SEE Eng. Pat. 406 of 1905; this J., 1905, 1010.—T. F. B.

Dyestuff of the triphenylmethane series; Production of new ——. Act. für Anilin-Fabr. Fr. Pat. 359,002, Oct. 30, 1905.

THE phenyl ether of *o*-aminophenol-*p*-sulphonic acid ("1-amino-2-phenylether-5-sulphonic acid") $C_6H_3(NH_2)(OC_6H_5)(SO_3H)$, is condensed with tetraethyldiaminodiphenylcarbinol. A second sulphonic acid group is introduced into the product; the amino-group is replaced by hydrogen and the disulphonated leuco-compound is then oxidised to the corresponding dyestuff. For example: 75 parts of tetraethyldiaminodiphenylcarbinol and 54·5 parts of the phenyl ether of *o*-aminophenol-*p*-sulphonic acid are dissolved in 500 parts of water and 32 parts of sulphuric acid of 66° B. The whole is then heated to 95°—100° C. for 24 hours. On cooling, the sulphate of the product of condensation separates in crystals which are filtered off, washed and dried. One hundred parts of this product are heated with 200 parts of 100 per cent. sulphuric acid to 60°—70° C., until a sample is completely soluble in water. The mass is then diluted with 300 to 400 parts of water and cooled. The greater part of the disulphonic acid separates on cooling. Seventy-nine parts of the sodium salt of the disulphonic acid, of 87·6 per cent. strength, are dissolved in a mixture of 20 parts of sulphuric acid of 66° B. and 180 parts of water, and are diazotised by means of a concentrated solution of 7 parts of sodium nitrite. To the solution of the diazo compound so obtained, 200 parts of alcohol and then about 3 parts of cuprous oxide are cautiously added with shaking. When all the nitrogen has been expelled, the alcohol is distilled off, the solution filtered, and oxidised with lead peroxide and sulphuric acid. By filtering from lead sulphate and drying, the dyestuff is isolated. It dyes unmordanted wool in greenish-blue shades from an acid bath. The dyeings are even, bright, and fast to alkalis.—E. F.

Aminonaphthols; Production of ——. F. Sachs. Fr. Pat. 359,064, Nov. 2, 1905. Under Int. Conv., Dec. 7, 1904.

AMINONAPHTHOLS are prepared by heating the corresponding naphtholsulphonic acids with sodium amide. In this way the sulphonic acid group is replaced by an amino group, and good yields of aminonaphthols are obtained. Diluents may be used. For example, an intimate, well-dried mixture of 2-naphthol-7-sulphonate of sodium, naphthalene and sodium amide is introduced into a vessel heated to 200°—230° C. and maintained at that temperature for one to two hours. The melt is then poured into water, the naphthalene distilled off in a current of steam, the residue neutralised and 2.7-aminonaphthol separated by filtration. In some cases molecular transformation takes place and the resulting aminonaphthol has not the amino-group in the same position, relatively to the hydroxyl group, as the sulphonic acid group in the original molecule. For example, 2-naphthol-6-sulphonic acid yields 2.5-aminonaphthol and 2-naphthol-8-sulphonic acid yields 2.5-aminonaphthol mixed with other isomeric compounds. E. F.

GERMAN PATENTS.

Nitroanthraquinonesulphonic acids; Process of preparing 1.5- and 1.8- — —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 164,203, Jan. 18, 1903.

BY nitrating anthraquinone-α-sulphonic acid, a mixture of 1.5- and 1.8-nitroanthraquinonesulphonic acids is obtained: it can be readily resolved into its components by reason of their different solubilities.—T. F. B.

Phenylglycin; Process of preparing ——. E. Lippmann. Ger. Pat. 163,515, June 9, 1903. XX., page 392.

1.3-Dialkylpyrogallol ethers; Process of preparing ——. Basler Chem. Fabr. Ger. Pat. 162,658, June 16, 1903. XX., page 393.

p-Acidylamino-o-aminophenols and their derivatives; Process of preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 164,295, Aug. 6, 1903.

c p-DIAMINOPHENOL and its derivatives are converted into the corresponding *p*-acidylamino-*o*-aminophenols by treatment, in neutral or acid aqueous solution, with the calculated quantity of acidylating agent. The resulting derivatives, being *o*-aminophenols, are of value in the production of mordant dyestuffs.—T. F. B.

5-Nitro-1-benzaldehyde-2-sulphonic acid; Process of preparing —— from 5-nitro-2-chloro-1-benzaldehyde and alkali sulphite. Farbwerke vorm Meister, Lucius und Brüning. Ger. Pat. 165,613, Oct. 9, 1904.

2.5-CHLORONITROBENZALDEHYDE is converted into 5-nitrobenzaldehyde-2-sulphonic acid by heating it in anhydrous or aqueous alcoholic solution in presence of suspended alkali sulphite. The yield is said to be almost quantitative.—T. F. B.

α-β-Dinaphthazine; Process of preparing asymmetric ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 165,226, Nov. 10, 1904.

ASYMMETRIC α-β-dinaphthazine is obtained by melting β-naphthylamine with an alkali hydroxide: this method is superior to that in which bleaching powder is used, since, in the latter case, chloro-derivatives are formed. When nitrobenzene is added to the melt, no dinaphthazine is formed, but only α-β-naphthophenazine. The dinaphthazine can be converted in the usual manner into amino derivatives, which are of value for preparing azo dyestuffs: its hydroxy derivatives, prepared by sulphonation and melting with alkali, are also of value in the production of dyestuffs.—T. F. B.

Glyoxylic acid, its esters and amide, and phenylglycin and its derivatives. Process for preparing — — from oxalic acid and its derivatives by electrolytic reduction. Kinzlberger und Co. Ger. Pat. 163,842, Sept. 10, 1903. XX., page 392.

Dyestuff; Process of preparing a red sulphide — —. Kalle und Co., Act.-Ges. Ger. Pat. 165,007, April 19, 1904. Addition to Ger. Pat. 152,373, June 12, 1903. (See this J., 1905, 614.)

The hydroxyphenylhosindaline, prepared as described in Ger. Pat. 163,239 of 1904 (this J., 1906, 175), is utilised for the production of a sulphide dyestuff as described in the principal patent. The dyeings obtained with it on wool are more yellowish-red than those previously produced.—T. F. B.

Dyestuffs giving green shades after chroming, Process for preparing monoazo — —. Badische Anilin und Soda Fabrik. Ger. Pat. 164,989, July 27, 1904.

Sulphonic acids of *o*-diazophenols, or of 1.2- or 2.1-diazonaphthol or their derivatives are combined with 2-anthrol. The resulting dyestuffs give shades which are converted to fast bluish-green to yellowish-green on subsequent chroming.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 313.)

Paraphenylenediamine Brown on tissues; Production of, and resists for — —. H. Schmid. Bull. Soc. Ind. Mulhouse, 1905, **75**, 404–409.

The sole application in dyeing and tissue printing which the brown compound produced by the limited oxidation of *p*-phenylenediamine has as yet received, has been in conjunction with Aniline Black, in dyeing, the black resulting from the joint oxidation of a mixture of *p*-phenylenediamine and aniline, as Monnet (Ger. Pat. 4257 of 1886) discovered, showing no tendency to turn green on exposure to gaseous sulphur compounds. Attempts made to form the brown compound, by means of mixtures analogous to those employed in the production in dyeing and printing of Aniline Black, have invariably failed, owing on the one hand to the compound in question being prematurely generated in the dye-baths and printing mixtures, and on the other hand to the cotton tissues becoming injuriously acted upon by the mineral acid liberated. These drawbacks, it is now found, are overcome by neutralising a considerable portion of the acid of the diamine salt employed, or, better, by applying the diamine base in conjunction with ammonium chloride. In the latter case, the base acts on the ammonium salt in the steaming operation, liberating ammonia and forming with the acid the dihydrochloride of the base which, under the influence of an oxygen carrier, *e.g.*, ammonium metavanadate, reacts with the alkali chlorate also present in the mixture, thus yielding the brown compound. The tissues are padded in a solution containing, per litre, 16–20 grms. each of *p*-phenylenediamine, ammonium chloride and sodium chlorate, 1·5 grm. of "Rongalite C," and 0·015 grm. of ammonium metavanadate. White resists may be obtained upon the tissues which have been thus padded, and then carefully dried at a low temperature, by printing a mixture of Rongalite C (200 grms.) and gum thickening (800 grms.). Coloured effects are produced with mixtures similar to those employed in discharging Paranitraniline Red, or with colour-lakes fixable with albumin, in admixture with alkali sulphites, hydrosulphite- (hyposulphite-) formaldehyde compounds, &c. For direct printing, a mixture containing about 25 grms. of the diamine base per litre is made. The brown is developed by steaming the padded or printed tissues for a few minutes. The tissues may, however, be steamed for an hour or longer without injury. The brown produced is, it is stated, very fast.—E. B.

Diphenyl Black; Production of — — on tissues prepared with sodium β-naphtholate. M. Richard. Bull. Soc. Ind. Mulhouse, 1905, **75**, 411–414.

Tissues prepared with sodium β-naphtholate (by means of a solution containing, per litre, 17 grms. of β-naphthol, 19 grms. of caustic soda-lye at 36° B. and 8 grms. of ammonium ricinoleate) and dried in the "hot flue," are printed with diazotised *p*-nitraniline, &c., for red and other colours, and, for a black, with a mixture of "diphenyl oil" (45 grms.), aniline hydrochloride (45 grms.), lactic acid (45 grms), acetic acid (60 grms.), hydrochloric acid (12 c.c.), copper sulphide paste (15 grms.) mixed with water (20 c.c.), ammonium chloride (15 c.c. of a solution at 25° B.), sodium chlorate (35 grms.) dissolved in water (100 c.c.), the whole being reduced and thickened with starch paste (608 grms.). They are then steamed for one and a half minutes, passed through a bath of chalk or of tartar emetic and chalk, washed and soaped. Instead of a mixture of "diphenyl oil" and aniline hydrochloride, "diphenyl oil" or "diphenyl base" alone may be employed, the proportion of hydrochloric acid taken being modified. While, in order to produce Aniline Black on tissues prepared with sodium β-naphtholate, it is necessary to add to the printing mixture sufficient mineral acid to combine with both the aniline present in the mixture and the soda in the tissue, with the mixture of aniline salt and "diphenyl oil" recommended, a black is obtained, by the aid of less mineral acid than is required to combine with the "diphenyl oil." There is, therefore, no danger of tendering the fibre when this mixture is employed.

Stricker considers that the mixture for black described is likely to be of service in tissue printing, inasmuch as the method of development of the black is simple, the shade of the resulting colour is satisfactory, and the colours associated with the black are less tarnished by this than they are by the Logwood Black ("noir réduit") commonly employed.—E. B.

Naphthylamine Claret; Discharging — — with sodium hydrosulphite (hyposulphite), in the presence of caustic soda. L. Baumann and J. Frossard (of La Société E. Zundel). Bull. Soc. Ind. Mulhouse, **75** 1905, 421–424.

In a previous communication (this J., 1905, 435) a mixture was described which was capable of discharging Naphthylamine Claret, Betanaphthylamine Red, Orthonitrophenetidine Scarlet and other insoluble azo dyestuffs, when printed upon cotton tissues dyed with them, and steamed. A careful grinding of the printing mixture, which contained undissolved matters, was considered essential for its successful application. It has since been found that a similar mixture, containing sodium hydrosulphite, if not in solution, at least in such an extreme state of division that, without grinding, it exhibits no tendency to scratch the printing rollers, is obtained by using this compound when it is in a freshly precipitated and therefore relatively pure condition. A white discharge mixture is prepared, for example, by dissolving caustic soda (200 parts), in water (100 parts), adding glycerin (200 parts), and freshly precipitated sodium hydrosulphite, in the form of a pressed paste (500 parts), and, further adding, after four to six hours, thick gum solution (100 parts). The tissues printed with this are steamed for four to six minutes, then washed and soaped. Coloured discharges are obtained by admixing suitable dyestuffs with the white discharge mixture.—A *rose discharge*, with Cyanosine soluble in alcohol (50 parts), dissolved in phenol (150 parts), the solution being mixed with 800 parts of the white discharge printing-mixture; a *yellow discharge*, with Flavanthrene C in paste (150 parts) and 850 parts of the white discharge mixture; a *blue discharge*, from Phenocyanine V concentrated (40 parts), made into a paste with 60 parts of warm water and thus introduced into 900 parts of the white discharge mixture; blue discharges may also be obtained from Indigo, but this dyestuff does not give very satisfactory results, owing to the Indigo White in the mixtures rapidly becoming oxidised on exposure to air in the colour-boxes of the printing machine; *olive* discharges are produced from mixtures of the blue and yellow discharge mixtures. It is advantageous to add a little light petroleum

to the mixtures to prevent the formation of sodium carbonate in them from their direct contact with air. The discharges are produced by steaming for four minutes with very damp steam. After steaming, the tissues are passed through a 20 per cent. solution of an alkali bichromate, washed and soaped at 60°—70° C. Treatment with bleaching powder solution, to clear the whites, is unnecessary. The most important application of the process, it is stated, is in the discharging of tissues dyed with Naphthylamine Claret. For the effective discharge of this dyestuff it is pointed out that the tissues, after being prepared with β-naphthol, should not long remain undeveloped.—E. B.

Naphthylamine Claret; Discharging —— with sodium hydrosulphite, in the presence of neutral iron compounds. L. Baumann, G. Thesmar and A. Hug (of La Société E. Zundel). Bull. Soc. Ind. Mulhouse, **75**, 425—428.

Observing the relative facility with which azo dyestuffs containing nitro groups, *e.g.*, Paranitraniline Red and Paranitronaphthylamine Claret, can be discharged with sodium hydrosulphite-formaldehyde, the authors tried the effect upon the Naphthylamine Claret dyestuff of mixtures to which "nitro" compounds, such as *p*-nitraniline, nitrobenzene and sodium nitrite, were added. The last-named compound, in a neutral mixture and in the presence of an iron salt, was thus found to aid very powerfully the reduction of the dyestuffs in question. The presence in the printing-mixture of sodium ricinoleate and sodium citrate is further favourable to the action, the former of these salts probably neutralising the acidity of the iron salt employed and the latter preventing the precipitation of iron oxide upon the printed tissues. The presence of free alkali in the printing-mixture is injurious, as it causes the discharging power of the latter to be diminished. As the "catalytic" iron salt, ferric chloride is to be preferred to ferrous sulphate on account of its being more readily obtainable in a fairly pure condition than the latter salt. The two salts, however, employed in equivalent quantities, give almost identical results. A suitable printing-mixture is composed of a neutral starch-gum tragacanth paste (400 parts) in which sodium hydrosulphite-formaldehyde ("Rongalite C." 400 parts) is dissolved, and to which are added sodium ricinoleate (80 parts of a 50 per cent. solution), ferric citrate (120 parts of a solution prepared by dissolving together 16 parts of ferric chloride, 32 parts of sodium citrate, and 24 parts of glycerin, in 48 parts of hot water), and sodium nitrite (32 parts of a 40 per cent. solution). The discharge is produced on steaming for 3—4 minutes the tissues printed with this mixture. After steaming, the tissues are thoroughly washed and are then soured with either sulphuric or hydrochloric acid at 1° B., to which a little oxalic acid may be added. They are again washed and then soaped. A chlorinating operation to clear the whites is not needed. Exact determinations of the length of time during which the printing-mixture remains undecomposed have not been made, but it is stated that, provided it be neutral, the mixture appears to keep well. At the end of two days, it retains its full power of discharging. When the sodium nitrite, instead of being employed in the printing-mixtures, is applied to the tissues, in a preparation solution (see this J., 1906, 176), a solution containing 4 grms. of the salt per litre is used.

Besides discharging Naphthylamine Claret, the discharge mixture gives excellent discharges upon tissues dyed in Paranitraniline Red, Chloramsidine Pink, Orthonitrotoluidine Orange, Dianisidine Black and Chrysoidine Bronze. It yields imperfect discharges upon Benzidine Puce and Nitrophenetidine Scarlet.

Coloured discharges may be obtained by adding basic dyestuffs, dissolved in phenol, together with tannic acid, to the white discharge-mixture. Any iron left in the printed parts of the tissue, after steaming and souring, is removed by passing the tissues through a dilute, warm solution of oxalic acid. The dyestuffs of the Gallocyanine group, such as Modern Violet, may also be employed, without a mordant. Fast Black ("noir reduit"), a Logwood preparation, being capable of withstanding the necessary souring operations, may be printed, along with the white and coloured discharges.—E. B.

Naphthylamine Claret, Discharging —— with sodium hydrosulphite in the presence of other compounds. H. Schnud. Bull. Soc. Ind. Mulhouse, **75**, 1905, 429—432.

Baumann and Frossard (sealed note No. 1495, dated Sept. 23, 1904; see abstract above), in endeavouring to obtain an alkaline, discharge printing-mixture for Naphthylamine Claret, free from matters which scratch the surface of the printing rollers (see also this J., 1906, 176), have discovered that a mixture exempt from this defect is produced with sodium hydrosulphite, which has been manufactured and precipitated from solution immediately before use. As, however, most printworks are not in a position, like the Moscow works ("La Manufacture E. Zundel"), to make the hydrosulphite compounds they consume, the method described is not likely to be of general interest. On this account, the second process (sealed note No. 1543, dated June 20, 1905; see preceding abstract), due to Baumann, Thesmar and Hug, in which sodium hydrosulphite-formaldehyde ("Rongalite C"), a compound which is an article of commerce, is employed, will attract more attention. An important advantage of this second method is that it enables basic dyestuffs, such as the Methylene Blues, Nile Blues, Auramine, Thioflavine T, and the Phosphines, Rheonines and Rhodamines, as well as the dyestuffs of the Gallocyanine class, to be employed in the production of coloured discharges. With these dyestuffs, effects are obtained which, in point of brilliancy and fastness, rival those already produced upon grounds dyed in Paranitraniline Red.—E. B.

Arsenic in wall-papers, fabrics, &c.; Note on the application of the electrolytic method to the determination of ——. T. E. Thorpe. XXIII., page 394.

Hydrosulphites and hydrosulphite compounds; Determination of —. A. Seyewetz and Bloch. XXIII., page 394.

English Patents

Threads, Manufacture of artificial ——. R. Linkmeyer, Herford, Germany. Eng. Pat. 4755, March 7, 1905. Under Int. Conv., June 8, 1904.

A cupro-ammoniacal solution of cellulose is rendered suitable for the production of threads by the removal of a large part of the ammonia present.

This is effected either by injecting air into the solution or by shaking in contact with air. The process is assisted by subjecting the solution to the action of a vacuum.—A. B. S.

Cellulose threads; Manufacture of lustrous ——. R. Linkmeyer, Herford, Germany. Eng. Pat. 4765, March 7, 1905. Under Int. Conv., Oct. 17, 1904.

A cupro-ammoniacal solution of cellulose is discharged under pressure into a solution of soda- or potash-lye which precipitates the cellulose. The threads are then treated with air, water vapour or similar means to eliminate the free ammonia, and finally washed with a solution of sulphuric acid to remove the copper. A. B. S.

Wool-washing machines. G. W. and A. P. Tatterson, Stockton, U.S.A. Eng. Pat. 4779, March 7, 1905.

See Fr. Pat. 352,153 of 1905; this J., 1905, 1064.—T. F. B.

Textile fabrics; Machines for washing and scouring ——. J. S. Ainley, Kirkheaton, Yorks. Eng. Pat. 13,053, June 24, 1905.

Two, three or more series of rollers spaced at suitable distances apart are mounted in bearings above a tank, each series comprising three rollers arranged one above another. The fabric to be washed is passed between the middle and one of the outer rollers in each series, a length of the fabric being allowed to hang loosely between all the rollers so that it is immersed in the liquor in its passage

through the machine. After leaving the last series it is passed between the middle and second outer roller in each series, the fabric being divided into two or more "drafts" travelling in different paths, and when finally "dratted," the ends are fastened together to make an endless fabric, which can be passed through the machine backwards and forwards as frequently as desired. By this arrangement the material is alternately immersed in the wash liquor and then squeezed as it passes from one set of rollers to another, this action expediting the washing process and subjecting the fabric to the liquor whilst the latter is fresh and fully active, less soap being required than in the present washing machines.—D. B.

Textile fibres; Process of bleaching ——. H. Zeitschner, Helenabrunn, Germany. Eng. Pat. 5296, March 14, 1905.

THIS invention relates to a dry process of bleaching textile fibres, and consists in subjecting them to the action of chlorine or other bleaching agent in a gaseous form, the material being humidified to a slight extent by the admission of aqueous vapour prior to and during the bleaching process. It is then aired and subsequently treated with hydrogen gas in conjunction with moist air or water vapour, and is finally subjected to a wet treatment for the complete removal of the chlorine or other bleaching agent.—D. B.

Calico and similar fabric; [Waterproofing] Printing - . L. Frankenstein, J. W. Spencer, H. Spencer and C. L. C. Lane, Manchester. Eng. Pat. 9809, May 10, 1905.

THE colour is mixed with a solution of rubber thinned with naphtha to the desired consistency. This is printed on with engraved rollers or otherwise, and the solvent naphtha is driven off with heat. For bright colours the rubber is rendered white by addition of zinc oxide or a white pigment. (Reference is directed to Eng. Pats. 2719 of 1866, and 7725 of 1896.)—A. B. S.

Dyeing Vats. H. H. Lake, London. From J. Leontieff, St. Petersburg. Eng. Pat. 21,937, Oct. 27, 1905.

SEE Fr. Pat. 358,895 of 1905; following these. T. F. B.

Waterproof fabrics, Manufacture of - . A. J. Boult, London. From L. A. Bond, Logansport, U.S.A. Eng. Pat. 21,125, Oct. 18, 1905.

SEE Fr. Pat. 358,619 of 1905; this J., 1906, 313. - T. F. B.

Woven fabrics; Filling the pores of - — *with pulverised substances.* J. Lohmann, Fahr, Germany. Eng. Pat. 23,911, Nov. 20, 1905.

A WEB of fabric, which has traversed a chamber containing the pulverised substance and preferably provided with apparatus for stirring the latter, is caused to travel past an adjustable pad or cushion, by which the powder on the fabric is uniformly distributed, the fabric being then passed between cylinders, which press the powder into the pores and also serve to impart movement to the web.—D. B.

UNITED STATES PATENTS.

Dyeing apparatus. E. Zillessen, Passaic, N.J. U.S. Pat. 813,478, Feb. 27, 1906.

THE apparatus consists of a number of superposed, open, relatively shallow dyeing trays through which the fabric is passed in succession with the aid of tension-rollers. There are arrangements for feeding dyeing materials into the trays, either into each tray independently, or in such a manner as to maintain a circulation of dye-liquor through the apparatus.—E. F.

Dyeing apparatus. E. Zillessen, Passaic, N.J. U.S. Pat. 813,479, Feb. 27, 1906.

THE arrangement described differs from that of U.S. Pat. 813,478 (see preceding abstract) merely in that two feed-pipes for supplying dye-liquor are attached to each tray, one on each side of the line of travel of the fabric. This arrangement is also claimed in the case where one tray only is used.—E. F.

Dye-Vat. F. I. Stone, Atlanta, Ga. U.S. Pat. 814,173, March 6, 1906.

THE vat consists of an outer casing, with a ring at the top, having an inwardly inclined flange, and an inner casing open at both ends and provided with a support for the contents, such as a loose bottom with detachable supporting cross bars. Steam can be discharged upwards between the two casings by means of a perforated steam pipe. There are also arrangements for supporting the inner casing within the outer one.—E. F.

Multicoloured dye effects in woollen fabrics, &c.; Process of producing ——. M. Becke, Höchst-on-the-Maine, Germany. U.S. Pat. 815,671, March 20, 1906.

THIS invention relates to the production of multicoloured effects in woollen and mixed fabrics. Animal hair is dyed with woollen dyestuffs fast to milling and acid, and is then treated with a tanning substance and a metallic salt, so as to render it dye-resistant. This material is then worked up with untreated fibre into spun goods or woven fabrics, and the latter dyed with ordinary wool acid dyestuffs in an acid bath. Goods or fabrics treated in this manner and dyed different colours are also claimed.
—B. N.

Fibrous material; Blue - - *and process of dyeing same.* V. Fussgänger, Assignor to Farbwerke vorm. Meister, Lucius und Bruning, Höchst on the Maine, Germany. U.S. Pat. 816,457, March 27, 1906.

SEE Eng. Pat. 406 of 1905; this J., 1905, 1011.—T. F. B.

Colours for printing on fabrics; Process of producing metallic or lustrous ——. L. Lilienfeld, Vienna. U.S. Pat. 815,600, March 20, 1906.

SEE Eng. Pat. 6645 of 1902; this J., 1903, 694.—T. F. B.

Steaming fabrics. Apparatus for ——. C. H. Fish, Dover, N.H. U.S. Pat. 814,124, March 6, 1906.

THE steaming chamber is adapted to contain steam under pressure. The fabric is led into, and withdrawn from the chamber by means of rollers, of which the centre one, which assists both in feeding in and withdrawing the fabric is covered with resilient material. The rollers are so packed that steam cannot escape.—E. F.

FRENCH PATENTS.

Silk; Treatment of artificial - - . Soc. Anon. Fabrique de Soie Artificielle de Tubize. Fr. Pat. 358,987, Jan. 7, 1905.

NITROCELLULOSE silk is spun directly on to bobbins, which are then placed in a closed vessel, with entrance and exit tubes for liquids. The alcohol is washed out with water and may be recovered by subsequent rectification. The nitrocellulose is then denitrified by suitable liquid reagents in the same apparatus. It is first treated with denitrifying liquids which have been already used for the same purpose, and have, therefore, become less effective: and then with successively fresher and stronger liquids, until finally freshly prepared denitrifying solutions are used. The denitrification can be performed in this manner in one hour. The denitrified fibre is washed with water and then bleached without removing from the apparatus. The fibre is subsequently washed and dried in the same apparatus, a current of air being used for the purpose. The advantages of the method are said to be:—Economy of time and of the liquids employed (since they are recovered and re-employed); also saving of alcohol, healthier conditions for workmen, production of a more regular and stronger product, economy of fibre, there being less mechanical manipulation, and almost complete prevention of danger of explosion or fire.—E. F.

Reeds and similar materials; Treatment of —— *for the production of textile fibres.* C. de Hatvany-Deutsch. Fr. Pat. 358,828, Oct. 24, 1905.

THE reeds or other material are treated with sodium hydroxide solution of 1 to 2 per cent. strength, at a temperature below 100° C. and preferably between 50°

and 80° C., the air being first removed by exposure either to a vacuum or to pressure. In this way, the material is thoroughly impregnated with the solution. The best results are obtained by first exhausting the air, then admitting the sodium hydroxide solution, exposing to pressure and heating. The residue is washed, the water removed by centrifugalising or otherwise, and the fibre dried. The yield of fibre is 30 to 40 per cent. of the raw material.—E. F.

Dyeing animal fibres; Method of ——. H. R. Vidal and G. E. Junius. Fr. Pat. 359,093, Jan. 10, 1905.

The sulphide black obtained by fusion of *p*-aminophenol, or of substituted diphenylamines derived from this product, with sulphur, differs from most sulphide dyestuffs by not being precipitated from its solution in alkali sulphide solutions by acetic acid, other organic acids or sodium bicarbonate. The solutions to which such reagents have been added are not greenish but bright yellow in colour. Such solutions, in which the alkalinity of the sulphides has been neutralised by acetic acid or sodium bicarbonate, dye wool in blue shades by oxidation in the air in the same manner as an indigo vat. The colour develops together with, and proportionally to, the oxidation. The method can also be applied to the dyeing of silk.—E. F.

Wool; Production of violet to blue shades on — fast to air. Fabr. de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 359,600, Jan. 27, 1905.

See U.S. Pat. 794,315 and Eng. Pat. 1367 of 1905; this J., 1905, 841 and 965.—T. F. B.

Rinsing arrangement for dye-vats for piece goods. J. Leontieff. Fr. Pat. 358,895, Oct. 27, 1905.

Immediately after leaving the dye-vat the goods are led over rollers and through a pan fixed below the dye-vat and filled with water, or between sprinkling rollers, or through a combination of pan and sprinkling rollers. Instead of being filled with water, the pan may contain any solution used for after-treatment of the dyed fabric, and is fitted with heating devices, so that hot liquids may be employed.—E. F.

Dyeing and mercerising; Winding of cotton on bobbins for ——. P. Fontaine. Fr. Pat. 359,302, Nov. 10, 1905.

The cotton is wound on to a perforated tube, preferably conical in shape and made of a suitable metal. The larger end of this tube rests in a groove surrounding an opening connected with the liquid supply. A ring of felt is placed at each end of the tube in order to keep the cotton in place, and the whole arrangement is kept in position by means of a screw which passes through the centre of the tube, and is fitted with a nut which screws down on a metal plate at the small end of the bobbin.
—A. B. S.

Cotton bobbins; Process and apparatus for dyeing ——. P. Fontaine. Fr. Pat. 359,311, Nov. 10, 1905.

The apparatus consists of a cylindrical tank with a conical bottom. This tank is fitted with an air-tight cover, and the conical bottom portion is separated from the upper part by a diaphragm which is perforated with holes to carry the bobbin tubes. The upper and lower portions of the vessel are connected with the two pipes of a centrifugal pump so that the dye-liquor can be pumped through the holes in the diaphragm and so through the cotton on the bobbins. A valve is fitted to allow the air to escape on running in the dye-liquor, and there is a steam coil for heating the liquid round the bobbins.
—A. B. S.

Dyeing machine. P. Klug. Fr. Pat. 359,334, Nov. 11, 1905.

The material to be dyed is packed into vessels with perforated bottoms, which fit tightly one above the other. These vessels are placed in the dyeing tank, and can be quickly removed and be replaced by others at the end of each operation.—A. B. S.

Dyeings on fabrics; Production of fast ——. Badische Anilin und Soda Fabrik. Fr. Pat. 359,466, Nov. 15, 1905. Under Int. Conv., Oct. 30, 1905.

The dyestuffs of the Indanthrene class can be dyed as follows:—The cotton is padded with a mixture of one of the above colours with a suitable thickening agent and then dried. The treated material is then passed for half an hour, at 60°—65° C., through a jigger containing about 300 litres of water, 7·5 litres of caustic soda of 30° B., and 3 litres of a hydrosulphite solution prepared by mixing together:—3·3 kilos. of hydrosulphite B.A.S.F., 25 litres of water, and 1¾ litres of caustic soda of 30° B.

The material is rinsed and passed through a bath of weak sulphuric acid (2 c.c. per litre), rinsed again, and soaped at the boil.—A. B. S.

Velvet; Printing and embossing ——. F. Boyer. Fr. Pat. 359,164, Nov. 4, 1905.

A velvet with the pile lying down is printed by means of an engraved plate charged with the requisite colour; without removing the velvet from the press, a second engraved plate is applied to its back surface. The projecting portions of this plate are fitted with felt or similar substance and impregnated by contact with water thickened with starch or otherwise. By contact, the moisture passes into the velvet, and the pile thus softened becomes erect.—A. B. S.

Aldehyde derivatives; Production of — and their application as discharging agents. Badische Anilin und Soda Fabrik. Third Addition, dated Oct. 28, 1905, to Fr. Pat. 350,607, Jan. 7, 1905. Under Int. Conv., Aug. 18, 1905.

See Eng. Pat. 21,538 of 1905; this J., 1906, 15.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 313.)

United States Patent.

Dyeing leather. R. Rieder, Osterwieck, Germany. U.S. Pat. 816,378, March 27, 1906.

See Addition of March 13, 1905, to Fr. Pat. 291,355 of 1899; this J., 1905, 968.—T. F. B.

French Patent.

Sheep-skins, goat-skins, &c.; Printing of tawed or tanned —. H. C. P. Sardine. Fr. Pat. 359,381, Jan. 20, 1905.

The skins, either tawed or tanned, are printed with the required colours in suitable patterns.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 310.)

Hydrosulphites and hydrosulphite compounds; Determination of ——. A. Seyewetz and Bloch. XXIII., page 394.

Sodium sulphide; Analysis of commercial ——. R. Blondel. XXIII., page 394.

English Patents.

Absorbents for gases or vapours and the application thereof for purifying or recovering gases or vapours, or like purposes; Improved ——. J. Dewar, Cambridge. Eng. Pat. 7808, April 12, 1905.

The claim is for the substitution of certain earthy oxides

for the charcoal used in the process described in Eng. Pat. 13,638 of 1904 (this J., 1905, 793), and for the absorption and recovery of gases or vapours by such oxides at ordinary or lower temperatures. The recovery of the absorbed gases or vapours from the oxide is effected by heating, extraction with suitable solvents, or by treating the oxide with some suitable agent to convert the vapour into another substance which may be subsequently recovered. The earthy oxides include those of aluminium, iron, chromium, thorium, magnesium and silicon, and the patentee states, as a guide for the proportions to be used, that he has found that 10 grms. of anhydrous substances, cooled to the temperature of boiling liquid air, will absorb the following volumes of air, measured at 0° C. and 760 mm. pressure:—Alumina, 1000 c.c.; silica, 400 c.c.; meerschaum, 600 c.c.; magnesia, 300 c.c.; iron oxide, 180 c.c.; thoria, 150 c.c. The most suitable temperature at which to use the oxides is said to be about −20° C.—W. H. C.

Lime kilns; Construction and arrangement of ——. S. W. Shoop, Altoona, U.S.A. Eng. Pat. 16,893, Aug. 21, 1905.

SEE U.S. Pat. 787,537 of 1905; this J., 1905, 969.—T. F. B.

Sulphate of ammonia; Method of manufacturing — —. J. Grossmann. Eng. Pat. 20,837, Oct. 14, 1905. III., page 366.

Hydrogen peroxide; Producing —— [*electrolytically*]. G. Teichner. Eng. Pat. 24,507, Nov. 27, 1905. XI.A., page 379.

UNITED STATES PATENTS.

Zinc sulphate solution; Apparatus for converting —— *into zinc oxide.* C. E. Dewey, Assignor to the American Zinc and Chemical Co., Denver, Colo. U.S. Pat. 815,516, March 20, 1906.

THE apparatus comprises a calcining chamber and an evaporating chamber, both having open ends, and the axes of which are in line. The two chambers can be rotated independently, and are so mounted that one end of one chamber is as close as possible to one end of the other chamber. A fire-box or other source of heat is provided at the end of the calcining chamber remote from the evaporating chamber, and a dust-chamber at the end of the evaporating chamber remote from the calcining chamber. The zinc sulphate solution is fed into the evaporating chamber at the end adjacent to the dust-chamber, and means are provided, outside the chambers, for transferring the material from the evaporating chamber to the calcining chamber.—A. S.

Nitrogen; Apparatus for producing pure ——. C. Linde, Munich, Germany, Assignor to C. F. Brush, Cleveland, Ohio. U.S. Pat. 815,601, March 20, 1906.

SEE Eng. Pat. 11,221 of 1903; this J., 1903, 907.—T. F. B.

FRENCH PATENTS.

Sulphuric acid; Concentrating ——. A. Gaillard. Fr. Pat. 359,442, Nov. 14, 1905.

THE sulphuric acid to be concentrated is delivered into a pulveriser placed in the upper part of a tower constructed of acid-resisting material and cased with lead. A coke fire is maintained at the bottom of the tower, the heated air and gases from which, circulating up and down, mingle with the suspended acid particles, together with which they are drawn through a second (lead) tower, in which condensation of the concentrated acid takes place.—E. S.

Peroxides; Preparation and purification of ——. Soc. Anon. les Etablissements Poulenc Frères. Fr. Pat. 359,523, Jan. 24, 1905.

BARIUM peroxide, mixed with a little water, is added progressively to concentrated nitric acid contained in a vessel provided with a mechanical agitator, the temperature being maintained below 10° C., and the additions being continued until the acid is nearly neutralised. The crystals of barium nitrate that form are separated from the accompanying hydrogen peroxide. The latter is completely neutralised by baryta water, and then sodium phosphate solution, or a milk of barium phosphate is added until the precipitate formed ceases to be coloured by iron. The filtered liquid, still containing in solution barium nitrate, is distilled *in vacuo* to obtain hydrogen peroxide solution of over 50 vols. strength, the distillation being assisted by the introduction of a little steam. Pure zinc peroxide may be obtained by dissolving a salt of zinc in the solution thus produced (or in a more dilute solution) and precipitating by an alkali. The same process is available in obtaining other metallic peroxides.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 316.)

Glass; New method of making ——.

THE United States Vice-Consul at Nüremberg reports a new invention in the glass-plate industry. It is the invention of Mr. Fourcault, a Belgian, who has sold his patent to the European syndicate of plate-glass manufacturers for £190,400. This syndicate consists of German, French, and Belgian manufacturers, and one Bohemian factory. Hitherto, in the making of window glass the molten substance has been blown into cylinders by glass-makers' pipes, and subsequently flattened, while in the making of plate glass the viscid mass was cast from the pots and rolled. The new invention draws the molten substance from the pot and conducts it between rollers lying side by side. Seventeen pairs of these rollers are built up tower-like above the pot. The liquid mass cools on its way between the rows of rollers and comes out from them polished on both sides, in any desired thickness (this being regulated by the relative position of the rollers), beautifully flattened and ready for use. At present, dimensions of from 1 to 4 m. can be made. One early result is expected to be that the manufacturing of plate glass of 4 m. and less will undergo an entire change, as the making of glass plates will come chiefly within the scope of the plate-glass furnaces. [T.R.]

FRENCH PATENTS.

Ceramic industry; Mechanical washer for earthy materials for the — —. M. Roubaud. Fr. Pat. 359,549, Nov. 4, 1905.

THE washer described consists of a vat, the bottom of which is shaped thus:— ⌣⌣, in section. Two shafts are mounted longitudinally on the top of the vat, to each of which a toothed wheel is keyed; the wheels are of equal size and engage each other, one being driven by a pulley and belt. Straight or slightly-curved arms or paddles are fastened to the shafts, and spaced in such a way that the paddles on one shaft, as it rotates, pass between those on the other shaft. By the slow and regular movement of the paddles, all the light particles contained in the mixture are brought to the surface of the water during one-half of the period of rotation, and during the other half, enough time is allowed for the heavy particles to sink.—W. C. H.

Earthy body that can be cast [Slip] for artistic and industrial objects; Process for the preparation of an ——. C. Müller. Fr. Pat. 359,370, Nov. 11, 1905.

THE mass for the casting of various objects in moulds is composed of magnesia, chalk, ground minerals, magnesium chloride, &c., together with ammonia, which renders the mass gelatinous and prevents the deposition of the heavy particles in it, and the separation of a watery layer on the top or bottom.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 317.)

English Patent.

Loam, clay and the like; Machinery for preparing or treating ——. P. Baur, Brugg, Switzerland. Eng. Pat. 20,296, Oct. 7, 1905. Under Int. Conv., Dec 3, 1904.

The material to be worked is placed in the upper space between two adjacent cylinders revolving towards each other, and is thus pressed through holes in the walls of one or both cylinders into the interior, emerging by the ends, which are left open. The bearings of one cylinder are held and forced towards the other cylinder by means of springs, but are capable of sliding away from it, so as to allow any hard substances in the clay, such as stones, which cannot pass through the holes in the cylinder walls, to fall through between the two cylinders.—A. G. L.

United States Patents.

Wood; Method of preserving ——. J. B. Card, Chicago, Ill. U.S. Pat. 815,404, March 20, 1906.

The wood is placed in a closed receptacle filled with a mixture of liquids of different specific gravity, *e.g.*, a solution of zinc chloride and creosote. Pressure is applied to the receptacle and at the same time the liquids are caused to circulate through it, and, after the impregnation is finished, are forced out of the receptacle into a reservoir by means of air-pressure.—A. G. L.

Building material. C. M. Depew and H. E. McCoy Assignors to Pumice Stone Construction Co., all of San Francisco, Cal. U.S. Pat. 815,801, March 20, 1906.

The building material consists of a mixture of volcanic pumice of nut size and containing about 20 per cent. of alumina, besides silica, iron oxide and alkalis; scoria crushed to about the consistency of ordinary sand, containing about 27 per cent. of alumina, and which when ground is of dark colour, does not dust or powder, and has sharp edges and angular surfaces; and Portland cement.—A. G. L.

Cement; Manufacture of hydraulic ——, *and apparatus therefor.* B. Enright, Fordwick, Va. U.S. Pat. 815,080, March 13, 1906.

The process described consists in passing the highly-heated products of combustion and decomposition from a rotary clinker-forming cement kiln, through an incandescent charge of fuel and cement-producing material in a vertical kiln. By the partial or complete calcination of the material in the vertical kiln, the carbon dioxide issuing from the rotary kiln and that produced in the lower part of the vertical kiln are reduced to carbon monoxide, which is collected and utilised, and the cement-forming material obtained from the vertical kiln is also used. The contents of the vertical kiln are maintained at such a temperature and under such conditions that the reduction of the carbon dioxide can take place and at the same time the partial or complete calcination of the cement-forming material. As an alternative, a relatively small proportion of fuel may be employed in the vertical kiln, and the resulting gases, including those from the rotary kiln, may be passed through incandescent fuel to effect the reduction of the carbon dioxide. The chief components of the apparatus for carrying out the process are a rotary kiln, connected at its upper end with a separating chamber, which in turn is connected with the vertical kiln. Chambers containing coke or similar fuel are also connected with the separating chamber and with the vertical kiln, and means are provided for directing the products of combustion from the rotary kiln, or gases issuing from the vertical kiln, through either of the chambers containing fuel. The separating chamber is provided with an emergency stack, and steam and an air-blast can be supplied to the lower portion of the vertical kiln, from which means for carrying off the gases are provided. There are air-inlets into the vertical kiln, and absorbers connected with it and the air-inlets; and means are provided for passing the gases issuing from the vertical kiln, and also the air admitted to it, through the absorbers. The two kilns are separated by a damper, and a compartment, separated from the vertical kiln by doors, is arranged below the latter, as a receptacle for the calcined material from it. A ring with an inclined periphery is secured to the rotary kiln, and a similar ring attached to the separating chamber fits the former ring, to exclude air from the separating chamber.—W. C. H.

Cement; Apparatus for making ——. R. C. Carpenter, Ithaca, N.Y. U.S. Pat. 815,080, March 20, 1906.

See Eng. Pat. 4821 of 1903; this J., 1903, 951.—T. F. B.

Kiln; Rotary cement ——. H. Hitzel, Assignor to Alpha Portland Cement Co., both of Alpha, N.J. U.S. Pat. 815,705, March 20, 1906.

In combination with the rotary kiln there is arranged a hood with an air-chamber in it, a blower, a pipe leading from the hood-chamber into the blower, an exit-pipe leading from the blower through the hood into the kiln, and a pipe communicating with the blower and with a source of powdered fuel. Within this last pipe there is placed a rotary screw conveyor, the speed of which, as well as that of the blower, can be regulated so as to furnish either a uniform or varying quantity of fuel.—A. G. L.

French Patents.

Emery; Process for the manufacture of artificial ——. A. Gacon. Second Addition, dated Oct. 30, 1905, to Fr. Pat. 332,770, June 4, 1903. (See this J., 1903, 1294; and Eng. Pat. 23,492 of 1904; this J., 1905, 92.)

According to the present Addition to the original patent the bauxite employed in the manufacture of artificial emery is previously dehydrated. In order to economise the fuel required, the dehydration is effected by placing the bauxite above the materials that are being fused to produce the emery, with or without some separator. Further, the artificial emery produced is subjected to a second fusion, whereby the quality of the product is considerably improved. Waste chips, &c., obtained in the manufacture are also re-fused, either by returning them direct to the furnace, with fresh flux, or by making them into cakes together with useless emery dust, and treating these cakes alone in the fusing furnace, or mixing them with the fused emery before subjecting the mass to the second fusion. The waste is thus worked up again into useful emery blocks.—W. C. H.

Moulded bodies [of silicon carbide]; Process of making solid ——. Gebr. Siemens und Co. Fr. Pat. 359,260, Nov. 9, 1905.

See Eng. Pat. 21,347 of 1905; this J., 1906, 122.—T.F.B.

Wood; Process for the impregnation of ——. Act. Ges. für mechanische Holzbearbeitung A. M. Luther. Fr. Pat. 359,493, Nov. 16, 1905.

By this process the wood is impregnated with molten sulphur, and not with any substance dissolved in a menstruum, which has to evaporate, and thus tends to leave empty spaces. Wood is immersed in sulphur, heated to about 140° C., until the bubbling ceases, when the temperature is lowered to 110° C., and the wood gradually withdrawn from the sulphur. On cooling, the sulphur that has penetrated the pores, solidifies.—W. C H.

X.—METALLURGY.

(*Continued from page* 321.)

Lead and sulphur. K. Friedrich and A. Leroux. Metallurgie, 1905, **2**, 536—539. Chem. Centr., 1906, **1**, 1086—1087.

The authors have prepared a melting-point diagram for lead-sulphur alloys (obtained by fusing together pure lead and pure natural galena). The results, as also the microstructure of the solid products, show that the statement of Bredberg (Annalen, **9**, 274), as to the formation of the compounds, Pb_2S and Pb_4S, when lead and lead sulphide are fused together, is incorrect. The only compound of lead and sulphur formed in mixtures containing from 0·6 to 13·5 per cent of sulphur, is the sulphide, PbS, which begins to crystallise at 1103° C., whilst the eutectic mixture solidifies at about 327° C.—A. S.

Phosphorus; Influence of —— on the solubility of carbon in iron. F. Fettweis. Metallurgie, 1906, **3**, 60—62. Science Abstracts, 1906, **9A**, 174—175.

The author repeated Stead's experiments (this J., 1900, 1019), taking special precautions to ensure the saturation of the iron with carbon, and making re-determinations of the phosphorus in each alloy produced. He concludes from his results that Stead's alloys were not completely saturated with carbon. Alloys containing 15·8 per cent. of phosphorus, corresponding to the compound, Fe_3P, could not be obtained free from carbon, and it appears, therefore, that iron phosphide is capable of dissolving a small quantity of carbon. This view also affords a rational explanation of the proportions of carbon in other iron-phosphorus alloys.—A. S.

Copper matte; Roasting of ——, with utilisation of the furnace gases for the manufacture of sulphuric acid to be used in the extraction of copper from low-grade ores. A. Gmehling. Oesterr. Z. Berg. Hütt., 1906, **54**, 69—73, 88—90. Chem. Centr., 1906, **1**, 1060—1061.

Low-grade oxidised and mostly silicious copper ores containing, on the average, 2—5 per cent. of copper, are abundant in Chile. They are easily accessible, but have not hitherto been utilised, owing mainly to expensive freight charges. The author gives an account of the results obtained at a works erected at Guayacan, for the "Sociedad chilena de Fundiciones in Valparaiso" for the purpose of working up copper matte, with utilisation of the furnace gases. The matte contains 40—50 per cent. of copper, 22—27 of sulphur, and 23—30 of iron, and also, on the average, 150 grms. of silver and 5 grms. of gold per metric ton. It is roasted in muffle furnaces similar to those used for roasting zinc blende and pyritic ores. The roasted product is then mixed with silicious oxidised copper ores (containing not less than 6 per cent. of copper), rich slags and charcoal, and smelted in reverberatory furnaces to a crude copper of 97—98 per cent. purity. The furnace gases, after leaving the dust-chamber, are drawn through a lead tower, filled with coke, over which water or dilute sulphuric acid is caused to trickle. The acid wash takes up copper (0·25 to 1 grm. per litre), which, together with arsenic, is separated by treatment with a dilute solution of calcium sulphide. The washed gases are dried by sulphuric acid, heated in a system of horizontal wrought iron tubes and then passed into a contact-chamber for the manufacture of sulphuric acid by the Schroeder-Grillo process (Eng. Pats. 25,158 of 1898; 17,034 of 1900 and 10,412 of 1901; this J., 1899, 584; 1901, 579; 1902, 344). In the reaction chamber the temperature rises to 560° C. A yield of 90—96 per cent. of the theoretical amount of sulphur trioxide is obtained, and it is stated that in 24 hours, 2250 kilos. of commercial acid containing 93 to 96 per cent. of sulphuric acid can be obtained with 1 kilo. of contact material, with a consumption 0·75 kilo. of fuel per kilo. of acid.—A. S.

Copper and sulphur. E. Heyn and O. Bauer. Metallurgie, 1906, **3**, 73—86. Science Abstracts, 1906, **9A**, 176—177.

Copper and cuprous sulphide are not mutually soluble in all proportions, so that fused alloys of copper and sulphur at certain concentrations (*viz.*, with more than 9 per cent. of cuprous sulphide) form two layers, the lower one being richer in copper. No mixed crystals of copper and cuprous sulphide are formed, but there is an eutectic containing 3·82 per cent. of cuprous sulphide. Solid alloys containing less than this amount of cuprous sulphide consist of crystals of copper surrounded by the eutectic, whilst alloys richer in sulphide consist of crystals of the latter embedded in the eutectic. Sulphur dioxide alone does not attack copper at temperatures between 900° and 1100° C., but in presence of a reducing agent such as carbon or hydrogen, cuprous sulphide is formed. Cuprous sulphide at its melting-point cannot co-exist with cuprous oxide; the two compounds react with formation of copper and sulphur dioxide, until the supply of one is exhausted.—A. S.

Cadmium; Combustion of — —. W. Manchot. Ber., 1906, **39**, 1170—1171.

If a small blow-pipe flame be directed on to the surface of molten cadmium, and the products of combustion collected in a beaker, then, on introducing an acid solution of potassium iodide into the beaker, a blue coloration is produced, indicating the presence of a peroxide of cadmium.—A. S.

Antimony and antimony sulphide. Chrétien and Gumchant. Comptes rend., 1906, **142**, 709—711.

At all temperatures, from the fusion point to the boiling point of antimony sulphide, a mixture of the sulphide with metallic antimony separates into two layers—the upper, a solution of the metal in the sulphide, the lower, a solution of the sulphide in the metal. The proportion of metal in the upper layer increases with the temperature from 11·3 per cent. at 530° C., to 20 per cent. at 810° C. Above that, it increases very slowly to 21·9 per cent. at 1180° C. The composition of the solution at 810° C. corresponds nearly to the formula SbS. When cooled suddenly, from high temperatures, the alloys do not conduct electricity; but if cooled slowly, they do, in virtue of the separated metallic antimony.

The densities of the metal and the sulphide are given as follows:—

Metal.		Sulphide.	
°C.		°C	
13	6·75	13	4·63
898	6·55	643	3·85
1156	6·45	1116	3·82

The sulphide expands on melting by about 17 per cent. of its volume.—J. T. D.

Titanium; Distillation of — —. H. Moissan. Comptes rend., 1906, **142**, 673—677.

The author has succeeded in distilling titanium in the electric furnace (see this J., 1905, 1312, and 1906, 29 and 268), though its boiling point is higher than that of any of the metals of the iron group.—J. T. D.

Gold production of the World; Total ——. J. P. Hutchins. Eng. and Mining J., March 31, 1906.

The following table shows the total amount of gold produced by the principal auriferous countries of the world from the date of first recorded production to the end of 1905:—

United States	1792–1905	$2,860,854,000
Australasia	1851–1905	2,539,117,000
Russia and Siberia*	1814–1905	1,434,679,000
Colombia	1537–1905	895,735,000
Brazil	1691–1905	720,902,000
Africa	1887–1905	711,246,000
Mexico	1521–1905	307,161,000
Canada	1858–1905	237,202,000
Bolivia	1545–1905	199,011,000
Peru	1533–1905	119,389,000
British India	1884–1905	115,116,000
Austro-Hungary	1493–1905	70,242,000
Chile	1545–1905	33,266,000

* Russia 28 per cent., Siberia, 72 per cent.

[T.R.]

Japan; Mineral production of ——. Bd. of Trade J., April 12, 1906.

ACCORDING to official returns, the output of iron in Japan in 1905 amounted to 190,375 tons, as compared with 112,328 tons in 1904 and 36,515 tons in 1903. Other important items in the mineral production of Japan for 1905 are:—copper, 35,693 tons; coal, 11,581,755 tons; and kerosene oil, 42,945,600 galls. [T.R.]

New Caledonia; Mining industry of ——. For. Off. Ann. Series, No. 3548.

THE subjoined table shows the amount of ore exported during the last five years from New Caledonia:—

Year.	Quantity.		
	Nickel.	Chrome.	Cobalt.
	Tons.	Tons.	Tons.
1901	132,814	17,451	3,122
1902	129,365	10,281	7,512
1903	77,360	21,437	8,292
1904	98,655	42,197	8,964
1905	125,289	51,374	7,919

[T.R.]

Platinum production of the Urals. Bd. of Trade J., April 5, 1906.

THE Ural platinum yield in 1905 was as follows:—

Mineral Districts.	1904.	1905.
	Oz.	Oz.
South Ekaterinburg	180	1,492
South Verkhoturski	113,900	113,718
Perm	35,596	39,261

[T.R.]

Tin exports of the Federated Malay States. Bd. of Trade J., April 5, 1906.

THE following statement shows the weight of tin and tin ore (tin exported in the form of ore having been taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during the years 1904 and 1905:—

State.	1904.			1905.		
	Tin.	Tin exported in the form of ore.	Total.	Tin.	Tin exported in the form of ore.	Total.
	Pikuls.	Pikuls.	Pikuls.	Pikuls.	Pikuls.	Pikuls.
Perak	147,397	303,273	450,670	139,005	307,776	446,781
Selangor	120,151	184,550	304,701	114,686	175,181	289,867
Negri Sembilan	49,810	35,879	85,689	48,998	36,135	85,133
Pahang	5,687	22,381	28,068	5,600	29,279	34,879
Total	323,045	546,083	869,128	308,289	548,371	856,660

NOTE.—1 pikul = 133⅓ lb.

[T.R.]

Germany; Mineral Production of —— in 1905. Bd. of Trade J., April 5, 1906.

THE following table shows the quantity and value of minerals and salts produced in the years 1904 and 1905:—

——	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	Thousand marks.	Metric tons.	Thousand marks.
Iron ore	22,047,393	76,668	23,444,073	81,771
Zinc ore	715,728	39,479	731,281	47,839
Lead ore	164,440	14,706	152,725	15,346
Copper ore	798,214	21,731	793,488	23,500
Silver and gold ore	10,405	1,206	9,628	1,202
Cobalt, nickel and bismuth ores	14,016	930	10,848	891
Manganese ore	52,886	591	51,463	598
Pyrites	174,782	1,386	185,384	1,463
Asphalt	91,736	891	103,006	990
Petroleum	89,620	5,805	78,869	5,207
Rock-salt	1,079,868	5,013	1,165,473	5,494
Kainit	1,905,893	26,565	2,317,829	32,558
Other potash salts	2,179,471	22,294	2,725,654	28,056
Coal	120,815,503	1,033,861	121,298,167	1,050,089
Lignite	48,835,080	112,101	52,498,507	120,767

The products of reduction works are stated to be as follows:—

	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	Thousand marks.	Metric tons.	Thousand marks.
Copper ingots	30,264	36,305	31,717	44,611
Zinc	193,058	84,650	198,208	97,920
Lead, pigs, bars, &c.	137,580	32,546	152,590	41,049
Litharge	4,832	1,117	3,786	1,077
Pig-iron	10,058,273	520,736	10,875,061	578,724

The production of refined salt, and of various salts, in refined or commercial form, is shown in the following table:—

	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	Thousand marks.	Metric tons.	Thousand marks.
Salt	621,786	14,706	612,062	14,787
Potassium chloride	294,802	35,142	370,914	43,770
Magnesium chloride	25,730	539	29,017	532
Glauber salts	75,170	1,924	68,454	1,893
Potassium sulphate	43,959	6,994	47,994	7,512
Potassium magnesium sulphate	29,285	2,294	34,032	2,554
Magnesium sulphate	39,412	607	58,758	895
Sulphate of alumina	52,880	3,249	52,892	3,343

[T.R]

English Patents.

Washing and concentrating metalliferous, diamondiferous and other deposits and tailings from ore-crushing, Method and apparatus for ——. J. Hutchings, London. Eng. Pat. 6556, March 28, 1905.

After "sizing" by an elaborate system of trommels and hydraulic separators, the graded "assortments" are variously agitated or magnetically selected, the valuable products being delivered into locked receptacles. When the overflow contains fine float gold, it is forced through a mercurial trough by means of copper brushes and thus amalgamated.—J. H. C.

Steel; Process of hardening high-speed ——. S. N. Brayshaw, Manchester. Eng. Pat. 11,208, May 30, 1905.

The article is heated to a temperature short of scaling or deteriorating the surface, it is then "soaked" in a bath at 900° to 950° C. and finally quenched in a bath at 100° C. —J. H. C.

Rifle and gun barrels and other metallic surfaces; Treatment of —— for removal of fouling therefrom. King's Norton Metal Co., Ltd., T. A. Bayliss, and H. W. Brownsdon, London, and H. H. Smith, Abbey Wood, Kent. Eng. Pat. 13,297, June 28, 1905.

Metal surfaces "fouled" with copper or copper alloys are cleaned by the use of a solution prepared as follows:—Fifty c.c. of ammonia solution of 0·880 sp. gr. are diluted with an equal volume of water. In this is dissolved a tablet containing 5 grms. of ammonium persulphate and 1 grm. of ammonium carbonate.—J. H. C.

Ore concentration. H. L. Sulman, H. F. K. Picard and J. Ballot, London. Eng. Pat. 5260, March 13, 1905.

See Fr. Pat. 354,959 of 1905; this J., 1905, 1177.—T. F. B.

Zinc furnaces. E. Dor-Delattre, Budel, Holland. Eng. Pat. 19,655, Sept. 29, 1905.

See U.S. Pat. 806,121 of 1905; this J., 1906, 26.—T. F. B.

United States Patents.

Furnace; Continuous-heating ——. W. R. Miller, Assignor to Forter-Miller Eng. Co., Pittsburg, Pa. U.S. Pat. 815,198, March 13, 1906.

The claim is for a hollow track, resting on hollow supports which extend through the bottom of a continuous-heating furnace for billets. A cooling fluid is circulated through the hollow supports and/or the hollow track, and the former are further protected from the action of the heat by projecting screens.—W. H. C.

Filter [*Iron-hydrogen alloy*]. H. C. Gesner U.S. Pat. 815,417, March 20, 1906. I., page 362.

Insulator for electric apparatus [*Iron-hydrogen alloy*]. *Alloy of iron and hydrogen agglomerated in strong coherent bodies; Production of articles of an* ——. H. C. Gesner. U.S. Pat. 815,418 and 815,419, March 20, 1906. XI.A., page 380.

Precious metals; Refining hydrometallurgical products containing ——. C. W. Merrill, Alameda, Cal. U.S. Pat. 815,851, March 20, 1906.

Finely-divided "hydrometallurgical" products are mixed with litharge, and a soluble lead salt, and the litharge and lead salt are reduced to metallic lead by heating, further quantities of the lead compounds being added to the mixture as required. The resulting lead is cupelled to recover the precious metals.—A. S.

Precious metals from zinc ores; Extraction of ——. A. R. Meyer; E. J. Meyer, Executrix of A. R. Meyer, Assignor to the United Zinc and Chemical Co., Kansas City, Mo. U.S. Pat. 815,614, March 20, 1906.

An intimate mixture of the ground zinc ore and metallic copper is heated in order to vaporise the zinc and form a matte containing the copper and the precious metals. The matte is separated from the residue, and the zinc vapour is condensed.—A. S.

Nickel ores; Process of treating ——. C. Langer, Clydach. Assignor to The Mond Nickel Co., London. U.S. Pat. 815,717, March 20, 1906.

See Eng. Pat. 13,351 of 1905; this J., 1905, 1113.—T. F.B.

Ores; Process of treating ——. C. E. Baker and A. W. Burwell, Cleveland, Ohio. U.S. Pat. 816,061, March 27, 1906.

A pulverulent ore containing a metal or metals and a metalloid, for example, a sulphide ore, is treated with chlorine, the charge being abraded to continually expose

fresh ore surfaces to the chlorine. The metal (or metals) is converted into chloride, and the sulphur or other metalloid is recovered in the elemental state.—A. S.

French Patents.

Lead and silver; Process for the extraction of —— from their ores. Accumulatoren-Fabr. Akt.-Ges. Fr. Pat. 359,434, Nov. 14, 1905.

For the extraction of lead and silver from ores containing sulphides of iron and copper, the ores are introduced into a bath of a fused halogen salt, as zinc chloride, together with lead oxide or zinc oxide, and the lead and silver are then separated by addition of an electro-positive metal or by means of an electric current.—A. S.

Pig iron; Method of making foundry ——. C. Henning. Fr. Pat. 359,501, Nov. 16, 1905.

See Eng. Pat. 23,592 of 1905; this J., 1906, 319.—T. F. B.

Metals; Process of refining —— by means of metallic calcium. F. Brandenburg and A. Wiens. Fr. Pat. 359,592, Nov. 18, 1905.

The refining of metals by means of calcium has not proved successful up to the present, as, owing to the high temperature of the bath of molten metal, the calcium has been volatilised immediately it entered the bath and has thus exerted only a superficial action. In order to overcome this difficulty, the patentees propose to use the calcium in the form of shavings, and to mix these with shavings of other metals, more or less fusible than calcium, as may be required. For example, in the refining of copper, a mixture of shavings of calcium with those of copper, bronze, &c., is used, and for iron or steel, a mixture of shavings of calcium with those of iron or steel.—A. S.

Copper-nickel matte; Process of refining ——. N. V. Hybinette. Fr. Pat. 359,660, Nov. 21, 1905.

See U.S. Pat. 805,555 of 1905; this J., 1906, 26.—T. F. B.

Iridium; Process of producing metallic ——. H. C. Parker. Fr. Pat. 359,668, Nov. 21, 1905.

See U.S. Pat. 805,316 of 1905; this J., 1905, 1310.—T. F. B.

Slag; Apparatus for granulating ——. G. K. Hamfeldt. Fr. Pat. 359,326, Nov. 10, 1905.

See Eng. Pat. 22,032 of 1905; this J., 1906, 269.—T. F. B.

German Patent.

Cupriferous ores and metallurgical products; Process for the lixiviation of —— by means of ferrous chloride or ferrous sulphate solution, with the simultaneous introduction of air. O. Froelich. Ger. Pat. 163,409, Aug. 8, 1903.

A short pipe, open at both ends, is fixed in an upright position in the lixiviating tank, and inside this pipe a propeller is made to rapidly rotate, whereby a more effective circulation and more intimate contact between the air bubbles and the mixture of ore and solution, is caused. It is claimed that by this means the process is considerably shortened; with low-grade ores containing 3 per cent. of copper, it is stated that the extraction is frequently complete in the course of a few hours.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 323.)

(*A.*)—ELECTRO-CHEMISTRY.

Arsenic in wall-papers, fabrics, &c.; Note on the application of the electrolytic method to the determination of ——. T. E. Thorpe. XXIII., page 394.

English Patents.

Accumulators; Impts. in electric ——. H. Leitner, Woking, Surrey. Eng. Pat. 7720, April 11, 1905.

The plates are pasted with a mixture composed of lead oxide and sulphate or other salt of ammonium moistened with a saturated solution of the same salt, and the plates are afterwards heated to such a temperature as will decompose the solid ammonium salt. The liberation of ammonia leaves the plates extremely porous.—B. N.

Water; Apparatus for the purification of ——, by electrical means. J. F. Lester, New York. Eng. Pat. 18,427 Sept. 12, 1905.

The apparatus comprises a receiving chamber, an electrolytic chamber, an ozonising chamber, an upper chamber, a filter and a pure water receiving chamber, all contained within an outer casing. Water to be purified enters the receiving chamber which is situated at the bottom of the apparatus and on one side of an upright partition which, extending nearly to the top, divides the outer casing into two compartments. The water then passes through a porous partition and enters the electrolytic chamber, which consists of a box-like compartment fixed to the before-mentioned partition, and forming a segment with the circular casing. A supply of water fills this segment and keeps the electrolytic chamber cool. The latter is provided with electrodes. From this chamber the water passes upwards into the ozonising chamber and thence into an upper chamber extending across the top of the apparatus. On the other side of the partition is placed a series of filtering layers, and below these is the chamber for receiving the pure water after it has passed downwards through the filters. The various chambers, &c., may be cleansed as required by forcing water into them through pipes.—W. P. S.

Bleaching liquor; Electrodes for use in the manufacture of ——. R. Kother, Cunewalde, Germany. Eng. Pat. 21,437, Oct. 21, 1905.

The electrolytic vessel is divided into a number of compartments by means of vertical non-conducting partitions, and is made with an inclined bottom. Through each vertical partition extends a horizontal electrode, one-half of which in one cell acts as anode, the other half functioning as cathode in the next cell. In each cell the anode is below the cathode, which last is only just covered by the electrolyte, and is perforated so as to allow the hydrogen generated to escape readily. The electrodes may be of platinum or of carbon, which last for the anode halves is covered with an insulating material and with platinum sheet, foil or wire, the platinum and carbon being in electrical connection.—A. G. L.

Hydrogen peroxide; Producing —— [electrolytically.] G. Teichner, Nuremberg, Germany. Eng. Pat. 24,507, Nov. 27, 1905.

Persulphuric acid, or its sulphuric acid solution, is distilled, preferably *in vacuo*, and at a temperature exceeding 30° C. (care being taken to exclude catalytic agents), to obtain hydrogen peroxide. Or the hydrogen peroxide may be extracted by ether in a continuously working extracting apparatus. The solution thus freed from hydrogen peroxide is electrolysed with certain prescribed precautions, to reproduce the persulphuric acid, so that "the persulphuric acid will simply serve as a transmitter of oxygen and the peroxide of hydrogen will be obtained in uninterrupted circulating process by indirect oxidation of water." Percarbonates and perborates may be also used as sources of hydrogen peroxide, the peroxide being extracted by ether, and the solution again subjected to electrolysis.—E. S.

United States Patents.

Mercurial alkaline process. [*Electrolytic.*] W. E. Harmon, Mechanic Falls, Me., Assignor to American Electrolytic Co., Philadelphia, Pa. U.S. Pat. 814,692, March 13, 1906.

This invention relates to a method of increasing the efficiency of a mercurial alkaline process by the insertion

of pieces of carbon, or a small quantity of powdered carbon, in the amalgamating compartment, in contact with both the mercury and the electrolyte, the quantity of carbon being maintained fairly constant during the process. —B. N.

Furnace; Electric pressure ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 814,727, March 13, 1906.

An inner conducting tube of resistance material is adapted to contain the material to be heated, and is surrounded by refractory insulating material, an outer conducting tube in its turn surrounding both inner tube and refractory material, and forming chambers at each end by extending beyond the ends of the inner tube. Inlet tubes connect with one chamber, and an outlet tube with the other. The outer tube is made in sections, the latter being insulated from each other by ring-shaped "gaskets." The inner tube is provided with carbon terminals, which surround the ends, and the terminals are adapted to slide axially within the chamber, and to become suitably connected with the inner tube. A ring of asbestos, or other yielding material, separates the insulating material from the terminal connections of the inner tube, the asbestos being adapted to relieve the tendency of the insulating material to pack under the influence of the furnace heat. The carbon terminals are each in contact on opposite sides with metallic plates, and a cup-shaped strap connects each carbon terminal with the outer tube, means being provided for pressing the rim of the strap against the wall of the outer tube, and also for pressing the bottom portion of the strap between the carbon terminal and one or other of the metallic plates. Electrical connection is made between the ends of the inner and outer tubes, the ends of the latter being insulated from each other except through the inner tube, and forming the terminals of the furnace. Means are provided for modifying the pressure within the furnace.—B. N.

Purifying water by electrolysis; Apparatus for ——. H. C. Bailey, St. Louis, Mo., Assignor to Electra-Pura Water Co., New York. U.S. Pat. 814,764, March 13, 1906.

This invention relates to an apparatus for electrically treating water, and consists of a hollow casing or body composed of insulating material, which can be separated into two portions. In the upper and lower interior sides of the body are arranged spiral grooves, opposite to and in line with each other when the parts of the casing are placed together, and a pair of spiral metallic coils, which can be removed by separating the casing, fit into the grooves. The outer ends of the coils are secured to the outer casing, the inner terminals being near to the centre of the receptacle and adjacent to each other. The coils are so arranged as to form channels parallel to each other, so that water, under pressure, may flow in one direction towards the centre, the water then entering a secondary channel and flowing in a reverse direction towards the outer side without traversing the same channel more than once. One channel is provided with an inlet, and the other with an outlet; and an electrical circuit has its positive and negative terminals respectively connected to the coils. —B. N.

Vacuum lamps; Method of producing ——. D. M. Moore, Assignor to Moore Electrical Co. U.S. Pat. 814,794, March 13, 1906. II., page 365.

Electrolytic apparatus. F. McDonald, Roaring Spring, Pa. U.S. Pat. 814,864, March 13, 1906.

The electrolytic cell is provided with an anode compartment in connection with a tank for supplying a solution of brine, the tank being provided with a ball float, which is connected by levers with a valve in the supply pipe. The tank is connected by an overflow with a re-saturating tank, the latter being in turn connected with an overflow tank, from which the liquid is raised to an elevated tank by means of a pump. Means are provided for conducting the brine from the elevated tank to the valve. A gas-collecting pipe connects the cell to a series of vertical towers.—B. N.

Insulator for electric apparatus. H. C. Gesner, New York, N.Y. U.S. Pat. 815,418, March 20, 1906.

This invention relates to an electric insulator or high-resistance body composed of particles of an alloy of iron and hydrogen fritted into a coherent mass, or a mixture of this alloy with a material of higher specific resistance, such as fire-clay, may be used.—B. N.

Alloy of iron and hydrogen agglomerated in strong coherent bodies; Production of articles of ——. H. C. Gesner, New York, N.Y. U.S. Pat. 815,419, March 20, 1906.

The powdered alloy is moistened and compressed into a body, and then heated to a temperature sufficient to cause the component particles to frit or partially fuse together. Articles, compressed or agglomerated in this manner into strong coherent bodies, are also claimed. (See preceding abstract.)—B. N.

Water; Apparatus for decomposing —— by electrolysis. W. F. M. McCarty, Rocky Ridge, Md., Assignor to T. A. Darby, New York. U.S. Pat. 816,355, March 27, 1906.

The apparatus consists of two tanks connected together near the bottom by a conduit or pipe. In each tank an electrode of large superficial area, connected to a source of electricity, is suspended vertically. The electrodes are corrugated and perforated, and of spiral form, and the outer coil of each has a "radial discharge portion" projecting laterally and located directly opposite one end of the conduit.—A. S.

French Patent.

Electrolytic process. J. Hargreaves. Fr. Pat. 359,502, Nov. 16, 1905. Under Int. Conv., Nov. 22, 1904.

See Eng. Pat. 25,331 of 1904; this J., 1905, 1240.—T.F.B.

German Patent.

Glyoxylic acid, its esters and amide, and phenylglycin and its derivatives; Process for preparing —— from oxalic acid and its derivatives by electrolytic reduction. Kinzlberger und Co. Ger. Pat. 163,842, Sept. 10, 1903. XX., page 392.

(B.)—ELECTRO-METALLURGY.

English Patents.

Iron; Process and apparatus for the electrical production of cast ——. Soc. Electro-Metallurgique Française, Froges, France. Eng. Pat. 6468, March 27, 1905. Under Int. Conv., March 25, 1904.

See Fr. Pat. 341,611 of 1904; this J., 1904, 871.—T. F. B.

Electroplating vats; Impts. in ——. F. E. Bagnall, Coventry. Eng. Pat. 22,901, Nov. 8, 1905.

A vertical rotary shaft enters and extends nearly to the base of the electro-plating vat, and is rotated by mechanical means, the shaft having plates or blades arranged at angles to each other on a polygonal frame carried by the shaft. The plane of each blade is tangential to the shaft, the blades being connected to a source of electricity so as to form anodes, while at the same time they serve to effectively circulate and agitate the electrolyte. One vertical edge of each blade may project outwards beyond the carrying facet of the frame to which it is fixed —B. N.

United States Patents.

Electroplating apparatus. G. L. Meaker, Chicago, Ill. U.S. Pat. 815,027, March 13, 1906.

This invention relates to an electroplating apparatus

comprising a tank containing an electrolyte, an anode, a generator, and a tray for supporting the articles to be plated, the bottom of the tray being made of conducting material and acting as the cathode. Means are provided for giving a horizontal vibratory movement to the tray, the rearward motion being slow and the forward one rapid, the articles being thus advanced from one end of the tray to the other. The movement is produced by a cam, provided with "an abrupt shoulder," and a lever, which is acted upon by the cam, connected to the tray. The supporting surface of the latter has transverse shoulders, forming a ridged or corrugated surface, in order to effect the turning of the articles during their progressive movement.—B. N.

Furnace; Electric ——. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 815,221, March 13, 1906.

This invention relates to an electric furnace in which a fused ferruginous bath is covered with a layer of inert material, such as bauxite slag, and with a layer of "comminuted coke resister" floated on the inert material. Several positive and negative terminals of an electric circuit are connected alternately to different regions of the resister.—B. N.

Etching of zinc by electrolysis; Process of deep ——. O. C. Strecker, Darmstadt, and H. H. Strecker, Mainz, Germany. U.S. Pat. 815,875, March 20, 1906.

See Eng. Pat. 21,322 of 1904; this J., 1905, 504.—T. F. B.

Ore-separator; Magnetic ——. R. R. Moffatt, Brooklyn, N.Y., Assignor to Imperial Ore Separator Co., New York. U.S. Pat. 816,491, March 27, 1906.

The apparatus comprises side frames supporting a magnet composed of two sets of opposed poles and two parallel cores, each core connecting one pole of one set in magnetic circuit with a pole of the other set. The poles of one set are nearer together than the poles of the other set, whereby two magnetic fields of different intensity are produced, and the poles of the same set are connected in magnetic circuit with each other by the side frames. A feed-conveyor passes through openings in the side frames, and "separating-conveyors" are also provided.—A. S.

Ores; [Electrical] Process for the reduction of —— C. P. Townsend, Washington, D.C., Assignor to E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 815,881, March 20, 1906.

This invention relates to a method of reducing sulphide ores, such as galena, and consists in supporting or floating the ore upon a body of molten metal, which forms the base of the ore, under a fused electrolyte consisting of a haloid salt which is inert towards the ore. An electric current is passed to the ore as cathode from superposed anodes. The process of decomposing lead sulphide and separating lead electrolytically, by bringing the sulphide into contact with a cathode in a fused electrolyte of sodium chloride, the lead sulphide being practically insoluble in the latter, is also claimed.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 324.)

Cocoa-nut oil; Keeping qualities and causes of rancidity of ——. H. S. Walker. Philippine J. of Science, 1906, 1, 117—142.

The greater fertility of cocoa-nut trees near the seashore is attributed by the author to the soil being more porous than in inland regions and to being, as a rule, saturated with water at a depth of only a few feet from the surface. Chemical analysis showed little difference between soil from near the seashore and that from places further inland. As regards the effect of age upon the nut, it appeared from the average of a number of determinations that there was a slight increase in the proportion of kernel, copra, and oil in nuts that had been stored for a maximum of three months, but that afterwards there was a decided decrease. Green nuts contained only about half as much oil as nuts that were quite ripe, and the ripening process continued to some extent after cutting. The colour was found to have little, if any, influence on the composition of the nut. The quality of nuts from seashore trees was as good as that of nuts from inland trees, both yielding, on the average, the same proportion of oil.

The author, contrary to the commonly accepted belief, finds that pure cocoa-nut oil, properly prepared, is equal, if not superior, in keeping qualities to other fats and oils, and he attributes the fallacy to different observers not having procured fresh samples. The commercial product undoubtedly shows rapid deterioration, but this largely depends on the initial acidity of the oil. This acidity and its attendant bad taste and odour is developed in the copra itself, prior to the expression of the oil. Thus, in a sample cut up and exposed to moist air for a month, the acidity rose from 1·5 to 23·3 per cent. The active agents causing the hydrolysis of the fat in copra are moulds (principally *aspergilli*), either alone or in conjunction with certain bacteria, and the most suitable conditions for their development are a proportion of from 9 to 17 per cent. of moisture and a constant and moderately high temperature. A sample of copra containing 4·76 per cent. of water remained free from organisms, and no change in the acidity took place. On the other hand, several species of bacteria were found in copra containing 23 to 50 per cent. of water, but these had hardly affected the fatty portion and had formed very little free acid. No moulds were formed in these samples. Commercial copra usually contains from 9 to 12 per cent. of water, an amount favourable to the growth of moulds. It is advisable, therefore, to dry the copra, so that it shall not contain more than 5 per cent. of moisture, and to express the oil as soon as possible, whilst avoiding prolonged storage in a warm, damp atmosphere. Hot air apparatus, rotary or stationary, was found the most efficient means of drying copra, and it is suggested that hot-air drying might be used in conjunction with a centrifugal method, provided the by-product, "cocoa-nut cream," could be disposed of. Vacuum drying cannot be used effectively for cocoa-nuts from which the oil is to be expressed. Mould does not grow readily on pure cocoa-nut oil, but given a certain proportion of nutrient substance and of moisture, a growth may develop which will rapidly attack the oil. Thus, a sample of pure oil to which had been added 1 per cent. of "latic" (a coagulated residue, produced in the native process of making cocoa-nut oil, by boiling down an emulsion of fresh cocoa-nut kernel, and consisting chiefly of albumin and sugar), and 1 per cent. of water was exposed to the action of a mould in an incubator, and showed an increase in acidity of from 0·1 to 8·63 per cent. in a week. Direct oxidation by the action of air and light also plays a part in the deterioration of cocoa-nut oil, as of other fats, but this factor is of little importance in comparison with the changes due to mould action and can be prevented, to a large extent, by keeping the storage vessels as nearly full as possible.—C. A. M.

Cocoa-nut oil. J. J. Reijst. Pharm. Weekblad, 1906, **43**, 117—128, 151—163. Chem. Centr., 1906, **1**, 1061—1063.

In discussing the employment of cocoa-nut oil for the manufacture of soap, the author states that all fats can be saponified by the "cold process" provided the operation be carried out below the temperature at which the mixture separates into three layers, a lower one of lye, an upper one of melted fat and a middle layer of soap, but this can be done only if lye of a suitable concentration be employed. The separation into layers with rise of temperature is connected with changes of density, viscosity and capillarity. If the layers mix again to a homogeneous liquid on addition of water, this will be found to occur at the same concentration and temperature at which the soap dissolves. Potassium soaps can be "salted out" by using a soluble potassium compound such as potassium hydroxide or potassium carbonate.

For the examination of the fatty acids of cocoa-nut oil, the author used Heintz's method. An ethereal solution of the fat, cooled to 0° C., was saturated with bromine, the excess of the latter removed by sodium

thiosulphate, the ether distilled off, and the residue saponified with alcoholic alkali. The alcohol was then expelled, dilute sulphuric acid added, and the volatile acids distilled off with steam. The non-volatile acids were dissolved in dilute potassium hydroxide solution, the soap dissolved in water, and a quantity of silver nitrate, equivalent to considerably more than half of the bromine originally absorbed, was added. After boiling cautiously for half an hour, the mixture was acidified with hydrochloric acid, the layer of fatty acids dissolved in alcohol, the solution neutralised with ammonia and precipitated with magnesium acetate. The mixture was then treated with half its volume of hot water, cooled, the magnesium salts of the fatty acids separated, and in the filtrate, the dissolved hydroxy-acids liberated by acid, and freed from any adhering unsaturated acids by petroleum ether. The only unsaturated acid found by the author in cocoa-nut oil was oleic acid, whilst the highest member of the saturated acids was myristic acid; butyric acid was not present.

The constants found by the author for the glycerides of crude cocoa-nut oil and of various butter substitutes prepared from the same are given. For the detection of cocoa-nut oil in butter-fat, see this J., 1906, 324.—A. S.

Cod liver oils; American ——. L. M. Tolman. J. Amer. Chem. Soc., 1906, **28**, 388—395.

Samples of American and Norwegian cod-liver oils and other fish-liver oils, of known origin, were examined, the object being to ascertain whether pure American cod-liver oils conform to the requirements of the U.S.P., and also whether American oils differ materially from Norwegian oils. The results obtained show that, especially in the case of American oils, the composition and characters of the oils vary very considerably according to the condition of the fish, that is, according to the season at which the fish were caught. The variations in this respect are not so pronounced with Norwegian oils, as these are prepared from fish which are caught during a very short season and are thus in about the same condition. The oils were examined with regard to sp. gr., refractive index, iodine value and colour reactions with sulphuric and nitric acids. Only one of the American oils had a sp. gr. outside the allowed limits (0·918—0·922 at 25° C.), but this determination is of no value for indicating adulteration with other fish-liver oils. The iodine values of the American cod-liver oils varied over a wider range than is allowed in the U.S.P. With respect to the colour reactions, these were found to be not characteristic of cod-liver oil, but of fish-liver oils generally; besides, pure American oils frequently react differently from Norwegian oils, giving with nitric acid a purple colour changing to brownish-yellow, instead of rose-red changing to lemon-yellow. In the nitric acid test, the concentration of the acid has a marked influence on the colour produced. (See also this J., 1906, 272.)—A. S.

Sapindus rarak, Constituents of the fruit of ——. O. May. Arch. Pharm., 1906, **244**, 25—35.

The pericarp of the fruit of *Sapindus rarak* contains 13·5 per cent. of *sapindus-saponin*, $C_{16}H_{28}O_{10}$. The seeds yield 26·17 per cent. of a yellow non-drying oil, having the sp. gr. 0·911 at 15°C.; acid value, 5·3; ester value, 184·8; iodine value 65·08; Reichert-Meissl value 0·7; Hehner value 80·05. The fatty acids were composed mainly of oleic, with some stearic and palmitic acids.

—J. O. B.

Cholesterol; Reduction of ——. C. Neuberg. Ber., 1906, **39**, 1155—1158.

Ten grms. of purified cholesterol (from gall stones) were dissolved in 800—1000 c.c. of hot amyl alcohol, and the solution treated with 80 grms. of metallic sodium, more solvent being added when the liquid became turbid. After complete solution of the metal (five to seven hours), the liquid was diluted with water and rendered just acid by means of dilute sulphuric acid. The amyl alcohol layer was washed with water and distilled, and the oily residue, which frequently became crystalline under water, was purified by a single recrystallisation from dilute alcohol. If, however, it still remained oily, it was separated from the water and dried *in vacuo* over sulphuric acid and lime, the pale yellow syrupy residue dissolved in a little hot absolute alcohol, and the solution treated with water until it became turbid. The yield of crystalline product amounted to 30 to 50 per cent. of the original substance, and other oily products, not further examined, still remained in the mother liquor. The solid reduction product when purified by recrystallisation from alcohol, formed small white prismatic crystals melting at 119° to 124° C. Its elementary analysis agreed with that of dihydrocholesterol, $C_{27}H_{46}O$. It was readily soluble in chloroform, benzene, toluene, ether and ethyl acetate, less soluble in alcohol, methyl alcohol, and petroleum spirit, and insoluble in water. It gave the following reactions in the cholesterol tests:—(1) With Salkowski's reagent there was only a gradual slight reddening and fluorescence. (2) In Obermüller's test only a slight blue coloration appeared. (3) In the reaction with δ-methylfurfural the reduction compound, when present in small quantity gave only a yellow coloration with no absorption band, but with larger amounts there was the characteristic red coloration and the absorption band became visible. Unlike cholesterol it was dextro-rotatory, its reading $[\alpha]_D$, in ethereal solution being +18°·35 ($\alpha = 3°40'$; $l = 2$). In the author's opinion this dihydrocholesterol is probably identical with the naturally occurring coprosterol.

—C. A. M.

Pecan, black walnut, and butternut. L. E. Levi and E. G. Wilmer. XIV., page 384.

Ethyl alcohol free from aldehyde; Preparation of —— for use in oil and fat analysis. F. L. Dunlap. XX., page 391.

Dimethyl sulphate; Utilisation of —— in determining tar oils in mixtures with rosin and mineral oils, and its behaviour towards fatty oils, oil of turpentine and pinolene. E. Valenta. III., page 366.

English Patents.

Fats and the like; Apparatus for the recovery of ——. C. Kremer and Ges. für Abwässer-Klärung, m.b.H., Berlin. Eng. Pat. 24,030, Nov. 21, 1905.

Claim is made for improvements in connection with the apparatus described in Eng. Pat. 14,461 of 1903 (this J., 1903, 1095). In order to prevent particles of fat escaping with the overflow, annular channels are placed between the fat-collecting vessel and the outlet. The baffles, formed by the channels, also produce an increase in the current, causing greater friction of the depositing solid particles, and thus promoting the separation of fat mechanically carried down by them.—C. A. M.

Lubricating oil. R. J. Crowley and F. F. Payne, London. Eng. Pat., 2680, Feb. 3, 1906.

Claim is made for a mixture of castor and olive oils, the latter being in the larger proportion, say, three to one. The mixture does not oxidise or deposit sediment.

—C. A. M.

German Patents.

Wool-fat; Process for decomposing —— into two portions, by one of which water is absorbed readily, and by the other with difficulty. J. Lifschütz. Ger. Pat. 163,254, Oct. 15, 1903.

See this J., 1905, 1242.—A. S.

Fatty preparations; Process for the manufacture of emulsifiable ——. Ges. zur Verwerth. der Bolegschen Wasserlöslichen Mineralöle u. Kohlenwasserstoffe, G.m.b.H. Ger. Pat. 163,387, Aug. 14, 1904.

Fatty preparations capable of forming permanent emulsions are prepared by agitating animal and vegetable oils, fats and waxes with the soluble rosin oils prepared according to Ger. Pat. 148,168 (see Eng. Pat. 12,349 of 1899; this J., 1900, 526) at a temperature of 60°—80° C. The products are suitable for the manufacture of pharmaceutical preparations, salves, lubricants, and finishes.

—A. S.

Fats; Process for the extraction of ——. A. Sachs. Ger. Pat., 163,057, Oct. 29, 1904.

The claim is for the use of liquefied carbon dioxide for the extraction of fats.—A. S.

Soap masses; Mould and cooling device for liquid —— in which the bottom is raised for the removal of the solidified soap block. Weber and Seeländer. Ger. Pat. 163,058, June 22, 1904.

The mould is provided with a movable bottom and is suspended from its centre of gravity. By rotation of a screw, gearing with a cog-wheel on the spindle by which the mould is suspended, the latter can be tipped over and the soap block delivered directly on to a table.—A. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 326.)

(*A.*)—PIGMENTS, PAINTS.

English Patent.

Paint or composition; New anti-fouling ——. F. E. Dunnett, G. H. Nelson, and F. E. Nelson, London. Eng. Pats. 14,202, July 10, 1905, and 14,611, July 15, 1905.

The claim is for the utilisation of the final residuum (alkali sludge) obtained in the distillation or refining of petroleum as the essential ingredient of anti-fouling and non-corrosive compositions. For use as a paint, the "alkali sludge" or "petrolatum" is mixed with red lead or other suitable pigment in such proportions that the product may contain between 75 and 95 per cent. of the "petrolatum."—M. J. S.

French Patents.

Paint; Antiseptic and preservative —— for ships' bottoms and other submerged structures. G. G. Schobert. Fr. Pat. 359,488, Nov. 16 1905. Under Int. Conv., Nov. 17, 1904.

See Eng. Pat. 24,989 of 1904; this J., 1905, 142.—T. F. B.

Mica; Pulverisation of ——. F. R. Tiller. Fr. Pat. 359,312, Nov. 10, 1905.

Mica contained in a closed vessel (an iron cylinder for instance) is strongly heated for several hours, so that on cooling it may become opaque. The mica is then cut into strips, and is subjected in a closed vessel to the action of hot water, or of a heated vapour. The softened mica is then withdrawn, and after expulsion of the moisture, is ground to a fine powder, which is stated to be brilliant and silver-white.—E. S.

German Patent.

Beech wood tar; Process for preparing an alkali-soluble product from —— which is solid at the ordinary temperature. Chem. Fabr. Florsheim, Dr. H. Noerdlinger. Ger. Pat. 163,446, June 18, 1903. III., page 367.

(*B.*)—RESINS, VARNISHES.

Philippine wood oils. A. M. Clover. XX., page 389.

Spirit varnishes; Influence of resins on the decolorisation of —— by light. R. Namias. Monit. Scient., 1906, **20**, 265—266.

The coloured varnishes prepared by dissolving resins in alcohol and tinting with artificial colouring matters, are in many cases rapidly decolorised when the film which they leave on evaporation is exposed to air and sunlight. That this bleaching is due to some action exerted by the resin is shown by the fact that when the resin is absent, the decolorisation takes place much more slowly, and that different resins show differences in their influence, the smallest effect being produced by gum lac and myrrh, whilst elemi and mastic have the greatest.—M. J. S.

Pine wood; Products of the distillation of ——. W. H. Walker, E. W. Wiggins and E. C. Smith. III., page 365.

Dimethyl sulphate; Utilisation of —— in determining tar oils in mixtures with rosin and mineral oils, and its behaviour towards fatty oils, oil of turpentine and pinoline. E. Valenta. XXIII., page 394.

(*C.*)—INDIA RUBBER, Etc.

Rubber and rubber goods; Laboratory method of testing the durability of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 628.

The method is based upon the assumption that the durability of rubber and of rubber goods, varies inversely as the ease with which they are oxidised by atmospheric oxygen, and so partially converted into resinous products of the nature of Spiller's resin (J. Chem. Soc., **3**, [2], 44), and of the bodies described by Herbst (this J., 1906, 224).

The sample to be examined is rolled into a thin sheet and dried to constant weight *in vacuo* over calcium chloride, or in a drying-oven at 100° C. 0·4 to 0·8 grm. of the dried sample are now sealed up in a thick-walled tube from which the air has been displaced by oxygen, and the tube is heated for 5 to 20 hours at 100° C. The tube is then allowed to cool, the rubber removed and rapidly weighed, and the increase in weight is taken as an inverse measure of the durability of the sample. The increase in weight shown by a sample of good rubber in five hours amounts to from 2 to 4 per cent.

In certain cases, samples of rubber-goods when tested in this way, show a decrease in weight (due to the oxidation of free sulphur to sulphur dioxide), followed by an increase. The author regards this decrease, too, as being a measure of the durability of the goods, since it is an indication of great porosity in them. Observations should be made of the decrease in tensile strength after oxidation, and taken into account in forming an idea of the durability of the goods, or rubber, examined.

A modification of the sealed-tube method is described in which the rubber sample is contained in a U-tube which is immersed in boiling water. The U-tube is connected with a reservoir containing oxygen, under moderate pressure only.—E. W. L.

Rubber Industry of French West Africa. For. Off. Ann. Series, No. 3543.

In February, 1905, an ordinance was published, applicable to the whole of French West Africa, consisting of five articles, whose object is to secure the following results:—(1) The suppression of adulteration of rubber, (2) the preservation of existing rubber plants; (3) the creation of new plantations; and (4) the creation of schools of instruction in the methods of cultivating and gathering rubber.

In the course of 1904 Sudan rubber fell rapidly in price owing chiefly to adulteration, but after the ordinance had been put in force, it rose again steadily, so that, during 1905, Sudan "twists" rose from 8 fr. 60 c. to 9 fr. 20 c., in January, to 9 fr. 60 c. to 10 fr. 20 c. in September. Sudan "niggers" also rose about a franc during that period.

The best French Guinea rubber, known as Conakry "niggers," continues to be exported in sacks bearing the customs seal as a guarantee of quality, but every other quality may be exported without it. The result of this compromise is that Conakry "niggers" have maintained their price. The application of the new regulations had a most marked effect in the Beyla district of Upper Guinea. The rubber produced there improved to such a degree that in April, 1905, it was given a special quotation on the Bordeaux market under the appellation of Beyla "niggers," and at once ranked with Conakry "niggers."

Because of its backward state, the new regulations are

not to be introduced into the Lower Ivory Coast until 1907; but they have been introduced into the upper districts which formerly belonged to the Sudan.

[T.R.]

UNITED STATES PATENT.

Rubber and the like; Process for extracting —— from wood. A. V. de la Corte, San Luis Potosi, Mexico. U.S. Pat. 814,675, March 13, 1906.

CERTAIN classes of wood are broken to a suitable size and subjected to dry grinding, pressure and heat being applied during the grinding process, especially in the final stages. The particles of rubber agglomerate and are mechanically separated from the woody tissue.—C. E. F.

FRENCH PATENT.

Elastic material [Rubber substitute]; Manufacture of ——. L. C. G. Lesage. Fr. Pat. 359,183, Nov. 6, 1905.

THE material consists of a solution of gelatin in glycerin, to which is added formaldehyde or another coagulant, a solution of rubber or gutta-percha, and a vulcanising agent, and which is afterwards treated with a definite quantity of compressed air or other gas in a fine state of division. The mixing of the materials and the introduction of the air are effected in a special apparatus provided with a hollow shaft carrying hollow mixing blades, through which the air or gas under pressure is introduced. The mixing apparatus is jacketed. During the mixing a heating agent is circulated through the jacket and afterwards cold water, in order to rapidly cool the mass.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 327.)

Pecan, black walnut and butternut. L. E. Levi and E. G. Wilmer. Hide and Leather, Dec. 23, 1905. J. Amer. Chem. Soc., 1906, **28**, 110—117.

THE shells of these nuts gave by analysis the following results:—

	Soluble solids.	Non-tannin.	Tannin.
	Per cent.	Per cent.	Per cent.
Pecan shell	14·01	2·38	11·63
Pecan whole nut	9·04	3·13	5·91
Black walnut, burr. ..	31·20	16·50	14·70
Black walnut, shell ...	5·27	0·30	4·97
Butternut, burr.	41·53	29·67	11·86
Butternut, shell	2·29	1·58	0·71

The oil extracted by petroleum spirit from the "meat," the "meat" and shell and from the whole nut was determined, as also the constants of the oils.

	Pecan oil.	Black walnut oil.	Butternut oil.
Oil in whole nut .	21·72 per cent.	5·18 per cent.	7·88 per cent.
Oil in meat	—	40·05 per cent	54·01 per cent.
Sp. gr. at 21° C..	0·9156	0·9225	0·9263
Turbidity point...	—2° C.	—3° C.	0° C.
Solidifying point .	—7° C.	—13° C.	—10° C.
Hehner value	95·65	93·30	91·26
Saponification value	190·4	190·0	189·8
Iodine value	104·1	146·8	161·7
Acid value	0·59	0·22	0·21

—D. B.

ENGLISH PATENTS.

Plastic masses from casein and the like; Process for the manufacture of ——. L. Collardon, Leipzig, Germany. Eng. Pat. 22,525, Nov. 3, 1905.

SEE Fr. Pat. 359,073 of 1905; this J., 1906, 327—T. F. B.

Glue; Manufacture of ——. C. W. Luther, Reval, Russia. Eng. Pat., 16,432, Aug. 12, 1905.

CLAIM is made for the manufacture of a glue, specially suitable for hygroscopic organic material such as wood, by treating an albumin, *e.g.*, defibrinated blood, with an alkaline-earth, preferably slaked lime, and water. The addition of a porous substance, such as wood meal, is advisable, and the separation of water from the glue may be prevented by the addition of a small proportion of a caustic alkali—not exceeding 1 per cent. of the weight of the albumin. The mixture is stirred for about 15 minutes until it begins to thicken, and is then allowed to stand until it forms a fairly hard jelly.—C. A. M.

GERMAN PATENT.

Glue-containing materials; Process for the separation of fat-solvents from ——. E. Bergmann and T. Berliner. Ger. Pat. 165,235, Oct. 24, 1903.

GLUE-CONTAINING materials from which the fat has been extracted by volatile solvents, are treated with cold water, without centrifugalising, for the purpose of removing the fat-solvent, and also blood and other impurities. The process allows of the extraction of the fat from "spetches," or glue-stuff (*Leimleder*), without the glue being also dissolved, as is the case in the usual method of removing the fat-solvent by means of steam.—A. S.

XV.—MANURES, Etc.

(*Continued from page* 327.)

Copper salts in irrigating waters. W. W. Skinner. J. Amer. Chem. Soc., 1906, **28**, 361—368.

THE author describes some experiments in connection with the injurious effect upon vegetation of copper salts, which as a waste product from the mining and reduction of copper ores, are frequently carried into and contaminate water supplies, which later on are used for irrigation purposes. In the wet method of concentrating low-grade copper ores, quantities of copper, up to 1·5 per cent., may remain in the tailings which are discharged on to the "dump" or directly into the stream, and thence upon the irrigated land. It has been shown that one part of copper per 700,000,000 is sufficient to retard the growth of wheat seedlings, whilst 1 part in about 800,000 is fatal to the growth of corn. In the author's opinion the presence of one part of copper per million should condemn water for irrigation purposes. It has been generally held that the presence of carbonates and bicarbonates renders the copper insoluble, but the author's experiments show that even in presence of considerable quantities of bicarbonates and carbonates, sufficient copper may remain in solution to be toxic to plants. The amounts of copper dissolved by different carbonate solutions are shown in the following table:—

Solution.	Parts of copper per million, in the solution.
Saturated solution of sodium bicarbonate ...	953·00
*Solution equivalent to soil containing 0·05 per cent. of sodium carbonate	1·70
*Solution equivalent to soil containing 0·025 per cent. of sodium carbonate	0·40
Solution containing 1·1075 grms. of calcium bicarbonate per litre	207·10

* These were sodium bicarbonate solutions of strengths corresponding to soil solutions, which would result from adding one-third of an acre-foot of irrigating water to soils containing the quantities of sodium carbonate indicated, assuming that the latter would be completely converted into bicarbonate.

—A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 328.)

Beetroots and beet juices; The "objectionable" [melassigenic] nitrogenous constituents of ——. K. Andrlik and J. Urban. Z. Zuckerind in Böhmen, 1906, **30**, 282—286.

In a former paper (this J., 1905, 808) the authors defined the nitrogenous constituents of beet juice which are not precipitated by cupric hydroxide in presence of alum, and which do not belong to the class of amides or ammonium compounds, as "objectionable" or melassigenic nitrogen. These injurious compounds are not removed from the juice by the usual process of triple saturation, nor by any of the processes to which the juice is subjected in the factory. In two beet-sugar factories there were found in the concentrated syrups, 96·3 and 94·9 per cent. of the "objectionable" nitrogenous constituents originally present in the beets themselves. The storage of beets, especially at a relatively high temperature, is accompanied by a disappearance of sugar by respiration and a progressive deterioration in the purity of the juice, *i.e.*, the ratio of sugar to non-removable non-sugar. This deterioration corresponds with an increase in the proportion of "objectionable" nitrogen in the juice, caused probably by a breaking down of the proteids of the beet during storage. The determination of this form of nitrogen, as prescribed by the authors, *loc. cit.*, can be made with a high degree of accuracy, and constitutes a very important criterion of value in the examination of beets and beet juices.—J. F. B.

Celluloses [beetroot and ramie]; Nature of certain ——. E. Ernest. XIX., page 388.

United States Patent.

Starch; Apparatus for drying ——. E. E. Perkins, Melrose, Mass. U.S. Pat. 815,373, March 20, 1906.

The apparatus for the continuous drying of starch consists of an elongated closed chamber with an exit for the moist air at the top and an inclined floor with an exit for the dry starch at the bottom. A number of endless conveyors are arranged one above the other to carry the starch backwards and forwards through the length of the chamber on its way from the top to the bottom. A heater is provided beneath the floor through which hot air is delivered to one end of the apparatus; the air escapes at the top and enters an external cooling chamber in which the suspended moisture is condensed and separated, whilst the cooled dry air is returned through the heater. —J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 331.)

Extract of malt; Conditions for increasing the —— to nearly the laboratory value. F. Cerny. Österr. Brauer- und Hopfen-Zeit., 1906, Nos. 1 and 2; Z. ges. Brauw., 1906, **29**, 202—203.

The brewery yield of extract from a malt may be increased to a value about 1—2 per cent. less than that found in the laboratory by improving the arrangement of the running-off vessel (Läuterbottich) and regulating the running-off and sparging. The best depth for the grains is 30—35 c.m. (12—14 in.). The false bottom should cover, as nearly as possible, the whole bottom of the tun and should be furnished with slits, not holes. The false bottom should be placed as low as possible and not more than about one-fifth inch from the bottom of the tun. The construction of the rakes is of importance for perfect extraction of the grains, and there should be a sufficient number of independent running-off pipes, each provided with a cock. The temperature at which mashing and running-off are begun—about 167° F.—should be maintained until the end of the sparging, during which the grains should be stirred up several times by the rakes. The outside mashing machine may be advantageously replaced by a pipe passing nearly to the bottom of the tun, "balling" being prevented by a rapidly-rotating propeller.—T. H. P.

Saccharification; Influence of composition of the water on ——. A. Fernbach. Ann. de la Brass, 1906, No. 5; Woch. f. Brau., 1906, **23**, 159—160.

The author discusses the influence of lime and magnesia salts in the brewing water, in the light of recent researches on the influence of the reaction of the medium on ferment action (this J., 1906, 192).

The earthy salts of the waters react with the alkali phosphates of the malt, and a portion of the phosphoric acid is precipitated. Although this double decomposition may not be of much consequence in the case of gypsum waters, it is of importance in the case of waters whose hardness is of the "temporary" character. The earthy carbonates of these waters neutralise the acid primary phosphates, and increase the alkalinity of the medium towards Methyl Orange. Maquenne and Roux have shown that the effect of adding acid to the medium, until it is nearly neutral to Methyl Orange, is to increase the diastatic activity and to increase the proportion of maltose formed as compared with the dextrin. Conversely the effect of waters with high temporary hardness is to lower the maltose: dextrin ratio and incidentally to darken the colour of the wort, owing to the increased alkalinity. The use of such waters is therefore indicated for the brewing of dark beers in which these effects are desirable, and the degree of their influence on the course of saccharification will be all the more marked the greater the weakening of the diastase by high curing. Hard waters of this type will have the same influence as increasing the temperature of mashing. Since the effect of alkalinity on the activity of the proteolytic enzyme closely resembles its effect on the diastase, it is very probable that the amide: albumose ratio of the wort would be affected in the same manner as the maltose: dextrin ratio. It is important, therefore, to ensure constancy of composition of the brewing water if the character of the beer is to be maintained.—J. F. B.

Brewery infection and pure yeast. R. L. Siau. J. Inst. Brewing, 1906, **12**, 118—134.

Before introducing a system of pure yeast fermentation into a brewery the most serious sources of infection must be investigated, and measures taken to minimise the danger. In the brewery in which the author's experiments were conducted, direct observation showed that the wort arriving on the cooler at a temperature of about 170° F., ran off it in a sterile condition until the temperature sank below 135° F. When, however, the cooler has run nearly empty and the temperature of the wort has sunk to about 120° F., it will be found that the later runnings are heavily infected. The author has found that a practically sterile wort may be passed from the cooler to the refrigerator by arranging that no wort enters the latter at a lower temperature than 130° F. This is done by allowing the first copper wort to run off the cooler until only about two barrels remain, the temperature having meanwhile fallen to about 140° F. The second copper wort is now admitted to the cooler at a temperature of 170° F., and thus effects a sterilisation of the residual first wort. The last two barrels of the second wort are similarly re-heated and sterilised by the spargings, the last two barrels of which may be run to waste. Briant (this J., 1904, 722) states that there is a danger of infection at temperatures on the cooler as high as 160°—170° F.

The prevention of infection on the refrigerator can only be effected by using a closed refrigerator supplied only with filtered air. With open refrigerators the infection can be reduced by protecting the beer as far as possible from aerial organisms and scrubbing out the channels after the passage of every brewing. Similar treatment can be applied to the wort pipes by passing a current of steam as frequently as possible. The author introduced a pure culture of yeast from a single cell into the brewery by gradual stages. Under ordinary conditions it was found necessary to renew the working stock by fresh pure cultures

every six to seven weeks. The beer was normally attenuated, took finings well, and possessed a remarkably clean flavour; after racking, it usually came into condition in two to three days. After the third week of storage the beers were quite flat, and failed to recover condition; single cell yeast is only recommended for beers which are to be drunk after a very short storage. For the first two or three weeks of storage, there is a slow fall in gravity of 2°—2·5° caused by the continued action of the culture yeast on the malto-dextrins which are fermented only with difficulty. At the end of that time the deposit of culture yeast appears starved and exhausted, and the gravity remains constant until, after about a fortnight, a visible development of wild yeasts is observed, accompanied by a further fall in gravity of about 1°. The question whether a noticeable after-fermentation is obtained when single-cell yeast is employed depends first on the relative proportion of slowly fermentable, complex malto-dextrins present in the wort, and secondly on the attenuative power of the yeast towards these bodies. These factors determine whether the yeast performs the whole of its work before racking, or whether a gradual loss of gravity continues in the early stages of storage.—J. F. B.

Wines; The "graisse" sickness [ropiness] of ——. E. Kayser and E. Manceau. Comptes rend., 1906, **142**, 725—727.

The authors have isolated and studied the micro-organism which causes ropiness in wines. It resembles the mannitol ferment in many respects, but is distinguished from the latter by the precipitate, without film, which it forms in culture media. The organism grows in chains of 0·7 -0·9 μ in diameter. With age, the chains become longer and felted together, and finally form a glutinous mass at the bottom of the liquid. The bacillus is somewhat anaërobic in habit and grows most rapidly at a temperature of about 30° C. It prefers highly nitrogenous media, peptones being the best nitrogenous nutrients and levulose the most favourable carbohydrate. From levulose, the products of fermentation consist mainly of mannitol, with smaller quantities of lactic and acetic acids, carbon dioxide and alcohol; traces of ammonia are formed, but no hydrogen. Dextrose is fermented less readily and yields no mannitol. Cane sugar is inverted and fermented, milk sugar is also attacked. Certain free acids, such as malic, tartaric and succinic acids, and especially citric acid, are highly inimical to the development of the bacillus; acetic acid has only a feeble influence. The bacillus can be acclimatised to the presence of antiseptics in wine. The degree of ropiness is proportional to the degree of suitability of the composition of the medium. The ropiness always disappears after the lapse of several months and the bacilli collect at the bottom; heating to 80° C. also destroys the ropiness. The bacilli are killed by heating at 50°—55° C. for 15 minutes. Certain wines of the Champagne district, especially those which undergo a slow, continued fermentation, are more susceptible to attack than others. The factors which influence susceptibility are: free acidity, organic nitrogenous substances, alcohol and potash salts.—J. F. B.

Wine imports into the United Kingdom. Parliamentary Paper, No. 88 of 1906 (Price ½d.).

According to this return, 10,871,229 galls. of wine were imported into the United Kingdom during 1905, from the following countries:—Spain, 3,062,112; Portugal, 2,943,571; Madeira, 43,892; France, 2,392,367; Germany, 426,366; Holland, 571,202; Italy, 253,417; Australasia, 861,902; other countries, 316,340 galls. [T.R.]

Malt analysis; Determination of extract values in ——. *by the refractometer.* O. Mohr. XXIII., page 395.

English Patents.

Brewing beer and other beverages; Process of fermentation in relation to ——. G. F. Wittemann, Brooklyn, U.S.A. Eng. Pat. 16,071, Aug. 5, 1905. Under Int. Conv., Aug. 6, 1904.

See Fr. Pat. 358,228 of 1905; this J., 1906, 194.—T. F. B.

Wines, brandies, alcohols and liqueurs; Process for ageing ——. J. M. L. Desvignes, Lyons, France. Eng. Pat. 21,547, Oct. 23, 1905. Under Int. Conv., Oct. 31, 1904.

See Fr. Pat. 350,279 of 1904; this J., 1906, 36.—T. F. B.

United States Patents.

Alcohol; Apparatus for recovering waste —— *from liquor casks and barrels.* T. H. Naughton, Boston, Mass., Assignor to Mary A. Naughton and M. Dunn, Springfield, Mass. U.S. Pat. 815,463, March 20, 1906.

A number of empty barrels are arranged end to end and are connected together in series by tubes carried by head-blocks and passing into the heads of the barrels through elastic, ring-shaped cushions. The first barrel of the series is connected with a steam supply and the last barrel with a condenser. The pipe leading from the last barrel to the condenser is provided with a steam injector.—J. F. B.

Alcohol; Process for recovering waste —— *from liquor casks and barrels.* T. H. Naughton, Boston, Mass., Assignor to Mary A. Naughton and M. Dunn, Springfield, Mass. U.S. Pat. 815,464, March 20, 1906.

Waste alcohol is recovered from a series of practically empty casks by injecting steam into the series of connected casks and drawing, by means of a short-circuited circulation, the contents of the barrels through the last barrel, vaporising the alcohol and condensing the vapours. (See preceding abstract.)—J. F. B.

French Patents.

Alcohol; Production of —— *from amylaceous matters saccharified by mucedinæ and fermented by yeast.* G. Jacquemin. Fr. Pat. 359,236, Jan. 14, 1905.

The apparatus comprises a series of closed vessels every part and fitting of which is capable of being sterilised by a current of steam, the various points of communication with the outside air being immersed in baths of antiseptic solution. The vessels are provided with mechanical stirrers, cooling and heating coils, escape pipes, trapped aseptically, for discharge of waste gases, pipes for filling and emptying and for the admission of sterilised air. The air supply is sterilised by passing through a combined chemical and mechanical air-filter and through a long worm which is frequently sterilised by steam, the condensed moisture serving to wash the filtered air. Saccharification of the liquefied starch is effected in the well-known manner by means of pure cultures of mucedinæ, and fermentation may either be conducted in the same vessels by pure cultures of yeast under aseptic conditions or may be effected in open tuns, after the addition of antiseptics, by yeast specially cultivated and acclimatised to resist antiseptics.—J. F. B.

Fermentation in three stages; Process of ——. J. T. and T. H. Board. Fr. Pat. 359,369, Nov. 11, 1905. Under Int. Conv., Dec. 6, 1904.

See Eng. Pat. 26,698 of 1904; this J., 1905, 1183.—T. F. B.

Acetifying apparatus working with stationary films of pure mycoderma and automatic feed. H. Frings, Jun. Fr. Pat. 359,115, Nov. 4, 1905.

The acetifying apparatus consists of a number of shallow tanks disposed one over another with air-tight joints. The uppermost tank is divided by zig-zag partitions, so as to form a surface condenser through which the fresh wort and the exhausted air are fed in contrary directions and cooled by water circulating inside the partitions. This water is then used for driving the fan for the air supply and finally for cooling the wort after sterilisation. The fresh wort from the condenser passes into a vessel in which it is used for cooling finished vinegar which has been sterilised by heat; the wort becomes hot and is sterilised. The interchange of heat between fresh wort and finished vinegar ensures their mutual sterilisation, the losses of heat being made good by heat from a boiler controlled automatically by a thermo-regulator.

A portion of the wort, whilst still hot, is withdrawn to a closed coke-tower into which the air intended for oxidation purposes is pumped. In this tower the air is heated and saturated with vapour, the warm air serving to maintain the temperature in the acetifying tanks whilst its state of saturation prevents evaporation in the latter. The cooled wort is fed into the acetifying tanks, in which films of pure-cultivated mycoderma have previously been formed, and the flow of wort at a constant level is maintained at such a rate that a single passage through the tanks suffices for complete acetification. The vinegar then goes to the heating apparatus whilst the exhausted air charged with vapours is caused to deposit these in the condenser before being discharged.—J. F. B.

Acetification; Apparatus for automatic ——. L. Royer. Fr. Pat. 359,413, Nov. 14, 1905. Under Int. Conv., Dec. 10, 1904.

See Eng. Pat. 24,245 of 1905; this J., 1906, 194.—T.F.B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

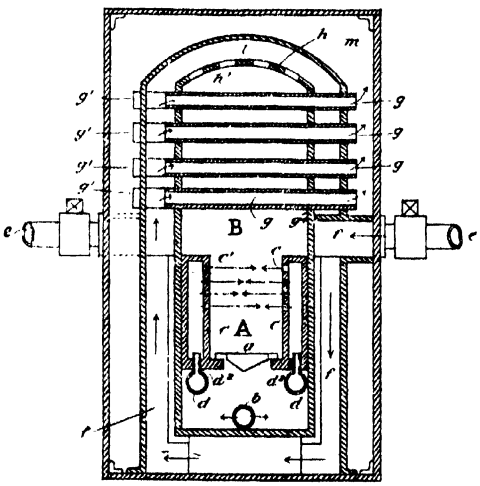
(*Continued from page* 333.)

(*A.*)—FOODS.

Milk; Determination of proteids in — —. A. Trillat and Sauton. XXIII., page 395.

English Patents.

Furnaces or apparatus for supplying heated air and gases for industrial purposes. [*Drying tea, &c.*]. P. D. G. Clark, Balangoda, Ceylon. Eng. Pat. 10,107, May 13, 1905.



The primary air to support the combustion of the fuel on the grate, *a*, enters, preferably under pressure, through the pipe, *b*, and the secondary air, also under pressure, enters through the pipes, *d*, *d*, and the jets, d^2, into the chambers, *c*, *c*, where it is heated by contact with the walls of the combustion chamber, A. The heated secondary air leaves the chambers, *c*, *c*, by the passages, c^1, c^1, and passes over the surface of the burning fuel. The openings, c^1, are made of different sizes so that the jets of heated air may mix more completely and the sum of the area of these openings is made small so that the air only leaves the chambers, *c*, *c*, slowly. The products of combustion pass upwards from the chamber, A, to the tube chamber, B, around the tubes, and through the ports h^1, in the dome, *h*, into the space, *l*, where they mix with another supply of warmed air, which enters the apparatus at *e*, passes down the channels, *f*, underneath the grate, *a*, and up the channels, f^1, into the space, *l*. The mixture of gases then passes through the tubes, *g*, g^1, is there further heated by the products of combustion from A, and collects in the space, *m*, from which it is conducted away to be used.—W. H. C.

Alimentary substance; Process for the preparation of an ——. A. de Sousa Reis, Oporto, Portugal. Eng. Pat. 21,946, Oct. 27, 1905.

See Fr. Pat. 358,713 of 1905; this J., 1906, 332.—T. F. B.

Flour; Method of and apparatus for treating —— *with gases.* M. A. and C. P. Eybert, Livron, France. Eng. Pat. 23,009, Nov. 9, 1905. Under Int. Conv., April 10, 1905.

See Fr. Pat. 353,179 of 1905; this J., 1905, 1027.—T.F.B.

Corn and its products; Process for bleaching and sterilising ——. O. Zimmermann, Ludwigshafen on Rhine, and C. H. Buchenau, Düsseldorf-Reisholz, Germany. Eng. Pat. 25,010, Dec. 2, 1905.

The corn is subjected for a short time to the action of a dilute solution (of from 1 to 5 per cent. strength) of sodium hyposulphite (hydrosulphite), or other salt of hyposulphurous (hydrosulphurous) acid. The bleached corn may be afterwards rinsed with water.—W. P. S.

United States Patent.

Bleaching and sterilising [*foods, &c.*]; [*Electrical*] *apparatus for* ——. S. Leetham, York, Assignor to The Ozonised Oxygen Co., Ltd., Manchester. U.S. Pat. 816,482, March 27, 1906.

See Eng. Pat. 5790 of 1904; this J., 1905, 341.—T.F.B.

French Patents.

Milk; Process for drying and preserving —— *in powder form.* P. F. Bévenot and E. de Neveu. Fr. Pat. 359,526, Jan. 24, 1905.

See Eng. Pat. 29,307 of 1904; this J., 1906, 36.—T.F.B.

Coffee extracts; Preparation of ——. H. Koerner. Fr. Pat. 359,263, Nov. 9, 1905.

For making an extract of roasted coffee the ground material is treated with volatile solvents, such as alcohol, ether, benzene, acetone or petroleum spirit, in order to extract the aromatic essential oil. The grains are then freed from solvent and extracted with boiling water until exhausted. The aqueous extract is evaporated and dried at 110° C., and is then powdered and thoroughly mixed with the essential oil extracted in the first operation. In the case of green coffee, the beans are ground and exhausted with boiling water, the extract being evaporated to dryness, roasted at a suitable temperature, re-dissolved in water and filtered. The residual grains are dried and roasted, and are then exhausted with volatile solvents for obtaining the aromatic oil. The residue from this treatment may be submitted to a second extraction with water, the combined aqueous extracts being evaporated to dryness, powdered and flavoured with the essential oil.
—J. F. B.

Coffee; Use of oxygen or ozone for maturing and improving ——. J. M. L. Desvignes. Fr. Pat. 359,451, Nov. 15, 1905.

Green coffee is matured and improved by treating it in a closed vessel with oxygen or ozone. The best results are obtained when the coffee has been rendered more porous by storage in a hot chamber immediately before treatment with the oxidising gas, and by exhausting the air from the closed vessel before admitting the oxygen. If desired the oxygen may be ozonised in the vessel itself whilst it is in contact with the coffee. Full maturation of the coffee can thus be effected in a few days.—J.F.B.

Fruits and vegetables containing sugar; Drying —— *and preparations of these materials.* J. R. Hatmaker. Fr. Pat. 359,689, Nov. 22, 1905. Under Int. Conv., Nov. 24, 1904.

See Eng. Pat. 25,563 of 1904; this J., 1905, 1249.—T.F.B.

(B.)—SANITATION; WATER PURIFICATION.

English Patents.

Sewage and other foul or impure waters; Apparatus for the purification of ——. W. O. Travis, Hampton, Middlesex. Eng. Pat. 4980, March 9, 1905.

The sewage, previously deprived of most of its suspended solids by treatment in a settling tank such as that described in Eng. Pat. 11,073 of 1903 (this J., 1904, 676), is subjected to bacterial treatment while passing at a suitable speed through tanks provided with sets of inclined plates of slate, stoneware, cement or the like. The fine suspended matters together with colloidal and other organic and inorganic substances are deposited on these plates and finally drop to the bottom of the tank, where they are further acted on by the bacteria. The sludge is afterwards periodically drawn off by means of suitable pipes which are provided at the bottom of the tank.—W. P. S.

Precipitation and decantation in the treatment of liquids [water]; Continuous ——. E. Declercq, Lille, France. Eng. Pat. 5332, March 14, 1905.

See Addition of March 7, 1905, to Fr. Pat. 348,375 of 1904; this J., 1905, 983.—T. F. B.

Oil in feed and other water; Impts. in and apparatus for determining the amount of ——. D. B. Morison. Eng. Pat. 8031, April 14, 1905. I., page 362.

Filtering of liquids [Water]; Impts. relating to the ——. A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 8565, April 20, 1905.

The claim is for the application of the filter for sewage described in Eng. Pat. 22,724 of 1904 (this J., 1905, 685) to the filtration of water for domestic and other purposes.
—W. H. C.

Water; Apparatus for the purification of —— *by electrical means.* J. F. Lester. Eng. Pat. 18,427, Sept. 12, 1905. XIA., page 379.

United States Patent.

Purifying water by electrolysis; Apparatus for ——. H. C. Bailey, Assignor to Electra-Pura Water Co. U.S. Pat. 814,764, March 13, 1906. XI., page 380.

French Patent.

Water; Process and apparatus for the purification of ——. J. F. Wixford. Fr. Pat. 358,991, Sept. 22, 1905. Under Int. Conv., Sept. 23, 1904.

The water is pumped from a river or similar source and delivered into two separate wells. In these wells the water receives the addition of predetermined quantities of ferrous sulphate and lime solutions from tanks which contain these chemicals. The tanks are supplied with water, the supply to the lime tank being heated. The treated water is then led from the wells by pipes which empty into a conduit leading to a settling tank. Ferrous fluoride may be employed in place of ferrous sulphate and the supply of lime must be sufficient to render the water distinctly alkaline. (See also U.S. Pats. 807,008 and 807,412 of 1905; this J., 1906, 86—87.)—W. P. S.

(C.)—DISINFECTANTS.

English Patent.

Disinfection of premises, articles and such like; Process and apparatus for the ——. P. Lassablière, Paris. Eng. Pat. 25,072, Dec. 2, 1905. Under Int. Conv., Dec. 3, 1904.

The apparatus has for its object the complete conversion of trioxymethylene into formaldehyde and consists of a pressure-chamber closed by a lid secured by bolts. The lid carries a pressure-gauge, a safety-valve, a tapped opening for introducing the disinfecting products, and an outlet pipe for the formaldehyde vapour. This pipe is provided with a screw-down needle-valve and a spring-valve which, even when the needle-valve is opened, only allows the gas to escape when the pressure in the chamber is more than 3 kilos. (per sq. cm.). Means are provided for heating the pressure-chamber, and amyl, methyl, or ethyl alcohol, &c., may be added to the trioxymethylene in order to prevent the discharge of any of the latter in an unconverted condition.—W. P. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 334.)

Celluloses [Beetroot and ramie]; Nature of certain ——. A. Ernest. Z. Zuckerind. in Böhmen, 1906, **30**, 279—282.

Exhausted beetroot slices and ramie fibres were treated alternately with hot, concentrated baryta water and 4 per cent. hydrochloric acid until residues of practically pure celluloses were obtained. The celluloses were then dissolved in a liquid composed of 250 grms. of concentrated sulphuric acid and 84 grms. of water per 100 grms. of cellulose. The products were diluted, hydrolysed by heating at 95°—97° C., and neutralised by strontium hydrate. The solutions were concentrated, the dextrinous components were precipitated by alcohol and the filtered liquids were evaporated to syrups, the yield of syrup being, however, relatively small. In both cases, the syrups obtained appeared to contain nothing but dextrose, whence it is concluded that both the celluloses investigated belong to the class of dextroso-celluloses. The beet cellulose differed from the more normal type of ramie cellulose, in that it showed a greater tendency to the formation of humus substances during hydrolysis.
—J. F. B.

Arsenic in wall-papers, fabrics, &c.; Note on the application of the electrolytic method to the determination of ——. T. E. Thorpe. XXIII., page 394.

English Patents.

Threads; Manufacture of artificial ——. R. Linkmeyer. Eng. Pat. 4755, March 7, 1905. V., page 371.

Cellulose threads; Manufacture of lustrous ——. R. Linkmeyer. Eng. Pat. 4765, March 7, 1905. V., page 371.

United States Patents.

Paper making machines; Apparatus for supplying colouring material in —— *for the manufacture of one side coloured, clouded-coloured and marbled papers.* C. Tittel, Josefsthal, Austria-Hungary. U.S. Pat. 815,763, March 20, 1906.

See Eng. Pat. 17,163 of 1905; this J., 1906, 87.—T. F. B.

Paper making machine. C. Tittel, Josefsthal, Austria-Hungary, U.S. Pat. 816,402, March 27, 1906.

See Eng. Pat. 10,798 of 1904; this J., 1904, 834.—T. F. B.

French Patents.

Peat half-stuff [Paper manufacture]; Process and apparatus for manufacture of ——. A. Kirner. First Addition, dated Oct. 24, 1905, to Fr. Pat. 353,538, April 17, 1905 (this J., 1905, 1028).

The roller-mills in which the peat is reduced to pulp are improved by imparting to each of the rolls a movement in the horizontal plane along the axis, in addition to the rotary motion. This axial motion may be in contrary directions for the two rolls of a mill, or may be in the same direction at different speeds.—J. F. B.

Paper-pulp from graminaceous plants, and more especially from esparto, diss and the dwarf palm; Manufacture of ——. L. Echégut. Fr. Pat. 359,550, Nov. 6, 1905.

The plants are crushed between rollers, chopped into suitable lengths, and then boiled for a short time with

a solution of sodium carbonate. The liquor is drained off and the material washed in the boiler; the washed material is then treated with a solution containing 2—6 per cent. of sodium nitrate and 7—10 per cent. of sulphuric acid, with which it is boiled for several hours. When the fibre has become thoroughly loosened by this treatment, it is drained, washed and bleached.—J. F. B.

Fibres; Process of bleaching natural —— for paper-making. A. Jouve. Fr. Pat. 359,452, Nov. 10, 1905.

Natural fibres are treated either hot or cold with an alkaline solution; the pulp is then washed and "soured," and is bleached by treating it with a 2—5 per cent. solution of a manganate or permanganate, which is added to the pulp in small quantities at a time until the action is complete. Finally the pulp is washed and treated with sulphurous acid or a solution of a sulphite or "hyposulphite." It is stated that the addition of a little hypochlorite to the manganate solution economises the latter, and confines its action to the colouring matters, thus protecting the cellulose from being attacked by the oxidising agent.
—J. F. B.

Paper making machine. H. Parker. Fr. Pat. 359,297, Nov. 10, 1905. Under Int. Conv., April 17, 1905.

See U.S. Pat. 808,614 of 1905; this J., 1906, 88.—T. F. B.

Paper; Manufacture of [couching and drying] ——. E. Armengaud, sen. Fr. Pat. 359,419, Jan. 21, 1905.

The paper is couched underneath the machine on the return journey of the making-wire. The web is transferred to an endless wire-band which carries it over the drying cylinders, the transference being effected by the pressure of a perforated upper couch-roll against a solid lower couch-roll which is surrounded by a short endless felt. The web of paper on the wire-band then travels a short distance until a second draining felt engages the compound band, so that the wire lies between the paper on the outer side and the felt on the inner side. This felt is continuously dried, during its passage, by pressure between a pair of rollers, and it passes, with the paper and wire, over a portion of the first drying cylinder. Just before this is reached, however, the compound band passes over a suction-box, the felt being protected from friction by a short endless wire band which supports it over the suction-box.—J. F. B.

Fuel; Agglomeration of ——. [Utilisation of waste cellulose lyes]. A. E. Tavernier and C. Oulman. Fr. Pat. 359,249, Nov. 8, 1905. II., page 365.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Lithium theobromine, a soluble derivative of theobromine. E. Dumesnil. J. Pharm. Chim., 1906, **23**, 326—328.

Lithium theobromine is prepared by adding an excess of theobromine to a solution of lithium hydroxide. The liquid is filtered and evaporated, and the residue dried at 110° C. in a vacuum. The amount of lithium found in the product corresponds to the formula, $C_7H_7N_4O_2Li$. Lithium theobromine forms silky crystals, soluble in about half their weight of water. The solution becomes turbid on exposure to the air, owing to the separation of theobromine. Therapeutic trials show that lithium theobromine is as active as four or five times its weight of theobromine.—F. Shdn.

Anagyris fetida; Alkaloids of ——. G. Goessmann. Arch. Pharm., 1906, **244**, 20—24.

Commercial anagyrine hydrobromide has been separated by Partheil and Spasski (Apoth.-Zeit., 1895) into two bases, cytisine, $C_{11}H_{14}N_2O$, and anagyrine, $C_{15}H_{22}N_2O$, the composition of the latter being arrived at indirectly, since it could not be separated in a sufficiently pure state for analysis. The author has attempted to separate the two alkaloids by means of phenylisothiocyanate; the mixed alkaloids were dissolved in alcohol, treated with excess of phenylisothiocyanate, and left in contact for three days. The phenylcytisine-thiourea which separated was filtered off, and the filtrate evaporated on the water-bath, *in vacuo*. The residue was warmed for a short time with dilute hydrochloric acid, when an insoluble oily portion separated. On standing, this deposited white prismatic needles, which were identified as xanthogen-anilide, m. pt. 72°—74° C.; the oil was phenylisothiocyanate. The hydrochloric acid filtrate was made alkaline and the crude anagyrine shaken out with chloroform. The chloroformic extract was freed from the solvent *in vacuo*, and the residue distilled. A trace of a body forming scale-like crystals passed over at 200°, the bulk of the alkaloid distilling at 245° C. under 30 mm. pressure. The base so obtained was a honey-coloured, resinoid, amorphous mass, amounting to about 64 per cent. of the crude base. On analysis, figures were obtained which although not in accordance with the formula of Partheil and Spasski for anagyrine, were not sufficiently diverse to suggest another formula. The base was found to be free from cytisine. Although the method has failed so far to absolutely confirm the formula for anagyrine, it has proved to be of practical value for the separation of the bases, since cytisine can be readily regenerated from the phenylcytisine-thiourea.
—J. O. B.

Mydriatic alkaloids of the genus Datura. E. Schmidt. Arch. Pharm., 1906, **244**, 66—72.

Datura alba. Nees.—This species of *Datura* has been considered to be identical with *D. fastuosa*, concerning the nature of the alkaloids of which various statements have been made. The seeds of two varieties of *D. fastuosa* have been examined—one with white, the other with blue flowers. Those of *Datura fastuosa*, white double-flowered variety, gave 0·20 per cent. of scopolamine and 0·023 per cent. of hyoscyamine. Seeds of *D. fastuosa*, blue double-flowered form, yielded 0·216 per cent. of scopolamine and 0·034 per cent. of hyoscyamine.—J.O.B.

Almonds, bitter; Influence of heat on the toxicity of ——. G. Velardi. Boll. Chim. Farm., 1906, **45**, 65—67. Chem. Centr., 1906, **1**, 1030.

Bitter almonds, some whole and some cut into pieces, were heated in an air-bath, starting from a temperature of 70° C., and rising by increments of 5°, the temperature being maintained constant at each point for two hours and samples of the almonds withdrawn, powdered, allowed to stand in contact with water, distilled, and the distillate tested for hydrocyanic acid. Up to 103° C., hydrocyanic acid was formed from all the test samples, but at 105° C., in traces only, from the whole almonds, whilst above 105° C. it was necessary to macerate the heated almonds with powdered sweet almonds to obtain evidence of hydrocyanic acid at all. In all cases the whole almonds proved more resistant to heat than those cut into pieces, and, indeed, were still capable of yielding traces of hydrocyanic acid after heating to 190° C.

Pure amygdalin when heated rapidly, was found to melt at 208°—210° C.; when heated slowly it began to darken at 170° C., and melted at 180° C., forming a resinous mass. The latter was soluble in water, slightly soluble in 65 per cent. alcohol, and when macerated with water and powdered sweet almonds, immediately yielded hydrocyanic acid. It contained 4·09 of nitrogen, as compared with 2·96 per cent. before heating (calculated for $C_{20}H_{27}O_{11}N$, 3·06 per cent., and for $C_{20}H_{27}O_{11}N+3H_2O$ 2·70 per cent. of nitrogen). The author considers that to render bitter almonds quite harmless, they should be heated to 170° C., at which temperature the amygdalin is stated to become incapable of developing hydrocyanic acid by the action of ferments.—A. S.

Philippine wood oils. A. M. Clover. Philippine J. of Science, 1906, **1**, 191—202.

Wood Oils.—The author defines these as fluid resins having only slight drying power and containing a high proportion of volatile matter, the oily portion of which may amount to as much as 75 per cent. of the resin and consists entirely of sesquiterpene substances. These products closely resemble copaiba and gurjun balsams.

Oil of Supa is obtained from *Sindora Wallichii*, a tree

said to be widely distributed throughout the Philippine islands. A freshly-cut tree is stated to yield about 10 litres of the oil, which in certain districts is used for illuminating purposes. It is mobile, homogeneous, and light yellow in colour, with a slight fluorescence. Its odour is faint but characteristic. The specimen examined by the author had a specific gravity of 0·9202 at 30°/30° C., and an optical rotation of − 31·3° in a 100 mm. tube at 30° C. When cooled below 20° C., it yielded a deposit of white crystals consisting of a hydrocarbon, melting at 63° to 64° C. The oil absorbed oxygen slowly from the air, forming, after several weeks, a thin hard film. When distilled under a pressure of 40 mm., nearly the whole of the oil passed over between 143° and 149° C., the residue being fluid and showing no sign of polymerisation. The distillate had a sp. gr. of 0·9053 at 30°/30° C., and when redistilled, boiled at 255° to 267° C. (760 mm.) leaving practically no residue. It was found that cadinene constituted a large portion of the distillate from the original oil, but no other crystalline derivatives could be obtained. The distillate absorbed oxygen on exposure to the air, gradually becoming viscous, and when spread in a thin layer slowly hardened, and became darker in colour. The optical activity of the oil was destroyed by heat, so that the rotation of a distillate obtained at the ordinary pressure was only −5·4°. The non-volatile portion of the oil (about 27 per cent.) contained solid hydrocarbon (m. pt. 63° to 65° C.), which separated out on the addition of alcohol. When dried *in vacuo* it gave the following results on elementary analysis: Carbon, 85·43; and hydrogen, 14·94 per cent. (total, 100·37). It constituted about 6 per cent. of the original oil of supa.

Balao: Oil of Apitong.—This resin is obtained from the *Apitong* tree belonging to the genus *Dipterocarpus*, and is in common use throughout the Islands. It is collected in a cup-shaped cavity cut in the body of the tree. The freshly exuded product is white, but darkens rapidly on standing, and when exposed, in a thin layer, slowly hardens to form a tough durable varnish, for which purpose it is used by the natives of the Philippines. The resin, as thus obtained is a viscous fluid, containing a large amount of granular solid matter in suspension. It has a feeble but distinctive odour, and appears to be soluble in all the ordinary solvents except alcohol. It hardens when treated with steam, and cannot be distilled under reduced pressure owing to frothing and solidification of the partially dehydrated residue, and the only way to remove the whole of the water, which appears to be in a state of chemical combination, is to apply a free flame. Oil continues to distil after removal of the water, and the distillate gradually becomes reddish-green, until at 270° C. signs of decomposition appear in the flask. Specimens distilled in this way yielded about 50 per cent. of distillate, consisting of water with 22 to 28 per cent. of oil. The residue was a dark brittle product. The oil obtained by direct distillation had a b. pt. of 151° to 154° C. at 40 mm., after being fractionated twice under reduced pressure. Its optical rotation at 30° C. was +78·5°, and its sp. gr. at 30°/30° C. 0·9127. No solid crystalline product could be isolated from balao oil, but the author concludes that it is unquestionably a sesquiterpene or mixture of sesquiterpenes.

Malapaho: Oil of Panao.—This resin is obtained from *Dipterocarpus vernicifluus*, the method of extraction being the same as in the case of balao. It dries more slowly than the latter, and is therefore not so widely used. The fresh resin is white, and viscous, and has a characteristic odour. It absorbs oxygen from the air, becoming dark-brown in colour, and when exposed in a thin film, hardens very slowly. When heated to 100° C. its mobility increases, in which respect it differs from balao. It is soluble in ether and chloroform, and partially soluble in alcohol and benzene. When distilled over a free flame it behaves like balao. A specimen examined by the author yielded 25 per cent. of water, 35 per cent. of oil, and 40 per cent. of solid residue. The sesquiterpene from malapaho distilled over almost completely between 256° and 261° C. at 760 mm., and when purified by redistillation under reduced pressure was a colourless product, with a sp. gr. of 0·9165 at 30°/30° C., and a rotation of "−54°" in a 100 mm. tube at 30° C. The solid product was similar to that from balao, but was lighter in colour. On destructive distillation it yielded 50 per cent. of a liquid which partially distilled between 200° and 300° C., leaving a residue resembling rosin oil. None of the constituents of the volatile oil of malapaho could be identified.

Mayapis Resin is obtained from the *Dipterocarpus* tree, mayapis (*D. anisoptera Vidaliana*) and is regarded by Tavera as identical with gurjun balsam. The specimen examined by the author contained 15 per cent. of water, and 25 per cent. of sesquiterpene oil, which could be distilled off without decomposition, leaving a hard residue. The oil purified by redistillation at 17 mm. was light yellow, and had the characteristic odour of the resin. It boiled at 132° to 140° C. (17 mm.) and had a sp. gr. of 0·9056 at 30°/30° C. The original resin was very viscous at the ordinary temperature and hardened when heated to 100° C., forming a white solid. The same effect was produced by exposure to the air, the resin drying much more rapidly than either balao or malapaho. The properties of this sample were quite different from those generally given for gurjun balsam.—C. A. M.

Terpenic compounds; Formation and distribution of —— in the orange. E. Charabot and G. Laloue. Comptes rend., 1906, **142**, 798—801.

Young leaves and stems from new branches were examined in May and in June; in June examination was also made of leaves and stems from branches two to four years old.

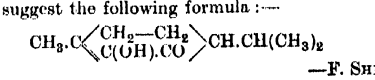
In the first case the leaves contained much more essential oil than the stems, both relatively and absolutely; in the second, the proportion had increased in the leaves and diminished in the stems, whilst the absolute amount had increased in both. The third set (from older branches) showed a decrease in the proportion of essential oil in both leaves and stems; but the absolute amount in the leaves had increased, whilst that in the stems had diminished.

The essential oil contained but little citral; that from the leaves more than that from the stems. From the first to the second stage the proportions of citral and of esters had both increased, the combined alcohol more than the free. Later, esterification became less active.

—J. T. D.

Buchu-camphor; Decomposition and synthesis of ——. F. W. Semmler and McKenzie. Ber., 1906, **39**, 1158—1170.

After reviewing previous work upon this subject, the authors examined Buchu-camphor or diosphenol, $C_{10}H_{16}O_2$, which they found to have the following constants:—m. pt. after several recrystallisations, 83°—84° C.; b. pt. at 10 mm., 109°—110° C.; optically inactive, soluble in caustic alkalis, though gradually at first. It only takes up one acetyl or benzoyl group. It gives a mono-oxime, m. pt. 125° C., which cannot be changed into a nitrile. On heating with hydrochloric acid in a sealed tube, it is converted almost entirely into thymol with a little carvacrol. On oxidation with ozone *α*-isopropyl-*γ*-acetyl-*n*-butyric acid is produced. Reduction with sodium and alcohol gives a glycol, $C_{10}H_{20}O_2$, which is oxidised by permanganate to *α*-isopropyl-*α'*-methyl-adipic acid. If Buchu-camphor be oxidised with permanganate, an acid, $C_{10}H_{16}O_4$, is obtained. This on distilling *in vacuo* loses water and passes into a keto-acid, $C_{10}H_{14}O_3$, which melts at 104°—105° C. when crystallised from water, and forms a mono-oxime melting at 182° C. The synthesis was accomplished by the careful oxidation of oxymethylene-menthone, $C_{11}H_{18}O_2$, with ozone. The diketone produced is inverted by acids or alkalis into its enol form, diosphenol, identical with Buchu-camphor, for which the authors suggest the following formula:—



—F. Shdn.

Pinene hydrochloride and camphene hydrochloride. A. Hesse. Ber., 1906, **39**, 1127—1155.

Pinene hydrochloride and camphene hydrochloride can both be made to react with magnesium to form the Grignard magnesium compounds. These, on treatment with

water decompose :—$R.MgX + H_2O = R.H + Mg(OH)X$. Both pinene-magnesium hydrochloride and camphene-magnesium hydrochloride, when decomposed in this way, yield the same camphane, melting at 153° C. The magnesium compounds are readily produced by adding the respective hydrochlorides to a reaction previously started between magnesium and an organic halogen compound. Or, the hydrochloride can be added to an alkyl-magnesium halide already formed. With pinene hydrochloride 80—85 per cent. is converted into the magnesium compound, the rest chiefly into hydrodicamphene, $C_{20}H_{34}$. About 60 per cent. of camphene hydrochloride is converted into the magnesium compound, the rest into hydrodicamphene, which, as far as could be ascertained, was identical with that obtained from pinene. If pinene-magnesium hydrochloride be oxidised by the air and decomposed with water, borneol is the principal product, with some hydrodicamphene and a little isoborneol. Camphene-magnesium hydrochloride on oxidation and treatment with water gives 45 per cent. of alcohols, 2/3 borneol and 1/3 isoborneol, 21 per cent. of hydrodicamphene, and about 34 per cent. of camphene and camphane, but the camphane produced in every case is inactive. But borneol and hydrodicamphene whenever produced are active, if an active substance has been the starting point. The author concludes that pinene hydrochloride and bornyl chloride are identical. Also, that the chlorine atom in camphene hydrochloride is attached to the same atom to which chlorine is attached in pinene hydrochloride; and that borneol and isoborneol are stereoisomeric secondary alcohols. The products of the reaction were as a rule complex mixtures of the following compounds:—unchanged substance, pinene or camphene hydrochloride; camphane and camphene; borneol and isoborneol; hydrodicamphene. Details are given for the determination of their respective amounts.—F. Shdn.

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The method proposed is a modification of that devised by Winkler (this J., 1905, 1253), for the preparation of pure absolute ethyl alcohol. One litre of 95 per cent. alcohol is well mixed with a solution of 1·5 grms. of silver nitrate in about 3 c.c. of water, and a cold solution of 3 grms. of potassium hydroxide (purified by alcohol) in 10—15 c.c. of alcohol is slowly poured in, without shaking. The alcohol is allowed to stand over night or until the precipitated silver oxide has settled, and the clear solution is withdrawn and distilled. The product dissolves potassium hydroxide to a colourless solution. The method is not applicable to methyl alcohol.—A. S.

Chloroform and ether; Evolution of heat on mixing ——. L. Rosenthaler. Arch. Pharm., 1906, **244**, 24—25.

When chloroform and ether are mixed, under varying conditions, a notable rise of temperature invariably ensues, some compound being undoubtedly formed.—J. O. B.

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In presence of halides, the absorption of oxygen from the air by solutions of guaiacol and quinol (hydroquinone) is very much more rapid than without them. The order of activity of the metals tried, is:—sodium, manganese, calcium, potassium, barium, lithium, strontium. The first four of these are among the elements always found in living organisms. Oxy-salts—sulphates, nitrates, &c.—do not exhibit this accelerating power in the same way as halides.—J. T. D.

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Secondary α-benzylborneol $C_8H_{14}\begin{cases}CH\cdot CH_2C_6H_5\\ \vdots\\ CHOH\end{cases}$ is obtained quantitatively as a viscous oil, by reducing benzyl camphor in absolute alcohol by means of a large excess of sodium. It boils at 179°—181° C. under 13 mm., has sp. gr 1·1325 and rotary power $[\alpha]_D = +26°\ 10'$, and yields an acid phthalate, which on saponification produces a benzylborneol having a slightly higher rotatory power than the original. The corresponding *benzylcamphene* is obtained along with the phthalate, or by heating benzylborneol with formic acid or with pyruvic acid. As the camphenes obtained by these different methods, however, differ in boiling point and in rotatory power, the original benzylborneol is probably mixed with benzylisoborneol.

Tertiary β-benzylborneol $C_8H_{14}\begin{cases}CH_2\\ \vdots\\ C(OH)CH_2C_6H_5\end{cases}$ prepared by treating camphor with phenylmagnesium bromide in ethereal solution, boils at 165°—170° C. under 10 mm., and has a rotatory power $[\alpha]_D = -12°\ 0'$. It is readily dehydrated by heating with pyruvic or formic acid, or phthalic anhydride, yielding benzylcamphene melting at 24° C., and lævorotatory $[\alpha]_D = -60°\ 44'$. A small amount of a liquid isomeride is at the same time produced. The corresponding tertiary phenyl compounds are similar and similarly obtained.

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Jowett and Marshall have previously shown that the specific rotatory power of pilocarpine or iso-pilocarpine in aqueous solution is diminished by addition of caustic alkali, a minimum value being obtained when one molecular proportion of alkali is present. Furthermore, the solution thus treated no longer exhibits the characteristic physiological action of pilocarpine (Marshall, J. Physiol., 1904, **31**, 153). This change is attributed to the opening of the lactone ring in the pilocarpine molecule, with formation of the corresponding hydroxy-acid. The authors find that this difference in action between a lactone and the corresponding hydroxy-acid is also shown by terebyl- and phthalidecarboxyl-tropeïnes, which produce an atropine-like effect on the heart, but lose this action after a molecular proportion of alkali has been added to the base.

Ladenburg has stated that the mydriatic action of a tropeïne depends not only on the presence of a tropine complex, but also on the nature of the acyl group attached to it, which must contain (1) a benzene residue, (2) an aliphatic hydroxyl in the side-chain containing the carboxyl group. The authors' experiments with five new tropeïnes, *viz.*, phthalidecarboxyl-, terebyl-, protocatechyl-, methylparaconyl-, and glycollyl-tropeïnes, arranged in order of activity, show that whilst the conditions given by Ladenburg appear to be those most favourable for the development of mydriatic action, yet terebyltropeïne which does not contain a benzene nucleus exhibits a distinct mydriatic action. All the new tropeïnes mentioned were much less active than atropine or homatropine.

Glycollyltropeine, $CH_2(OH).CO.C_8H_{14}ON$, was prepared by neutralising tropine with glycollic acid and digesting the resulting solution with dilute hydrochloric acid (1:40) for 24 hours on the water-bath. After purification, the base formed laminar crystals melting at 113°—114° C.; m. pt. of the hydrochloride is 171°—172° C. The remaining four tropeines were prepared by passing hydrochloric acid gas through a solution of tropine neutralised with the acid in question, and maintained at a suitable temperature for two to three hours. *Methylparaconyltropeine*,

$$CO<\begin{matrix}O.CH(CH_3)\\ -CH_2-\end{matrix}>CH.CO.C_8H_{14}ON,$$

was obtained as a colourless oil; m. pt. of hydrobromide, 196°—197° C. *Terebyltropeine*

$$CO<\begin{matrix}O.C(CH_3)_2\\ -CH_2-\end{matrix}>CH.CO.C_8H_{14}ON,$$

formed small diamond-shaped crystals, melting at 66°—67° C.; m.pt. of hydrochloride, 82° C. *Phthalidecarboxyltropeine*,

$$C_6H_4<\begin{matrix}CH-CO.C_8H_{14}ON\\ CO-O\end{matrix},$$

formed square laminar crystals, melting at 79°—80° C.; m. pt. of hydrochloride, 242°—244° C., with decomposition. *Protocatechyltropeine*, $C_6H_3(OH)_2.CO.C_8H_{14}ON$, separated from alcohol in stout acicular crystals, melting at 253°—254° C., with decomposition.—A. S.

Coca leaves; Analysis of the alkaloids of Java . A de Jong. XXIII., page 395.

Sapindus rarak; Constituents of the fruit of — . O. May. XII., page 382.

Xanthic leucomaines; Action of —— on copper. N. Slommesco. XXIV., page 395.

Cod liver oils; American ——. L. M. Tolman. XII., page 382.

United States Patents.

Alkyloxyacetyl cyanamide and process of making same. A. H. C. Heitmann and E. C. Clemmensen, Assignors to Parke, Davis and Co., Detroit, Mich. U.S. Pat. 814,693, March 13, 1906.

Alkylhydroxyacetylcyanamides are obtained by the condensation of alkylated hydroxyacetic acids and cyanamide or urea, the oxygen of which is substituted. By hydrolysis of the product, the corresponding alkylhydroxyacetylurea is obtained. Diethylhydroxyacetyl cyanamide, obtained by condensing diethylhydroxyacetic acid with cyanamide, is a colourless crystalline substance of m. pt. 235° C., soluble in water and alcohol, but insoluble or only slightly soluble in organic solvents.—T. F. B.

Alkylaminoacetopyrocatechol and process of making same. F. Stolz, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on Maine, Germany. U.S. Pat. 815,653, March 20, 1906.

See Eng. Pat. 22,064 of 1904; this J., 1905, 43.—T. F. B.

Medicines; Process of making ——. R. Gross, Rastenberg, Assignor to Ferro-Phosphat Ges. E. Schramm und Co., Hamburg, Germany. U.S. Pat. 816,547, March 27, 1906.

See Fr. Pat. 343,174 of 1904; this J., 1904, 1040.—T. F. B.

French Patent.

Organo-magnesium compounds; Process for preparing and oxidising —— [Preparation of borneol]. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 359,547, Nov. 2, 1905.

By the action of magnesium on a solution of pinene hydrochloride, hydrobromide or hydriodide in a suitable solvent (*e.g.*, ether, or a hydrocarbon), in presence of some substance which acts catalytically, (iodine, an alkyl or aryl halide, &c.), organo-magnesium halides of the general formula $C_{10}H_{17}MgX$ are obtained in good yield (80 to 85 per cent.); these possess the property of absorbing oxygen, forming complex products, which are converted into borneol by decomposition with dilute acids.—T. F. B.

German Patents.

Anhydrides of monobasic organic acids; Process for preparing ——. Verein f. Chem. Ind. Ger. Pat. 163,103, June 26, 1902. Addition to Ger. Pat. 161,882, March 30, 1902.

The mixture of alkali and alkaline-earth salts of the acid is treated with phosphoryl chloride or carbonyl chloride, instead of with sulphuryl chloride as in the principal patent (this J., 1905, 1323). The yields are stated to be much higher when the above modification is introduced, and the risk of the formation of mixed chlorides is avoided.—T. F. B.

Phenylglycin; Process of preparing ——. E. Lippmann. Ger. Pat. 163,515, June 9, 1903.

Phenylglycinamylester is saponified by heating with concentrated caustic soda solution, and the sodium salt of phenylglycin is then liberated by means of acid; the saponification had only been possible previously by the use of alcoholic alkali solutions. The yield by the above process is stated to be about 97 per cent. of the theoretical yield, whereas that from aniline and monochloroacetic acid is only about 33 per cent.—T. F. B.

1.3-Dialkylpyrogallol ethers, Process of preparing ——. Basler Chem. Fabrik. Ger. Pat. 162,658, June 16, 1903.

1.3-Dialkylpyrogallol ethers are obtained from the trialkyl ethers of gallic acid or of pyrogallol by heating under pressure with alkali or alkaline-earth hydroxides in aqueous or alcoholic solution. The products, which had formerly only been obtained in small quantity from beech wood tar, are applicable to the preparation of perfumes, photographic developers, dyestuffs and pharmaceutical preparations.—T. F. B.

Beech wood tar; Process for preparing an alkali-soluble product from —— which is solid at the ordinary temperature. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger Pat. 163,446, June 18, 1903. III., page 367.

Glyoxylic acid, its esters and amide, and phenylglycin and its derivatives; Process for preparing —— from oxalic acid and its derivatives by electrolytic reduction. Kinzlberger und Co. Ger. Pat. 163,842, Sept. 10, 1903.

Oxalic acid and its esters and amide, as well as its other derivatives which are capable of reduction, are reduced electrolytically, with a lead cathode, in presence of sulphuric acid (containing 2 to 90 per cent. of monohydrate), in a cell provided with a diaphragm. The current may be from 2 to 10 ampères per sq. m., and the temperature of the electrolyte must be kept low. Glyoxylic acid and its derivatives are produced in good yield. By replacing the oxalic acid by oxanilic acid or its derivatives, phenylglycin or one of its derivatives is produced.—T. F. B.

Esters from alcohols and phenols; Process of preparing ——. J. Houben. Ger. Pat. 162,863, Dec. 8, 1903.

This process is for the esterification of alcohols and phenols which are unstable under the ordinary conditions of preparation (*e.g.*, benzyl alcohol). The alcohol is added to an ethereal solution of an alkylmagnesium chloride, and after some time, the anhydride or chloride of the fatty acid, also in ethereal solution, is added, the mixture being cooled during the whole reaction. The following equations represent an instance of such an esterification:—

$$C_6H_5.CH_2OH + C_2H_5MgCl = C_6H_5.CH_2OMgCl + C_2H_6;$$
$$C_6H_5CH_2OMgCl + (CH_3CO)_2O = C_6H_5.CH_2O.COCH_3 + CH_3CO.OMgCl.$$

—T. F. B.

Condensation products from aldehydes and negatively substituted acetic acids; Process of preparing ——. E. Knoevenagel. Ger. Pat. 164,296, Jan. 23, 1904. Addition to Ger. Pat. 156,560, Dec. 16, 1902. (See this J., 1905, 689.)

Cyclic aldehydes are condensed with equimolecular pro-

water decompose :—$R.MgX + H_2O = R.H + Mg(OH)X$. Both pinene-magnesium hydrochloride and camphene-magnesium hydrochloride, when decomposed in this way, yield the same camphane, melting at 153° C. The magnesium compounds are readily produced by adding the respective hydrochlorides to a reaction previously started between magnesium and an organic halogen compound. Or, the hydrochloride can be added to an alkyl-magnesium halide already formed. With pinene hydrochloride 80—85 per cent. is converted into the magnesium compound, the rest chiefly into hydrodicamphene, $C_{20}H_{34}$. About 60 per cent. of camphene hydrochloride is converted into the magnesium compound, the rest into hydrodicamphene, which, as far as could be ascertained, was identical with that obtained from pinene. If pinene-magnesium hydrochloride be oxidised by the air and decomposed with water, borneol is the principal product, with some hydrodicamphene and a little isoborneol. Camphene-magnesium hydrochloride on oxidation and treatment with water gives 45 per cent. of alcohols, 2/3 borneol and 1/3 isoborneol, 21 per cent. of hydrodicamphene, and about 34 per cent. of camphene and camphane, but the camphane produced in every case is inactive. But borneol and hydrodicamphene whenever produced are active, if an active substance has been the starting point. The author concludes that pinene hydrochloride and bornyl chloride are identical. Also, that the chlorine atom in camphene hydrochloride is attached to the same atom to which chlorine is attached in pinene hydrochloride; and that borneol and isoborneol are stereoisomeric secondary alcohols. The products of the reaction were as a rule complex mixtures of the following compounds:—unchanged substance, pinene or camphene hydrochloride; camphane and camphene; borneol and isoborneol; hydrodicamphene. Details are given for the determination of their respective amounts.—F. Shdn.

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XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 339.)

APPARATUS, Etc.

French Patent.

Gases; Apparatus for [Automatic] analysis of ——. Monopol Betriebskontroll-Apparate K. Stembock. Fr. Pat. 359,352, Nov. 2, 1905. Under Int. Conv., Dec. 7, 1904.

The gas to be analysed, is aspirated through an inverted U-shaped tube, which serves to measure off the sample, and is contained in a vessel into which water is continuously flowing. When the water reaches a certain level in the vessel, the gas inlet- and outlet tubes become sealed off, and the measuring tube then contains a definite volume of the sample. As the water continues to rise in the vessel, the sample is driven over into a second vessel containing an appropriate absorbent liquid; the unabsorbed gas is led up into an inverted, graduated bell, floating in a non-volatile liquid, and the height to which the bell rises indicates the volume of the unabsorbed, and hence the percentage of absorbed gas. The apparatus is provided with an automatic device for registering on a diagram the proportion of absorbed gas; and various devices for automatically filling and discharging the apparatus, adjusting the pressures, &c., are described.—H. B.

INORGANIC—QUANTITATIVE.

Cadmium; Determination of ——. H. Baubigny. Comptes rend., 1906, **142**, 577—580.

Cadmium sulphide in contradistinction to all other cadmium salts, which are easily decomposed on heating, especially in contact with organic matter, can be heated for the incineration of the filter paper, without any loss of metal, to a temperature of 500° C., provided always that it contains neither traces of a volatile salt such as the chloride, nor an organic salt, which would decompose at this temperature. A very accurate method of estimating cadmium is based on this observation. (For details of method, see following abstract.)—E. F. A.

Cadmium; Determination of ——. H. Baubigny. Comptes rend., 1906, **142**, 792—793.

The solution of sulphate, containing not more (unless the amount of cadmium be considerable) than 2 c.c. of concentrated sulphuric acid per 100 c.c., is heated to from 85°—90° C., hydrogen sulphide is passed through it till it has cooled to 50°—55° C., and it is then allowed to stand for three to four hours. The precipitate thus formed, is very dense and readily removed from the precipitating vessel. It is filtered and washed with water (any sulphide adhering to the delivery tube is dissolved by hydrochloric acid, which is kept for use at a later stage), the filter dried by blotting paper, put damp into a porcelain crucible, which is placed in a porcelain capsule and carefully heated till the drying and charring of the paper are complete. Then the flame is increased, an inverted funnel being placed as a jacket round the crucible, till the filter ignites and burns away. The sulphide is then, after cooling, dissolved in the hydrochloric acid used to clean the delivery tube, and evaporated with a few drops of sulphuric acid, all these operations being conducted in the crucible. When the temperature reaches 400°—450° C., pure and stable cadmium sulphate remains, and is weighed after cooling.—J. T. D.

Hydrosulphites and hydrosulphite compounds; Determination of ——. A. Seyewetz and Bloch. Rev. Gén Mat. Col., 1906, **10**, 101—103.

When sodium hydrosulphite is added to a solution of silver chloride in excess of ammonia, there is an immediate precipitation of silver: $2AgCl + 4NH_3 + Na_2S_2O_4 + 2H_2O = 2NaCl + 2(NH_4)_2SO_3 + Ag_2$. The amount of silver produced, depends solely upon the amount of hydrosulphite present, and is not affected by the oxidation products, sulphites, bisulphites, or thiosulphates. The sodium hydrosulphite solution is added to four or five times the equivalent amount of silver chloride dissolved in excess of ammonia. The silver is collected, ignited, and weighed. The amount of formaldehyde-hydrosulphite, CH_2O, $NaHSO_2$, H_2O, present in "hyraldite" for instance, can be determined as follows: The solution is added to four times the equivalent quantity of silver chloride in excess of ammonia, and the mixture heated nearly to boiling for four to five minutes. The silver is collected and weighed. One molecule of the formaldehyde compound reduces 2 mols. of silver chloride.—F. Shdn.

Sodium sulphide; Analysis of commercial ——. R. Blondel. Bull. Soc. Ind. Rouen, 1906; Chem. Zeit., 1906, **30**, Rep. 94.

The novelty of the Battegay method consists in the ease with which the sulphide can be determined in presence of thiosulphate and other technical admixtures. The free alkali is first saturated with acetic acid, and a titrated solution of zinc sulphate is added, the end point being detected by means of cadmium sulphate paper. When the test paper no longer assumes a yellow tinge, the precipitation of the zinc sulphide is complete.—C. S.

Arsenic in wall-papers, fabrics, &c.; Note on the application of the electrolytic method to the determination of ——. T. E. Thorpe. Chem. Soc. Proc., 1906, **22**, 73.

Known quantities of the material, as a rule about 2 grms., are moistened with lime water, mixed with calcined magnesia, dried, and charred. The ash is treated with dilute sulphuric acid, half a grm. of potassium meta-bisulphite added, the solution boiled and diluted to a definite volume, and the whole or an aliquot portion, depending on the amount of arsenic suspected to be present, is added to the electrolytic arrangement already described (this J., 1903, 965). The deposit of arsenic so obtained is then compared with deposits obtained in precisely the same way by the addition of known quantities of arsenic, ranging from 0·005 to 0·0125 mgrm. of arsenious oxide, to materials free from arsenic, as in the method of testing brewing materials for arsenic already described (*loc. cit.*). A single incineration of the suspected material suffices for several tests. The amounts of lime-water and magnesia recommended to be used have been proved by direct experiment to retain amounts of arsenic ranging from 0·0025 to 5 mgrms. when contained in 2 grms. of wool or paper.

Many samples of woollen materials met with in commerce contain very notable quantities of arsenic, arising probably from the wide-spread use of arsenical dips.

Acid; Volumetric determination of free —— *in the presence of iron salts.* C. C. Ahlum. Chem. Soc. Trans., 1906, **89**, 470—473.

In the volumetric determination of free acid in chalybeate waters it is necessary to remove iron from the solution before titrating with alkali, as otherwise the colour change of the indicator is obscured. The method recommended by the author for separating the iron is based upon the fact that with ferric salts, sodium dihydrogen phosphate gives a precipitate of ferric phosphate, with simultaneous formation of free acid, according to the equation:—

$$Fe_2(SO_4)_3 + 2NaH_2PO_4 = 2FePO_4 + Na_2SO_4 + 2H_2SO_4.$$

100 c.c. of the acid solution containing iron salts are treated with excess of a 10 per cent. solution of sodium dihydrogen phosphate, the precipitate is filtered off, and the filtrate titrated with N/10 sodium hydroxide solution, using Methyl Orange as indicator. This gives the amount of free acid originally contained in the solution *plus* that liberated from the ferric salts present, and the latter quantity can be calculated from the proportion of ferric salts determined in a separate portion of the solution.

—A. S.

ORGANIC—QUANTITATIVE.

Dimethyl sulphate for determining tar oils in mixtures with rosin and mineral oils, and its behaviour towards fatty oils, oil of turpentine and pinoline. E. Valenta. III., page 366.

Malt analysis; Determination of extract values in —— by the refractometer. O. Mohr. Woch. f. Brau., 1906, **23**, 136—140.

The author has examined a large number of worts, obtained in the ordinary course of the analysis of malt by the standard German method, in the Zeiss immersion refractometer, and has compared the results with those of careful determinations of the extract values made by means of the pyknometer. The refractometer values of the extract were taken as the differences between the scale-readings for the worts and the scale-reading for pure water at the same temperature (17·5° C.). In this way the value of 1° increase of scale-reading was calculated in terms of degrees Balling determined by the pyknometer, and the average was found to be as nearly as possible 0·25° Balling. This factor can be used with confidence for the paler classes of malt, *i.e.*, those yielding worts of a colour below that corresponding to "type 40" on the German colour-scale. With malts of a darker colour than type 40, closer results are obtained if 0·04° Balling be subtracted from the calculated extract values. The greater divergence between the refractometer and the pyknometer extract values with dark malts, appears to be connected with the lower diastatic power of this kind of malt, and the divergences seem to be greater the lower the degree of saccharification obtained, *i.e.*, the lower the ratio of maltose to dextrin. It is open to question whether in such cases the error does not really lie in the pyknometric values rather than in the refractometer values. The above factor of 1° of refractometer increase = 0·25° Balling is only valid for worts of the usual concentration as obtained in malt analysis, *viz.*, from 7·5° to 8·6° Balling. It cannot be used for more dilute solutions, as in beer analysis, nor for more concentrated solutions, as in brewery worts. The value of the factor for the same wort increases as the concentration is decreased. For beer extracts the Ackermann slide rule has been designed, but for strong brewery worts no data are as yet available. Any observations in this direction should take into account not only the concentration, but also the maltose : dextrin ratio, representing the degree of saccharification.—J. F. B.

Milk; Determination of proteids in. A. Trillat and Sauton. Comptes rend., 1906, **142**, 794—796.

Five c.c. of milk are diluted with distilled water to 25 c.c., and boiled for five minutes; five drops of commercial formalin are added, and the liquid is again boiled for two to three minutes. After five minutes, 5 c.c. of 1 per cent. acetic acid are added, and the liquid is well shaken. The pulverulent precipitate is allowed to settle, then filtered off and washed, the fat is extracted from the contents of the filter by acetone in a Soxhlet apparatus, and the residual proteïds dried at 75°—80° C. and weighed. The method is applicable to diluted, skimmed, sterilised, or curdled milk, and the authors have proved that the whole of the proteïds are separated by the method, and that they undergo no change in composition or in weight. The fat, of course, can be determined after evaporation of the acetone.—J. T. D.

Coca leaves; Analysis of the alkaloids of Java ——. A. de Jong. Rec. trav. Chim. Pays-Bas, 1906, **25**, 1; Chem.-Zeit., 1906, **30**, Rep., 110—111.

The moisture is determined by heating 1 grm. of the alkaloids on the water bath. To determine the impurities the alkaloids are heated with 30 c.c. of 0·3-N barium hydroxide solution for two to three hours in a flask fitted with a condenser. The liquid is passed through a tared filter and the residue washed. After shaking the residue with dilute hydrochloric acid the insoluble portion is filtered off and weighed. The δ-isotropinic acid is extracted from the hydrochloric acid solution by shaking three times with ether and weighing the residue left on evaporating the ether. The undecomposed alkaloids are determined by adding excess of ammonia to the hydrochloric acid solution and shaking out with ether. The barium hydroxide filtrate, containing benzoic, cinnamic, and ε-isotropinic acids, is treated with 12 c.c. of N/1-sulphuric acid and shaken out three times with ether. The ether is shaken with 20 c.c. of barium hydroxide solution, through which carbon dioxide is passed to remove the excess of barium. After evaporation of the filtrate, the residue is dried at 110°—120° C. The barium salts of the acids are decomposed with 2—3 c.c. of concentrated hydrochloric acid and the almost insoluble ε-isotropinic acid is collected on a tared filter. The cinnamic acid in the filtrate is determined by means of bromine, and the benzoic acid by difference. In order to determine the bases and the γ-isotropinic acid, the sulphuric acid solution, after shaking out with ether, is treated with 20 c.c. of N/1-barium hydroxide solution, carbon dioxide passed through, and the liquid filtered. After partial evaporation, hydrochloric acid is added, causing the precipitation of γ-isotropinic acid, which is filtered off. The filtrate, after treating with excess of sulphuric acid, is again filtered and made alkaline. The pseudotropine is obtained by shaking out with chloroform, and the amount of ecgonine is determined by difference.
—F. Shdn.

Ethyl alcohol free from aldehyde; Preparation of —— for use in oil and fat analysis. F. L. Dunlap. XX., page 391.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 339.)

Xanthic leucomaines; Action of —— on copper. N. Slomnesco. Comptes rend., 1906, **142**, 789—790.

Theobromine, theophylline, urea, and probably other xanthic leucomaïnes, precipitate copper from its solution, in the cuprous condition. Probably this is not merely a case of simple reduction, but also one of combination of the copper with the bases; for when these bases are boiled with copper filings, precipitation of yellow hydroxide also occurs. The smallest trace of copper is precipitated by these reagents, and it is probably because of this precipitation in the organism, that small amounts of copper do not prove poisonous.—J. T. D.

English Patent.

Tobacco; Process for improving inferior qualities of ——. P. Hondius, Utrecht, Holland. Eng. Pat. 16,025, Aug. 4, 1905.

An extract is prepared from waste or residues (stalks, leaves and the like) of tobacco of better quality. This extract is evaporated to a syrup or more or less solid condition and can be used, when diluted, for impregnating inferior kinds of tobacco.—W. P. S.

Trade Report.

Truck Acts; Committee on the ——.

The Home Secretary has appointed a Committee to inquire into the working of the Truck Acts.

The Right Hon. Thomas Shaw, M.P., Lord Advocate for Scotland, is Chairman of the Committee, and the members are:—

Mr. E. A. Brotherton, M.P. for Wakefield (a chemical manufacturer);

Mr. F. Cawley, M.P. for the Prestwich Division of Lancashire (a bleacher and calico printer);

Mr. M. Delevingne, of the Home Office;

Mr. J. Ramsay Macdonald, M.P. for Leicester (Labour);

Mr. F. Maddison, M.P. for Burnley (Labour);

Mrs. H. J. Tennant; and

Mr. A. F. Yarrow, of the firm of Yarrow and Co., shipbuilders.

The terms of reference are "to inquire into the operation of the Truck Acts, and to consider and report what amendments, or extensions, of those Acts, or changes in their administration, are desirable; particularly whether fines and deductions from wages should be prohibited; and further, to consider and report whether the practice of shop assistants and certain classes of workpeople being lodged and boarded by their employers gives rise to abuses needing remedy by an extension of the Truck Acts or by other action of the State."

Correspondence on the subject should be addressed to the Secretary, Mr. T. E. Bettany, at the Home Office, Whitehall, S.W.

NATAL: IMPORT TRADE OF —— IN 1905.

Bd. of Trade J., April 12, 1906.

THE following are particulars of the imports into Natal during the years 1904 and 1905, the figures for each half-year being shown separately:—

Articles.	1904.		1905.	
	Jan.–June.	July–Dec.	Jan.–June.	July–Dec.
	1,000's of £.	1,000's of £.	1,000's of £.	1,000's of £.
Candles	30	27	23	27
Cement	28	20	13	24
Earthenware	31	26	28	32
Food and drink—				
Beverages (ale and beer, spirits and wine)	164	160	157	148
Sugar	51	52	117	37
Glass and glassware	37	43	34	41
Leather and leather manufactures	163	177	210	228
Nitrate of soda	—	40	39	27
Oils (paraffin, &c.)	74	60	62	80
Painters' colours	23	22	20	19
Paper	32	32	33	32
Soap	46	35	47	32

GERMANY: TRADE OF ——.

For. Off. Ann. Series, No. 3544.

THE following tables show the value of certain imports into and exports from Germany, during the last three years:—

Imports.

Articles.	In 1,000*l.*		
	1903.	1904.	1905.
Coal, coke and other fuel	8,113·7	8,381·7	10,136·8
Tar, pitch, resin, asphalt	2,267·2	2,414·6	2,504·4
Earths, ores, precious metals	26,683·8	37,426·3	28,834
Iron and manufactures of iron	2,815·5	3,046·9	3,156·5
Tin and manufactures of tin	1,813·5	1,870·6	1,757
Copper and manufactures of copper	6,612·1	8,439	8,273·4
Zinc and manufactures of zinc	559·6	610·2	682·2
Lead and manufactures of lead	666·6	784·4	996·3
Drugs, dyestuffs, chemical products	13,718·8	14,902·6	15,896·9
Leather and manufactures of leather	3,471·7	3,484·8	3,568
Oils and fats	11,446·3	11,358·5	12,510·6
Petroleum	5,529·1	5,037·4	5,036·6
Indiarubber wares	4,680·3	6,115·1	7,379·6
Paper, cardboard and wares thereof	903·4	1,249·6	1,086·8
Hides and skins	16,491·9	17,452·7	18,965·5

Exports.

Articles.	In 1,000*l.*		
	1903.	1904.	1905.
Coal, coke and other fuel	14,399·2	14,957·2	15,096·5
Tar, pitch, resin, asphalt	675·8	740·7	834·1
Earths, ores, precious metals	9,488·9	8,662·4	9,899·5
Iron and manufactures of iron	31,718·1	29,116·1	33,126·4
Tin and manufactures of tin	633·2	717·9	744·1
Copper and manufactures of copper	7,821·9	9,046·4	10,307
Zinc and manufactures of zinc	2,122·7	2,460·6	2,413·6
Lead and manufactures of lead	895·5	822·1	979·4
Drugs, dyestuffs, chemical products	19,698·8	20,637·3	23,196·3
Leather and manufactures of leather	8,638·3	9,188·1	9,665·3
Oils and fats	2,345·8	2,747·6	2,631·6
Petroleum	86·3	108	132·3
Indiarubber wares	3,144·4	3,486·5	4,616·4
Paper, cardboard and wares thereof	6,095·2	6,358·3	7,158·8
Hides and skins	7,418·3	8,322	9,548·5

New Books.

"THE GAS WORLD" ANALYSES OF ACCOUNTS OF GAS UNDERTAKINGS, 1904—5. John Allan and Co., offices of "The Gas World," 3, Ludgate Circus Buildings, London, E.C. Price 7s. 6d. net.

THIS work takes the form of a bound collection of sheets, which run from I. to IV. SHEET I. contains a tabulated account of the Gas Undertakings for 1904—5, of all the principal towns and cities in Great Britain and Ireland, and the particulars given relate to (i) Coal Carbonized; (ii) Gas made and sold; (iii) Yield of Residuals; (iv) Public Lamps; (v) Mileage of Mains; (vi) Consumers; (vii) Price of Gas; (viii) Illuminating Power; (ix) Financial Results; (x) Revenue. SHEET II. The particulars here relate to:—(i) Manufacturing Charges; (ii) Rates and Taxes; (iii) Distribution Charges; (iv) Management Charges; (v) Bad Debts; (vi) Capital Paid-up; (vii) Capital per ton and per thousand; (viii) Reserve Funds. SHEET III. *Continuation of Sheet I.* SHEET IV. *Continuation of Sheet II.*

THE CYANIDE INDUSTRY. Theoretically and Practically considered. By R. ROBINE and M. LENGLEN, both Chemical Engineers, and the latter "Laureat" of the Conservatoire Nat. des Arts et Métiers; Director of Works, &c. Translated by J. A. Le Clerc, Ph.D. With an Appendix by C. E. Munroe, Ph.D. John Wiley and Sons, New York. 1906. Price 17s. net. Chapman and Hall, Ltd., London.

8vo volume, containing 330 pages of subject matter with 25 illustrations, and followed by an appendix of patents (abstracts) filling 70 pages, and thereafter the alphabetical index. The subject matter is sub-divided as follows:—PART I. CHEMISTRY OF CYANOGEN AND ITS DERIVATIVES. (i) General Considerations; (ii) Physical and Chemical Study of Cyanogen and its Derivatives; (iii) General Properties and Methods of Determination of the Various Cyanide Compounds; (iv) Thermo-chemical Data of the Cyanide Compounds. PART II. PRESENT CONDITION OF THE CYANIDE INDUSTRY. PART III. METHODS OF MANUFACTURING CYANIDE COMPOUNDS. (i) Non-synthetic and Synthetic Processes, also Special Processes; (ii) Manufacture of Ferrocyanides; (iii) of Ferricyanides; (iv) of Sulphocyanides; (v) of Prussian Blue and various other Compounds. PART IV. USE OF CYANOGEN COMPOUNDS.

SCIENCE AND THE MANUFACTURER. By Keith Quinton. Guilbert Pitman, 85, 86 and 87, Fleet Street, London, E.C. 1906. Price 2s. net.

SMALL 8vo volume, containing 86 pages of subject matter with ten half-tone illustrations. The contents are as follows:—I. General and Preliminary. II. The Training of the Expert. III. Examples of Manufactures—(1) Colours; (2) Oils and Varnishes; (3) Metals; (4) Cements, Bricks and Roads; finally, a description of an ideal Technical Laboratory.

AN INTRODUCTION TO CHEMICAL CRYSTALLOGRAPHY. By P. GROTH. Professor of Mineralogy and Crystallography in the University of Munich. Authorised Translation by Hugh Marshall, D.Sc., F.R.S. Gurney and Jackson, London. 1906. Price 4s. net.

SMALL 8vo volume, containing 118 pages of subject matter, and an alphabetical index. There are six illustrations. The matter is classified as follows:—I. Crystal Structure and its Possible Varieties. II. Polymorphism. III. Comparison of the Crystal Structure of Chemically allied Substances (Morphotropy). IV. Isomorphism. (A) Similarity of Crystal Structure in Substances possessing Analogous Chemical Constitution; (B) Relations between Crystals and Solutions of Isomorphous Substances; (C) Isomorphous Mixtures, &c. V. Molecular Compounds. VI. Racemic and Optically Active Compounds.

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DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

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When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the journal depends.

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Death.

Lease, Jos., 3, Lord Street West, Southport. April 28.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 9032. Fullerton, Hodgart and Barclay, Ltd., and Liversedge. Evaporators, heating, boiling and vacuum pans, stills and the like. April 17.

,, 9305. Szek and Schauli. Rotary and like dryers. April 20.

,, 9502. Loew. Filters.* April 23.

,, 9803. Richter. Apparatus for aspirating, treating and forcing fluids.* April 26.

,, 9820. Kunick. Process for drying liquid mixtures. April 27

[C.S.] 14,379 (1905). Boult (Milwaukee Evaporator Co.). Vacuum pans and like evaporators. May 2.

,, 14,571 (1905). Prosser and Upton. Calcining kilns. May 2.

,, 15,024 (1905). Allen. Furnaces. April 25.

,, 18,833 (1905). Boult (Goldman and Co.). Filters. April 25.

,, 19,385 (1905). Theisen. Treatment of liquids and semi-liquids for evaporating, distilling, concentrating and like purposes, with continuous re-utilisation of the heat employed. May 2.

,, 20,318 (1905). Brown. Construction of regenerative furnaces. April 25.

II.—FUEL, GAS, AND LIGHT.

[A.] 9121. Boult (Soc. in Partecipazione per la Combustione Liquida). Hydrocarbon fuel burners or furnaces.* April 17.

,, 9307. Hoseason. Manufacture of incandescent mantles for gas burners. April 20.

,, 9327. Seymour. Coke ovens. April 20.

,, 9395. Radcliffe. *See under* III.

,, 9501. Tait. Gaseous fuel for generating motive power.* April 23.

,, 9701. Cox. Carburetting apparatus. April 25.

,, 9773. Holmes. Apparatus for extracting tar from illuminating gas. April 26.

,, 9800. Bécigneul. *See under* VII.

,, 9988. Fairweather (G. Seyfarth und Sohn). Gas producers.* April 28.

[C.S.] 7713 (1905). Elworthy and Williamson. Manufacture of gas for illuminating, heating or power purposes. April 25.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows —
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the journal depends.

Bowman, Dr. F. H., l/o Deansgate; 4, Albert Square, Manchester.

[C.S.] 11,986 (1905). Garroway. Manufacture of pure sulphur dioxide and Glauber salts. April 25.

,, 17,886 (1905). Raschen, Wareing, and United Alkali Co. Treatment of gases containing arsenious chloride and the obtainment of arsenious acid therefrom. May 2.

,, 1204 (1906). Lake (Nordyke and Marmon Co.). Catalytic apparatus. May 2.

,, 2929 (1906). Simes and Bowes. Recovery of cyanogen compounds from crude gases and from by-products in the manufacture of cyanides. May 2.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 9281. Jones. Glazing and enamelling kilns. April 19.

[C.S.] 17,292 (1905). Wagner and Hermsdorf. Process for enamelling iron or steel goods. April 25.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 9318. Hamer. Treatment of plaster of Paris and of mixtures or compositions containing plaster of Paris as the chief constituent. April 20.

,, 9405. Coppen. Process for hardening and strengthening plaster of Paris and the like. April 21.

,, 9666. Morgan. Utilisation of slate waste. April 25.

,, 9785. Berglund. Manufacture of bricks of calcareous sand or the like. April 26.

[C.S.] 8285 (1905). Bruhn. Preliminary treatment of blast furnace slags for the production of cementitious material. April 25.

,, 8804 (1905). Thom. Manufacture of artificial marble and stone. May 2.

,, 9610 (1905). Goldschmidt. Refractory substance for lining crucibles for alumino-thermic processes. April 25.

,, 15,796 (1905). Jaspart. Manufacture of artificial stone. April 25.

X.—METALLURGY.

[A.] 9210. Malden and Malden. Process for consolidating finely divided ore materials.* April 18.

,, 9287. Casper. Recovery of copper from solutions. April 19.

,, 9288. Casper. Apparatus for use in the recovery of copper from solutions containing it. April 19.

,, 9289. Casper. *See under* XI.

,, 9339. De Bechi and Rücker. Treatment of complex sulphide ores. April 20.

,, 9426. Savelsberg. Smelting ores. April 21.

,, 9453. Wallis and Wallis. Manufacture of cast iron. April 23.

,, 9606. Murdock. Rotary converters. April 24.

,, 9687. King. Nodules of metalliferous material. [U.S. Appl., May 4, 1905.]* April 25.

[A.] 9750. O'Brien (Chambaud). Aluminium alloys.* April 26.

,, 9799. Grönwall. Heating, smelting or reducing materials. [Swed. Appl., May 8, 1905.]* April 26.

,, 9868. Dott. Metallic alloys. April 27.

,, 9913. MacIvor, Fradd, and The Metals Extraction Corporation, Ltd. Treatment of garnierite, nickel ores, or oxidised mattes containing nickel and cobalt. April 27.

,, 9914. MacIvor, Fradd, and The Metals Extraction Corporation, Ltd. Treatment of sulphide nickel ores containing arsenic or antimony. April 27.

,, 9971. Poulenc. *See under* VII.

,, 9981. Sulman. Ore concentration. April 28.

,, 9996. Defays. Manufacture of steel in Martin furnaces. [Belg. Appl., April 29, 1905.]* April 28.

[C.S.] 6255 (1905). MacIvor and Fradd. Treatment of ores containing nickel. May 2.

,, 21,762 (1905). Howard. Mechanical roasting or desulphurising furnaces. May 2.

,, 25,976 (1905). Johnson (Saponia-Werke F. Boehm). Material for cleaning and protecting metal. May 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 9164. Petersson. Electric furnaces for treating gases by means of electric arcs. [Swed. Appl., April 18, 1905.]* April 18.

,, 9279. Johnson (Badische Anilin und Soda Fabrik). Production of long, stable electric arcs. April 19.

,, 9289. Casper. Electro-deposition of metals. April 19.

,, 9393. L'Hommedieu. Electroplating apparatus. [U.S. Appl., April 22, 1905.]* April 21.

,, 9425. Cowper-Coles. Apparatus for the manufacture of iron tubes by electro-deposition. April 21.

,, 9435. Hille und Muller. Treatment of sheet metal and depositing metallic coatings thereon by electrolysis.* April 21.

,, 9706. Atkins. Electrolytic apparatus. April 25.

,, 9959. Gauntlett. Deposition of metals or metallic compounds on, and their combination with metals or metallic articles. April 28.

[C.S.] 5721 (1905). Parker. Electric furnaces. April 25.

,, 8721 (1905). Westdeutsche Thomas-Phosphat-Werke. Preparation of nitrogen-oxygen compounds by means of electricity. May 2.

,, 8836 (1905). De Frise. Ozonising apparatus. May 2.

,, 25,174 (1905). Soc. Anon. Electrometallurgique (Proc. P. Girod). Electric furnaces. May 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 9202. Carter and Newell. Oils used for lubricating purposes. April 18.

[A.] 9206. Haenflein and Kornfeld. Treatment of lubricating and other oils. April 18.

[C.S.] 15,231 (1905). Ridgill. Extraction of oil and fatty matters from substances containing them. May 2.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A.)—PIGMENTS, PAINTS.

[A.] 9989. Meister, Lucius und Brüning. *See under* IV.

[C.S.] 9017 (1905). Chatillon. Preparation of antimonial substances used for painting and other purposes. May 2.

,, 9017A (1905). Chatillon. Preparation of products of antimony for painting and other purposes. May 2.

,, 589 (1906). Ullrich. Fast lime colour. April 25.

(B.)—RESINS, VARNISHES.

[C.S.] 8590A (1905). Noordlinger. *See under* III.

,, 23,744 (1905). Meyer. Process for removing resin from the surface of rattan. May 2.

(C.)—INDIA-RUBBER.

[A.] 9290. Wilderman. Manufacture of rubber. April 19.

,, 9598. Richards and Stevens. Process for removing organic impurities from crude rubber. April 24.

,, 9627. Wheatley. Treatment of india-rubber substitutes. April 24.

[C.S.] 7705 (1905). Morisse. Direct utilisation of the lactiferous juices of caoutchouc, gutta-percha and balata. April 25.

XIV.—TANNING; LEATHER, GLUE, SIZE, ETC.

[A.] 9622. Soc. Franç. La Norgine. Preparation of a soluble glutinous substance in a dry and neutral state from tang acid. [Fr. Appl., May 23, 1905.]* April 24.

,, 9629. Pichard and Pichard. *See under* VI.

,, 9893. Lake (Barron). Machines for treating hides, skins and the like.* April 27.

XV.—MANURES, ETC.

[A.] 9029. Fels and Garry. Manufacture of guano and fertilisers from fish, fish waste, animal waste, and like materials. April 17.

,, 9513. Savigny and Savigny. Manufacture of superphosphates of nitrated limes. April 23.

,, 9944. Von Seth. Manure. April 28.

,, 9961. Hill-Jones. Fertilisers. April 28.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 9416. Fokányi, de Tornyay and Weiser. Process for drying molasses and molasses foodstuffs. April 21.

[A.] 9808. Dessau. Substance produced from the fumes of certain sapotaceæ. April 26.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 9205. Monti. Process for preparing concentrated worts, juices, syrups and scented extracts. April 16.

,, 9886. Pollak. Conversion of diastatic malt extracts into solid form for rendering the same durable.* April 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

[A.] 9205. Monti. *See under* XVII.

,, 9292. Coopman. Manufacture of butter. April 19.

,, 9416. Fokányi, de Tornyay and Weiser. *See under* XVI.

,, 9889. Laves. Preparation of easily soluble iron albuminoid and durable iron albuminoid solutions. April 27.

,, 10,004. Hansen and Schilbred. Preservation of food. [Appl. in Norway, May 1, 1905.]* April 28.

,, 10,007. Ahrens. Preservation of raw meat.* April 28.

C.S.] 27,081 (1905). Pink. Bread-making and a stimulant for yeast applicable thereto. April 25.

XIX.—PAPER, PASTEBOARD, ETC.

[C.S.] 7766 (1905). Stephan (Rolier). Coating and drying of paper. April 25.

,, 12,413 (1905). Binns. Manufacture of paper. April 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 9183. Newton (Dr. Wolters Phosphat Ges.). Production of easily soluble compounds of phosphoric acid and silicic acid.* April 20.

,, 9205. Monti. *See under* XVII.

,, 9270. Bibus and Scheuble. Manufacture of esters. April 19.

,, 9707. Wolff. Production of an anæsthetic.* April 25.

[C.S.] 7840 (1905). Clemmensen and Heitmann. Hypnotic compouds. April 25.

,, 9404 (1905). Haworth and Baker. Manufacture of carbon tetrachloride and sulphur chloride. May 2.

,, 19,352 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of diamides of dialkylmalonic acids. May 2.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 9100. Mills (Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils). Sensitive plate for colour photography.* April 17.

[C.S.] 3165 (1905). Kelly. Development of photographic plates, films and the like. April 25.

„ 7693 (1905). Robicsek. Manufacture of sensitised gelatin emulsion papers. April 25.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 9791. Vender. Method for making plastic horny explosives. April 26.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 17,708 (1905). Hartung. Apparatus for use in gas analysis. May 2.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. Full particulars will be announced later.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see Journal for April 30th, p. 341) will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Eustace Carey has been nominated to the office of President under Rule 8; Dr. E. G. Love, Mr. A. Gordon Salamon, and Mr. Chas. Wightman have been nominated Vice-Presidents under Rule 8; and Dr. E. Divers, F.R.S., has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's office, at least one month before the date of the Annual General Meeting, at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

ALTERATION OF BY-LAWS.

With a view to facilitate the voting of members residing abroad, notice is hereby given, in accordance with Rule 35 of the By-laws, that the Council will propose to the forthcoming Annual General Meeting the amendment of the Society's By-laws as follows:—

1. Rule 18. (*a*) That the words "At least two months before the date of each Annual General Meeting," in the first and second lines thereof, be replaced by the words, "In the second issue of the Society's Journal for the month of April in each year."

(*b*) That the words "date of that meeting," in the fourth line thereof, be replaced by the words "Annual Meeting next ensuing."

(*c*) That the words "At least one month before the date of;" in the sixth line from the end thereof, be replaced by the words "not later than the last day of May prior to."

2. Rule 19.—That the words "at least five days before the commencement of the said meeting," in the two last lines thereof, be replaced by the words, "in the second issue of the Society's Journal for the month of May."

Death.

Leese, Jos., 3, Lord Street West, Southport. April 28.

Canadian Section.

Meeting held at Toronto, on Friday, April 6th, 1906.

DR. E. J. SMALE IN THE CHAIR.

THE DETERMINATION OF BORIC ACID, ALONE AND IN THE PRESENCE OF PHOSPHORIC ACID.

By [illegible] and [illegible].

[illegible] method, depends on the formation of [illegible] over a weighed quantity of calcium oxide, [illegible] ester is decomposed and the boric acid [illegible] after ignition, is calculated by increase of [illegible].

Berzelius' method, used and recommended by Thaddeeff (2), depends on the formation of [illegible] borofluoride from the distilled trimethyl [illegible]; its accuracy is, however, found to be doubtful [illegible] the imperfect insolubility of the compound [illegible]. Other methods, such as that of Partheil and Rose (3) and that of Mylius and Meusser (4), are pronounced "unsatisfactory," "complicated" and "tedious."

This paper deals primarily with the separation of boric acid as the trimethyl compound and its subsequent gravimetric estimation as the barium salt. The first series of experiments is connected with this, the second has reference to volumetric methods of estimating boric acid in the distillate, and the last deals with the direct titration in mixtures of other acids.

1.—In order to determine, first, if boric acid is completely expelled as the trimethyl salt by distillation, quantities of from 0·5 to 1·5 grms. of boric acid (5) were placed in a retort, 250 c.c. of methyl alcohol added and the mixture distilled at a temperature of from 66° to 67° C. when it was found that after distillation at this temperature for an hour the residue in the retort contained only a small proportion of boric acid and, after one and a-half hours, none could be detected.

The estimation of the boric acid, thus expelled as the trimethyl compound, with barium chloride solution was proceeded with. Known amounts of boric acid were dissolved in methyl alcohol (6), placed in a retort, and the distillate allowed to mix with a concentrated aqueous solution of barium chloride. The trimethyl borate reacts with the water according to the equation—

$$B(OMe)_3 + 3H_2O = B(OH)_3 + 3MeOH.$$

The boric acid thus liberated reacts with the barium chloride to form barium borate and free hydrochloric acid in which the former dissolves. Caustic alkali was then added and the resulting precipitate of barium borate, $Ba(BO_2)_2$, washed with alcohol till free from all traces of chlorides, dried at 110° C. and weighed on a tared filter. The resulting weights of precipitate were in all cases too high and this was found to be due to the presence of barium hydroxide which was precipitated on concentrating the solution from filtration (6). The proceeding was then modified to obviate this, and the liberated hydrochloric acid in the reaction—

$$2B(OH)_3 + BaCl_2 = Ba(BO_2)_2 + 2HCl + 2H_2O$$

neutralised accurately by means of semi-normal sodium hydroxide with phenolphthalein as indicator. The use of this strong solution of sodium hydroxide—and also of barium chloride—was necessary to prevent the solution of part of the barium borate in water, in which it was found to be appreciably soluble. Weighing the precipitated barium salt gave results corresponding to 99·93 per cent. of the theoretical.

Being now fully satisfied with the accuracy of the method, determinations of the boric acid in pure borax were undertaken. Amounts of borax of about 1 grm. were weighed out, mixed carefully with from 20 to 25 c.c. of concentrated sulphuric acid and added to 250 c.c. of methylated spirit (6) contained in a retort. An excess of sulphuric acid was found to be necessary to prevent the reprecipitation of the salt by the alcohol. The mixture was then subjected to distillation at a temperature of from 65°—70° C. and it was found advisable to keep the bulk of the alcoholic solution approximately constant by leading into the retort from a distilling flask a fresh supply of spirit. About 30 minutes sufficed to drive over most of the boron compound, but usually it was found to be necessary to continue the distillation for longer. A period of one and a half hours was adopted above as the best time for the operation. The estimation of the boric acid was then carried out as

Wt. of borax taken.	Wt. of $Ba(BO_2)_2$.	Percentage found.
0·9738 grm.	1·1262	99·0
0·9700 ,,	1·1270	99·4
0·9384 ,,	1·0900	99·6

The presence of any appreciable comparative amount of water in the retort is to be avoided, as the trimethyl borate would then be decomposed, yielding the alcohol and boric acid, which would not distil over; the result would then be too low.

This method was further applied to mixtures containing phosphates and sulphates in addition to borates with perfectly satisfactory results.

2. *Volumetric estimation with previous distillation.*—As boric acid can be titrated with standard sodium hydroxide in the presence of glycerine, and the end-points in the formation of sodium borate indicated by phenolphthalein, several determinations were tried after decomposing the borate in alcoholic solution with sulphuric acid. The apparatus used was the same as in the previous experiments: the distillate was collected in water, made up to a litre and aliquot portions taken for titration. To each portion thus taken it was found necessary to have about one-third of the bulk of the solution glycerine[10]. The results of the titration gave 99·75 per cent. of the boron compound, this error—0·25 per cent.—being considerably less than the literature on the subject would lead one to expect.

3. *Direct volumetric estimation in the presence of phosphates and sulphates.*—A mixture of a phosphate, a sulphate[11] and a borate were treated with decinormal sulphuric acid till acid to Methyl Orange, thus setting free phosphoric and boric acids. Decinormal sodium hydroxide was then run in until the solution was neutral to Methyl Orange, which was found only to indicate the end of the formation of the sodium dihydrogen phosphate; a still further amount of alkali had to be added before the solution began to react alkaline with phenolphthalein showing that the disodium compound had been formed [12]. The boric acid not being neutralised at once in aqueous solution by alkali, glycerine was then added, and the titration of the boric acid completed. The results are given below from which the accuracy of the method may be seen:—

Amounts of $Na_2B_4O_7,10H_2O$.	Amount formed by titration as above.	Per cent.	Error.
0·2390 grm.	0·2385 grm.	99·82	0·18
0·2990 ,,	0·2986 ,,	99·85	0·15
0·3824 ,,	0·3823 ,,	99·95	0·05
	Average	99·88	0·126

An error avoided here by titrating the solution previously with the sodium hydroxide till neutral or faintly alkaline, is the quantity of alkali of necessity absorbed by the water before the first trace of alkalinity is apparent. Experiments showed this to be an appreciable amount: in the case of 50 c.c. alcohol and 50 c.c. water, 0·0016 grm. potassium hydroxide was required.

The authors intend applying these methods to the determination of boric acid in food stuffs.

(1) 1905, 809.
(2) See Gooch, Ann. Chem. J., 9, 23—33, and Montemartini Gazz. chim. ital., 26, 344—348.
(3) This J., 1896, 953.
(4) See (2) and (3).
(5) Ber., 1901, 3611.
(6) Ber., 1904, 397, and this J., 1904, 269.
(7) The composition of the boric acid employed—whether $B(OH)_3$, HBO_2 or $H_2B_4O_7$—was determined by estimating the amount of B_2O_3 contained in it. A weighed amount of boric anhydride, formed by fusing the boric acid to a clear glass, was dissolved in water and titrated against potash with phenolphthalein as indicator. A weighed amount of boric acid was also titrated against the same potash. Hence the percentage of B_2O_3 in the acid used was found. In these titrations—and all subsequent ones in the second part of this paper—25 to 30 per cent. of glycerine was used, as it is found that the neutralisation of boric acid by alkali cannot be done with any degree of accuracy except in the presence of glycerine or other polyatomic alcohol. (R. T. Thomson, this J., 1898, 432.)
(8) Ordinary methylated spirits (free from mineral oil) were found to act equally well.
(9) Pure sodium hydroxide was used, prepared from metallic sodium.
(10) See note (7). Also J. Amer. Chem. Soc., 1898, 288. The determinations were done before the above papers were noticed.
(11) The sulphate might have been omitted, as it took no part in the subsequent reaction.
(12) A strong solution of disodium hydrogen orthophosphate is slightly alkaline to phenolphthalein. Comparative experiments were made with varying amounts of a saturated solution of this salt and equal quantities of water; phenolphthalein added to each and decinormal potassium hydroxide added to the water till the shades of pink were identical:—

Phosphate solution in c.c.	Alkali required for 50 c.c. of water.
0·00	0·02 c.c.
0·50	0·06 ,,
1·00	0·08 ,,
2·00	0·09 ,,
3·00 made up	0·10 ,,
4·00 to 50 c.c.	0·11 ,,
5·00	0·12 ,,
6·00	0·12 ,,
7·00	0·12 ,,
8·00	0·12 ,,

For most solutions of this salt, therefore, a deduction of 0·1 c.c. would be the maximum correction necessary.

London Section.

Meeting held at Burlington House, on Monday, April 2nd, 1906.

MR. A. G. SALAMON IN THE CHAIR.

THE RÖSE-HERZFELD AND SULPHURIC ACID METHODS FOR THE DETERMINATION OF THE HIGHER ALCOHOLS. A CRITICISM.

BY V. H. VELEY, F.R.S.

The methods for determining the alcohols of higher molecular weight than ethyl alcohol (sometimes, though not always, generically classified as fusel) in various spirits have recently become of special importance.

The two methods adopted most officially are those of Röse-Herzfeld, originally described about 20 years ago (1) and recognised in this country, Germany and Switzerland, and the sulphuric acid method adopted in France, consequently practised in this country and officially used as a general qualitative test for the purity of all kinds of alcohol in Russia.

In the present communication it is proposed to give a brief account of various experiments made to determine the accuracy, or otherwise, of these two rival processes, and also to pass such a criticism upon each as may be considered justified by three or four years' experience.

Proportion of higher alcohols in various kinds of fusel.—If the higher alcohols be reckoned in terms of 100, the proportions of each vary within the following wide limits, according as the spirit is obtained from some kind of grain, potatoes, wine, grape skins, &c.:—

Alcohol (2).	Percentage proportion.
Primary propyl	0·1 to 6·8
Primary butyl	0·0 to 62·8
Isoprimary butyl	0·4 to 24·3
Isoprimary amyl (two)	68·8 to 99·5
Hexyl	Trace
Heptyl	Trace
Glycerol	Trace
Isobutylene glycol	Trace

In the case of spirit obtained from the same source variations are produced by different yeasts or bacteria originally present or accidentally introduced, especially Granulobacter saccharobutyricum (Beijerinck) [*Bacillus hamosus* (Migula)].

Experimental work—Preparation of control ethyl alcohol.—Ethyl alcohol, purchased from Kahlbaum as of 99·8 per cent. per volume, was purified by the method adopted by Stutzer (3), namely, by fractional distillation with soda, the only difference being that a fragment of the solid hydrate was used instead of a few drops of solution.

The first and last portions of the distillate, namely, 25 per cent., each were rejected; the middle portion of 50 per cent collected and redistilled in a similar manner. The middle portion of the second distillation was used as the control spirit. This alcohol sometimes contained traces of aldehydes when tested with Guyon-Schiff's reagent made up with acid fuchsin (sodium salt of rosaniline sulphonic acid), which appears to be more delicate than the same reagent made up with ordinary fuchsin (rosaniline hydrochloride) (4).

It is possible that, though the aldehydes in the original spirit were decomposed by the soda, traces were reformed by aerial oxidation of the alcohol vapour as observed by Ilges. If this is the case the substitution of freshly precipitated silver oxide for the soda as recommended by Winkler (5), (while the present work was in progress), would not improve matters.

Purification of higher alcohols.—The following higher alcohols were used in the course of the investigation: primary propyl, primary and isoprimary butyl, two samples of fermentation amyl (obtained from (1) grain and (2) wine) and glycerol. All the samples were purchased from Kahlbaum with the exception of the sample of amyl alcohol obtained by the fractional distillation of wine, for which I am indebted to the courtesy of Mons. Ordonneau.

All these samples, except the last, were fractionally distilled and the portions coming over at the following boiling points were used for the investigation:—

Alcohol.	B.Pt. (corr.).
Primary propyl	96·3— 97·3
Primary butyl	116·3—117·0
Isoprimary butyl	108·0—108·1
Amyl (grain)	129·5—130·2
Amyl (wine)	128·5—129·5

The glycerol (sp. gr. = 1·26) was reckoned to be of 98 per cent. strength according to the table of Gerlach (6). Standard solutions of these several alcohols were made up to contain 0·5 grm. per litre (1/2000) in control alcohol of 50 per cent. per volume, or 100 grms. higher alcohol in 100,000 c.c. absolute ethyl alcohol.

These solutions were used directly for the sulphuric acid method, but for the Röse-Herzfeld method they were diluted with the quantity of water required to reduce to 30 per cent. per volume.

Determination of sp. gr. at 15° C.—As accuracy in the determination of the specific gravity of the spirit is one of the most important factors in the Röse-Herzfeld method, the modified form of Sprengel's pyknometer and method of weighing described in a previous communication (6) were adopted.

A Bunge's short-beam balance, fitted with a telescope for reading 0·1 mgrm. was used, and the weights standardised, as against a 10 grm. weight. The temperature was recorded by a thermometer graduated to 0·1 C., the various calculations of which have been previously described (7). A difference of 0·5 mgrm in two weighings of the pyknometer corresponded to a difference in value of 0·000022 in specific gravity of a 30 per cent. alcohol solution.

Calibration of the Röse-Herzfeld apparatus.—Each apparatus used was calibrated for every 0·2 c.c. by dropping in distilled water from a pipette, which delivered this volume of water at 15° C., and tables of corrections drawn up. Since the apparatus, as usually made, is graduated to 0·02 c.c., there might be an error of reading of 0·01 c.c., which corresponds to 0·022 per cent. fusel = 22 parts per 100,000, according to the table of Sell (8).

The process.—It is not, of course, necessary to describe the process, which is given more or less fully in various manuals, but it may be worth while to deal with certain precautions and to add a few personal observations.

(1) *The chloroform.*—This was sheltered from light by keeping the containing bottle in a black paper mantle; even though each separate sample may be tested in a control experiment, yet this is a very necessary precaution, as it is well known that chloroform, as other chloro-derivatives of hydrocarbons, decomposes slightly and slowly even in diffuse sunlight with liberation of hydrochloric acid. The result of using such acid containing chloroform would be that, besides the sulphuric acid purposely added (1 c.c. sp. gr. = 1·268, 35·5 per cent. H_2SO_4 at 15/15), there would be extracted by the aqueous spirit the hydrochloric acid, which would affect the rise of the chloroform column.

Though the effect of hydrochloric acid on the mutual solubility of chloroform and water has not apparently been a subject of investigation, yet it would follow as a logical consequence of the work of Wright (9) and Schreinemaker (10) on the mutual solubilities of chloroform, water and acetic acid and of chloroform, water and alcohol that an error in the determination would be introduced. Further, it has been shown by Gelsthait (11) that the presence even of carbonic acid, as in the spirit manufactured from maize, does affect the rise of the chloroform, and hence, the determination.

(2) *Method of working.*—It is not, of course, necessary to describe the process of cleansing with concentrated sulphuric acid and other details, but it may be worth while to put on record two observations:—

Firstly. If, after shaking, the chloroform is allowed to drop very slowly from the upper to the lower bulb, a more distinct line of demarcation between the chloroform and aqueous layer is obtained.

Secondly. My observations are in accordance with those of Grünheit (12) that, after the manipulation has been completed the chloroform slowly contracts, sometimes requiring an hour before a constant level is reached; this is more especially the case for distillates obtained from spirits of commerce, brandy, whisky, &c.

Disadvantage of the method.—This lies in the fact that if b is the rise of the chloroform in the blank experiment with the control spirit, and a, the rise with the fusel containing spirit, then the difference $a-b$, the basis of the determination is in most cases very small compared with a and b. In the case of an atomic weight determination this disadvantage would be considered fatal.

Results obtained with various higher alcohols.—It has been shown that the fusel obtained from various sources gives approximately the same value per unit weight fusel per unit volume alcohol, if the results are expressed in terms of amyl alcohol, the predominating substance. As above stated, it has been thought desirable to examine each of the higher alcohols separately, and the results are given in the table as under in column (I.) the alcohol used, in (II.) the difference of sp. gr. from 0·996575 in 10^{-6}, in (III.) the value of $(a-b)\times 2·22\times 1000$, namely, grammes per 100,000 absolute alcohol found, in (IV.) the amounts purposely introduced. The difference between the values of (III.) and (IV.) is the error:—

I.	II.	III.	IV.
Primary propyl	+25	134·0	100·0
do. butyl	—27	196·0	100·0
do. do.	—45	222·0	200·0
Isoprimary butyl	—25	89·0	100·0
do. do.	—45	177·5	200·0
Amyl (from grain)	—5	115·0	100·0
do. (from wine)	+5	127·0	100·0
Glycerol	—5	94·4	100·0

As a possible error in reading by estimation of 0·01 c.c. would account for a difference of 22 in the values of III. and IV., it appears that all the several higher alcohols give the same value in the Röse-Herzfeld method. The errors beyond the number 22 might be due to various causes, such as variation of temperature, impurity in

alcohol not eliminated, &c., all acting in the same direction.

But, if all the necessary, but tedious, precautions are adopted, this method may be regarded as accurate not only for commercial purposes, but also for legal jurisdiction.

Preparation of distillates obtained from commercial spirits.—My practice has been to heat for one hour the distillates obtained from brandy, &c. (50 or 100 c.c. taken) with a fragment of solid caustic soda in a flask fitted with an inverted condenser, whereby the aldehydes are destroyed by resinification and the esters by saponification. The liquid is then subsequently distilled almost to dryness.

Though the process has the disadvantage, whatever method be subsequently employed, that the higher alcohols derived from the esters of more complex molecular weight come over in the distillate and the true value of such alcohols is raised accordingly. On the other hand, if the sulphuric acid process is adopted, and the aldehydes only are destroyed by heating with *m*-phenylene diamine (an unsatisfactory method), or preferably with aniline phosphate [13], the less complex esters act as matter in the way, thus tending to lower the value of the higher alcohols, while the more complex esters (amyl acetate for example) themselves produce a coloration, which tend to raise the value.

My experience has been that more information is obtained by adopting the soda method especially for the detection of certain artificial essences used for brandies. For when the sulphuric acid method is subsequently applied, a bright red (instead of a yellow) coloration is produced, indicating the probable presence of such substances as vanillin or Peru-balsam. If in such cases the Röse-Herzfeld process is also applied, the value for the higher alcohols is far too low, and the chloroform is rendered milky.

The sulphuric acid process.—It is not, of course, necessary to describe this process, which has been so widely adopted; it is only necessary to deal with its defects, and to describe certain modifications, which, in my experience, have proved advantageous.

The conditions and nature of the reaction.—So far as I am aware no interpretation has been given of the reaction, nor why it ever begins. Of the higher alcohols it appears to be characteristic, under usual conditions, of those which contain an isoprimary group CHR_2, and my observations are in accordance with those of others, that no coloration is produced with ethyl, primary propyl and butyl alcohols, however long the process of heating be protracted.

But, further, so far as my experiments have gone, it would appear to be quite doubtful if any reaction would take place even with isoprimary butyl alcohol regarded as the most susceptible, and consequently taken as the type, if the alcohol and the sulphuric acid are pure, and the containing vessel quite clean. The following details will serve to illustrate this point. A small soda-glass stoppered bottle was thoroughly soaked out by a sample of Merck's special sulphuric acid (sp. gr. 15/4 = 1.84161) (found to be free from organic matter, sulphurous, hydrochloric, nitric and nitrous acid, but to contain an inappreciable trace of ammonia), firstly, by heating for some hours at 100°, and, subsequently, by allowing to stand for several days. The acid was then poured out; 20 c.c. of a standard, 1/2000 solution of isoprimary butyl alcohol (freshly distilled) introduced, and then 20 c.c. of the same sample of sulphuric acid added slowly, the bottle being immersed in ice-cold water. When this mixture was heated at 110° no coloration was developed for 30 minutes, and at the end of an hour only a slight coloration ensued. On repetition of such an experiment, the greater the care bestowed on the preliminary cleansing process, the longer the time required for the development of the colour, and conversely the less the care, and the less pure the sample of sulphuric acid, the more rapid the development of the colour.

Of course, these results are in accordance with numerous observations upon other reactions, which have proved that no chemical change takes place between two substances only. But until the nature of the impurities has been ascertained, which start the reaction between the acid and the alcohol, there will always be an element of uncertainty in the application of the method.

Effect of temperature.—It has been objected that the depth of tint varies with the temperature [14]. This is, of course, true, and my experience, doubtless confirmed by others, has been to the effect that a difference of 2°—3°, other conditions being the same, causes a considerable difference in tint. But, as all chemical changes vary with temperature, this objection can hardly be regarded as serious.

Isoprimary butyl alcohol as the standard.—It has been objected that a solution of this alcohol is used as the comparative standard, and the results are given in terms of it, but with the exception of spirits obtained from beet and grape skins, the proportion of this alcohol is quite insignificant, and may amount to as little as 0·5 per cent. It has been further stated [15] that the tint produced by the fermentation amyl alcohols is, in round figures, 6/10 of that produced by isoprimary butyl alcohol. In an experiment two solutions were made up according to the usual details, in the proportions of (1) 100 amyl alcohol and (2) 60 isoprimary butyl and 40 ethyl alcohol; the tints produced were in the ratio of 119:120, or practically 1:1, but it was found that this ratio only held good under these conditions.

It has been suggested that an amyl rather than an isoprimary butyl alcohol standard should be adopted; this would appear to be more rational, but there is the disadvantage that, whereas a solution containing 125 mgrms. per litre of isobutyl alcohol produces a quite inappreciable coloration (a result personally confirmed), a solution containing 250 mgrms. per litre of fermentation amyl alcohol would also produce an inappreciable coloration (a result also confirmed).

A determination upon this basis would possess an order of accuracy much less than of the Röze-Herzfeld method. It is probably best to make the determination in terms of isoprimary butyl alcohol, and then multiply by the factor 10/6 to convert into terms of amyl alcohol.

However this may be, it is somewhat difficult to understand the degree of assurance with which the results of analyses are put down to five figures, when an error of 5 per cent. in a tintometer reading, which is possible for the same individual, might in a genuine spirit of commerce cause an error of 2 to 8 units in the third figure.

The following sentence from Girard and Cuniasse's Manual (page 244) appears to be quite unintelligible:—"Enfin le dosage colorimetrique des alcools superieurs au moyen de l'acide sulfurique est un procédé conventionnel auquel on ne saurait demandé des *chiffres absolus, mais des données analytiques exactes constantes et comparables.*"

Curve of correction.—If C,*c* be the concentration mgrms.-litre) of an isobutyl solution (C,*c*) and H,*h* be the heights of column in the tintometer (H,*h*), then it appears from the results of former observers $Ch/cH = a$ variable, or in other words the heights of columns (depths of tint) are not directly inversely proportional to the respective concentrations as in certain other colour reactions, such as Nessler's test for ammonia, *m-phenylene* diamine for nitrous acid, or aniline acetate for furfural. A curve of correction has therefore been drawn out (Girard and Cuniasse Manual, page 204). It, therefore, appears desirable to ascertain the relation between the values of the abscissæ, *y*, (teneur realle) and those of the ordinates, *x* (teneur apparente) [16]. The most natural assumption to make is that the variation of *y* per unit of *y* is in a fixed ratio to the variation of *x* per unit of *x*, namely:—

(1) $$dy/dx = ky/x.$$

This on integration gives

(2) $$\log. y = b \log. x + a.$$

From the numbers given $a = 0{\cdot}28$, $b = 0{\cdot}6$, or

3 $$\log. y/100 = 0{\cdot}6 \log. x/100 + 0{\cdot}28.$$

The values of *x* corrected in terms of *y* given and of *y* corrected in terms of *x* given are set forth in the following table, which may be found useful, and any intermediate value may be duly corrected by equation (3):—

Milligrams per litre.

Values of y (x given).		Values of x (y given).	
Found.	Calculated.	Found.	Calculated.
200	240	70	22
300	270	180	210
400	390	330	340
500	500	500	500
600	601	680	676
700	706	890	879
800	803	1100	1090
900	897	1320	1330
1000	1005	1600	1585

Hence it would appear that from the co-ordinates of the point $y=300$, $x=100$, the curve is regular.

The curve from the origin to this point need hardly be considered, as on the one hand effected by the limit of delicacy of the reaction, and on the other by some induction period between the reacting substances.

Method of working.—As the sulphuric acid process has, *inter alia*, formed the basis of contracts between vendor and purchaser, and as valuable information is, notwithstanding its defects, obtained by its application, I would briefly describe slight modifications which I have found useful. The processes of heating the mixture in equal volumes of the sulphuric acid and alcohol solution, either (1) till it begins to boil, or (2) in an open flask in a calcium chloride or other bath, are both more or less unsatisfactory, as a loss is likely to occur by evolution of vapour of the higher alcohol before it is attacked by the sulphuric acid. To avoid this loss I have been accustomed to use glass-stoppered bottles of about 50 c.c. capacity, and during the heating operation the stopper is kept tied down. I have further found that a bath of saturated ammonium chloride solution, provided with a constant water-level appparatus, is very convenient; a constant temperature of 100°—110° can readily be maintained. The process of cleansing the bottles with concentrated sulphuric acid is described above, and my custom has been to soak out the bottles for at least a week before using them for a determination. Cleansing by nitric in addition to sulphuric acid, as recommended by some writers, is a source of danger, and even distilled water, unless freshly prepared, may introduce error.

Form of tintometer.—As a sequence to the criticism of the sulphuric acid method, I may possibly be allowed to remark that a form of tintometer, which can be adjusted suitably for all eyes remains as yet to be devised. The simple form of two tubes, one with a fixed and the other with an adjustable column interposed between two mirrors, though convenient for rapid working, possesses the disadvantage that two coloured discs appear at a distance apart on the upper mirror, and an observer insensibly looks at each disc successively with the same eye, and not one disc with one eye simultaneously. Even if this is the case, the two eyes of the same person are seldom, if ever, physiologically the same as regards appreciation of colour (17). The Duboscq form possesses the advantage that the two discs are viewed simultaneously by one eye; but neither of these two forms permit the interposition of suitable coloured screens. Donnan's (18) tintometer possesses this advantage, and, according to my experience, gives concordant results though with considerable labour; on the other hand, it appears to possess two disadvantages: (1) Equality of tint does not correspond to equality of height (though a table of corrections can be drawn up), and (2) a small inner disc is brought to the same tint as a much larger outer disc, and consequently the eye becomes soon confused and tired.

I have tried various observers with the same pair of coloured liquids and the same illumination (*viz.*, 16-candle electric lamp with silvered back at 3 ft.) with invariably the same result, some being more and others less rapidly fatigued.

But, as stated above, in this tintometer a coloured screen in the form of a suitable solution can be introduced, so that if an observer's eye is not very sensitive to differences of tint of one colour, its complimentary colour can either be produced, or certain rays may be eliminated and tints thereby produced to which the observer's eye may be more sensitive.

Thus, in my case, I have found that not only is my right eye more sensitive than the left, but both eyes are more sensitive to variations in shades of green, than in shades of yellow. The interposition of a screen made of a dilute ammoniacal solution of copper sulphate, in the sulphuric acid higher-alcohol method, whereby a green tint is produced renders the results more concordant, at least, for myself.

It might not be wholly out of place to remark that as regards colorimetric observations, the personal element is of a two-fold nature, namely, that of one individual with another, and that of the same individual with himself, according to his state of health.

If facts such as these are considered, so much capital would not be made, especially by ill-informed persons, of variations in the results obtained by two observers, in an analysis of the same sample of spirit, which, in the case of the aldehydes and higher alcohols, may amount to a few parts per 100,000, and in the case of furfural to a few parts per 1,000,000.

Such differences are generally wholly immaterial as regards the main issue, though it is possible that even these differences might be reduced if some standard illumination for tintometer readings could be agreed upon.

Finally, it is hoped that the results and observations detailed in this communication may prove of interest; though possibly they are of a general character, yet they are the outcome of three to four years' experience; my object has been to criticise methods rather than to add to the accumulation of analyses.

"Auxiliis ac instrumentis res perficitur."—*Bacon.*

(1). Röse, Rep. Analyt. Chem., 6., 61. Hersfeld, Brennerei-Zeitung, 1886, 56.
(2). Ordonneau Comptes rendus, 102, 217 (1886).
Claudon and Morin, Bull. Soc. Chim., 49, 178 (1888).
Windisch Kaiserlich. Gesundheitsamt., 8, 214, 228 (1892).
Behrend Zeits. f. Spiritus Industrie, 13, 273 (1890).
Briem stated generally that the fusel from beet consists mainly of propyl and isoprimary butyl alcohols.
(3). Zeits. f. Analyt. Chemie, 1896, 159.
(4). Note—I have found that the Schiff's reagent made up with samples of fuchsin, obtained from different makers, varies in delicacy. Paul, Zeits. Analyt. Chem., 35, 647, (1896) gives the reference to fuchsin and methyl violet 5 R.
(5). Ber. Deutsh. Chem. Ges., 38, 3612 (1905).
(6). Journ. Soc. Chem. Industry, 1903, 1227.
(7). Veley and Manley, Proc. Roy. Soc. 76 (A) 472 (1905).
(8). Kaiserlich-Gesundheitsamt. Bd. 4.
(9). Proc. Roy. Soc. 49, 114 and 50, 375 (1891).
(10). Zeits. f. Physikal Chem., 23, 652 (1897).
(11). Zeits. f. Spiritus Industrie, 1894, 21.
(12). Zeits. f. Analyt. Chem., 36, 259 (1899).
(13). Cf. Mohler Ann. Chim. Phys. [6] 23, 129 (1891).
(14). Saare. Jahsbrich des Vereine der Spiritus fabrikation 2, 35 (1902).
(15). Girard et Cunlasse Manuel, 212 (Paris, 1899).
(16). I have to express my obligations to Professor Rason for working out the above solution.
(17). Cf. Burch Phil. Trans., 1890, B 1 and Proc. Roy. Soc. 98, 204, 1890.
(18). Zeits. f. Physikal Chem., 19, 465 (1896).

Discussion.

Dr. J. T. Hewitt said all who had anything to do with spirit analysis had to pay more attention to estimations of this description than they desired. He was much interested in Dr. Veley's remark, that the more care that was taken in the estimation of the higher alcohols by the colorimetric process, the worse the result. This might, perhaps explain some of his own results. He certainly found that by the colorimetric process he could not get results to agree with those of other chemists, though results obtained by the Allen-Marquardt process usually agreed better. It certainly was a very troublesome matter to know what to do in this case. He thought Dr. Veley had put his finger on the whole thing—it depended on the care taken. Where one chemist was satisfied with guaranteed pure isobutyl alcohol, another might take the trouble to rectify it before using it. He himself took the precaution of rectifying it twice over, and even under those conditions, he found he still got a coloration with strong sulphuric acid. That might

be due, however, to "his favourite wash-bottle." He would have been glad if Dr. Veley had compared the results of this method with the Allen-Marquardt process. He was personally a convert to the latter process, because it was possible to get concordant results, and the process did seem to be based on scientific principles. Dr. Veley got very good results with the Röse-Herzfeld process when he extracted the higher alcohols from an alcohol to which he had added higher alcohols in certain proportions. But suppose he tried the experiment of taking not merely alcohol, but alcohol to which he had added higher alcohols and the other normal secondary products of spirits, would his results then tally? The whole idea underlying the application of this process seemed to him to be wrong; it could not be only the higher alcohols which were extracted. Even if the esters were saponified other substances present in spirits remained which could not be classed amongst the secondary products which go to make up the coefficient of which they heard so much about at present. There were, undoubtedly, a great many spirits, certain Irish whiskies, which might be boiled for a long time with caustic soda, and distilled until there was reason to think that all the aldehydes and esters, and all the acids were gone, and there ought to be nothing but alcohols according to the tables in the books; yet substances were present which did not tally with anything which came under the heading of higher alcohols. These substances must be extracted by chloroform to a certain extent, and certainly he thought the Allen-Marquardt process seemed more promising.

Dr. P. Schidrowitz said in his opinion both these processes were radically wrong. He was surprised that Dr. Veley had made no reference to the only process which was based on accurate scientific chemical methods; a process by which the chemist did obtain chemical substances which were measured by ordinary chemical means, namely, the Allen-Marquardt oxydation process. With regard to the Röse-Herzfeld method, he was, of course, aware of the claims put forward for it in Germany, and he had himself found that when they used the pure higher alcohols in this method with very great care, good results were obtainable. But he had also found, and pointed out in a paper before that Society in 1902, that working with commercial spirits, the process gave entirely erroneous results; in fact occasionally actually negative results could be obtained, and the chloroform column, instead of rising, was depressed. This was possible because, as Windisch, in 1889, pointed out, there were certain substances which did have this effect on the chloroform column. He should like, moreover, to point out that this process which was at one time in use, in the Government Laboratory in America, had now been abandoned. Dr. Wiley, the Chief of the Laboratory, himself informed him they had had to abandon it as useless, and were now using the Allen-Marquardt. He did not know what process was officially used in this country, but he should doubt if it was the Röse-Herzfeld, because, on the last occasion on which any official evidence was given, namely, that before the Spirits Committee in 1901, the results given by Dr. Bell were based on a purely chemical oxidation method. He had also a communication from the gentleman who was conducting a series of investigations for the Indian Government on the spirit question, who had tried all these methods on a large number of samples, and had to abandon them all except the Allen-Marquardt. He (Dr. Schidrowitz) had during the last few years made a very large number of experiments in conjunction with his colleague Mr. Kaye, on the various processes for estimating higher alcohols, and their application in practice, and had come to the conclusion that the only process which gave reliable results was the Allen-Marquardt oxydation process, carried out on the lines of the modification described by him before that Society in 1902. Coming to the colorimetric method, he cordially agreed with everything Dr. Veley had said and more than agreed. As he had pointed out on a number of occasions for several years past, this process, both in principle and in practice, was a bad one.

Mr. A. C. Chapman said for a good many years he had had a considerable experience in the estimation of the higher alcohols in spirituous liquids; in fact, long before it became a matter of almost everyday procedure. He had tried all the more important methods proposed for the estimation of these constituents, including the Röse-Herzfeld, the colorimetric method, the physical methods based on surface tension, the original method of Marquardt, and later, and more particularly, the process to which Dr. Hewitt and Dr. Schidrowitz had referred, the Allen-Marquardt method. He was bound to say that he agreed with every word those speakers had used. The Röse-Herzfeld was bad both in principle and practice; the results were exceedingly uncertain, and, as Dr. Veley himself had pointed out, it was objectionable, inasmuch as the difference, which was the quantity measured, was exceedingly small compared with the large volume of solution with which one had to deal. The colorimetric process was, if anything, worse, at any rate it had proved so in his hands. He had finally come to regard the Allen-Marquardt process as the only reliable one at present existing for the estimation of these higher alcohols. In the first place, it was based on definite chemical reactions, and one had it in one's power, moreover, to ascertain to some extent the degree of accuracy of one's results, because one could roughly ascertain that the bodies which one had extracted were really the higher alcohols. It was a perfectly simple extension of the process, and one which many analysts made use of to convert the distilled acids into barium salts, and then ascertain the mean molecular weight of the fatty acids, thus obtaining an insight into the true nature of the bodies extracted by the carbon tetrachloride. Other processes were purely arbitrary. It was quite possible that one worker making use of the Röse-Herzfeld, or the colorimetric process, might get concordant results, but, as had been pointed out, it was exceedingly difficult to obtain results which would agree with those obtained by somebody else. He did not think the same objection applied in anything like the same degree to the Allen-Marquardt process, for he had had the opportunity of comparing his own results with those obtained by some of his colleagues, and had been struck with the comparatively small differences in the numbers obtained. With the other processes, more especially those to which Dr. Veley had referred, nothing like the same amount of concordance could be obtained. The paper would be valuable as a guide to many who still persisted in using these processes, but at the same time it would be well if such could be converted to the Allen-Marquardt process.

Dr. Veley, in reply, said the speakers who had dealt with this paper had, perhaps, misunderstood slightly the purpose of the discussion of these processes. It was his endeavour to point out that the first process was unsatisfactory, and the second more unsatisfactory. But, like many other unsatisfactory methods, they had the official sanction of certain European Governments; and it would appear, therefore, that it would be best to peaceably persuade the Governments, or the persons in charge of official laboratories, that these processes were unsatisfactory. The Röse-Herzfeld method, for example, had the merit of being described in an English Blue Book, and certainly he believed that the Somerset House laboratories had still a certain appreciation of the process. He was aware, of course, that there were processes which were more accurate, but his whole purpose was to criticise these two which had the most official sanction.

Dr. Schidrowitz said if Dr. Veley referred to the Bonded Spirit Blue Book when he said the Röse-Herzfeld method was described in it, it was described there only in order to be blamed.

New England Section.

Meeting held at Boston, on Friday, April 6th, 1906.

MR. HENRY HOWARD IN THE CHAIR.

THE SUBSTITUTION OF PYRITES FOR BRIMSTONE IN THE MANUFACTURE OF SULPHITE PULP.

BY FREDERIC J. FALDING.

Technical sulphur dioxide, known as "burner gas," is prepared by the combustion in air of some raw material which consists largely of sulphur. Such materials are brimstone, which is sometimes almost pure sulphur; pyrites; various other metallic sulphides, in some of which, such as copper or zinc sulphides, the sulphur content is only of secondary value; together with one or two other materials, such as "spent oxides" and sulphuretted hydrogen, which are in the nature of waste products from other industries. As air contains about 21 per cent. of oxygen, it follows that sulphur when burned in air can theoretically produce a burner gas consisting of 21 per cent. of sulphur dioxide and 79 per cent. of nitrogen. This would imply perfect combustion in pure air, which is not a technical condition. When brimstone is used under the best conditions, a burner gas containing as high as from 18—20 per cent. of sulphur dioxide can be obtained. Burner gas, produced from pure pyrites, can only contain 16 per cent. of sulphur dioxide. In practice it will only contain 11 to 12 per cent., although, with proper precautions, suitable combustion furnaces, and favourable conditions, as high as 14 per cent. can be obtained.

Generally speaking, the range of percentages of sulphur dioxide contained in burner gas, where high percentage is desirable, may be stated to be 14 to 18 per cent. when prepared from brimstone, and 10 to 14 per cent. when prepared from pyrites. If an average is taken of these percentages, or comparing them as 16—12, it is evident that to obtain equal volumes of sulphur dioxide, it will be necessary to use one-third more burner gas when it is made from pyrites or metallic sulphides than when it is made from brimstone.

Furthermore, the preparation of burner gas from pyrites or metallic sulphides results in a gas containing various impurities, such as arsenic, selenium, &c., some of them injurious in the technical processes for which burner gas is used, and more or less difficult to eliminate. If, therefore, it is desired to prepare a pure burner gas containing as high a percentage of sulphur dioxide as possible, it would appear that brimstone is best suited to the purpose, and one would expect to find brimstone universally employed by manufacturers who use this gas. The contrary is, however, the case. Only a comparatively small and decreasing proportion of burner gas is made from brimstone, and gas so made is largely confined to the sulphite pulp industry of the United States.

The volume of "burner gas" used throughout the civilised world is enormous, yet its history is comparatively recent, the different industries in which it is directly employed are comparatively few, and the principles governing its technology and commercial production, whilst not very complicated, are not generally so well understood as they might be with advantage to the manufacturing processes in which it is employed.

The sulphuric acid and sulphite pulp industries use nearly the whole of this burner gas. A small amount is used for bleaching processes, and some in various metallurgical processes. The requirements of these two industries as to the mechanical or physical and chemical conditions of the burner gas are also practically identical. Its purity is as advantageous to the sulphite pulp maker as it is to the sulphuric acid manufacturer.

Large quantities of sulphuric acid are made for fertiliser purposes, of course, where no particular purity is called for, but, on the other hand, commercial sulphuric acid must be pure enough to be used in the preparation of many foodstuffs, and for other purposes calling for a high degree of purity. For the manufacture of sulphuric acid by the contact process, this burner gas must contain no impurity other than nitrogen, save possibly some carbon dioxide, discoverable by either chemical or optical test. Arsenic, so constant an impurity in the burner gas made from pyrites, and the most difficult impurity to remove from the gas, is an absolute "poison" to the contact mass, rendering it inert almost immediately, even in exceedingly small quantities. It is probably not well known that the very large quantity of sulphuric acid used (probably about 150,000 tons yearly of 60° B.) in the United States, in the steel and iron industry for pickling sheets, wire, &c., previous to galvanising or tinning, must contain less than 0·002 per cent. of arsenic.

The strength or percentage content of sulphur dioxide contained in the burner gas is also, within certain limits, of equal importance to both the sulphite pulp and the sulphuric acid manufacturer. A low tenor of sulphur dioxide in the burner gas means a larger investment in plant, larger apparatus, and an increased manufacturing cost to both industries.

In the United States, previous to 1881, one or two small plants had attempted to use pyrites, practically all manufacturers using brimstone. At that time the Albert mine, at Capelton, Canada, was acquired by Geo. H. Nichols and Company—later the Nichols Chemical Company. From that time on, pyrites mines were discovered and worked in Virginia, Massachusetts, Newfoundland, Canada, Georgia, and elsewhere, and the European pyrites were imported, until to-day the amount of brimstone used for producing burner gas in the sulphuric acid industry is practically nothing.

Between 1881 and 1891 reliable statistics are not available, but in 1892—in addition to the domestic production in Virginia and Massachusetts, and zinc blende used by Messrs. Mathiessen and Hegeler, at Lassalle, Ill.—upwards of 135,000 tons of pyrites were imported into the United States for the production of burner gas, whilst last year 566,000 long tons were imported, in addition to an estimated domestic production of over 200,000 tons, and a much extended use of zinc blende.

The penalty of increased cost of plant and process costs attached to the use of pyrites has not prevented its practically universal adoption by the sulphuric acid industry, and it is only reasonable to suppose therefore that there must be some predominant advantage in the use of pyrites, at any rate in the sulphuric acid industry.

The manufacture of sulphite pulp is of much more recent inception than that of sulphuric acid. At first many difficulties were experienced in its manufacture, and as its price was relatively high, the cost of a small item of raw material entering into its manufacture was inconsiderable, and naturally the purest, least troublesome, and most available material was adopted. The quantity of sulphur used, compared to the tonnage of sulphite pulp, is comparatively small, averaging probably considerably less than 300 lb. to the ton of pulp, whilst in sulphuric acid manufacture, sulphur constitutes about one-third of the weight of acid, or about 670 lb. to the ton. As in all new industries, however, after the first monopoly is broken and competition begins to be felt, lower production cost becomes necessary. This is already resulting in the substitution of a burner gas made from pyrites or other metallic sulphide in Germany, Norway, and Europe generally—a substitution which is rapidly becoming complete.

In the United States, the industry, whilst very great, is still more recent than in Europe. It is only within the last few years that American sulphite pulp manufacturers have learnt to use brimstone successfully. Some sporadic attempts have already been made here to substitute pyrites for brimstone, but no general move has as yet been made in this direction, although strangely enough, it is true that the success of this substitution in Europe is largely due to the employment of American apparatus (Herreshoff and O'Brien furnaces, &c.).

One reason which has retarded the use of pyrites by

the sulphite pulp manufacturers is that too much has been expected. It is useless to expect to obtain the same burner gas when using pyrites as has been obtained when using brimstone. The volume of pyrites burner gas will always be at least one-third greater than that of brimstone burner gas, and certain modifications in the acid plant will become necessary. As, however, the volume of the gas greatly decreases by proper cooling, and the velocity of its absorption is at the same time greatly increased, much may be done by securing a more efficient cooling of the gas. At 0° C., 1000 cb. ft. of 12 per cent. burner gas made from pyrites would contain as much sulphur dioxide as 1000 cb. ft. of 16 per cent. burner gas made from brimstone at 100° C. A more expensive equipment for roasting the pyrites and purifying the gas must also be faced. The matter is not one of inventing new processes and apparatus. Burner gas from pyrites up to 12 per cent., and pure gas, to a degree of purity far and away beyond that required in pulp manufacture, has already been obtained and is in commercial use both by acid and pulp makers.

In short, it may be definitely stated that the question is no longer a technical one, it is simply and purely a financial proposition.

Can pyrites be obtained, and a suitable burner gas be produced and used in making sulphite pulp, at a cost sufficiently less than the brimstone burner gas to provide—first, for the interest and amortisation on the additional capital investment; second, for the increased manufacturing cost; and, third, to provide a sufficiently attractive margin of profit or a sufficiently lower manufacturing cost per ton of pulp to justify the larger investment and the trouble involved in the deviation from established methods?

Whilst it is difficult to submit cost figures which will apply to every case, I think that the following figures are reasonably conservative when applied to many New England localities, and, at any rate, may form a basis upon which more accurate calculations may be made for any given locality. It is assumed that the best of each class is used, and in the case of brimstone, that such a quality is supplied, that 99 per cent. of its weight will be recoverable as sulphur dioxide, and that pyrites will be used which will yield 40 per cent. by weight of sulphur as sulphur dioxide. Fines or granular pyrites are assumed, as it is only by the combustion of "fines" pyrites in MacDougall type furnaces, that strong gas can be secured.

The cost of such a quality of brimstone and of the very best quality of "fines" pyrites, delivered *ex* ship at Atlantic port, would to-day be respectively about 22.00 dols. and 6.00 dols. per long ton. To this price must be added 0.25 dols. per ton for the cost of unloading at factory, sampling and assaying. The cost of handling and roasting will vary with the quantities handled, and the character of the equipment at any factory. When the quantities handled are about equivalent to 7·5 tons of actual sulphur in 24 hours, it may be said that brimstone should not cost over 40 cents per ton and pyrites not over 50 cents per ton, including repairs and incidentals. Should the factory be located away from tide water, railway freight would have to be added. The equivalent of a freight of 2.00 dols. per ton on pyrites, would be 2.75 dols. per ton of brimstone. We have, therefore, the following costs of delivering and handling our raw materials:—Brimstone: Atlantic port, 22.65 dols. per long ton; inland, 25.40 dols.; pyrites, Atlantic port, 6.75 dols.; inland, 8.75 dols. per long ton.

Therefore 1 ton (2000 lb.) of sulphur will be equivalent to 1·01 ton of 99 per cent. brimstone, and 2·143 tons of 49 per cent. pyrites; hence the cost of one short ton of sulphur at Atlantic port as brimstone will be 20.43 dols., and as pyrites, 12.92 dols. At inland factory as brimstone, 22.91 dols.; and as pyrites, 16.74 dols.

Take the case of a factory at the seaboard and inland respectively as above, using 7·5 tons of sulphur daily, or 2,700 tons yearly. If this sulphur is supplied as brimstone it would cost 55.161 dols. seaboard, and 61.857 dols. inland. If it were supplied as pyrites it would cost 34.884 dols. seaboard, and 45.198 dols. inland; leaving a difference of cost in favour of pyrites of 20.277 dols. seaboard, and 16.659 dols inland.

As the plant for roasting pyrites and purifying the gas would cost at a liberal estimate about 30,000 dols. for a plant of this capacity; 12 per cent. may be written off for interest and amortisation, which would leave the net difference some 3,600 dols. less, or 16,677 dols. seaboard, and 13,059 dols. inland, which would represent the net saving or cheapening of the manufacturing cost of the pulp. This should amount to from 75 cents to 1.00 dol. per ton of pulp; and with care and the purchase of a cheaper pyrites may be considerably more.

I believe these figures are conservative. They will undoubtedly vary according to the locality, conditions at any given plant, and the skill used in making the change: in operating, in purchasing supplies, and, in short, with the excellence of the individual management.

In the sulphuric acid industry, it is a very common statement, that, before a change from pyrites to brimstone could be considered, brimstone would have to be sold at from 12.00 dols. to 14.00 dols. per ton, according to the location of the factory.

Imported pyrites can be obtained in the open market at varying prices according to the quality, and on contracts extending from one year up. All such imported pyrites can be used for producing a burner gas suitable for sulphite pulp making, but some of them will require a rather more costly purifying plant than others. It would be well, therefore, to construct a purifying plant, capable of treating the more impure gases from the cheaper pyrites; and in this way to be in a position to burn any ore which could be obtained to best advantage. Imported pyrites are brought principally from Spain, Portugal and Newfoundland. Pyrites is also produced in Massachusetts, and a company of undoubted financial standing has been for some time developing, and is now about to put on the market high grade "fines" of a great purity, mined in St. Lawrence County, New York. Other local deposits will undoubtedly be developed if stimulated by a local demand. The copper-bearing pyrites of New Hampshire, Maine, Vermont, and other New England States will also ultimately form a valuable source of supply.

Discussion.

Mr. F. G. Stantial inquired about the percentage of sulphuric anhydride in burner gas.

Dr. F. H. Thorp asked if arsenic had any injurious action other than the objection of having it present in the pulp on account of its poisonous character.

Mr. Falding said, that with proper regulation of draught it was possible to keep down the percentage of sulphuric acid to a mere trace, much less than was usually present in gases from brimstone burned in a large excess of oxygen. The poisonous nature of arsenic was the objection to its presence in pulp.

New York Section.

Meeting held at Chemists' Club, on Friday, February 23rd, 1906.

DR. RUSSELL W. MOORE IN THE CHAIR.

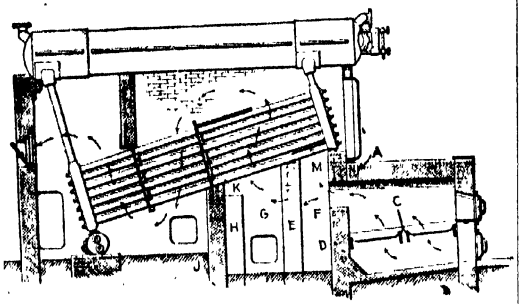
A PRACTICAL WAY OF BUILDING SMOKELESS FURNACES.

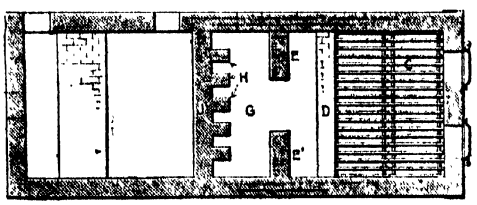
BY ERNEST H. FOSTER.

A vast number of devices for preventing smoke are successful in so far as they accomplish the desired result, but either they are too expensive, or they occupy too much space, require too much attention, deteriorate in certain parts, curtail the capacity of the furnace, or require conditions which do not exist in ordinary plants

To be practicable, a furnace must not only provide such nearly perfect conditions of combustion that smoke will not be formed, but the construction must be so simple, that it can be built without difficulty and without employing experts, and the working conditions must be such as not to unduly tax the average fireman. These results would seem to have been accomplished by the Wing Wall Furnace invented by Prof. Wm. Kent, and applied successfully to a fair number of boilers up to the present time. This furnace is suitable for either a water-tube or fire-tube boiler, and is designed to provide the essential features required for perfect combustion in the furnace, such as heat-retaining masses of refractory material in the path of the gases and means for intermingling the products of combustion from various parts of the grate.

The furnace consists of an arch, A, over the grate, C, (see Figs.), a pair of "wing walls," E, E¹, or piers built





out from the side walls of the setting, and a number of brick piers, H, H, H, in the combustion chamber, G, so disposed as to present as much incandescent surface as possible to the gases of combustion in passing. The arch over the fire and these two wing walls form the chief features of this furnace. The products of combustion on leaving the grate pass over the bridge wall, D, in a wide horizontal stream. These will vary in temperature at different points. Where fresh coal has been thrown on the grate the gases will be distilled in greater volume and will be insufficiently supplied with air. This is where the smoke is formed, whereas from the portion of the grate which has been previously coaled the fire will be burned out and the bed of coals porous, the gases will not only be smokeless but will be incandescently hot and will have a surplus of air. Unimpeded, these gases would pass through the boiler in this state and never mix. In this furnace, however, the space between the two wing walls is of such a form as to divert the stream of gases from a horizontal plane into a vertical plane, thereby mixing the cool, freshly-distilled hydrocarbon gases with the hot incandescent products of combustion, allowing the surplus of air from one portion to make up for the deficiency of the other portion. The conditions requisite for perfect combustion have therefore been produced, and when the gases have passed between the wing walls and are ready to enter the boiler flues they have been thoroughly burned and are free from smoke. To get the best results out of this furnace the foreman has only to feed coal to the grate at regular periods, alternating between the two sides.

In making the application to a water-tube boiler of the Babcock and Wilcox type, the furnace is usually built out in front like a Dutch oven, whereas with the horizontal tubular or Heine type of boiler the furnace need not extend beyond the boiler setting. It must not be thought that the interposition of the arch under the boiler shell will cut down the heating surface of the boiler. A small portion of the heated gases does pass between the shell and the arch. The cooling effect of the shell serves to preserve the arch, while the arch in its turn protects the shell at this point and the boiler receives as much heat at this point as the shell is capable of transmitting in any event.

It will be seen that the construction of this furnace can be easily handled by an ordinary mason or boilersetter. The walls will be of ordinary fire brick, except the wing walls, which, if made up with the best grade of fire brick, will last a very long time. It is only necessary, in making the design, to so properly proportion the various passages as not to choke the gases and so restrict the capacity of the furnace. The saving by using Wing Wall Furnaces instead of a common furnace will be from 5 to 10 per cent with the best bituminous coal, such as Pocahontas, Cumberland or Clearfield, and will be from 10 to 15 per cent. with Pittsburgh and Ohio coals, and 15 to 20 per cent. with Illinois coal.

Nottingham Section.

Meeting held at Nottingham on Wednesday, February 28th, 1906.

MR. J. M. C. PATON IN THE CHAIR.

THE BACTERIOLOGICAL TESTING OF DISINFECTANTS.

BY T. H. LLOYD.

The relative values of disinfectants are usually based on the amount of active principle contained in them. This method of examination is correct when the preparations owe their activity to their amount of chlorine, available oxygen, &c., but where organic compounds are concerned, deductions based on analytical percentages are usually far from the truth, as the substances with which they are associated have a deciding influence on their behaviour as germicides. The aromatic series of organic compounds is largely called upon to supply the wants of the manufacturer, and differences in the constitution of nearly-related families are sometimes taken advantage of in the production of their specialities. Such differences are sometimes small and obscure, and need a large amount of research and time to reveal them. The organic principles employed are usually associated with glue, resins, hydrocarbons and other substances, any one of which may have been selected for some particular property which it possesses, and a statement of analysis which shows percentages of phenols, hydrocarbons, resin acids, alkali, &c., gives no data of value. The physical condition in which the disinfectant is to be used, too, is a point of considerable importance, as it has been repeatedly found that an emulsifying preparation, containing one third the amount of active agents of a solution, is much the more powerful germicide. Chemical methods are of great service in foretelling the suitability of a given bactericide for a particular purpose. For instance, chlorine or ozone might be recommended for the sterilisation of water which contained little organic matter, but they would not be suggested for the disinfection of fluids heavily charged with organic impurities such as sewage. The use of the salts of copper, mercury, or of many of the heavy metals which form compounds with albumin, would not be suggested for use in its presence, as their usefulness would be greatly restricted by it. Great service has also been rendered in the classification of compounds having antiseptic and germicidal properties, but beyond the limits thus briefly sketched, chemistry does not go in the deciding of the efficiency of disinfectants.

Bacteriological methods.—Until recently, the want of uniformity in the conditions under which disinfectants were tested, led to the utmost confusion as to their capabilities and great conflict of opinion among observers working on the same substance. Many attempts were made to lay down standard conditions for all workers, but without much success, until the Rideal-Walker method was published.* These observers pointed out that the following factors were to be reckoned with before the desired uniformity could be obtained:—(1) Time; (2) age of culture; (3) choice of medium; (4) temperature of incubation; (5) temperature of medication; (6) variation in vital resistance of the same species; (7) variation in the resistance of different species; (8) the proportion of culture to disinfectant.

The introduction by them of pure phenol as a standard control solved the whole of these factors, and as the method has been adopted by the War Office, the Admiralty and other public bodies, I give it as it was originally published:—

"To 5 c.c. of a disinfectant, add five drops of a 24-hour old blood-heat culture of the organism in broth, shake, and take sub-cultures every 2½ minutes up to 15 minutes. Incubate these sub-cultures at 37° C. for at least 48 hours. Allowing 30 seconds for each act of medication, and the same time for making each sub-culture, four dilutions of the disinfectant under examination, together with one standard control, may be tested against the same culture under conditions which make the results strictly comparable.

"When a dilution of the disinfectant is obtained, which does the same work as the standard carbolic acid dilution, the former is divided by the latter, and the ratio so obtained is termed the carbolic acid co-efficient."

The temperature at which tests are carried out is from 15° to 18° C., as this is found the easiest to maintain in a laboratory all the year round. Good relative values are usually obtained in the hands of any one worker, if the conditions described are observed, but it is unfortunate that a large number of workers on the same organism and the same samples show a good deal of variation as far as the co-efficients found are concerned. This points to the existence of a disturbing factor or factors which the authors have either not taken into account or omitted to mention. The following is an illustration of the variability of co-efficients and the general constancy of relative values. Some time ago I determined the values of two coal-tar preparations which were somewhat similar in constitution. They were then sent to other analysts—six in all—who, with one exception, used the method as described. The relative values found by five of us were in fair agreement, but in no two cases were the co-efficients alike. They varied from 5·5 to 9·3. These differences were very striking; but had one sample only been examined by all of us, they would have been still more confusing, as it would not have been shown that the factor or factors affecting the results were constant for any one observer. Repeated examinations by several of us yielded the same result. Inquiry showed that in some cases distilled water was used for dilution of the samples, and in others, tap water; whilst, in one case, an agar culture replaced the prescribed broth culture.

On learning these facts, I started some experiments in the hope of clearing up these discrepancies. They were as follows:—

The action of distilled water for dilution was compared with that of a moderately hard tap water. The effect of a filtered and unfiltered agar culture on the co-efficients was tested. The effect of filtration of broth cultures, together with a determination of any difference which might arise if the unfiltered broth culture were shaken immediately before some of it was removed for the medication of the dilute disinfectant. So as to make the conditions of experiment as nearly alike as possible, they were carried out at a temperature of from 56° to 58° F., as this was found to be the most convenient. The same saponaceous emulsifying preparation was used in all cases; the same platinum wire was used for taking sub-cultures throughout, the size of the loop being 3 mm. in diameter. The broth was as constant as possible in composition, and was made as follows:—10 grms. of Lemco were dissolved in 1000 c.c. of water. To this were added 10 grms. of Witte's peptone and 5 grms. of common salt. After boiling for half an hour, the broth was made neutral to phenolphthalein with normal sodium hydroxide solution; 15 c.c. of normal hydrochloric acid was then added. After boiling for 30 minutes, the broth was filtered, allowed to cool, made up to 1000 c.c., filled into tubes and sterilised. The same strain of *B. typhosus* was also used for all the observations; the cultures used for the tests were of uniform age, *viz.*, 24 hours old. In each case the culture was shaken and allowed to stand for 20 minutes (so as to permit the clumps to settle) before any of it was withdrawn for the tests.

Distilled water.—Table 1 shows the co-efficient obtained with freshly made emulsions, and Table 2 shows the figures obtained when the emulsions had stood for seven days, the solutions being shaken just before use.

TABLE 1.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 880	+	—	—	—	—	—
"	1: 990	+	+	—	—	—	—
"	1:1100	+	+	+	—	—	—
"	1:1210	+	+	+	+	—	—
Carbolic	1: 110	+	+	+	—	—	—

Carbolic acid co-efficient, $\frac{1100}{110} = 10$. Sub-cultures: Period of incubation, 72 hours; temperature, 37·5° C.*

TABLE 2.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 660	+	—	—	—	—	—
"	1: 770	+	+	—	—	—	—
"	1: 880	+	+	+	—	—	—
"	1: 990	+	+	+	+	+	—
Carbolic	1: 110	+	+	+	+	—	—

Carbolic acid co-efficient between 8 and 9. Sub-cultures: Period of incubation, 72 hours; temperature, 37·5° C.

* In these tables, + indicates growth; — no growth.

Tap water.—Table 3 shows this had the effect of reducing the germicidal value of the sample somewhat as compared with the distilled water, even when the solutions were fresh.

TABLE 3.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 880	+	+	—	—	—	—
"	1: 990	+	+	+	—	—	—
"	1:1100	+	+	+	+	—	—
"	1:1210	+	+	+	+	+	—
Carbolic	1: 110	+	+	+	—	—	—

Carbolic acid co-efficient, 110—9. Sub-cultures: Period of incubation, 72 hours; temperature, 37·5° C.

Table 4 shows that when the emulsions were allowed to stand for seven days there was a drop in the co-efficient of over 50 per cent. Considerable separation had taken place, and the globules which had settled out could not be got back into a state of perfect emulsion when the containing flask was violently shaken. I may here state that I have observed the same effect of tap water on a non-saponaceous emulsifying preparation; in fact, all the emulsions I have examined in this way show a falling off more or less great.

TABLE 4.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 660	+	+	+	+	—	—
"	1: 770	+	+	+	+	+	+
"	1: 880	+	+	+	+	+	+
"	1: 990	+	+	+	+	+	+
Carbolic	1: 110	+	+	+	—	—	—

Carbolic acid co-efficient, about 6. Sub-cultures: Period of incubation, 72 hours; temperature, 37·5° C.

Agar cultures—Filtered and unfiltered.—Freshly made dilutions of the fluid under examination were made for this test with distilled water. A 24-hour old blood heat slope culture was taken and to it was added 2 c.c. of sterile distiled water. The tube was then shaken until the growth was entirely removed. The resulting emulsion of organisms was not allowed to settle. It was added to the dilutions of disinfectant in the ordinary way. The result is very striking, the co-efficient being nearly halved, as a glance at Table 5 will show. A microscopic examination by means of a hanging drop of the emulsified culture showed that it was largely composed of clumps of the bacilli.

TABLE 5.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 500	+	+	+	—	—	—
"	1: 600	+	+	+	+	+	—
"	1: 700	+	+	+	+	+	+
"	1: 800	+	+	+	+	+	+
Carbolic	1: 110	+	+	+	+	—	—

Carbolic acid co-efficient, between 5 and 6. Sub-cultures; Period of incubation, 76 hours; temperature, 37·5° C.

Table 6 shows the co-efficient obtained when these clumps are removed by filtration.

TABLE 6.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 880	+	—	—	—	—	—
"	1: 990	+	—	—	—	—	—
"	1:1100	+	+	—	—	—	—
"	1:1210	+	+	—	—	—	—
Carbolic	1: 120	+	+	+	—	—	—

Carbolic acid co-efficient, over 10. Sub-cultures: Period of incubation, 76 hours; temperature, 37·5° C.

Filtered broth culture.—The co-efficient for this is identical with that obtained on an unfiltered culture which has been allowed to stand. See Table 7.

TABLE 7.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 880	—	—	—	—	—	—
"	1: 990	+	—	—	—	—	—
"	1:1100	+	+	—	—	—	—
"	1:1210	+	+	+	—	—	—
Carbolic	1: 110	+	+	—	—	—	—

Carbolic acid co-efficient, $\frac{1100}{110} = 10$. Sub-cultures: Period of incubation, 76 hours; temperature, 37·5° C.

A glance at Table 8 reveals the fact that the co-efficient is slightly lowered if the culture is constantly shaken before some of it is withdrawn for the tests.

TABLE 8.

Sample.	Dilution.	Time culture exposed to action of disinfectant. Minutes.					
		2½	5	7½	10	12½	15
Disinfectant + ...	1: 770	+	+	—	—	—	—
"	1: 880	+	+	—	—	—	—
"	1: 990	+	+	+	—	—	—
"	1:1100	+	+	+	+	+	—
Carbolic	1: 110	+	+	+	—	—	—

Sub-cultures: Period of incubation, 76 hours; temperature, 37·5° C.

The foregoing experiments appear to indicate that, to secure greater concordance in results, less latitude should be allowed to the individual operator, and since it is desirable that this be remedied, it should be directed, first, that distilled water only should be used for dilution; second, that agar cultures should be abandoned in favour of broth, and that the broth cultures should be filtered through ordinary filter paper so as to remove clumps. It should also be made imperative that the carbolic acid used should be standardised by bromine titration, as the pure crystals on the market contain varying amounts of moisture—sometimes as much as 8 per cent. The authors of the method recommended that carbolic acid of the B.P. should be used as it was supposed to be uniform in composition, containing 100 parts of phenol in 110 parts. My experience of it is that it shows considerable variation. It is very evident that accurate work is out of the question if the disinfectants are to be put into competition with a variable standard.

Another point which calls for consideration is the composition of the broth used. I have had long experience with the one just described, and I have found it to give the most uniform results. When meat is used instead of Lemco, the composition of the broth is variable. The acidity of meats varies very considerably, therefore varying amounts of soda salts are formed on neutralisation. Undoubtedly the vital resistance of an organism depends very greatly upon the medium in which it is grown, and should this vary from day to day, trouble will be experienced, as the dilution of carbolic acid necessary for killing it will be anything but constant.

The method just described may be objected to on account of the fact that the conditions of experiment are far removed from those which obtain in practice, but I submit that most of the standard laboratory methods we are accustomed to are open to the same objection. Yet none would discard them on this account since the indications which they afford are of great value. It has been shown that the test can be modified to meet any individual requirements. For instance, the compatibility of a disinfectant with soap may be tested by diluting it with a standard soap solution. The effect of organic matter on its utility may also be tested by the introduction of solutions of organic matter such as albumin and urine, but the conditions

under which these modifications are carried out must be standard.

The Sanitary Institute has appointed a strong committee to consider the question of standardisation of disinfectants, and Colonel Firth and Prof. MacFadyen, who have directed the work found necessary for its deliberations, have reported in favour of the "drop method," as devised by Rideal and Walker. The report, together with a very large amount of the experimental work done, is contained in the February number of the Journal of the Royal Sanitary Institute. They have recommended that the garnet and thread tests be discarded, as they are too elaborate and unreliable. They have also put forward for consideration a modification of the Rideal-Walker test which was devised by Major Fowler. The single organism is here replaced by a mixture of urine and fæces. It is described in the report above referred to, and also in an article by Major Fowler himself, which appeared in the January number of the Journal of the Royal Army Medical Corps. The mixture is prepared as follows:—1 grm. of fresh fæces is rubbed up in a mortar with 100 c.c. of freshly passed urine. The resulting emulsion is filtered through an ordinary filter paper to remove lumps. Three c.c. of the filtrate are then added to 3 c.c. of the disinfectant solution it is required to examine. The subsequent procedure is then similar to that already described. The sub-culture tubes must be examined at the end of 24 hours and any growth in them then is regarded as *B. coli*. As the *B. coli* is somewhat more resistant than the *B. typhosus*, it is assumed that any of these which may be present are killed off if the readings show negative. The main difficulty with this method is the inconstancy of the composition of the material to be examined, and also the variability of the forms of bacteria present. Sporogenous forms, though not of much importance from the pathogenic point of view, are likely sometimes to make the results obscure. I have had some experience with the method and obtained results which are not strictly concordant with one another; still, I think that where any doubt exists as to the behaviour of the disinfectants in the presence of fæces, indications of great value can be got by it. Some of the co-efficients obtained by Major Fowler are very interesting when they are compared with those obtained on the single organism, as they show that many of the highly prized disinfectants of the past, are, in the presence of the mixture, very much affected in activity.

Discussion.

Mr. J. H. Worrall said he still held that the bacteriological examination of disinfectants was a very marked advance upon the hitherto unsatisfactory methods of chemical analysis. Since Rideal and Walker's paper was read, many observers had carefully watched the progress of their method. A unit or so of difference in the carbolic acid co-efficient obtained by different workers upon the same disinfectant might be allowed, but when two bacteriologists of repute reported 2 and 15 respectively as the co-efficients for the same disinfectant on the same germ, the failure of the practical carrying out of the method must be acknowledged. It was unfortunate that tenders should be asked by sanitary authorities in terms of the Rideal-Walker method until at least uniform results could be obtained by separate investigators. But supposing this method were perfect in its working, what could be said respecting the great differences obtained when using the same disinfectant upon different germs? These differences had been attributed to selective action. The disinfecting value of mercuric chloride as found upon the *B. typhosus* would fail when used for treating an open wound contaminated with the *M. pyogenes aureus*. The Rideal-Walker method professed to measure only one property of a disinfectant. There were, however, several other properties of very great importance, *e.g.*, the permanence of disinfecting-action. Then there was the power of discrimination between germs and innocuous organic matter. The permanganates did not discriminate, and consequently their value, determined upon germs in presence of little organic matter, gave no measure of their actual value when used for disinfecting morbid materials in practice. Besides these properties there were others, such as harmlessness to the higher animals, freedom from destroying action on tissues and colours, and capability of mixture with different kinds of water. Just as the potable value of water could not be determined by a single test, even though that should be a bacteriological one, so a satisfactory evaluation of a disinfectant could not be arrived at by a germicidal estimation only.

Mr. S. R. Trotman thought the points brought forward by Mr. Lloyd were of much importance. The chief difficulty that arose in deciding upon a standard method was that disinfectants had varying properties and were used under very varying conditions, the latter being in general quite different from those under which they were tested. It was obviously impossible to devise a method which would meet all possible objections, but in drawing up such a process he thought it should be remembered that a bacteriological test on specific organisms favoured some preparations more than others, and that, if possible, some compromise should be made between chemical and bacteriological methods. The author had referred to the age of the solution tested as a disturbing factor in the Rideal-Walker method. That was an important point, for one rarely had to deal with a true solution in the case of a disinfectant. In view of the discrepancies shown by the author, it would at present be difficult to deal with fraudulent preparations, but as soon as a workable process was agreed upon he saw no reason why the sale of disinfectants should not be controlled by the Food and Drugs Act.

Mr. J. Golding said he was not particularly enamoured of standard methods, and in this case, where the science was so very young indeed, it would be a great pity that progress should be hampered by standard methods. If any particular method of testing were made a standard method, he would like it to be laid down as essential that distilled water should be made only in glass condensers.

Mr. L. Archbutt remarked that the directions given for the neutralisation of broth always seemed to him to be a weak point in bacteriological methods. Very varied instructions were given. Some used litmus, others phenolphthalein; some again used sodium carbonate, others caustic soda. Others directed that after neutralisation a certain definite excess of caustic soda should be added. As the amount of free carbon dioxide in the broth must vary, the excess of alkali must also vary if phenolphthalein or litmus were used as indicator, and this, he always understood, had a great influence on the development of some of the organisms.

Dr. F. H. Jacob said that from the practical point of view disinfectants were used, not in distilled water or broths, but in tissues which exercised an immense influence on the action of the germicide. The statistics of any antiseptic should show, under what circumstances the tests were made. It was very necessary at all times that the organisms should grow vigorously.

Mr. Ainslie-Walker said he fully agreed with many of the views expressed by the author. That the public were entitled to the same measure of protection which the law provided against adulterated food stuffs always appeared to him obvious. The exact nature of the control, however, was still a debatable point. Personally, he was strongly in favour of a bacteriological control. Long experience had convinced him that the best method of determining the efficiency of a given disinfectant was to place it in competition with a standard disinfectant of known strength, such as pure phenol, and to make direct appeal to the relative germicidal action on vigorous cultures of micro-organisms, as he had stated in a note to "The Practitioner."* He was aware that the subject did not lend itself to that exact treatment which was given to chemical analysis, but much could be done with the aid of a little system to prevent glaring discrepancies being made, to the discredit of the investigator, and the confusion of the general

*Vol. lxix., No. 413, p. 820.

public. As Mr. Worrall had stated that in his opinion the Rideal-Walker method was unreliable, basing his opinion on certain discordant results recently published, he would like to refer them to a paper dealing fully with these results, which he had written in conjunction with Dr. Sommerville of King's College ("Public Health," March 1, 1906); where any method of test was under examination, the least they were entitled to expect was that the investigators should work with samples of uniform composition. Yet this simple precaution had not been taken in the cases referred to by Mr. Worrall. To show to what extent this question might affect the work of different investigators, he had recently examined a sample of a certain well-known disinfectant which had been standing in his laboratory for some time. The top layer (about 1 in. in depth) was pipetted off and carefully tested. A portion from the bottom of the bottle was then drawn off for comparison. The carbolic acid coefficient of the bottom layer was 20·5, and of the top layer under 0·05 when measured against *B. typhosus*. Exception had been taken to the carbolic coefficient on the ground that the conditions laid down by the authors of the test did not conform to those existing in practise. A complete answer to this would be found in the paper referred to in "Public Health." He would only add that, far from this being the case, by the simple expedient of adopting certain standard diluents, the method was capable of elucidating problems of the greatest practical interest. He had pleasure in supporting the various recommendations put forward by Mr. Lloyd with the object of ensuring uniformity of result. It was to be hoped, therefore, that in formulating the final details of the method upon which they were still engaged, the Committee appointed by the Royal Sanitary Institute would weigh carefully the various recommendations that had been put forward.

Mr. Lloyd, in replying, said that chemical considerations certainly should have some weight in the choice of a disinfectant, and these were briefly outlined in the paper just read. Perhaps they should have been more fully dealt with, but as the title of the paper indicated, bacteriological methods were being specially dealt with. Perhaps the best way to determine the usefulness of a disinfectant, even from the chemical stand-point, would be to modify the Rideal-Walker method in the manner suggested by Mr. Walker and himself, *viz.*, by the addition of known amounts of egg albumin, mucin, or urine when any effect which organic matter may have on the preparation under examination would be revealed by the lowering of the carbolic acid co-efficient. He was now engaged on work in this direction. The lack of uniformity in various samples, no doubt, was a cause in addition to those mentioned, which accounted for some of the varied co-efficients obtained on the same disinfectant and the necessity for thoroughly shaking the sample before any of it was removed for examination could not be too much insisted upon. The figures given by Mr. Walker as to the germicidal values of two layers in one bottle of a well-known preparation were quite in accord with what he himself had obtained. This also applied to some other preparations on the market. Mr. Worrall's point with regard to the selective action of disinfectants on various organisms was very interesting. It was an undoubted fact that various organisms showed differing resistances to one and the same germicide. The *B. typhosus* was selected as the standard organism as it appeared to be generally the most resistant of the non-sporogenous pathogenic organisms with the exception of the *Micrococcus pyogenes aureus*, and he would suggest that for surgical work the effect of a disinfectant upon this organism be specially tested in addition to that on the standard organism. The question of the permanence of disinfecting action in the case of clothes where there was a possibility of return to an infected house was one for the Medical Officers of Health to decide, as it was hardly conceivable that the disinfection of clothing would be carried out without complete disinfection of the house in which the infection had occurred. The toxic action of the preparation should also be specially determined and was quite apart from the general principle of standardisation. The chemist, in the examination of a preparation, could hardly be expected to undertake this test, neither could the action of the germicide on tissues be decided in an ordinary chemical laboratory. He was quite in agreement with Mr. Gelding with regard to the distillation of water in glass vessels, as there was some risk where copper was used that minute amounts of it might be dissolved out, and these would have a very decided antiseptic action. The broth used throughout the experiments detailed in the paper had been found to give very good results, and was published in the hope that it might be adopted for this class of work, because as pointed out by Mr. Archbutt so many different formulæ had been given from time to time, the reactions of which were very varied. At the same time he was prepared to accept any other formula that might be put forward which gave results which were as good.

Mr. C. T. Kingzett wrote that "he thought that of bacteriological tests, results were likely to be in many cases extremely misleading, and never wholly to be depended upon. On the other hand, he was convinced that chemical considerations and the experience gained in the employment of such preparations lead to much more practical results."

Scottish Section.

Presentation to Dr. Thomas Gray, Hon. Secretary, Scottish Section.

On Wednesday, July 26th, 1905, at the North British Station Hotel, Glasgow, shortly after the arrival of the members on tour from the Trossachs, Mr. David Perry Chairman of the Scottish Section, presented to Dr. Gray, the Secretary, a solid silver tea service and tray on behalf of a number of the members of the Section. This was given on the occasion of his approaching marriage, and as a recognition of the valuable services rendered by him during nine years as Hon. Secretary to the Scottish Section. Mr. A. McDonald, Mr. Tatlock and Dr. Clark, all spoke from personal experience of Dr. Gray's work for the Society. Dr. Wiley, of Washington, also spoke, and mentioned that he thought public work was more quickly recognised and rewarded on this side than in the United States. Dr. Gray acknowledged the presentation.

Meeting held at Glasgow, on Tuesday, March 27th, 1906.

Mr. David Perry in the Chair.

AN IMPROVED FORM OF THE WM. THOMSON CALORIMETER.*

By Thomas Gray, D.Sc., Ph.D.

While it is generally admitted that combustion in compressed oxygen in some form of bomb calorimeter is the only accurate method of determining the calorific value of a solid fuel, the high cost of the apparatus has prevented its general adoption. The demand for a cheaper instrument has led to the invention of a number of calorimeters in which combustion takes place in a current of moist oxygen at a pressure slightly in excess of that of the atmosphere. Some years ago the author, in conjunction with Dr. J. G. Robertson (this J., 1904, 704), carried out a large number of experiments with a calorimeter of this type, designed by Wm. Thomson (this J., 1886, 584). Twelve samples of coal, containing from 60 to 85 per cent. of carbon, were examined and the mean results were found to differ to the extent of −0·7 to −2·9 per cent. from those obtained by the use of a bomb calorimeter. The water value used in calculating these results was determined by weighing the

* Made by Messrs. Thomson, Skinner and Hamilton, Sandyford Street, Glasgow.

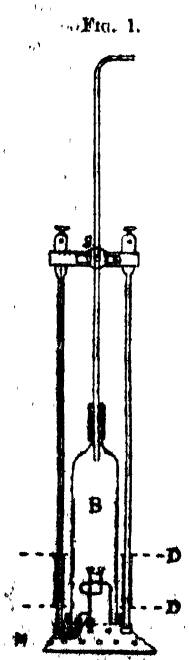
several parts of the instrument and multiplying the weights by the specific heats of the respective materials.

Differences of 100 to 150 calories were frequently observed between the results of the experiments with individual coal samples. These variations, which in an average coal having a calorific value of about 7000 calories represent approximately 1·5 to 2 per cent. of the total heating power, are largely due to the varying rate of the oxygen current, and to the impossibility of regulating the current so as to ensure perfect combustion of the coal and thorough cooling of the products of combustion which pass through the water in the calorimeter. By making use of the water equivalent determined by the combustion of a sample of coal of known calorific value, the errors due to incomplete combustion and imperfect cooling are partially compensated; the mean results calculated with the value thus obtained were only 0·04 to 1·1 per cent. lower than those determined by the bomb calorimeter (*loc. cit.* 707). These results led the author to conclude that the method might be of service to many users of coal, to whom the cost of a bomb calorimeter would be prohibitive, as a means of controlling the quality of their coal supplies; though the considerable variations referred to above would prevent it from being regarded as a standard method.

In the course of subsequent work with the apparatus some modifications have been introduced with the object of rendering it more durable and more convenient to handle. These consist of (*a*) the replacement of the bulged glass combustion chamber by a straight, somewhat wider, glass tube, (*b*) the substitution of thin perforated brass discs for the original wire gauze baffles, and, (*c*) the addition of arrangements for electrical ignition of the coal. The straight tube has a much longer life than the original form and can be replaced at a much smaller cost. The perforated discs are very much more durable than those constructed of wire gauze, and the possibility of starting the combustion by means of an electric current adds greatly to the convenience of manipulation. The glass calorimeter beaker is made of somewhat thicker glass, but this, as well as the tinned-iron casing, which serves as a heat insulator, retains the original form.

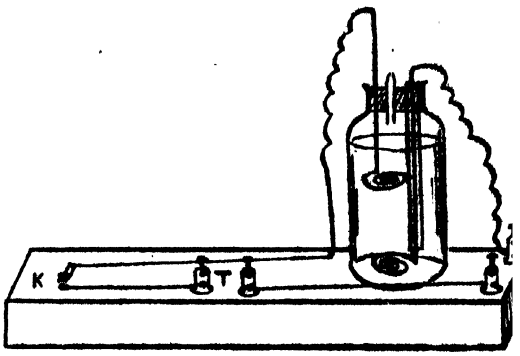
The internal combustion chamber is shown in the accompanying sketch (Fig. 1). The glass tube, B, which is about 6½ ins. long by 2 ins. diameter, sits loosely-clamped on the perforated metal base, M; a brass tube for supplying the oxygen passes through a thick-walled rubber tube fitted to the drawn-out upper end of the combustion chamber, and may be fixed in position by tightening the thumbscrew, S. Two upright brass tubes, joined above by a vulcanite cross piece and provided with terminals, transmit the current for igniting the coal. These tubes are in metallic connection with the metal base and through one of them an insulated wire passes from the terminal to a short insulated vertical rod inside the combustion chamber; a second rod, bent in the form of a ring to support the crucible in which the coal is burned, is in metallic connection with the metal base. The upper ends of these two rods are on a level slightly higher than that of the top of the crucible, and are connected by means of a thin platinum wire which can be made to glow by the passage of an electric current. The perforated metal discs, D, which serve to break up the bubbles of gas passing through the water in the calorimeter, are made to slide on the uprights so as to give access to the crucible.

Fig. 1.



The current may be obtained from storage cells, or from the ordinary lighting circuit when this is available. In the latter case, the resistance shown in Fig. 2 will be of service. To construct this, a wide-mouthed glass bottle, 6 ins. to 8 ins. high and 3 ins. to 4 ins. diameter, is filled with caustic soda solution of approximately 0·1 per cent. strength, and fitted with a rubber stopper. Two electrodes are made by twisting stout copper wire into the form of

Fig. 2.



flat spirals of about 2 ins. diameter, and bending the straight ends of the wire at right angles to these. One of these spirals rests on the bottom of the bottle, the straight portion passing through a glass tube which is fixed in the stopper: the upright wire of the other electrode also passes through the stopper, and a third perforation, into which a glass tube drawn out to a capillary is fitted, permits the gas liberated by the current to escape. The bottle is conveniently fixed to a wooden base provided with terminals, and a circuit-making key, as illustrated. The terminals, T, are connected to those of the calorimeter, and the other two terminals to the electric mains. The distance between the two electrodes is regulated by pushing the upper electrode down till the thin platinum wire glows on depressing the key, K. Further adjustment may be effected if necessary by altering the concentration of the caustic soda solution.

For the determination of the calorific value about 1 grm. of the coarsely powdered coal is weighed out approximately, compressed into a pellet, and weighed accurately. A piece of thin cotton yarn, about 6 ins. long, is tied round the pellet, the short end is cut off, and the pellet in transferred to the platinum crucible along with any powdered coal which may have been detached in the operation; the crucible is placed on the support, the free end of the yarn is tied round the thin platinum wire, and the loose end of the cotton is cut away. The glass combustion chamber, with the brass tube in position shown in the illustration, is placed on the stand and fixed by tightening the thumbscrew, S; a slow current of moist oxygen is passed through the apparatus, which is then immersed in the calorimeter beaker containing 2 litres of water, the temperature of which is 1·5° to 1·75° C. below that of the room. After an interval of 10 minutes the temperature of the water is read to 1/100° C., the oxygen supply is increased so that a rapid current of gas passes, and the cotton fuse is ignited by depressing the key. When the volatile matter is burnt the brass tube is gradually lowered till, at the end of the combustion, the opening is directly over the glowing coke. When the combustion is complete, the rubber tube connecting the oxygen supply with the calorimeter is detached to allow the water to enter the glass combustion chamber, the water is thoroughly stirred, using the apparatus held by the vulcanite cross-piece as a stirrer, connection is again made with the oxygen supply to continue the mixing, and the maximum temperature is observed.

Water value.—This should in every case be determined from the results of a number of combustions of an average coal of known calorific value. If W grms. coal of calorific value, C, are used and the observed rise of temperature is

t, then the water value, V, may be calculated from the equation:—$V = \frac{WC + F - 2000}{t}$ in which F represents the heat developed by the combustion of the cotton fuse.

Fuse correction.—This is determined by burning a measured length of the yarn rolled up into a ball, and noting the rise of temperature. The heat evolved by the passage of the current for the short space of time necessary to ignite the cotton is negligible in this method. It is advisable to arrange to make the current by depressing a key, rather than by means of an ordinary switch, as the experiment may be spoiled in the latter case through inadvertently leaving the switch on during the whole period of the combustion.

A carefully standardised thermometer graduated in 1/10° C. and read to 1/100° C. with the help of a lens will give a degree of accuracy which does sufficient justice to the method.

In modifying the original apparatus, the limitations of the method have been kept in view and refinements, such as the addition of a double jacket for more perfect insulation, which would add considerably to the cost of construction, have not been introduced. A high degree of accuracy is not attainable by this method, and in cases where this is desired some form of bomb calorimeter should be employed.

Yorkshire Section.

Meeting held at Bradford, Monday, March 19th, 1906.

MR. THORP WHITAKER IN THE CHAIR.

THE AVOIDANCE OF NOXIOUS EFFLUENTS IN THE MANUFACTURE OF SULPHATE OF AMMONIA.

BY J. GROSSMANN, PH.D., F.I.C. (OF MANCHESTER).

Since the passing of the Alkali Act of 1863, which has conferred incalculable benefits on the community without in any way interfering with the development of the industry which it primarily affected, a further condition has been added to those which up to that time determined the value of a process, and, however successful a method of manufacturing may be from the purely chemical or engineering point of view, it cannot now be considered satisfactory if it does not comply with the rules dictated by sanitary considerations. Progress in this direction has been naturally slow, as those in authority have liberally interpreted the provisions of the Alkali Act and subsequent enactments of a similar character, in such a manner as not injuriously to interfere with the existing modes of manufacture. In the case of sulphate of ammonia other circumstances had to be considered. Up to within comparatively recent times the bulk of ammonia was produced in gas works, which mostly belonged to municipal corporations. The ammonia liquors produced were either worked up by the corporation itself or by local manufacturers, and the residual products turned into the sewers. In the early stages of sewage purification these residual liquors were not considered to interfere with the subsequent treatment of the sewage so long as the solids were previously separated, and practically all that was required from the sulphate of ammonia maker was to settle the effluents well and to only discharge clear liquor. Even then serious nuisance occasionally occurred, but being strictly local and of rare occurrence, there was no inducement to take exceptional measures against it. It has, however, become an open question whether the ingredients present in the waste liquors from ammonia stills, even when diluted with sewage, may not interfere with the purification of the latter, particularly in the case of biological treatment, and besides the [illegible] situated in towns should be allowed to discharge their effluents into the sewers.

Far more serious is the effect of these effluents when the works which produce them are situated in the country, but even then, as long as the ammonia is only incidental to the manufacture of illuminating gas, the quantity in rural districts will be proportionate to the population, comparatively small, and capable of sufficient dilution. But where it is recovered from other manufacturing processes, such as coking, the quantity becomes disproportionate to the population, and a small village of a few hundred inhabitants may produce as much refuse gas liquor as a town of 100,000 or 200,000 inhabitants. That liquor will be discharged into the nearest stream in its natural concentrated condition, and according to the volume of water available in the stream cause more or less serious contamination.

It is evident that the solution of this problem may be approached from two directions: firstly, by attempting to render the waste liquors innocuous; secondly, by altering the process of manufacture in such a manner as to avoid the formation of the noxious effluent altogether. I have chosen the latter course for reasons which would lead too far to discuss in detail; the principal one, however, being that even if it were possible to remove the cyanogen compounds economically, there would still be sufficient tarry compounds and compounds of the nature of phenols left to render the final effluent noxious, and I know of no method of removing these organic compounds.

In designing my process which involves no startling new discoveries, but is in its main points a new combination of old and well-known reactions, I realised that in order to be acceptable to manufacturers it should as little as possible interfere with the present arrangements. My process, therefore, follows in its main line the present mode of manufacture, and branches off at a convenient point.

In the first place the ammonia liquor is distilled by means of steam in the same stills as used at present, but with this difference, that no lime or other alkaline substance is added.* The resulting liquor contains all the fixed salts of ammonia, besides tar oils and phenols, and salts of sodium. We will, in the first instance, assume that we carbonise 200 tons of coal per day, and that the total quantity of liquor leaving the still is 10,000 galls. per day. We also assume that we work with a fairly dry coal, which from its water in the state of moisture, and from the water formed during carbonisation from its hydrogen and oxygen compounds, yields 10 galls. of water per ton of coal = 2000 galls. of water per 24 hours. Taking it that we have used a quantity of steam equal to 1000 galls. of water for distillation, we find that out of the total quantity of 10,000 galls., 3000 galls. of water is freshly formed in every 24 hours. It is evident that the remaining 7000 galls. can, after cooling, be used again in the scrubbers for absorbing a further quantity of ammonia and ammonia compounds, and that we shall only have to dispose of the 3000 galls. in such manner as to avoid a nuisance.

The figures given here are actual results obtained frequently in gas works and sometimes in coke works. In the latter, however, the quantity of water formed every day often exceeds the figures given here, as the coal used may contain 10 per cent. and more moisture. It can easily be shown from thermodynamical consideration that it is against the interest of the coke manufacturer to use coal with an excessive amount of mechanical water admixture; and if, as is frequently the case, the amount of water freshly formed and added to the products of distillation reaches 20 galls. per ton of coal, and even exceeds it, it would be to the coke manufacturer's advantage to reduce that quantity to its lowest point by using the coal as dry as is practicable.

*My friend, Mr. Watson Smith, calls my attention to the publication of ammonium carbonate which takes place when lime or alkalies are not used, tending to produce complexities in the well-known equilibrium [illegible]. I was quite aware of [illegible] and [illegible] with ammonia-vapour, and have [illegible] that this action is the [illegible] desired [illegible].

[illegal] [illegal] [illegal] [

that it should in no case exceed in cost of working that of the present method. There is a saving in not using lime, which amounts to 3s. per ton of ammonium sulphate, a saving in the quantity of steam used, and the amount of labour should be the same as before. There should be a gain in the yield of ammonium sulphate equal to about 4s. per ton, as no ammonia left in the waste liquors from the stills is eliminated from the system. There is a gain through the recovery of thiocyanate and ferrocyanide, which, taking them at only 1d. per lb., would amount to from 4s. to 20s. and more per ton of ammonium sulphate; and the extra profit on ammonium chloride may be put down at from 9s. to 13s. and more. Against this probable saving of from 20s. to 40s., we have to allow for the cost of evaporation, the cooling of the liquors, and the amortisation and depreciation of the extra plant required. The cost of the first item will greatly depend upon local circumstances. Where the amount of water in coal is normal, there should be sufficient waste heat in coke-oven works to render this operation free from being a charge on the process. In gas works, where there is no waste heat, the charge should not amount to more than 5s. per ton of sulphate of ammonia, as there is always sufficient breeze in these works to spare, which has only a low commercial value, and in some cases almost none. And even where the amount of liquors produced is excessive, it will, in many cases, be found that there will be sufficient waste coal and coke of unmarketable quality which can be used for evaporating purposes. The cooling of the liquor also depends on local circumstances, but even under the most unfavourable conditions the charge for it would be small. The depreciation of plant could only take place in the evaporating apparatus, which is not expensive; and as the total installation is not costly, that item should not seriously affect the process. It must be borne in mind that this process has not been designed with a view to effecting a saving in manufacture, but with a view to alter the old process in such manner that it will comply with such sanitary conditions as may reasonably be imposed upon the manufacturer. If it will accomplish this without extra charge to the manufacturer, it will have done all that can be reasonably expected from such a process.

Discussion.

Mr. W. McD. Mackey said he thought there was only a restricted market for cyanides and ammonium chloride. Ammonium sulphate had a very stable price, and the market was one that was capable of almost indefinite expansion. What were the methods of evaporation to be used?

Dr. Wilson drew attention to the importance of the subject, on account of the large development in the coke oven industry within the last few years. This had caused an increase in the pollution of streams and the atmosphere. By the public health law, it was forbidden to discharge liquors from washing gases into streams and he was therefore glad of the conclusion that this could be totally avoided. In the West Riding of Yorkshire and in all colliery districts the industry was likely to increase. There had been very marked pollution in most of the cases of new works, and if manufacturers could change this it would be for the public good.

Mr. Purdy, speaking as manager of a coking plant, said the difficulty had been overcome at his works. The liquors were passed backwards and forwards through about 200 yards of open launder drain with wood hurdles for taking out the lime, &c., then mixed with the drainage water from the engines and boilers and run into a pond. They were pumped back as required into a tank, and thence to the boilers and so used again. This had done away with the use of boiler composition, as the liquors were found to be boiler cleansers. A careful watch had been kept on the boilers, plates, taps, &c., but no corrosion had yet been noticed.

Mr. Wilfred Wyld asked what materials Dr. Grossmann would recommend for the evaporators. Thiocyanates, sulphides and ammonium chloride would act on all ordinary metals such as iron, &c. Ammonium chloride crystals as obtained from gas liquors were usually in the crude state and almost black, and only a limited amount could be put on the market.

Mr. T. Fairley corroborated Mr. Wyld's remarks, and said he had found ammonium nitrate to be very corrosive, and to act almost like an acid with some metals. He thought the disuse of lime and recovery of ammonium chloride a distinct gain. If ammonium chloride was used for production of manures, the percentage of ammonia would give a limit below which its value could not fall.

Mr. F. Scudder said he was very much surprised at Mr. Purdy's statement that the waste ammoniacal liquors could, after dilution, be used again in the boilers. This was quite opposite to the inference to be drawn from the chemical analysis of such liquors. Coals carbonised in coke ovens seldom yielded less than 12 per cent. of water. The quantity of liquor to deal with would, therefore, on the average, be higher than that assumed in the paper. Colliery proprietors had been forced to face this question of dealing with the spent liquor on account of threatened legal proceedings. The initial cost of a coke oven bye-product recovery plant necessitated, in order that profitable results should be obtained, an increase in the yield of coke over that yielded from ordinary coking ovens, and the recovery of the ammonia in a marketable form. At present, the bulk of the waste liquors produced in the country go, after settlement, directly into the sewers, and that was one of the means of disposal. In Manchester that had not been found to interfere in any way with the bacteria beds or other methods used in the subsequent purification of the sewage. Dr. Grossmann had not stated the ratio of free to fixed ammonia in the liquors. Lime was not to be over-valued for driving off the fixed ammonia, the amount of sedimentary matters which had to be dealt with from the ammonia stills being a serious matter; caustic soda was therefore to be preferred, and as a matter of fact, several works in the south of England were employing caustic soda with economical results. A certain amount of clean water must be used for removing the last traces of ammonia in the scrubbers, and that would have to go into circulation, and would bring up the cost of evaporation considerably. Cyanogen compounds must not be counted upon as a source of profit, since the supply was very much in excess of the demand. He advocated careful consideration of the amount of water in the coals used, since it was advisable to have the ammonia in the most concentrated form possible.

Dr. Grossmann, in reply, said the cyanide industry in connection with gas works was developing very much, and gas works managers continued to put up plants for the recovery of cyanides. The main source of these compounds would, in the future, be the distillation of coal. He thought sufficient allowance had been made in his paper for any reduction in the market value of cyanides, by taking them at only 1d. per lb. From a chemist's point of view he was unable to understand Mr. Purdy's success in using the waste liquors when diluted in boilers, and felt that, sooner or later, accidents would happen and trouble be caused. Corrosion and discoloration in evaporating ammonium chloride solutions could be prevented, and he thought it likely that a method would soon be devised for even overcoming corrosion in many other cases. The relative value of crystallised ammonium chloride to sulphate did not depend on the ratio of ammonia in the two compounds. Ammonium chloride was from £5 to £10 per ton higher in price than the equivalent in ammonium sulphate. The amount of liquor which was produced every day from coal distillation and rendered evaporation necessary could be boiled down at little cost, as in a gas works a large amount of worthless fuel, and in coke works besides, unmarketable fuel waste heat was available. Mr. Scudder's statement that in Manchester the waste liquors from the gas works had not been found to interfere in any way with the bacteria beds or other methods used in the subsequent treatment of the sewage, was diametrically opposite to the information he (Dr. Grossmann) had on this subject from a most competent quarter.

Meeting held at Leeds, on Monday, April 9th, 1906.

PROF. H. R. PROCTER IN THE CHAIR.

RECENT IMPROVEMENTS IN THE BIOLOGICAL TREATMENT OF SEWAGE.

BY W. J. DIBDIN, F.I.C., F.C.S., ETC.

In February, 1904, I had the honour of placing before the Society certain suggestions with reference to the use of horizontal layers of slates, tiles or other suitable material for the purpose of facilitating the destruction of the matters held in suspension in sewage, and thus "effectually meet the sludge difficulty."

I now propose to submit for the consideration of the members the results of actual work accomplished on the lines then laid down. In the previous paper referred to, a series of results were given showing the effect on the organic matters in solution when the layers of slate were placed at intervals of 2 ins. apart. For the purpose of testing the question as to whether satisfactory results could be obtained when the layers were placed at greater or less intervals, I am permitted to quote from the results given by Dr. David Sommerville of the State Medicine Laboratories, King's College, London, in a paper which was published in "Public Health," September, 1904, *viz.* :—

"The immediate object of the experiments to be described was to determine the degree of purification, as measured by decrease in albuminoid ammonia, corresponding with definite spaces between the slabs of slate, with the view of establishing, if possible, an optimum space.

"Crude sewage, obtained through the kindness of Dr. Clowes from the London outfall, was used throughout. Operations were carried out in two laboratory tanks of different sizes, containing horizontal rows of slate slabs, arranged at distances apart, varying from 1 in. to 12 ins. Care was taken that the conditions of temperature, time given to filling and emptying the tank, time of contact of sewage with slates, &c., were as nearly as may be constant. The temperature was maintained at 16° C. to 18° C. Half an hour was allowed for filling a tank, half an hour for emptying, and two hours for undisturbed contact. Five hours were allowed for rest.

"The optimum vertical space between the rows of slabs, as indicated by the experiments, appears to be about 4 ins. A few examples selected from a large number of results will serve to make this manifest":—

No. of experiment.	Distance between rows of slab.	Percentage reduction of alb. ammonia.
	In.	
5	1	25
7	2	31
11	2	30
17	3	50
19	3	52
23	4	56
29	6	45
35	12	18
37	12	17

The Corporation of Devizes, having decided to make a series of experiments with the view of ascertaining how far the method of filling the primary contact beds with slate would answer for the sewage of that town, instructed their Surveyor, Mr. F. G. Billingham, to construct a pair of experimental beds, the first to be filled with slate placed at from 2 ins. to 3 ins. apart and having an initial gross capacity of 12½ cb. yds. and the second having a initial gross capacity of 25 cb. yds. and filled with breeze. This arrangement was intended to test the relative working powers as to quantity of sewage treated. If the preliminary experiments held good in practice the reduction in the size of the primary beds would be warranted. The results entirely confirmed the suggestion that this reduction in first cost would be justified.

The beds were first started at work in January, 1904, and were continued at work for 18 months when they were put out of use as the whole of the sewage was then treated on the new beds which had been constructed to replace the old system of chemical precipitation and sludge pressing.

The following are the results of the analyses made from time to time of the sewage, slate bed effluents and breeze bed effluents:—

First Series.

Table of results of analysis of samples of Sewage and Effluents from the Experimental Slate and Breeze Bacteria Beds at Devizes, Wiltshire.

Date of collection. 1904.	Sewage.			Slate Bed Effluent.						Coke Breeze Bed Effluent.				
	Ammonia.		Oxygen absorbed from permanganate at 80° F.	Ammonia.		Oxygen absorbed from permanganate at 80° F.	Purification per cent.		Suspended matters.	Ammonia.		Oxygen absorbed from permanganate at 80° F.	Purification per cent.	
	Free.	Albuminoid.	In 4 hours	Free.	Albuminoid	In 4 hours.	Alb NH_3	Oxygen absorbed 4 hours.		Free.	Albuminoid.	In 4 hours	Alb NH_3.	Oxygen absorbed 4 hours.
Jan. 29 ..	2·42	0·815	6·20	1·09	0·525	2·32	33	62	Traces	2·09	0·465	4.37	42	29
Feb. 3 ..	7·20	1·701	6·56	5·66	1·263	8·10	26	+	,,	5·34	0·602	5·85	64	11
,, 10 ..	0·82	0·462	7·76	1·23	0·448	7·67	3	1	,,	3·76	0·483	5·60	+	28
,, 11 ..	3·29	1·020	8·85	4·42	0·558	5·43	46	38	,,	1·36	0·390	3·00	61	66
,, 20 ..	8·19	0·990	5·02	8·50	1·015	6·59	+	+	,,	7·05	0·994	4·08	+	31
,, 24 ..	7·52	1·086	7·00	7·51	1·086	7·00	0	0	,,	6·42	0·959	4·20	12	40
,, 27 ..	4·28	1·200	6·40	Broken			—	—	,,	4·56	0·959	5·04	19	21
March 3 ..	6·46	1·554	8·82	5·56	1·204	6·53	22	26	,,	5·90	0·976	3·77	37	57
,, 11 ..	3·50	1·099	8·99	3·45	0·381	5·82	65	35	,,	3·58	0·144	3·04	86	66
,, 28 ..	6·41	1·428	20·00	6·02	0·843	3·50	41	33	,,	6·02	0·749	5·30	48	73
April 5 ..	5·27	0·689	4·34	5·02	0·568	3·64	17	16	,,	—	—	—	—	—
,, 14 ..	7·37	0·680	8·70	6·80	0·572	7·86	16	11	,,	3·97	0·335	3·60	50	58
,, 20 ..	10·31	1·470	9·55	9·66	1·050	8·25	28	13	,,	7·68	0·420	6·38	71	33
,, 20 ..	4·23	1·045	9·30	3·00	0·525	8·38	50	10	,,	2·50	0·332	6·02	68	35

These results were so far satisfactory in that they showed that the work of treating unscreened and unsettled sewage on the slates could be accomplished without nuisance from accumulated sludge and with the production of an effluent which was ready for final treatment on suitable fine beds. The effluents from the breeze beds, however, were not up to the standard and a careful examination was made as to the cause, when it was found that a large proportion of the material was too coarse, much of it running to 1—2 ins. in diameter. The bed was then refilled with suitable fine material, averaging from a quarter of an inch to one thirty-second of an inch. This was satisfactory.

[The analytical results obtained are given in Table (Second Series) on next page.]

It was noticed that at the end of the discharge from the slate beds a small quantity of semi-black matter flowed out from the bed. This was retained on the surface of the fine bed and there underwent disintegration and on being removed and thrown out on the surface of the adjoining ground dried up into a condition resembling ordinary mould, no offensive odours being emitted in the process. This was so far satisfactory in that it meant that there was a self-cleansing action going on by which the capacity of the beds would be retained for a longer period than would otherwise be the case. A sample of this matter was collected and submitted to careful chemical and bacteriological examination with the following results, *viz.* :—

	Per cent.
Water	38·6
Organic matter	25·2
Mineral matter	36·2
	100·0

The organic matter was found to consist almost entirely of the zoogloea masses of bacteria, the appearance under the microscope being comparable to an ordinary gelatin culture. A sample of the deposit on the top of the slate at about 18 in. below the surface of the beds was then collected, as also one from the under surface of the slates in the same position. The following are the results of the examination :—

Sept. 15, 1904.	Deposit from top of slate 18 ins. below surface.	Deposit from under side of slate 18 in. below surface of bed.
	Per cent.	Per cent.
Moisture	75·3	65·7
Organic matter	9·5	12·7
Mineral matter	15·2	21·6
	100·0	100·0
	Per cent.	Per cent.
Organic matter in the dry material	38·4	37·2
Nitrogen in the dry material	1·94	5·1
Bacteria per grain of wet material	=199,000,000	207,000,000

The microscopical examination of the matter from the upper surface of the slate revealed the presence of mineral *débris*, grit, &c. Spiral vessels, human hairs, leptothrix, anguillæ, vorticellæ, various starch cells, &c.

The matter from the under surface of the slate contained diatomaceæ, infusoria, starch cells, spiral vessels, monadina, spores of fungi, confervæ, hairs, muscular fibre, fragments of insects, &c.

On March 10th, 1905, further samples of the black "humus" discharged from the slate bed were collected and examined when fresh and after weathering, with the following results :—

	Fresh material.	Weathered mat
Appearance.	Black and smooth spreading.	Like ordina mould.
Odour.	Sewage.	None.
	Per cent.	Per cent.
Organic matter in dry material	40·5	32·5
Mineral matter in dry material	59·5	67·5
	100·0	100·0
Nitrogen per cent. on organic matter	8·42	7·62

The high nitrogen in the black "humus" from slate bed was doubtless due to the large number of li organisms it contained. The experiment on "weathering" is of the highest importance as sho the manner in which the solid matters of the sewage be disposed of without nuisance, especially when remembered that these beds receive the sewage wit being either screened or settled.

After the beds had been at work for 14 months, b charged on an average twice a day, the capacity of slate bed was measured, when it was found to hold 50 cent. of the original gross cubic content of the tank to the level of the slate filling. It was then rou flushed out when the capacity rose to 64 per cent. S of the slates at the sides were then removed, in orde allow the remainder of the slates to be flushed wi hose which so thoroughly cleansed the slates that water capacity rose to 82 per cent., which was the c content of the bed when newly filled with the sl thus showing that by this simple method the beds be restored, when required, to the condition of a bed. This particular bed, being the first constru on a working scale was not laid with the same skill now obtainable, nor were the slates as well split, espec the supporting blocks between the different layer slate. As now arranged the water capacity of a bed is about 87 per cent. of the total cubic conten the tank up to the level of the top layer of slate.

The whole of the sewage of the town was turned o the new installation on Sept. 12th, 1905, with the re of entirely confirming the above experiences with experimental beds.

[The analytical results obtained will be seen in T (Third Series) on next page.]

The effluent from the fine bed is then discharged o land.

The deposit from the slate beds has been allowed to on to the surface of the fine beds and there collecte channels, from whence it is removed and thrown u heaps on the surface of the fine beds to undergo weathe after which it is again spread out on the surface of the In future installations arrangements will be made this matter being discharged on to a special area of a or similar material, so as to keep the surface of the beds as open as possible.

Experimental trials of the use of the slate have been made by the Corporation of Trowbridge, v however, placed the effluent from a septic tank u them as well as on beds filled with granite, sandst coke and other material. The analyses of the respec effluents were made by Mr. Waterfall, F.I.C., &c., Bristol, who reported that "in either case slate gave best results," and as a result the Corporation are fil one half of the primary beds with that material.

Slate beds are also in operation at the works at E Wycombe for the purpose of eliminating the slu difficulty, the effluent from these being discharged di on to the land with satisfactory results.

From these various results it is evident that the gestion to use beds filled with layers of slate divided distance pieces has been justified, and that the meth although doubtless subject to improvement, deals ef tually with the sludge difficulty, and renders the sew fit for the further process of purification on either con

Second Series.

Table of results of analysis of samples of Sewage and Effluents from the Experimental Slate and Breeze Beds at Devizes, Wiltshire.

Quantities stated in grains per gallon.

Date of Collection. 1904.	SEWAGE.							SLATE BED.								NEW BREEZE BED WITH FINER MATERIAL.								
	Chlorine.	Ammonia.		Oxygen absorbed from permanganate at 80° F.	Suspended matters.		Dissolved solids		Chlorine.	Ammonia		Oxygen absorbed from permanganate at 80° F.	Purification per cent		Suspended matters		Dissolved solids		Chlorine.	Ammonia.		Oxygen absorbed from permanganate at 80° F	Purification per cent		N as NO_3.	Suspended matters.	Dissolved solids.	
		Free.	Albuminoid.	In 4 hours.	Total	Volatile.	Total.	Volatile.		Free	Albuminoid.	In 4 hours.	Alb. NH_3.	Oxgn absorbd 4 hours.	Total.	Volatile.	Total.	Volatile.		Free.	Albuminoid.	In 4 hours.	Alb. NH_3	Oxgn absorbd 4 hours		Total.	Total.	Volatile.
April 28..	—	8·26	0·875	10·80	—	—	—	—	—	8·03	0·497	9·58	45	11	—	—	—	—	—	5·26	0·049	11·17	94	?	—	—	—	—
May 13..	8·0	4·82	1·166	7·11	35·3	31·0	89·5	30·0	7·25	4·80	0·693	5·85	40	18	2·0	2·0	80·0	28·6	7·2	4·77	0·052	1·94	96	73	—	*Nil*	128·6	20·1
June 1..	7·0	5·18	0·860	3·89	69·3	32·7	54·1	14·3	7·26	5·08	0·542	3·69	37	5	4·6	2·1	57·6	16·1	8·6	3·13	0·130	0·81	91	79	0·368	,,	120·3	16·2
,, 20..	12·4	10·11	1·020	7·70	47·8	23·5	82·6	15·1	11·62	11·60	0·696	6·30	31	18	16·9	2·6	58·6	13·2	12·7	2·43	0·121	1·06	88	86	1·068	,,	144·4	20·4
July 4..	8·1	8·25	9·030	4·92	30·5	11·6	63·9	16·2	8·33	9·69	0·606	4·92	33	0	8·1	3·8	66·6	18·3	8·3	2·75	0·168	1·02	81	79	0·936	,,	107·6	11·2
Aug. 9..	25·6	5·78	0·787	4·24	40·2	9·6	100·4	20·0	24·60	5·73	0·569	4·30	27	—	37·0	8·4	92·0	20·0	19·4	5·51	0·263	1·49	66	65	Tr	Tr	121·3	5·5
Sept. 5..	20·3	7·72	1·060	4·85	61·8	52·4	90·2	15·8	20·30	7·30	0·787	4·35	26	10	12·6	6·8	84·4	16·8	19·8	2·84	0·357	3·05	67	37	*Nil*	,,	88·6	13·6
,, 26..	8·4	8·89	0·606	5·11	lo st				9·01	9·39	0·455	3·76	24	26		lost			7·1	3·57	0·130	1·26	78	76	1·117	,,	lo st	
1905.																												
Jan. 1..	6·0	7·26	0·899	5·37	71·0	41·0	49·8	6·8	7·55	7·03	0·892	5·48	1	0	Tr aces		62·6	24·0	9·0	2·12	0·402	2·42	55	55	1·240	*Nil*	80·0	14·0
March 6..	17·1	1·69	1·179	5·70	74·4	52·9	79·4	13·0	9·60	1·43	0·481	5·01	59	11	,,		63·0	10·8	11·6	1·06	0·234	0·79	80	86	0·250	,,	82·7	9·2
	These effluents did not putrify on incubation.																											

Third Series.

Table of results of analysis of samples of Sewage and Effluents from the Devizes Reorganised Works, treating the whole of the Sewage of the Town.

Quantities stated in grains per gallon.

Date of collection. 1905.	SEWAGE.							SLATE BED EFFLUENT								FINE BED EFFLUENT.											
	Chlorine.	Ammonia.		Oxygen absorbed from permanganate at 80° F	Suspended matters.		Dissolved solids		Chlorine.	Ammonia		Oxygen absorbed from permanganate at 80° F.	Percentage purification.		Suspended matters		Dissolved solids.		Chlorine.	Ammonia.		Oxygen absorbed from permanganate at 80° F.	Purification per cent.		Nitrogen as.		Suspended matters.		Dissolved solids.	
		Free.	Albuminoid.	In 4 hours.	Total.	Volatile.	Total.	Volatile.		Free.	Albuminoid.	In 4 hours.	Alb. NH_3.	Oxgn absorbd 4 hours.	Total.	Volatile.	Total.	Volatile.		Free.	Albuminoid.	In 4 hours.	Alb. NH_3	Oxgn absorbd 4 hours.	Nitrites.	Nitrates.	Total.	Volatile.	Total.	Volatile.
Sept. 12 ..	Sewage turned on to new works.																											
,, 17 ..	9·1	7·45	0·47	4·58	?	?		11·3	4·42	0·446	4·99	6	0	Tra ces			—	—	12·0	2·60	0·210	2·31	55	50	0	0	*Nil*	—	—*
Oct. 20 ..	12·5	8·27	1·86	12·15	499·9	220·6	118·2	34·2	15·2	4·58	1·344	4·84	29	60	,,		107·2	20·2	14·1	4·32	0·108	0·72	94	94	0	0	*Nil*	92·3	20·5*
1906.																												
Jan. 9 ..	12·6	7·29	1·10	8·36	32·5	15·8	97·5	31·5	10·2	5·31	1·020	6·02	7	28	7·0	5·8	73·5	1·0	7·7	3·23	0·091	0·53	52	93	0·66		Tra ces	—	—*
	*Did not putrify on incubation.																											

beds, sprinkling beds or on land when such is obtainable of suitable quality and quantity.

With regard to the discharge of sewage direct into the sea it is evident that the preliminary breaking up of the solid matters by inoffensive digestion on a slate bed would be an immense improvement over the common custom of sending it in with all the solid matters which float along the coast and form offensive deposits on the shore, as I found to be the case in one instance where the whole of the foreshore for a considerable distance at low water was reeking with sulphuretted hydrogen, and the stones and rocks and many of the seaweeds coated with *Beggiatoa alba*, the well known "sewage fungus," whilst *Bacillus coli communis* was abundant in all the samples collected. Such a state of things could not arise if the sewage before its discharge had been subjected to preliminary aerobic action on such beds as described above.

Discussion.

Dr. H. M. Wilson asked if, in the figures of purification given, percentages were calculated on the crude sewage, or on the sewage without its suspended matters. He also inquired what amount of suspended solids was left in the effluent, and what amount remained on the slate bed to be washed out. What was the nature of the suspended solids and the percentage of organic matter in them, and was there any method of distinguishing between living organic matter which would help purification, and dead organic matter which tended towards putrefaction? The advisability of adopting the proposed method was a question of cost. In this neighbourhood it might not be a cheap method, but the extra capacity of the beds was undoubtedly an advantage. Dr. Wilson pointed out that, although in testing one apparatus against another, percentage purification was a good criterion, the fitness of an effluent for a stream could not be thus ascertained, as the same percentage purification gave very different effluents with a strong sewage and with a weak sewage. Analyses were useless unless made on the matters in solution in sewage, after allowing suspended solids to settle. Some account, however, must also be taken of these solids, which usually contained about half the albuminoid nitrogen.

Mr. F. W. Richardson protested against the custom of reporting on sewages in the crude state without first allowing suspended solids to settle. This gave erroneous ideas as to efficiency of purification. The method of shaking up the whole, and endeavouring to get representative samples was unscientific, and consistent results could not be obtained in determinations of albuminoid ammonia, &c.

Mere settlement gave a large purification on account of the removal of flocculent matter, and this result was commonly credited as due to the special method of treatment employed by sewage-works engineers. He was pleased to hear that the septic tank was not a necessity, as its disuse did away with offensive odours. It was also satisfactory to know that the aerobic process was better, and that an approach could be made to natural methods, in which organic nitrogen was converted to inorganic nitrates, as in the case of waters in filtering into wells over wide areas.

A Member asked if slate tanks would work with brewery effluents.

Mr. Davies asked if Mr. Dibdin had ever tried the direct comparison of a primary slate bed followed by a sprinkling filter with the combination of two slate beds. He thought it would be of interest if Mr. Dibdin could give a few remarks concerning the actual chemical changes which occurred in the aerobic and anaerobic treatment.

Mr. Armytage said that at Yeovil the sewage from the fellmongering and leather-dressing yards of the glove factories was difficult to treat. Experiments had been tried for four years before finally adopting the septic tank system. Mr. Dibdin's suggestions, *re* fine beds, had been carried out there. Double contact was adopted with final deposition on land to satisfy the Local Government Board, thus making triple contact. Although the experimental plant was laid down within three yards of a public footpath, cottages and a glove manufactory, no complaints had been made as to nuisance or smell during the time the experimental plant was in use.

Mr. Fairley asked if Mr. Dibdin had thought of improving the fine beds on the lines of the other beds, since the durability of the latter had been so much increased? As contact beds depended on surface efficiency, thin laminæ of slate giving more surface than coke, would improve their value. One great advantage was that the increase of surface also gave increased capacity. The difference between septic tanks and slate contact beds was, that the former depended on anaerobic or putrefactive fermentation for success, whilst the latter worked through aerobic decomposition and oxidation. If sulphur were present in the first instance sulphurotted hydrogen and other offensive gases would be evolved. He asked if the laminated sandstone found in this neighbourhood could take the place of slate.

Mr. Harrison said that numerical values were comparatively worthless for gauging the purification of sewage, for the quality of the organic content must be taken into account in preference to the quantity. Mr. Dibdin had not mentioned what became of the matter washed out from the filters, and the cost of cleaning the slate bed and dealing with the undigested solids had not been given. The effluent from a slate filter did contain some suspended matter, and if this were placed on a contact bed, clogging and reduction in capacity would result. This would necessitate either remaking the bed or washing the bed material, and would consequently greatly increase the cost of treatment in a place like Leeds, where material was only obtained at a good price. He agreed that the ideal treatment should be aerobic. The difficulty in sewage works was not in purifying the matters in solution, but the suspended matter. The capital cost of the slate bed method in Leeds would render its use prohibitive.

Mr. W. McD. Mackey understood that the figures given could be taken as comparative in the same sewage. He was glad to see the diagrams giving the degree of aeration of the effluents. The albuminoid ammonia determination which had been employed so long, although very useful, was sometimes misleading, and he thought the degree of aeration of the effluent gave a very useful factor when considering the success of a sewage purification process. It was known that there were certain processes which took away oxygen. Of two similar effluents therefore, the one containing the more oxygen was the better. Dealing with the general question of the purification of sewage, he considered it was only fair that an engineer should get some credit for bringing about settlement of suspended solid matter.

Mr. Dibdin, in reply, said it was wrong to claim special credit for natural sedimentation in a process, because it was common to all methods. Suspended matter should be treated as such, and separated totally from dissolved matters. The percentage purification was stated in terms of dissolved matters in the sewage, the figures relating to suspended matters being given in the accompanying tables. It was impossible to distinguish between living and dead matters by chemical methods, but an approximate estimate might be obtained by microscopic examination and bacterial cultures. The best method of meeting the albuminoid nitrogen difficulty was by estimating the organic carbon and nitrogen, but this was seldom necessary for practical purposes. He had not tried slate beds for brewery effluents, and would be glad of an opportunity to do so. It was immaterial whether sprinklers, contact beds, or land were used for treating the effluent from the slate beds. The essential object of the slate bed was the retention and aerobic bacterial treatment of the suspended solids, the effluent thence passing to contact beds, sprinkling beds, land or tidal river, &c.

The essential difference between the aerobic and anaerobic treatment was that, in the first case, the action

took place in the presence of air, and consequently by organisms which effected disintegration, without the production of offensive gases, and whose action moreover was more rapid and complete than that of the anaerobic organisms which evolved grossly offensive odours, and to a large extent stultified themselves by their own emanations. He had not proposed slate for secondary beds, as the weight of the closely compacted fine slate would involve too large a cost for railway carriage of the material. For the same reason and also because of the difficulty of splitting it to the required thinness, sandstone was less suitable, although it worked well as an ordinary filling material, but did not give the extra working capacity obtained by flat, thin superposed surfaces such as tiles, slate, &c. He agreed with Mr. Harrison that quality was more important than quantity in sewage constituents. In the paper it had been explained that the matters washed out of the slate beds dried up on exposure to the air to a condition resembling mould without nuisance, instead of forming the usual "sludge lagoons" so commonly met with.

The question of the putrefaction in effluents had been raised. There was no complaint of smell at Yeovil or elsewhere where contact beds were used, but in many other cases serious nuisance was caused by the excessive putrefaction in the tanks, and the gases evolved were the cause of trouble when the liquid was distributed over the beds by the sprinklers. An effluent which maintained its aeration over 50 per cent. of the total possible was a good one and could not putrefy. With regard to the cost of the slate beds, he again pointed out the advantage of such a durable and permanent material. Effluents containing as much as 7 grs. of suspended matter per gallon had been satisfactorily dealt with by the same one acre bed at Barking Creek for 15 years, without indicating future trouble. Similar experience had been gained at many other—in fact innumerable other—places, and it therefore could not be seriously maintained that fine beds would not work. In fact, Manchester alone was extending their use largely. With reference to the cost of the slate, 12s. per cubic yard was equal to coke, &c., at 6s. in consequence of its giving a twofold working capacity. In addition to this, it was permanent and could be cleansed when required; in fact there was no comparison between the two in the long run. He was sorry that Leeds had not tried the slate in the manner in which he proposed it. They had a small sample at high railway rates, and tried it for sprinkler beds and as a substitute for fine beds, but not for the specific purpose for which it was introduced, *viz.*: primary contact beds to ensure the aerobic preliminary treatment of the crude sewage. After all the work that had been done by Mr. Harrison, he was glad to find him in agreement as to the aerobic principle being the correct one. He (Mr. Dibdin) had been fighting this battle for years, and congratulated himself that at last the point was being conceded in all directions. Even the strongest supporters of the anaerobic theory admitted that it was quite possible to "over septicise" the crude sewage, which was a convenient phrase to intimate that putrefaction was a blunder. In due time they would admit that the action took place to the best advantage when the sludge was laid out in thin layers on a well drained surface in the presence of air, as in land treatment under the best conditions. This was precisely the principle and practice of the slate bed, which thus came nearer to nature's method than any artificial treatment which had been proposed.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 363.)

High vacua; Production of —— by means of liquid air. G. Claude and R. J. Lévy. Comptes rend., 1906, **142**, 876—877.

THE principle of the method consists in raising the degree of exhaustion by stages. The space to be exhausted is connected with a series of two or more vessels containing charcoal. The apparatus is first exhausted by an air pump or water pump, which is then shut off, and the first (outermost) vessel of charcoal is immersed in liquid air, thus raising the vacuum in the space to be exhausted and the other charcoal vessels. The first charcoal vessel is then shut off and the second cooled, and this procedure is carried farther if necessary. The operation is very rapid and economical of liquid air; in fifteen minutes, starting from a pressure of 2 mm. of mercury, five Crookes tubes of 1 litre capacity each, were simultaneously exhausted to extinction of discharge.—J. T. D.

ENGLISH PATENTS.

Separating apparatus; Centrifugal ——. F. Kaehl, Berlin. Eng. Pat. 6782, March 30, 1905.

SEE Ger Pat. 155,562 of 1903; this J., 1905, 629.—T.F.B.

Separating apparatus; Centrifugal ——. Aktiebolaget Separator and A. J. Ericsson, Stockholm. Eng. Pat. 19,109, Sept. 21, 1905.

THE improvement is in respect of the method of transporting the solids along the periphery of the bowl of the separator to points above the scrapers which carry the solids towards the centre of the bowl. Scrapers attached to a cross-piece mounted on the shafts of the ordinary scraper wheels are provided; but they are placed above the ordinary scrapers, and move along the periphery of the bowl.—C. S.

Liquids; Apparatus for treating —— with gases or vapours. V. Defays, Brussels. Eng. Pat. 6850, March 31, 1905.

SEE Fr. Pat. 352,719 of 1905; this J., 1905, 959.—T. F. B.

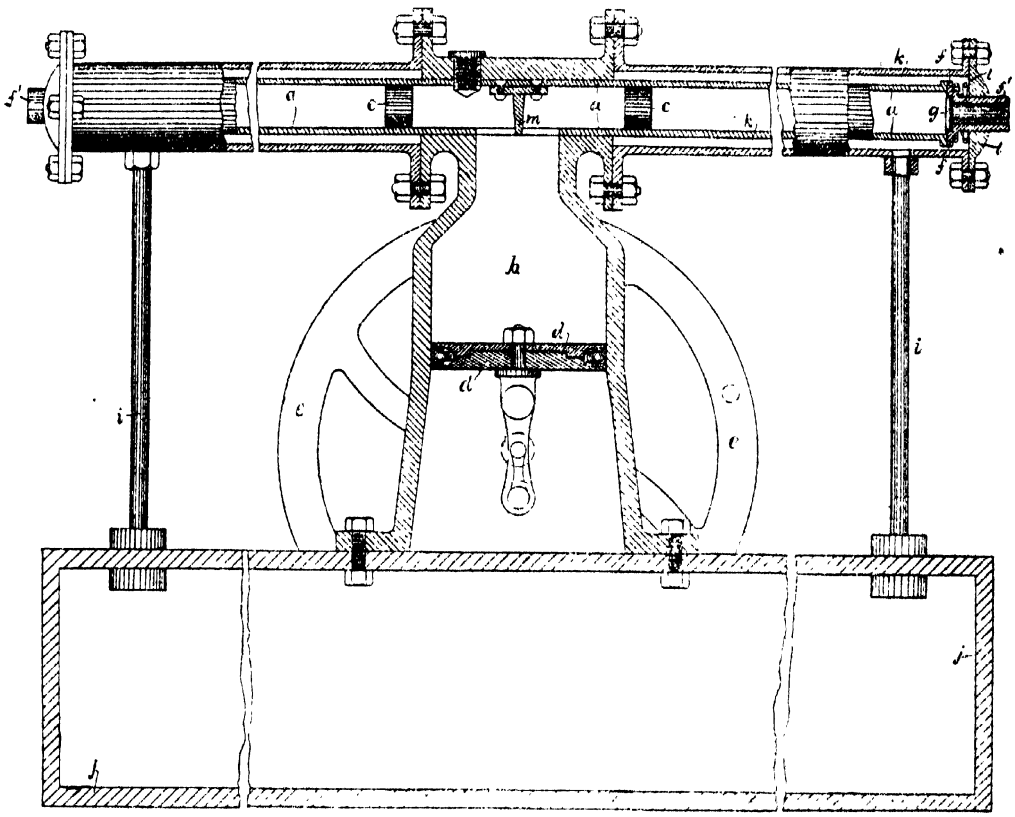
Mixer or agglomerator; Vertical ——. W. B. Westlake, jun., Swansea. Eng. Pat. 8855, April 27, 1905.

A VERTICAL cylinder is divided into an upper and a lower chamber by a horizontal partition. The upper chamber has a vertical, concentric, inner cylinder, and the lower one is divided by horizontal, perforated shelves. A central vertical shaft, on which blocks carrying agitating arms are fixed, passes through both chambers and is driven by spur-wheels fastened to it both above and below the casing. The material to be treated is fed into the top of the upper inner cylinder and passes from the bottom to the annular space, and thence to the shelves of the lower chamber, from the lowest of which it is taken away. An induced draught fan placed at the top, and communicating with the annular space, draws a current of heated air, mixed with a regulated supply of any desired reagent from a measuring apparatus through the lower compartments, and also carries away any vapours given off during the operation. The material in the upper chamber can be subjected to the action of steam or gas, which enters by a pipe passing through the outer casing, into and around the annular space and then into the inner cylinder. Reference is made to Eng. Pats. 853 of 1872, 8731 of 1885, 2807 of 1886, 2231 and 14,852 of 1899, and 21,300 of 1903 (see this J., 1887, 134; 1900, 231), and anything described therein is expressly exempted from claim.—W. H. C.

Purifying, humidifying or cooling air or other gaseous fluids; Impts. relating to ——. T. F. Shillington and J. A. Hanna, Belfast. Eng. Pat. 10,552, May 19, 1905.

THE air or gas is passed through a wheel formed of concentric rings or hoops, and which, on being rotated, serves to dissipate the humidifying liquid as spray amongst this air or gas, and the air or gas thus treated is subsequently passed through a cylindrical chamber provided with baffle-plates to cause the deposition of the liquid. —W. H. C.

Compressing air; Apparatus for ——, *applicable also for pumping liquids.* W. B. Barker and W. MacConnal, Liverpool. Eng. Pat. 10,557, May 20, 1905.



Two horizontal cylinders, *a*, having movable plugs or pistons, *c*, are mounted above a common vertical cylinder, *b*, provided with a piston, *d*, actuated by the wheel, *e*. The cylinder, *b*, is filled with a liquid such as water or oil, and during its upward stroke the piston, *d*, forces the liquid past the midfeather, *m*, into the horizontal cylinders, *a*, *a*, and causes the pistons, *c*, *c*, to move outwards. The pistons, *c*, drive the air in the cylinders, *a*, through the valves, *f*, into the annular jacket, *k*, and thence through the pipes, *i*, provided with non-return valves into the compressed-air reservoir, *j*. At the end of the upstroke, when the pistons, *c*, reach the end of the cylinders, *a*, the valves, *f*, are closed by springs, *l*, and as the piston, *d*, moves downwards, air enters the cylinders, *a*, through the pipes, f^1, and non-return valves, *g*.—W.H.C.

Fluids; Apparatus for effecting interchange of temperature between ——. E. F. Daniel and G. Thornley, Burton-on-Trent. Eng. Pat. 19,724A, Sept. 29, 1905.

THE vessel containing the liquid to be cooled, is fitted with any desired number of devices for ensuring the circulation of the attemperating liquid, each consisting of two concentric tubes with a narrow annular space between them, the cooling liquid being introduced through a third concentric tube, and delivered through a terminal chamber into the annular space, which it traverses as a thin layer. —C. S.

Drying and conditioning machines. J. H. Lorimer, Germantown, Pa., U.S.A. Eng. Pat. 22,816, Nov. 7, 1905.

SEE U.S. Pats. 811,306 and 811,307 of 1906; this J., 1906, 211.—T. F. B.

Hygroscopic packing materials; Impts. in ——. P. W Braun, Feuerbach, Germany. Eng. Pat. 23,658, Nov. 17, 1905.

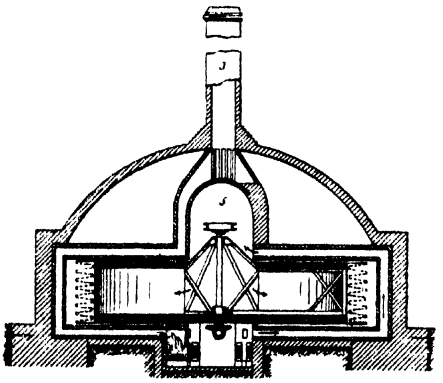
CALCIUM chloride, phosphorus pentoxide or other hygroscopic substance is finely ground, mixed with plaster of Paris in the proportion of 4 parts to 2, and then incorporated with ground peat (1 part), the whole being exposed to damp air, whereby it is rendered hard and unbreakable by shock whilst in use.—C. S.

UNITED STATES PATENTS.

Drying apparatus. W. Bell, Burgbrohl, Germany. U.S. Pat. 814,666, March 13, 1906.

THE drying chamber of the apparatus is circular in section, and in it a drum is mounted to turn about a vertical axis, means being provided for rotating the drum at suitable varying speeds. The periphery of the drum is perforated, or made of wire fabric, and provided with a number of perforated rings to form a number of grooves to which the

articles to be dried are attached by means of detachable perforated straps; the rings and straps may be of wire fabric. An operating drum is provided to wind on the detachable straps, and apply them to the drum. A number of "ventilating ladles" in the drying drum force hot air through the drum walls. The circular drying chamber has a central dome, 5, and there is a



central space beneath the chamber, and a number of furnaces arranged round the space, to which an air-shaft passes from without. From the furnaces flues pass radially in the floor of the drying chamber, vertically through the wall, and radially in the cover of the drying chamber, and upwards in the wall of the central dome, to the chimney, 3. Air channels on the sides of the flues communicate with the upper part of the central space and with the dome, as also a number of inclined air channels with the lower part of the central space, and with the circular drying chamber on the periphery. —W. C. H.

Kiln; Downdraft ——. G. E. Snowden, New Cumberland, W. Va. U.S. Pat. 816,752, April 3, 1906.

The kiln is provided with: a central cylindrical flue occupying one-third of its floor area; with radial flues extending from this central flue and closed at their outer ends; with independent segmental flues placed at opposite sides of the central flue, a series of radial flues extending from the segmental flues and disposed between each pair of floor-openings therein, chimneys placed in the kiln-walls, each communicating with a radial flue from a segmental flue, and also with heating-furnaces placed in the kiln-walls alternating with the chimneys.—A. G. L.

Furnace; Hot-blast ——. J. M. McClave, Toronto, Ohio. U.S. Pat. 816,877, April 3, 1906.

The claim is for a furnace with a closed ash-pit into which the admission of air can be regulated. The furnace is provided with air-heating flues, formed in the side walls and top, with separate outlets into the front and rear ends of the combustion chamber.—W. H. C.

German Patent.

Vacuum evaporating apparatus. H. André. Ger. Pat. 165,006, Feb. 23, 1904.

In order to render the apparatus claimed in Ger. Pat. 147,777, Jan. 16, 1902 (see Eng. Pat. 6847, March 24, 1903; this J., 1903, 787) suitable for the evaporation of thick liquids, and for roasting, carbonising, &c., the tubes rising from the baffle-plates are connected to a central hollow shaft, which rotates with the baffle-plates, and is provided with outlets for the vapours evolved. The lower end of the hollow shaft is furnished with a discharge-tube for the less volatile products formed. Further, in order to carry forward the material under treatment, the hollow shaft, or the under sides of the baffle-plates, are furnished with inclined plates or blades, of which alternate ones are longer than the others. The material falling from the baffle-plates on to the bottoms of the evaporating pans, is pushed by the longer blades towards the shorter blades, which in turn force it into and through the tubes connecting the different pans, whilst similar blades fixed to the under sides of the pan-covers distribute the material over the baffle-plates.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 365.)

Coals. E. Donath. Z. angew. Chem., 1906, **19**, 657—667.

The following is a summary of the author's arguments:—(1) In the majority of types there is a decided distinction between lignites (brown coals) and pit coals. (2) The transformation of lignite into coal cannot be brought about by an extension of the carbonising process over a considerable period or by contact-metamorphosis. (3) There is a marked difference in chemical composition between the substances which have given rise to the formation of lignite and of pit coal. (4) Lignite has its origin in substances containing lignin, whilst the material from which coal is developed appears to consist largely of proteids, which are probably of animal origin. (5) The formation of coal has in the majority of cases and for various reasons been accompanied by a more or less extensive process of distillation under pressure, the products of which are found in coal in a polymeric, condensed or other chemically changed state. (6) The caking property exhibited by certain coals is due to the presence of these pitch-like substances and products resulting from the decomposition of proteids, their amount being closely connected with the relative proportions of nitrogen and sulphur present in coal.—D. B.

Calorimeter; Alcohol —— for coal testing. W. M. Wallace. XXIII., page 445.

English Patents.

Peat and the like; Extracting moisture from —— [electrically]. W. Simm, Prescot, Lancs. Eng. Pat. 4792, March 8, 1905.

The peat is compressed by a plunger and is then subdivided by a number of electrode plates connected alternately in parallel with the poles of a dynamo supplying an alternating current of, preferably, over 200 volts. A dummy plate is used to make holes in the peat for the insertion of the electrodes, and means are provided for closing up the electrodes as the peat shrinks.—C. S.

Briquettes; Manufacture of —— [Utilisation of distillers' refuse]. Baron Armstrong, Rothbury, Northumberland. Eng. Pat. 6784, March 30, 1905.

"Pot ale" or distillers' refuse is concentrated by evaporation to the consistency of a thick syrup, heated and then well mixed with coal. When the briquettes are required to be waterproof, a little resin and linseed oil "foots" or glucose, or dextrin are added. A small quantity of tar improves the quality of the briquettes.—R. L.

Compressing air, or air and gas [for supplying burners]; Apparatus for ——. A. Clama, London. Eng. Pat. 5892, March 20, 1905.

The claim is for a gas-compressing apparatus for supplying gas under pressure to a burner. The compressor is actuated by a hydraulic piston and cylinder, connected to a supply of water under pressure. The admission of water to the hydraulic cylinder, and its subsequent expulsion when it has effected its work, is controlled by a special distributing valve, moved by springs, compressed by an auxiliary piston attached to a rod which passes through the hollow rod of the distributing valve, and is released by a rocking lever which bears against the rod of the distributing valve and the rod of the hydraulic piston. A self-starting device,

consisting of a spring catch, is provided to prevent waste, should the pressure in the water main fall below that necessary to work the apparatus.—W. H. C.

Gas producers; Construction and method of operation of ——. H. Lane, Manchester. Eng. Pat. 10,632, May 22, 1905.

A SUCTION producer is enclosed within two concentric casings, forming two annular spaces; the inner space, through which the hot gases from the producer circulate, is in communication at its upper end with the interior of the producer and at its lower end with the gas-outlet pipe; whilst the outer annular space, down through which the air is drawn on its way to the fuel, serves as the steam-generating chamber, an automatically regulated supply of water being caused to trickle down troughs or channels arranged on the exterior surface of the inner casing. The scrubber, through which the generated gases are drawn, is provided at the top with a flexible diaphragm, the pulsation of which, at each suction by the engine, is caused to operate the valve which controls the water supply to the producer. On starting the producer, the gas outlet pipe is put into communication with a chimney provided with means for increasing its draught, consisting of an annular grate or cup on its exterior, in which light combustible material may be burned, and perforations, through which the gaseous products are directed into the chimney.—H. B.

Gas producers; [Suction] ——. J. Fielding, Gloucester. Eng. Pat. 14,498, July 14, 1905.

To ensure the automatic regulation of the water supply in accordance with the steam requirements of the producer, water is allowed to descend in a continuous stream or series of drops near the air inlet. When the engine is not sucking, the water falls into a waste pipe and passes away, but at each suction stroke, the current of air deflects the descending stream of water into the producer.—H. B.

Grids for gas purifiers; Impts. in ——. F. H. G. Morris, Old Brentford. Eng. Pat. 10,971, May 25, 1901.

IN a gas purifier having distributing conduits arranged for the horizontal flow of gas, the purifying material is supported upon horizontal trays or grids placed one above the other at suitable intervals. The purifier casing is filled up with loose purifying material to the level at which the first grids are to be arranged, the first layer of grids is then put in place; the purifying material is next filled in to the level of the second grids, which are then put in place; and so on, until the casing is full.
—H. B.

Spent oxide from gas purifiers; Treatment of —— for the purpose of revivifying and rendering same fit for re-use. A. F. Browne, London. Eng. Pat. 26,899, Dec. 23, 1905.

SPENT oxide is revivified by passing through it such an excess of air as not only suffices for that purpose, but also to carry off much of the heat generated by the chemical action, and largely remove the deposited naphthalene. If necessary the product may be kept moist by means of steam or water spray.—H. B.

Sulphocyanides [Thiocyanates]; Manufacture of —— [from crude coal gas]. J. Tcherniac. Eng. Pat. 2708, Feb. 3, 1906. VII., page 427.

Mantle for incandescent lighting; Spontaneously-igniting incandescent ——. M. Pick, I. Fischel, G. Imiela, and E. Wallnig, Berlin. Eng. Pat. 19,435, Sept. 26, 1905.

AN igniting pellet composed of platinum black and argillaceous earth is attached to the inside of the mantle at a distance not exceeding 3 cm. from the gas inlet, and is connected with one or more ignition strips composed of ammonium-platinum chloride. (Reference is directed to Eng. Pats. 15,414 and 20,017 of 1898; this J., 1898, 1032, and 1899, 27.)—H. B.

Incandescent gaslight bodies; Improved process [and apparatus] for forming and hardening ——. Export-Gasglühlicht G.m.b.H., Neu-Weissensee, Germany. Eng. Pat. 24,032, Nov. 21, 1905. Under Int. Conv., Dec. 30, 1904.

IN forming and hardening mantles on a machine by this process, each mantle is rotated about its axis slowly and intermittently, instead of continuously and rapidly, the rotatory movements occurring preferably whilst the burner is below and not within the mantle. At each rotatory movement the mantle moves through only a small part of a circle. In the machine described, a number of horizontal discs are caused to rotate continuously by means of suitable driving gear, each disc having on its under side a pin, fixed excentrically. Beneath these discs a corresponding number of rotatable toothed wheels are so arranged that the pins on the rotating discs engage in the hollows between the teeth, whereby the wheels are caused to turn intermittently, a little at a time. The mantles to be treated, are suspended from wires attached to the under side of these wheels, and are thus given the desired gradual and intermittent rotation. A corresponding number of burners is provided below the mantles.
—H. B.

Mantles; A medium for fixing igniting material on incandescent ——. N. Hoock and L. Zucker, Berlin. Eng. Pat. 255, Jan. 4, 1906. Under Int. Conv., Sept. 19, 1905.

IGNITING pellets are affixed to incandescence mantles by means of a mixture of aluminium hydroxide, 35 parts; silicic acid, 5 parts; boric acid, 59 parts; with the addition of a small quantity of magnesia and carbonate of lithium or other alkali metal.—H. B.

Filaments for electric incandescence lamps; Process for the production of incandescence ——. Deutsche Gasglühlicht Akt.-Ges., (Auerges.), Berlin. Eng. Pat. 19,379, Sept. 25, 1905. Under Int. Conv., Jan. 17, 1905.

SEE Fr. Pat. 357,842 of 1905; this J., 1906, 116.—T.F.B.

UNITED STATES PATENTS.

Fuel gas; Process for making and burning ——. W. T. Griffin, Plainfield, N.J. U.S. Pat. 816,314, March 27, 1906.

A MIXTURE of superheated steam and finely-divided carbonaceous material is passed through a heated zone, the gases formed being conducted back through the zone to a point outside the same; a supply of oxygen is introduced into the current of gases and this mixture is burned beneath the heated zone.—R. L.

Gas calorimeter. C. E. Sargent, Chicago, Ill. U.S. Pat. 816,042, March 27, 1906.

THE heater is combined with a fuel meter and with a water supply. A trough which receives water from the heater is divided into two parts, each of which has a separate opening. The trough is pivoted below its centre and is capable of occupying two positions, moving under the influence of the water it contains, at a given period which is controlled by the meter. This control is effected by means of a stop to prevent the movement of the water-deflecting device, and an electromagnet to withdraw the stop. A partition in each trough section can hold back a portion of the water in each section after the trough has moved from one position to the other.
—R. L.

Carburetting apparatus. M. Steel, Gosforth. U.S. Pat. 816,267, March 27, 1906.

SEE Eng. Pat. 10,677 of 1904; this J., 1905, 665.—T.F.B.

Gas generator. J. G. L. Bormann, Charlottenburg, Germany. U.S. Pat. 817,035, April 3, 1906.

THE gas generator comprises a shaft provided with a lower and an upper grate, and a reservoir around the

shaft. Channels connect the reservoir and shaft immediately above the lower grate, whilst air conduits leading from the outer air extend into and through the reservoir and discharge into the generator. The gases discharged through the lower grate are passed through a vaporiser where they generate steam in a spiral pipe, which steam is blown into the generator below the lower grate.—R. L.

Gas; Method of manufacturing ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 817,126, April 3, 1906.

MASSES of refractory material contained in a gas generator are heated, and subsequently hydrocarbons, preferably petroleum oils, are brought into contact with the coolest portion of the heated mass, the vapours being passed downwards from the cooler to the hotter portions of the refractory material. The condensable hydrocarbons produced are removed from the fixed gases (oil-gas), which are subsequently submitted to a high degree of heat by bringing them in contact with the hottest part of the refractory material. The vapours are thus partially decomposed with formation of solid carbonaceous matter, steam being simultaneously admitted for the purpose of decomposing and gasifying that carbonaceous matter. The water-gas generated thereby and the oil gas are then mixed. Two generators may be employed for the two operations of generating and decomposing the fixed gases.—R. L.

Gas washing device. L. P. Lowe, San Francisco, Cal U.S. Pat. 817,127, April 3, 1906.

THE gas-washing apparatus claimed, consists of a casing containing transverse partitions extending upwards from the bottom of the casing, and "washer-plates" as deflectors, extending downwards to a level below the tops of the partitions. There are double transverse walls between the partitions, and openings in the sides of the casing, through which removable boxes for collecting the tarry residues may be passed.—R. L.

FRENCH PATENTS.

Retorts for the complete distillation of coal; Vertical ——. H. W. Woodall and A. McD. Duckham. Fr. Pat. 359,762, Oct. 27, 1905.

SEE Eng. Pat. 21,447 of 1905; this J., 1906, 306.—T.F.B.

Briquettes; Process of treating —— to consolidate them, by carbonising the agglutinant soluble in water. B. Wagner. First Addition, dated Nov. 9, 1905, to Fr. Pat. 350,536, Jan. 5, 1905 (this J. 1905, 721).

THE briquettes are heated indirectly, by causing the flame to play upon the exterior of the walls of the channels through which the briquettes are passed, instead of, or as well as directly, by causing the flame or hot gases to pass over the briquettes. The hot gases may travel in the same, or in an opposite direction to that taken by the briquettes, and the forward movement of the latter is controlled by a spiral guide formed on the inner surface of the channels.—W. H. C.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 367.)

Lignite pitch; Distinction between —— and other pitches. E. Graefe. Chem.-Zeit., 1906, **30**, 298—299.

THE main differences between lignite pitch and other pitches examined by the author are illustrated in the following table:—

	Usual or average melting pt.	Residue left after extraction with benzene.	Sulphur.	Iodine value.
		Per cent.		
Lignite pitch	86°	0·0	2·14	93·7
Coal-tar pitch	91°—92°	46·0	0·31	50·0
Wool-fat pitch	32°	0·0	0·00	36·9
Stearine pitch	43°	0·0	0·67	40·4
Petroleum pitch I...	33°	2·0	1·17	49·4
Petroleum pitch II.	73°	3·5	1·09	70·3
Petroleum pitch III.	126°	4·0	1·00	103·5
Lignite "goudron"	52°	0·0	1·88	66·5
Wood pitch	195°	42·0	0·00	140·0

—D. B.

Petroleum spirit ("benzine") and its treatment. G. Polack. J. Gasbel, 1906, **49**, 337—343.

FROM the behaviour of petroleum spirit, stored in cans and other receptacles, in numerous cases of fire, the author recommends that storage barrels holding over 2 cwt. should be made of welded, riveted or brazed sheet metal, tested to stand a pressure of 2½ atmospheres, and fitted with fusible plugs to act as safety valves. No taps should be allowed, the vessels being emptied through the bunghole either by a siphon or pump, and means provided for returning to the storage vessel the air displaced by the oil entering the smaller receptacles, instead of allowing it to escape freely. Small vessels, up to ½ cwt. capacity, may be of soldered sheet metal, whilst those of intermediate size should be welded or brazed in the body with soldered conical tops and screw stoppers. Carboys should not be allowed at all, being very dangerous. The storage vessels should be protected from exposure to heat, and to this end underground tanks are preferred.—C. S.

Petroleum production; Russian —— in 1905. Oil and Col. J., April 28, 1906.

ACCORDING to returns issued by the Association of Baku naphtha producers, the total output of crude petroleum in the main district during 1905, comprising the Apsheron peninsula, amounted to 414,700,000 poods, as compared with 614,600,000 poods produced in 1904, and 596,600,000 poods in 1903. The great conflagrations in August were the primary cause of the considerable decline in the production. The output in June reached 46 millions of poods, and in July, 47 millions, but in August the production receded to 32 millions, and in September to only 2,100,000 poods. In October, however, it advanced to 18 millions, and in November to 24½ millions, but in December there was a fresh reduction to 19½ millions. The export of all classes of naphtha products amounted to 375 million poods in 1905, as compared with 492 millions in 1904. [T.R.]

Nitrotoluene; Detection and determination of —— in nitrobenzene, and of toluene in benzene. P. N. Raikow and F. E. Uerkewitsch. XXIII., page 446.

ENGLISH PATENTS.

Coke ovens with regenerator action. F. J. Collin, Dortmund, Germany. Eng. Pat. 10,699, May 22, 1905.

SEE Fr. Pat. 354,919 of 1905; this J., 1905, 1166.—T.F.B.

Coke ovens; Coking of coal in ——. The Otto-Hilgenstock Coke Oven Co., Ltd., London. From Dr. C. Otto and Co., G.m.b.H. Dahlhausen, Germany. Eng. Pat. 14,783, July 18, 1905.

IN coking coal or similar substances in ovens, the supply of heat to the walls of the oven is cut off when the outer portion of the charge within the oven has been coked, for the purpose of allowing the heat in this outer portion to be utilised in coking the yet uncoked core of the charge. This may be done either by inserting dampers in the waste-heat flue or by closing the main cock of the heating-gas pipe.—R. L.

Emulsions of heavy mineral oils or the like; Manufacture of ——. J. P. van der Ploeg, Amsterdam. Eng. Pat. 7699, April 11, 1905.

THE heavy hydrocarbons are, if desired, first mixed with some light hydrocarbon to reduce the density to nearly that of water, and heated with about 1 per 1000 of an "alkaloidal" base, such as quinoline or pyridine, enough of an inorganic or organic alkaline salt or base being added to produce a slightly alkaline reaction. This mixture will, it is stated, form a durable emulsion with water.—C. S.

GERMAN PATENTS.

Coal-tar oils; Process for preparing dermatologically active, high boiling ——, *which do not darken.* Knoll und Co. Ger. Pat. 166,975, 1903. XVIIIC, page 440.

Distilling apparatus for gas-liquor and the like. C. Francke. Ger. Pat. 165,309, June 5, 1904.

THE invention relates to a device for agitating the contents of the still, consisting of a shaft or the like provided throughout its length with stirring blades and caused to rotate by means of vanes arranged turbine-fashion, against which the heating steam is made to strike.—A. S.

Cylinder oils; Testing apparatus for ——. F. A. Adolphe Tayart de Borms. Ger. Pat. 165,870, July 3, 1904.

THE oil is allowed to drop into a test cylinder where it is subjected to the action of steam under the same conditions of temperature and pressure that it will be subjected to in practice. The decomposition products of the oil can be collected and examined.—A. S.

Paraffins; Process for obtaining wax-like —— free from oil, from mineral oils. W. H. MacGarvey and S. Stransky. Ger. Pat. 163,386, Aug. 9, 1904.

THE paraffin is separated from the mineral oil by draining, filtering or pressing at the ordinary temperature (about 20° C.), and is then pressed in hydraulic presses at a gradually increasing temperature till the adhering crystalline paraffins are removed.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 370.)

Anthraquinone; Preparation of —— from benzoylbenzoic acid. G. Heller. Z. angew. Chem., 1906, **19**, 669—670.

THE charge consists of 1 kilo. of phthalic anhydride, 3·5 kilos. of benzene, and 1·8 kilos. of aluminium chloride. This mixture is introduced into a vessel lined with lead, provided with an agitator and a reflux apparatus, and heated by means of a hot water-jacket. At 30° C. evolution of hydrogen chloride commences, and as the temperature rises, the mass increases in viscosity, until it eventually becomes so thick that it stops the working of the agitator. When 70° C. has been reached, the heating is continued at that temperature, until the evolution of hydrogen chloride ceases. The mass is then cooled, diluted with 3 to 4 parts of water, the excess of benzene expelled by the introduction of steam, the residue rendered alkaline by the gradual addition of sodium hydroxide and boiled for several hours to decompose the aluminium compound into alumina and to form the sodium salt of benzoylbenzoic acid, from which the acid is obtained in the form of a crystalline mass by acidification. The yield is from 145 to 148 per cent. of the phthalic acid employed, being from 95 to 97 per cent. of the theoretical. The benzoylbenzoic acid is converted quantitatively into anthraquinone when heated with 5 to 6 parts of concentrated sulphuric acid for an hour at 150° C.—D. B.

Amino-p-dimethylaminobenzoic acid; The methyl ester of ——. F. Reverdin and E. Delétra. Ber., 1906, **39**, 971—974.

THE methyl ester of *p*-dimethylaminobenzoic acid is readily obtained by heating the acid for several hours with rather more than the theoretical quantity of methyl alcohol in presence of strong sulphuric acid on the water-bath. The ester is readily nitrated by adding it slowly to nitric acid of sp. gr. 1·34 at a temperature of 8°—12°C., this being finally allowed to rise to 16°—18° C. The yield is good. The mononitro compound formed, consists of yellow laminæ, melting at 71·5 C. It is reduced by tin and hydrochloric acid to the hydrochloride of amino-*p*-dimethylaminobenzoic acid methyl ester. The free base can be obtained by neutralising the aqueous solution of the hydrochloride with sodium carbonate, evaporating to dryness, and extracting the dry residue with alcohol. It is unstable in the air, and easily condenses with chlorodinitrobenzene. It is also readily diazotised in the usual manner, but the azo dyestuffs obtained from the diazo compound are not fast to washing or to soap, easily change colour, and possess no practical value. On adding the solution of the diazo-compound to a boiling aqueous solution of copper sulphate, hydroxy-*p*-dimethylaminobenzoic acid methyl ester is obtained, and can be isolated by adding sodium hydroxide in slight excess, filtering and then precipitating the hydroxy-compound with acetic acid. It melts at 176·5° C.—E. F.

Gallacetein of Nencki and Sieber, $C_{16}H_{12}O_6$; Synthesis of ——. C. Bülow and C. Schmid. Ber., 1906, **39**, 850—857.

IN 1881, Nencki and Sieber obtained "resaceteïn" by the action of zinc chloride on a mixture of resorcinol and acetic acid, or on resacetophenone; they also obtained "gallaceteïn" $C_{16}H_{12}O_6$, an isomeride of hæmateïn, by the action of zinc chloride on gallacetophenone (J. prakt. Chem. [2] **23**, 541). Bülow and Sautermeister (Ber., 1904, **37**, 354) have shown that resaceteïn is 2-(2.4.dihydroxyphenyl)-4-anhydromethyl-7-hydroxy[1.4-benzopyranol] (see this J., 1901, 704). The authors have now obtained trimethoxygallaceteïn by the condensation of pyrogallol with 2.3.4.trimethoxybenzoylacetone in presence of glacial acetic acid and dry hydrochloric acid gas, according to the equation:—

$$C_6H_3(OH)_3 + CH_3.CO.CH{:}C(OH).C_6H_2(OCH_3)_3 + HCl = (HO)_2C_6H_2{<}\begin{matrix}O\,(HCl)\,.\,C.C_6H_2(OCH_3)_3\\ C(:CH_2)\,.\,CH.\end{matrix} + 2H_2O.$$

By heating for 12 hours to 150°—180° C. in a sealed tube with concentrated aqueous hydrochloric acid, this forms the corresponding trihydroxy compound, 2-(2.3.4-trihydroxyphenyl)-4-anhydromethyl-7.8-dihydroxy[1.4-benzopyranol], identical with the gallaceteïn of Nencki and Sieber. This compound, in the form of its hydrochloride, shows the properties of a good mordant dyestuff. It yields more violet shades on chrome-mordanted wool than Alizarin Brown, and is quite as fast as the latter. The shades on alumina mordant are less fast, and bleed more. As the compound

$$(HO)\,C_6H_3{<}\begin{matrix}O\text{————}C\,.\,C_6H_2(OH)_3,\\ C(:CH_2)\,.\,CH\end{matrix}$$

an isomeride of Brasileïn, is not a good mordant dyestuff (Bülow and Schmid, Ber., 1906, **39**, 214), whereas gallaceteïn and the compound

$$(HO)_2C_6H_2{<}\begin{matrix}O\text{————}C\,.\,C_6H_5\\ C(:CH_2)\,.\,CH\end{matrix}$$

from pyrogallol and benzoylacetone, are typical mordant dyestuffs, the authors conclude that it is the hydroxyl groups in *o*-positions in the conjugated benzene nucleus of the benzopyranol group, and not the hydroxyl groups in the attached phenyl group, which confer the characteristic mordant-dyeing properties.—E. F.

Thionine and azoxine dyestuffs; Constitution of ——. F. Kehrmann. Ber., 1905, **39**, 914—926.

THE author replies to the criticisms of Hantzsch (this J., 1906, 173) and also describes fresh experiments, which support his own views as to the constitution of thionine and azoxine dyestuffs.—H. L.

English Patents.

Indophenolsulphonic acids; Production of ——. E. and E. Oehler, Offenbach a/Main, Germany. Eng. Pat. 7838, April 12, 1905. Under Int. Conv., Nov. 30, 1904.

See Fr. Pat. 352,200 of 1905; this J., 1905, 920.—T.F.B.

Indigo and similar colouring matters; Reduction of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 12,444, June 15, 1905.

See Addition of July 5, 1905, to Fr. Pat. 348,360 of 1904; this J., 1905, 1223.—T. F. B.

Colouring matters containing sulphur [Sulphide dyestuffs]; Manufacture of intermediate compounds and of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,763, Aug. 1, 1905.

See Fr. Pat. 357,600 of 1905; this J., 1906, 175.—T. F. B.

Dyestuffs; Manufacture of new anthraquinone —— *[Anthracene dyestuffs].* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,756, June 20, 1905.

See Fr. Pat. 355,331 of 1905; this J., 1905, 1223.—T.F.B.

Dyestuffs; Manufacture of new sulphurised —— *[Sulphide dyestuffs].* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 19,186, Sept. 22, 1905.

See Fr. Pat. 357,986 of 1905; this J., 1906, 175.—T. F. B.

United States Patent.

Dyestuff; Yellow Anthracene ——. M. Kugel, Wiesdorf, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 808,762, Jan. 2, 1906.

See Addition of Sept. 7, 1905, to Fr. Pat. 343,608 of 1904; this J., 1906, 260.—T. F. B.

French Patents.

Dyestuffs; Manufacture of black sulphide ——. L. Cassella and Co. Fr. Pat. 359,674, Jan. 30, 1905.

Tetra-amino-diphenyl-para-azophenylene (obtained by the oxidation of *p*-phenylenediamine) or its reduction product, is heated with sulphur. The product obtained is then heated with a concentrated solution of an alkali sulphide, which dissolves it, with the formation of a greenish-black sulphide dyestuff. The same product is obtained by heating the original substance with a polysulphide containing much sulphur.—A. B. S.

Dyestuffs; Process of making azo ——. Fabr de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 359,858, Feb. 4, 1905.

See Eng. Pat. 2228 of 1905; this J., 1905, 964.—T. F. B.

Dianisidine and diphenetidine; Preparation of disulphonic acids of ——. Act.-Ges. f. Anilin fabr. Fr. Pat. 359,214, Nov. 7, 1905.

Disulphonic acids of *o*-dianisidine and *o*-diphenetidine are prepared by treating these substances with fuming sulphuric acid, care being taken to avoid an appreciable rise of temperature. The new substances contain a sulphonic acid group in each nucleus in the *p*-position to the alkoxyl group. Both are readily soluble in water, but the sodium salts are sparingly soluble and crystallise well.—H. L.

o-Hydroxyazo dyestuffs; Production of ——. Fabr. de Prod. Chim. ci-devant Sandoz. Fr. Pat. 359,222, Nov. 7, 1905.

Diazotised *o*-aminophenol derivatives are combined with aryl-1.8-naphthylaminesulphonic acids. The new dyestuffs produce reddish-brown to violet shades on wool from an acid bath, which turn to black or dark blue on subsequent treatment with bichromate or copper sulphate. The shades after such treatment are stated to possess extraordinary fastness to light, acids, alkalis and milling. Among the *o*-diazophenols suitable are the diazo compounds of mono- and dichloro-*o*-aminophenol, mono- and dinitro-*o*-aminophenol, chloro-nitro-*o*-aminophenols, nitro-*o*-ammocresols, *o*-aminophenolsulphonic acids, their homologues and substitution products. The combination of *o*-nitro-*o*-amino-*p*-cresol with 1.8-phenylnaphthylaminesulphonic acid and of chloro-*o*-ammophenol-*o*-sulphonic acid with 1.8-*p*-tolylnaphthylaminesulphonic acid is described in detail. The first dyestuff produces brownish-violet shades on wool, which turn to intense blue-black on treatment with bichromate or copper sulphate. The latter dyes wool a reddish Bordeaux, which, on treatment with copper sulphate, changes to a rich violet-blue and on chroming to a dark blue. Combination is effected in slightly alkaline solution.—H. L.

Sulphurised organic compounds; Preparation of —— *and their utilisation for the production of a red dyestuff [Thioindigo Red].* Kalle und Co. Fr. Pat. 359,398, Nov. 13, 1905.

The preparation and properties of phenylthio-glycol-*o*-carboxylic acid, thioindoxyl-*o*-carboxylic acid, thioindoxyl, and a red dyestuff having probably the formula,

$C_6H_4<\begin{matrix}CO\\S\end{matrix}>C:C<\begin{matrix}CO\\S\end{matrix}>C_6H_4$, are described (see this J., 1906, 367). Phenylthioglycol-*o*-carboxylic acid is formed (1) by condensing thiosalicylic acid $C_6H_4(SH)COOH$ (1:2) with chloroacetic acid; (2) by combining diazotised anthranilic acid with thioglycollic acid. In the latter process, a substance of the formula, $C_6H_4(COOH).N_2.S.CH_2COOH$, is obtained as the first reaction product, which gives off nitrogen when heated in neutral, acid, or alkaline solution, and is converted with good yield into phenyl-thioglycollic-*o*-carboxylic acid. A white crystalline product of excellent purity is, it is stated, directly obtained. The evolution of nitrogen takes place at a temperature of 20°—25° C. in the presence of finely divided copper. Phenylthioglycollic-*o*-carboxylic acid is almost insoluble in cold water, but easily soluble in aqueous alkalis, and crystallises well from dilute alcohol; m. pt. 213° C. On heating with (or without) the addition of condensing agents such as caustic alkalis or acetic anhydride, it is converted into thioindoxyl-carboxylic acid. This substance is only stable in cold, neutral or alkaline solution. When heated, it loses carbon dioxide and is readily converted into thioindoxyl, especially in the presence of acids. By oxidising agents thioindoxylcarboxylic acid is converted into a red dyestuff. It is sparingly soluble in cold water, but dissolves in aqueous alkalis. On acidifying the solution, it is obtained as a yellowish-white crystalline product, which gradually turns red on exposure to the air or to light. Thioindoxyl is characterised by the great facility with which it is converted into a red dyestuff by contact with oxidising agents or the air. It is readily volatile in steam. The smell is similar to that of naphthol. The new dyestuff dissolves in chloroform to a red solution, possessing a beautiful yellow fluorescence, but is insoluble in the usual solvents. It is soluble in reducing agents such as sodium sulphide, hydrosulphite (hyposulphite), &c., forming a yellow solution from which the colouring matter is regenerated by oxidation. Fourteen examples are given to illustrate the various processes.—H. L.

Dyestuff; Process for the preparation of a red sulphurised —— *[Thioindigo Red].* Kalle und Co., Fr. Pat. 359,399, Nov. 13, 1905.

The preparation of the red sulphurised dyestuff (see preceding abstract) by treating thioindoxyl or analogous combinations with oxidising agents or with a current of air, is illustrated by four examples.—H. L.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 373.)

Bleaching of Wool; Process of ——. Thierry-Mieg and Co. Bull. Soc. Ind. Mulhouse, 1906, **76**, 47—49.

THE scouring with soap is replaced by treatment with sodium carbonate, thus avoiding the formation of calcareous soaps which are objectionable in printing. For muslin, the operations are:—(1) Treatment for thirty minutes in water at 40°C., 2000 grms. of sodium bicarbonate, or the equivalent of soda crystals, being added for six pieces; (2) rinsing during thirty minutes in water at 0°; (3) passing through a solution of sodium bisulphite of 6° B.; (4) steaming, under pressure, for three-quarters to one minute; (5) rinsing in cold water. A. Law and C. Binder, in a report to the Society, state that treatment with sodium carbonate may perfectly replace soaping, but they find that a brief treatment with bisulphite followed by steaming never gives so pure a white as a prolonged immersion in bisulphite alone, of the same degree of concentration. For the rapid production of a white as a ground for printing, the process, however, is of interest.—B. N.

Sulphide dyestuffs; Applications of ——. J. Heilmann and Co., and M. Battegay. Bull. Soc. Ind. Mulhouse, 1906, **76**, 50—54.

THE communication relates to the application of sulphide dyestuffs in printing, and the fixing of these colours by the aid of caustic soda and hydrosulphite (hyposulphite-) glycerin. The colour is dissolved by mixing and heating with sodium hydrosulphite, made into a paste with glycerin and caustic soda of 36° B. To assist the fixing of the dyestuff on the fibre, kaolin, a saturated solution of salt, and alkaline thickening, the latter consisting of caustic soda of 38° B. and gum water is added, after cooling. On red and claret grounds, the dyestuff is also mixed with hydrosulphite-formaldehyde. To discharge the colour, hydrosulphite-glycerin, mixed with kaolin, saturated salt solution and alkaline thickening is used, or, in the case of red and claret grounds, hydrosulphite-formaldehyde and gum water. The printed fabrics are steamed for five or six minutes in the Mather-Platt. In another report, C. Favre states that with certain dyestuffs the presence of glycerin appears to be indispensable, and in general gives purer tints, but does not offer any advantage over hydrosulphite-formaldehyde as far as the destructive action on the copper rollers is concerned. In printing with two colours, say black and blue, it does not prevent the inconvenience (though the new process lessens it) of the roller which prints the blue being attacked where it presses down on the black colour.—B. N.

Discharges and half-discharges on wool with potassium sulphite. J. Heilmann and Co. and M. Battegay. Bull. Soc. Ind. Mulhouse, 1906, **76**, 55—57.

POTASSIUM sulphite is used in calico printing in order to obtain half-discharges, the latter being secured by a passage through a Mather-Platt, or by a continuous steaming for half to three-quarters of an hour, under pressure, a clear white may be obtained. By using a mixture of dyestuffs, one of which is discharged by hydrosulphite- (hyposulphite-) formaldehyde, but sufficiently resistant to potassium sulphite, and by printing with this latter, both coloured and white discharges may be obtained by over-printing with hydrosulphite-formaldehyde. In a further report, O. Michel confirms the results which have been obtained by the authors.
—B. N.

Drying of printed pieces; Note on the ——. E. Boeringer. Bull. Soc. Ind. Mulhouse, 1906, **76**, 17—37.

THE author states that drying by steam plates is more economical as regards fuel than drying by hot air, but the best method is to pass the fabrics over drums heated by hot water, the hot water being heated by exhaust steam. Drying by means of plates or hot air combined with electrical driving of the machines, is not to be recommended, but, with electrical power at hand, the driving of machines by its aid, and the drying of the pieces by hot water heated with steam may be used with advantage in new installations. The economy resulting from this arrangement, however, is stated not to justify the transformation of an existing plant using the older process.
—B. N.

ENGLISH PATENTS.

Wool; Extraction of grease from —— and apparatus therefor. A. H. Burt, Mosman, H. Jackson and C. A. Finch, Sydney, N.S.W. Eng. Pat. 10,691, May 22, 1905.

SEE Fr. Pat. 354,667 of 1905; this J., 1905, 1107.—T.F.B.

Textile fabrics; Apparatus for washing ——. H. H. and T. S. Shuttleworth, Edenfield, Lancaster. Eng. Pat. 12,545, June 17, 1905.

THE material is repeatedly squeezed or beaten between a revolving drum and a curved surface or block arranged in an endless channel or trough, in which it travels round and round. The drum is arranged within a casing or box something after the manner of a paddle-wheel, and as the material clears the block both it and the water mingled with it are thrown forcibly against the casing, which is fitted with a grid or strainer. It is found that as the material as it is thrown sidewise and upwards tangentially from the drum, falls more quickly than the water, and so the two separate by the centrifugal force, and follow divergent paths, the water being uppermost. Thus the grid or strainer can be arranged so that only the water strikes upon it, the material falling back into the trough for a fresh passage under the wheel, whilst the dirty water passes out through the strainer.—D. B.

Fabrics; Method and means for winding —— in continuous bleaching apparatus, applicable also to other purposes. M. Muntadas y Rovira, Barcelona, Spain. Eng. Pat. 6160, March 23, 1905. Under Int. Conv., March 23, 1904.

SEE Addition of March 23, 1904, to Fr. Pat. 327,931 of 1902; this J., 1904, 933.—T. F. B.

Mordanting wool; Process for ——. Nitritfabrik, G.m.b.H., Berlin. Eng. Pat. 14,480, July 13, 1905. Under Int. Conv., July 14, 1904.

THIS invention relates to a process for mordanting wool by means of chromates, such as sodium or potassium bichromate, in the presence of a reducing agent, free formic acid being employed for this purpose.—B. N.

Yarns; Machines for gassing ——. R. E. Villain, Lille, France. Eng. Pat. 92, Jan. 1, 1906. Under Int. Conv., Jan. 7, 1905.

THE burners are so arranged that the flames are inverted, in order that ash and the products of combustion may be drawn away in a downward direction. For this purpose each burner is provided with an exhaust funnel connected to a longitudinal pipe, which communicates with a suction device.—D. B.

Fabrics [Moreens]; Finishing ——. H. R. Armitage, Clayton, Yorks. Eng. Pat. 6645, March 29, 1905.

THE object of the invention is to produce a fabric having the "watered" effect only in parts, leaving the other parts with the ordinary finish. For this purpose a press sheet made with thickened parts is used, the pressed designs being produced only where the raised parts come in contact with the fabric. Aluminium sheets may be used for this purpose.—D. B.

Tissues, woven fabrics and paper; Treatment of all kinds of —— for increasing their durability and rendering them waterproof. M. Pomortzeff, St. Petersburg. Eng. Pat. 15,518, July 28, 1905.

SEE Fr. Pat. 356,497 of 1905; this J., 1906, 15.—T. F. B.

UNITED STATES PATENTS.

Filaments and films; Manufacture of —— from viscose. C. N. Waite, Lansdowne, Pa., Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 816,404, March 27, 1906.

THE viscose products are initially subjected to a "setting" solution containing acid sodium sulphite and a dehydrating agent such as ammonium sulphate.—A. B. S.

Retting process for textile fibres. A. Van Steenkiste, Brussels. U.S. Pat. 816,622, April 3, 1906.

SEE Eng. Pat. 244 of 1902; this J., 1903, 210.—T. F. B.

Printing yarns; Apparatus for ——. A. Hofmann, Gothenburg, Sweden. U.S. Pat. 816,796, April 3, 1906.

SEE Eng. Pat. 24,387 of 1903; this J., 1904, 59.—T. F. B.

FRENCH PATENTS.

Red shades [Thioindigo Red] on animal or vegetable fibres; Production of ——. Kalle und Co. Fr. Pat. 359,400, Nov. 13, 1905.

THE red sulphurised dyestuff described in Fr. Pats. 359,398 and 359,399 (see page 424) is fixed on animal or vegetable fibres by means of the leuco solution. Bright bluish-red shades are produced which are very fast to water, acids, alkalis, washing, milling, soaping and light and remarkably fast to chlorine.

Example.—The dyestuff in the form of a 20 per cent. paste is treated with the necessary amount of sodium sulphide, sodium carbonate and common salt, or of hydrosulphite (hyposulphite) and caustic soda to form a yellowish solution, which only oxidises slowly on the surface. Cotton is introduced into the dye-bath and dyed at 80° C., or at the ordinary temperature. After dyeing the goods are squeezed and hung out in order to reoxidise the leuco compound.

Wool may be readily dyed in heavy shades from a weakly alkaline hydrosulphite vat, the leuco body possessing great affinity for the fibre. In general any method in use for dyeing indigo, such as the fermentation vat process, can be employed. For calico printing the following are two of the recipes given:—*Printing colour A.*—350 grms. of British gum, 3:2; 500 grms. of caustic soda of 40° B.; 150 grms of 20 per cent. dyestuff paste. *Printing colour B.*—400 grms. of British gum, 3:2; 350 grms. of caustic soda of 40° B.; 70 grms. of hydrosulphite NF; 200 grms. of 20 per cent. dyestuff paste. Colour A may be printed on cloth prepared with glucose, but this is stated to be not essential. After printing, the goods are dried, steamed for two to four minutes, washed in running water to regenerate the dyestuff from the leuco body, soured, washed and dried.

The claims embrace the processes described for dyeing and printing, and also, as new articles of manufacture, the dyed and printed tissues.—H. L.

Copper cylinders; Process for engraving ——for use in printing cretonnes, &c. The Calico Printers' Association, Ltd. Fr. Pat. 359,759, Oct. 24, 1905. Under Int. Conv., Dec. 14, 1904.

SEE Eng. Pat. 27,222 of 1904; this J., 1905, 1225.—T.F.B.

Printing on fabrics or paper; Apparatus for ——. Companhia Manufactora Fluminense. Fr. Pat. 359,677, Nov. 21, 1905.

CLAIM is made for a machine for printing two bands of tissue simultaneously on one main backing roller. The two bands of fabric, each furnished with a backing cloth, are fed on to the main roller at one side, one underneath the other; the band passes under some of the printing rollers, which only print the upper layer of cloth, the latter then runs off on guide rollers and the lower band passes on and is printed by other printing rollers.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 373.)

FRENCH PATENT.

Leather; Printing on ——. M. C. Lamb and J. D. G. Rennie. Fr. Pat. 360,391, Dec. 13, 1905. Under Int. Conv., May 26, 1905.

SEE Eng. Pat. 17,338 of 1905; this J., 1906, 17.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 374.)

Chamber process [Sulphuric acid]; Position of the fan in the ——. G. Schliebs. Z. angew. Chem., 1906, **19**, 671—672. (See this J., 1905, 1301.)

A REPLY to Niedenführ (this J., 1906, 120).—D. B.

Chloric acid; Preparation of pure —— and its application as an oxidising agent. V. Bernard. Ann. Chim. anal. appl., 1906, **11**, 81—82.

EIGHT hundred grms. of pure barium chlorate are dissolved in 1700 c.c. of hot distilled water; the solution is filtered into a capacious flask, and, when cold, treated with 243 grms. of sulphuric acid of sp. gr. 1·847, diluted with sufficient water to make about 2 litres of liquid; this is added to the barium chlorate solution in successive small quantities with thorough agitation, care being taken to obviate rise of temperature, as otherwise the acid formed will be oxidised to perchloric acid. After mixing, the barium sulphate is allowed to deposit, and the supernatant liquid is filtered through asbestos. About 1750 c.c. of chloric acid of sp. gr. 1·11 at 20° C. are thus obtained, containing only a trace of free sulphuric acid.

This acid is a valuable oxidising reagent, usefully replacing nitric acid or potassium chlorate in many analytical processes. It is specially useful in the determination of tin in brass and bronze by Hollard's electrolytic method, and for the oxidation of chromium salts in Storer's process.—J. O. B.

Phosphomolybdic acid; Behaviour of —— towards ether. A. Verda. Chem.-Zeit., 1906, **30**, 329—330.

WHEN the ordinary phosphomolybdic reagent (5 parts of phosphomolybdic acid, 7 parts of nitric acid, 100 parts of water) is shaken with excess of ether, it is decolorised, the colour becoming concentrated in a small quantity of dense liquid which separates at the bottom of the vessel. This proved to be a solution of phosphomolybdic acid in ether, for on evaporation of the ether there remained pure phosphomolybdic acid as an amorphous yellow powder, more readily reducible than the ordinary phosphomolybdic acid. Pure water dissolves out the phosphomolybdic acid from the yellow liquid, but water saturated with ether is without action on it. Ether forms with solid phosphomolybdic acid this yellow liquid, which, however, does not mix with the excess of ether. Solutions of phosphomolybdates, acidified and treated with ether, can in this way be made to yield pure phosphomolybdic acid.—J. T. D.

Bleaching powder; Constitution of ——. W. von Tiesenholt. J. pr. Chem., 1906, **73**, 301—326.

THE author maintains his view (this J., 1902, 913) that bleaching powder is the product of a reversible reaction between chlorine and lime; that other metallic oxides do not yield similar bleaching compounds is due to the different characters of the oxides and the corresponding chlorides. The reversed reaction (evolution of chlorine from the bleaching compound) occurs only in presence of water, and is due to the hypochlorous acid formed

by hydrolysis of the hypochlorite; the reaction of carbon dioxide upon bleaching powder also depends on the liberation in the first place of hypochlorous acid, the carbon dioxide neutralising the calcium hydroxide simultaneously formed. The same reactions are undergone by mixtures of calcium chloride and hypochlorite and of calcium chloride and lithium hypochlorite; calcium chloride is peculiarly well adapted to show this reaction because of its special properties in regard to water of crystallisation. While the existence in bleaching powder of the compound Cl.Ca.OCl is highly probable (though not proved), other complex compounds of calcium chloride and hypochlorite also exist in it. Chlorine monoxide reacts on lithium chloride and on calcium chloride, but only when water of crystallisation is present, and therefore, no doubt, by the formation in the first instance of hypochlorous acid. Hypochlorites, in the absence of water and in presence of free bases, are moderately stable compounds: mercuric hypochlorite can be obtained, for example, by the action of chlorine on mercuric oxide.—J. T. D.

Cyanogen and hydrogen cyanide; Synthesis of —— from their elements. T. Wallis. Annalen, 1906, **345**, 353—362.

THE author finds that the statements in text-books to the effect that cyanogen is formed by the interaction of carbon and nitrogen under the influence of the electric arc or electric sparks, is incorrect; any cyanogen produced, owes its formation to decomposition of hydrogen cyanide, formed primarily from nitrogen and hydrogen or water vapour. For the detection of cyanogen in presence of hydrogen cyanide, the use of an acidified (with nitric acid) solution of silver nitrate is recommended. The hydrogen cyanide is absorbed, whilst the cyanogen passes through almost completely. Any traces of cyanogen retained by the silver solution can be detected by filtering off the silver cyanide, separating silver from the filtrate by yellow ammonium sulphide, evaporating the solution, and testing the residue with a drop of sodium hydroxide solution for thiocyanate.

For quantitative purposes, the decomposition of cyanogen by alkali may be utilised. The mixture containing cyanogen and hydrogen cyanide is passed through standardised alkali: $(CN)_2 + 2KOH = KCN + KCNO + H_2O$. The total cyanide is then determined by titration with silver solution, and the cyanate by boiling a separate portion with dilute sulphuric acid and estimating the ammonia produced.—A. S.

Sulphuric acid; Electric conductivity of dilute solutions of ——. W. C. D. Whetham. XII., page 432.

Zinc and hydrochloric acid; Purification of —— from arsenic. L. T. Thorne and E. H. Jeffers. X., page 430.

ENGLISH PATENT.

Sulphocyanides [Thiocyanates]; Manufacture of ——. J. Tchernıac, London. Eng. Pat. 2708, Feb. 3, 1906.

CRUDE coal-gas, previously purified from ammonia, but still containing sulphuretted hydrogen, is passed systematically through a mixture of slaked lime and sulphur with water, until the free sulphur has entered into combination. The filtered liquid contains calcium thiocyanate. A salt capable of double decomposition with calcium thiocyanate may be added to this mixture of lime and sulphur previous to the described treatment, in order to obtain another thiocyanate. Also, the lime used may be slaked with the washing water, or with a solution of the salt to be added, in the case specified. Eng. Pat. 22,710 of 1902 (this J., 1903, 212) is referred to.—E. S.

UNITED STATES PATENTS.

Sulphuric acid; Process of making ——. R. Knietsch, Ludwigshafen-on-Rhine, Germany, Assignor to General Chemical Co., New York. U.S. Pat. 816,918, April 3, 1906.

SEE Eng. Pat. 6829 of 1901; this J., 1902, 344.—T. F. B.

Ammonia; Process of producing —— [electrolytically]. J. A. Lyons and E. C. Broadwell, Chicago, Ill. U.S. Pat. 816,928, April 3, 1906.

THE borate of an "electropositive metal" is fused and subjected to electrolysis, the anode being separated from the cathode by a jacket of resistive material. The boric anhydride produced is reduced to boron at the anode by the action of a reducing agent and "an intense heat," the boron is converted into nitride by means of nitrogen introduced between the anode and the jacket, and the nitride is subjected to the action of steam at a sufficient temperature to decompose it with formation of ammonia and boric anhydride.—A. S.

FRENCH PATENT.

Pyrites; Process of preparing —— for desulphurisation. U. Wedge. Fr. Pat. 359,767, Nov. 6, 1905.

SEE U.S. Pat. 804,690 of 1905; this J., 1905, 1302—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 374.)

ENGLISH PATENT.

Glass; Apparatus for drawing ——. J. A. Chambers, Allegheny, Pa. Eng. Pat. 2879, Feb. 6, 1906. Under Int. Conv., Feb. 15, 1905.

THE plant described consists of a tank, at the end of which is an overflow, by which glass flows into pots made of refractory material and mounted upon a rotating table. The larger portion of the table is within the pot chamber, and the smaller portion within the drawing chamber. Glass is allowed to flow into one pot, and the table is rotated far enough to bring the second pot under the overflow, while the first is carried round, and the glass in it kept molten by the heat of the pot chamber. By rotating the table further, this pot is brought into the drawing chamber, while a third pot is brought under the overflow and filled. After drawing the article from the glass in the first pot, through an opening in the roof of the drawing chamber, the table is rotated further, so that the second pot of glass is brought into the drawing chamber, and a fourth pot brought below the tank overflow to be filled, and the first pot from which the glass has been drawn, passes back into the pot chamber, where the hardened residue left in it is remelted before it is again filled with glass from the tank at the next rotation of the table.—W. C. H.

UNITED STATES PATENTS.

Quartz glass; Process for the manufacture of —— from quartz sand, &c. J. Bredel, Höchst on the Maine, Germany. U.S. Pat. 816,707, April 3, 1906.

SEE Fr. Pat. 343,845 of 1904; this J., 1904, 1028.—T. F. B.

Quartz glass; Manufacture of articles from ——. J. Bredel, Höchst on the Maine, Germany. U.S. Pat. 816,708, April 3, 1906.

SEE Fr. Pat. 344,170 of 1904; this J., 1904, 1090.—T. F. B.

Plastic material; Method of treating ——. A. A. Scott, Knoxville, Tenn. U.S. Pat. 816,385, March 27, 1906.

A STREAM of the plastic material is severed into blocks, which, in the green state, are placed in groups in one compartment of a kiln. Each group is surrounded by plates of combustible material or by a flash-wall of previously-dried blocks, and is dried by the action of a horizontally moving current of heated gases at a moderate temperature. The combustible material or flash-wall is then destroyed, another group of green blocks placed on the first and these dried, and finally all the blocks are fired at a high temperature. The waste heat from the firing of the blocks in one compartment serves for the drying of the green blocks in one of the other compartments.—A. G. L.

Plastic material ; Method of treating ——. A. A. Scott, Knoxville, Tenn. U.S. Pats. 816,386 and 816,387, March 27, 1906.

THESE two patents differ from the preceding only in the arrangement of the groups of green blocks within the compartments of the kiln for the purposes of drying. The groups may either be set with vertical flue-spaces between them, through which hot gases rise and are then deflected horizontally through the groups of blocks, or else moderately heated air is forced into the base of a mass of blocks and then distributes itself around and between them.—A. G. L.

FRENCH PATENT.

Tiles, glass, porcelain, ceramic products and the like ; Apparatus for burning or fixing the colours on printed ——. L. W. Stanley. Fr. Pat. 359,904, Nov. 28, 1905.

SEE Eng. Pat. 28,078 of 1904 ; this J., 1906, 122.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 375.)

Cements ; Decomposition of —— in sea-water or waters containing calcium sulphate. H. le Chatelier. Bull. Soc. d'Encourag., Revue de Metall., 1906, **3**, 74—77.

THE author finds that the addition to a cement of 2 per cent. of calcium stearate does not retard the action of sea-water upon it, whilst it sensibly reduces the tensile strength of cement-sand mixtures. The permeability to water of the set cement is but slightly reduced by the addition of calcium stearate.

The addition of barium carbonate (with the view of decomposing calcium sulphate and preventing the formation of calcium sulpho-aluminate) was also found to be but slightly operative, except with a slag-cement, in retarding disintegration by sea-water ; probably the barium sulphate formed is not voluminous enough to reduce sensibly the porosity of the cement.—J. T. D.

Slag cement and sea-water. Maynard. Tonind-Zeit., 1906, **30**, 440 ; Chem.-Zeit., 1906, **30**, Rep. 125.

To test the hypothesis that cements containing an insufficient amount of lime to form sulphaluminates are the best for use in sea-water, slag cement was taken, and mixed with varying proportions of lime. The results showed that the sample poorest in lime behaved the best, being as good as Portland cement and far superior to hydraulic lime. An important point is to store the blocks, before immersing them in sea-water, a sufficient time to enable the lime to combine with silica. Though decomposition may not be entirely precluded, the changes will not be accompanied by an increase in volume if the cement has been properly compounded.—C. S.

ENGLISH PATENTS.

Dustless roads and like surfaces ; Process and apparatus for the manufacture of materials for the construction of ——. W. Freakley, Hanley, and R. Bill, Stoke-on-Trent. Eng. Pat. 19,686, Sept. 29, 1905.

MATERIALS for the construction of dustless roads and like surfaces, are prepared by saturating crushed furnace slag (or other suitable crushed or granular mineral material) with tar, creosote, or other suitable bituminous substance or solution, in a heated state, by the application of heat and atmospheric pressure, by means of the apparatus described. The apparatus comprises a vessel, or saturator, provided with an air-tight removable cover at one end, the other end being convex. The saturator is mounted on trunnions and can be turned in any required position, in one plane. Below the lower end of the saturator is a tar boiler, heated by a suitable furnace, so placed that heat from it also heats the saturator. A delivery pipe, provided with a regulating valve, leads from the boiler into the saturator, through one of the trunnions, and the other trunnion is connected with an exhausting apparatus, provided with suitable safety-valves. The process is as follows :—Granulated material, previously heated to expel moisture from its pores, is charged into the saturator, while still hot, and the air-tight cover replaced. The saturator, heated by the tar boiler furnace, is then exhausted, to remove air, &c., from the granulated material, and by opening the regulating valve on the tar-delivery pipe, a certain amount of tar is driven into the saturator by atmospheric pressure. Air, compressed or not, is then admitted to the saturator, to force the tar into the pores of the granular material, and the saturator revolved to ensure the proper coating of the particles of the charge with tar. Any surplus tar is then poured off through a valve on the cover of the saturator, and the charge removed.—W. C. H.

Solid forms, such as rods, tubes, discs ; Manufacture of —— with aid of silicon. A. G. Bloxam, London. From Gebr. Siemens und Co., Berlin. Eng. Pat. 26,384, Dec. 18, 1905.

A MASS containing silicon, associated with silicon carbide, preferably, or with carbon, or other suitable material, is moulded, by aid of an agglutinant, if necessary, into the desired form, as, for instance, of rods, tubes or discs. These forms are heated for a considerable time in an atmosphere of nitrogen, whereby a nitrogenised compound is obtained which, in case carbon or a carbonaceous agglutinant, such as coal tar, is used in the composition, consists mainly of the compound, C_2Si_2N, which firmly cements the silicon carbide present. The rods or other forms thus produced are stated to endure heating to a high temperature in contact with the air, without change ; to be dense, conductors of electricity, and so hard as to be suitable for application as a substitute for carborundum for grinding purposes.—E. S.

Silicon monoxide [Pigment, &c.] ; Manufacture of ——. H. N. Potter. Eng. Pat. 26,788, Dec. 22, 1905. XIII.A., page 434.

UNITED STATES PATENTS.

Refractory material for electric insulation and other purposes. D. M. Steward, Chattanooga, Tenn. U.S. Pat. 816,270, March 27, 1906.

THE refractory material consists of a bisilicate of sodium and magnesium, produced by heating steatite and water-glass, or equivalent compounds, together.—A. G. L.

Refractory material ; Process of producing new —— for the manufacture of insulators and other uses. D. M. Steward, Chattanooga, Texas. U.S. Pat. 816,271, March 27, 1906.

A MIXTURE of magnesium silicate (steatite) and sodium silicate (water-glass) is converted into a complex bisilicate, by heating it for a determined period at a temperature at which reaction will take place.—A. G. L.

Slag cement and method of making the same. J. A. Shinn, Pittsburg, Pa. U.S. Pat. 816,389, March 27, 1906.

SEVENTY-FIVE to 90 parts of granulated slag, 10 to 20 parts of hydrated lime, and 3 to 15 parts of dehydrated iron oxide are mixed and ground dry so as to leave a residue of not more than 10 per cent. on a 200-mesh sieve.—A. G. L.

Slag ; Treatment of blast-furnace —— for production of material similar to trass, &c. H. Colloseus, Berlin. U.S. Pat. 817,158, April 10, 1906.

SEE Eng. Pat. 13,886 of 1905 ; this J., 1905, 971.—T.F.B.

Cements ; Manufacture of acid-proof and impermeable ——. R. Liebold, Weimar, Germany. U.S. Pat. Reissue No. 12,470, April 3, 1906.

SEE Addition of Oct. 5, 1905, to Fr. Pat. 345,421 of 1904 ; this J., 1906, 267.—T. F. B.

Cement-burning furnace. W. E. Snyder, Nazareth, Pa. U.S. Pat. 816,753, April 3, 1906.

THE furnace consists of a rotatory annular hearth fitted with a reverberatory hood, in which are a number of arc

electrodes, placed so that the arcs sweep across the entire extent of the hearth. Draught-compelling means are also provided which produce a current of air in opposition to the direction of movement of the hearth. A feed and discharge aperture is also provided in the hood, and a scraper is placed above the hearth in the aperture.
—A. G. L.

Cement; Apparatus for manufacturing ——. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 817,163, April 10, 1906.

Two rotatory kilns are placed side by side, with the upper end of one opposite the lower end of the other. A gas-producer is placed at the lower end of each kiln and a chimney-stack at the upper end. By means of two pipe connections a determined amount of waste gases from each stack is introduced into the producer opposite, together with a determined amount of air. Means are supplied for burning in each kiln the gas produced in its producer. Each stack is fitted with an air-heater, and each kiln with a heating-stove, and means are provided for conveying the air heated in each stack through a stove and thence to the opposite kiln to assist in burning the gas, as well as means for introducing regulated amounts of the products of combustion from the stoves into the pipe connections.—A. G. L.

FRENCH PATENTS.

Bricks; Process for covering —— with a protective coating to prevent efflorescence and blackening. M. Perkiewicz. Fourth Addition of Nov. 7, 1905, to Fr. Pat. 330,655 of Mar. 27, 1903 (this J., 1903, 1088; 1904, 19 and 602; 1905, 30).

THE bricks are covered with a strong solution of glue free from starch-paste, &c. Disinfectants, such as acids, metallic salts, formalin and phenol are added to the glue.
—A. G. L.

Dust on roads and the like; Composition which forms with water an emulsion for use in preventing or allaying the formation of ——. Kay Bros., Ltd. Fr. Pat. 360,039, Dec. 2, 1905. Under Int. Conv., July 11, 1905.

SEE Eng. Pat. 14,239 of 1905; this J., 1905, 1110.—T.F.B.

Roads and other surfaces; Oleaginous mixture for watering ——. R. M. Hahn. Fr. Pat. 360,208, Dec. 7, 1905. Under Int. Conv., June 2, 1905.

SEE Eng. Pat. 11,620 of 1905; this J., 1905, 926.—T.F.B.

GERMAN PATENTS.

Wood; Process for the manufacture of artificial ——. E. Helbing. Ger. Pat. 165,582, Nov. 27, 1903.

THE process described in Ger. Pat. 128,728 of 1900 (see Eng. Pat. 13,136 of 1901; this J., 1901, 991 and U.S. Pat. 694,014 of 1902; this J., 1902, 479) is modified by substituting barium hydroxide or strontium hydroxide, or a mixture of the two, for a portion or the whole, of the slaked lime.—A. S.

Wood; Process for fixing and improving the colour of impregnated or dyed ——. G. Hammesfahr. Ger. Pat. 166,388, June, 4, 1904.

THE wood after being dyed or impregnated is boiled with a mixture of slaked lime, rape oil or other oils or animal fats, and water.—A. S.

X.—METALLURGY.

(*Continued from page* 379.)

Ferromolybdenum; Pure ——. E. Vigouroux. Comptes rend., 1906, **142**, 889—891.

BY reducing a mixture of pure oxides of iron and molybdenum by aluminium in deficit, or by direct fusion of a mixture of pure iron and molybdenum reduced by hydrogen from their oxides, the authors have produced a series of alloys containing up to 80 per cent. of molybdenum. These have yielded the four definite compounds, Fe_2Mo, Fe_3Mo_2, FeMo, and $FeMo_2$; they are grey crystalline bodies, formed with considerable contraction of volume, non-magnetic, insoluble in hydrochloric but soluble in nitric acid. No compound was found containing less molybdenum than Fe_2Mo; from alloys of lower molybdenum-content hydrochloric acid dissolves out iron and leaves the compound, Fe_2Mo.—J. T. D.

Zinc-box precipitates; Production of high-grade gold bullion from ——. C. J. Morris. Inst. of Min. and Met., April 19, 1906. [Advance proof.]

THE author describes and compares the methods employed and the costs of producing gold bullion at the Myalls' United Mines five or six years ago and now. Formerly, the zinc was scrubbed and the slimes and fine zinc shreds were rubbed through a 40-mesh sieve, that which remained on the sieve being returned to the boxes, whilst that which passed through was roasted in an open pan for five or six hours over a wood fire, with the addition of about 5 per cent. of nitre. The roast was removed from the pan, mixed with about 50 per cent. of borax, 25 per cent. of sodium carbonate, and 12½ per cent. of sand, and fused in plumbago pots in a wind furnace, yielding bullion about 500 fine. The slags assayed from 30 to 70 oz., they were ground up with sweepings, &c., in a Berdan pan, leaving tailings assaying from 15 to 20 oz. Much gold was left in the boxes, sometimes twice as much as was obtained in the clean-up.

The present method is to scrub all the zinc except the fine shreds which, together with the slimes, are placed in an acid tank built of Oregon pine about 5 ft. deep and 4 ft. diam., provided with a four-armed revolving paddle and having plugged holes at intervals for drawing off the wash, and a locked cover. About 20 lb. of sulphuric acid are added from time to time as is found to be required, and the mixture of slime and dilute acid is left at rest all night. In the morning, all effervescence having ceased, about 12 times the bulk of water is added, while the slimes are agitated. After again resting, the wash water is drawn off into a settler and is found to contain only 1 to 2 dwt. of gold to the ton—most of which is recovered by prolonged settling. The washed slimes are removed, dried with about 5 per cent. of nitre, roasted, fluxed with 60 per cent. of assay slag, 20 per cent. of nitre and 5 per cent. of fused borax, and fused in Battersea clay pots; the bullion thus obtained is from 940 to 950 fine. The total cost of the operation by the former method yielding bullion 550 fine was £9 4s., of the present method yielding bullion 930 fine is £5 18s.; the freight and bank charges will, of course, be lessened in proportion to this difference of fineness. The value left in the zinc boxes is reduced by at least £250.—J. H. C.

Nickel silicides. W. Guertler and G. Tamman. Z. anorg. Chem., 1906, **49**, 93—112.

FROM a study of the alloys of nickel and silicon including the preparation of the melting-point diagram, and also micrographic examination, the existence of five compounds, Ni_3Si, Ni_2Si, Ni_3Si_2, NiSi and $NiSi_2$, was proved. The compounds Ni_2Si and NiSi separate directly from the melts on cooling, but the formation of the compound, $NiSi_2$, is due to a secondary reaction between primarily separated crystals of silicon and the residual melt. The two other compounds, Ni_3Si and Ni_3Si_2, are formed by secondary reactions between different kinds of mixed crystals in presence of the liquid melt; the first-named, Ni_3Si, from the two kinds of saturated mixed crystals containing 16·0 and 26·5 atoms per cent. of silicon respectively, and the latter, Ni_3Si_2, from the series of mixed crystals containing from 33 to 37·5 atoms per cent. of silicon.

The alloys containing 5·10 and 15 atoms per cent. of silicon, respectively, can be worked easily when cold, but not at a red heat. Alloys containing up to 22 atoms per cent. of silicon will withstand repeated blows, but as the proportion of silicon rises beyond 22 atoms per cent., the brittleness increases rapidly, and the alloy with 25 atoms per cent. of silicon breaks easily into thin plates. Alloys

containing from 50 to 75 atoms per cent. of silicon can be easily pulverised. The alloys containing up to about 20 atoms per cent. of silicon show a different degree of hardness according to whether they are cooled slowly or quenched. Their behaviour in this respect is exactly the reverse of that of carbon steels, the hardness decreasing if the alloys are quenched. The alloy containing about 15 atoms per cent. of silicon is the hardest when slowly cooled and the softest when quenched, but the difference in hardness according to the method of cooling is not so great with higher percentages of silicon. The softest alloys are those containing between 60 and 70 atoms per cent. of silicon.—A. S.

Auriferous tin-stone; Assay of ——. C. O. Bannister. Inst. of Min. and Met., April 19, 1906. [Advance proof.]

FIVE methods were employed, *viz.*:—(1) Scorification assay followed by cupellation; (2) crucible assay and cupellation; (3) solution in *aqua regia*, precipitation of gold by ferrous sulphate, and cupellation; (4) concentration of the gold in part of the tin by ordinary crucible assay, using anthracite, solution of the tin button in hydrochloric acid, and cupellation of the residue; (5) collection of the gold in the whole of the tin by fusion with potassium cyanide followed by solution of the tin and cupellation. For ores containing up to 26 oz. of gold to the ton convenient quantities to be taken are:—(1) 5 grms., (2) 25 grms., (3) 25 to 50 grms., (4) 25 grms., (5) 10 grms. It was found that the scorification method (1) always gave low results, the crucible assay (2) gives excellent results, the wet method (3) is tedious and gives good results as to the gold but loses the silver, methods (4) and (5) give low results and are unreliable for silver.—J. H. C.

Tin-dressing; Use of the impact screen in ——. J. H. Collins. Inst. of Min. and Met., April 19, 1906. [Advance proof.]

AT Wheal Kitty, in Cornwall, about two tons of tin-stuff per hour are crushed with old-fashioned Cornish stamps to pass a 20-mesh screen of which 25·5 per cent. remains on a 30-mesh, 40 per cent. passes 30-mesh and remains on 60, 13·5 per cent. passes 60 and remains on 80, 21·5 passes 80-mesh and 2 per cent. is fine slime. The slime and most of the fine sand which passes through 80-mesh are removed for separate treatment by hydraulic separators, and the remainder of the pulp is fed on to four Wilfley tables. The "heads" and "middlings" from these tables are removed for separate treatment, while the "tails," about 1¼ tons per hour, are passed over the screen, which is of 60-mesh brass wire cloth, 3 ft. square, inclined at an angle of 45°, and operated by a cam wheel giving 300 taps per minute. The over-screen product usually assays less than 0·1 per cent. of tin oxide, that passing through containing from 0·3 to 0·6 per cent., which is very easily and cheaply recovered by buddling and framing. The wear and tear of the screen is trifling, as is also the power required for operating the screen.—J. H. C.

Zinc and hydrochloric acid; Purification of —— from arsenic. L. T. Thorne and E. H. Jeffers. Analyst, 1906, **31**, 101—103.

THE conditions under which arsenic may be removed from zinc by means of sodium are described (see this J., 1902, 675). Commercial zinc is melted in a crucible at a temperature just above its melting point, and is then treated with sodium, the latter being added in small pieces at a time, until 1 grm. per pound of metal has been introduced. The zinc is now poured into a second heated crucible and back again once or twice; the crucible with its lid on is then heated to dull redness, the lid is removed and the heating continued for one hour, care being taken that the temperature does not rise much. The crust which forms is now pierced and the molten metal poured into another heated crucible and skimmed if necessary. This crucible and its contents are next heated to bright redness, skimmed, cooled and the zinc granulated just before the solidifying point is reached.

The authors have employed a copper-tin couple for removing arsenic from hydrochloric acid with complete success. Redistilled hydrochloric acid is diluted to a specific gravity slightly under 1·1 and then poured on to the couple which is conveniently prepared by dissolving cuprous chloride in excess of hydrochloric acid and adding a small quantity of granulated tin. The tin rapidly dissolves, at the same time reducing some copper in a spongy form. Zinc dust, or small pieces of zinc, are then added, when the remainder of the copper, together with the tin, is thrown down in the form of a dark gray, spongy couple, which is washed by decantation. About 3 grms. are used for each litre of the diluted acid. The mixture is gradually heated, a strong reaction taking place at about 70° C., and kept at a boiling temperature for 15 minutes. The acid is then distilled, a little of the couple and a small piece of copper gauze being placed in the distillation flask.

The couple should be gray in colour; if it is nearly black too much copper is present. The residue in the distillation flask serves conveniently for the preparation of fresh copper-tin couple.—W. P. S.

Magnesium; Alloys of —— with cadmium, zinc, bismuth and antimony. G. Grube. Z. anorg. Chem., 1906, **49**, 72—92.

THE author has investigated the alloys of magnesium with cadmium, zinc, bismuth and antimony, and has proved the existence of the compounds, CdMg, Zn_2Mg, Bi_2Mg_3 and Sb_2Mg_3. No evidence could be obtained of the existence of the compounds, $CdMg_4$, $CdMg_{30}$ and $ZnMg_4$, mentioned by Boudouard (this J., 1902, 976; 1904, 868). The compounds, MgCd, Bi_2Mg_3 and Sb_2Mg_3, decompose water, and are less resistant to the influence of moist air than either of their components. The compound, Zn_2Mg, on the other hand, is less acted upon by moist air than either zinc or magnesium, resembling in this respect the compound of aluminium and magnesium, Al_3Mg_4. —A. S.

Aluminium-bronze industry; Cause and prevention of explosions in the ——. M. M. Richter. Chem.-Zeit., 1906, **30**, 324—326.

THE author traced a number of explosions to electric sparks proceeding from excitation of the brushes in elevating, polishing and similar machines, by which sparks the ignition of mixtures of aluminium dust and air was determined. He recommends therefore that:—(1) The brushes in machinery employing them (Steigmühlen, &c.) should be replaced by brushes of aluminium wire; and (2) those in polishing machines should have their fibres soaked in weak sulphuric acid, should contain a few fibres of elastic wire, and should be bound with copper wire and electrically connected with the metal work of the machinery.—J. T. D.

Nickel and antimony; Alloys of ——. K. Lossew. Z. anorg. Chem., 1906, **49**, 58—71.

THE m. pt. curve of antimony-nickel alloys has two distinct maxima at 1158° C. and 1170° C. respectively, corresponding to the compounds, NiSb and Ni_5Sb_2, and three minima corresponding to eutectic mixtures. Starting from the solidifying point of antimony at 630° C., the curve descends to the first eutectic point at 611° C. (between 2 and 3 per cent. of nickel) and then rises to the first maximum at 1158° C. (32·83 per cent. of nickel). In the alloys, containing from 3 to 32·83 per cent. of nickel, three constituents can be recognised micrographically, *viz.*, the eutectic, yellow crystals of the compound, NiSb, and another compound, probably Ni_3Sb_5, forming a white ring round the yellow crystals. From 32·83 to 40 per cent. of nickel a series of mixed crystals separates, and from 40 to 47·60 per cent. of nickel the alloys consist of the mixed crystals and a second eutectic. From 47·60 to 54·97 per cent. of nickel, rounded crystals of the compound, Ni_5Sb_2 (m. pt. 1170° C.), separate from the eutectic, whilst from 54·97 to 57·0 the alloys consist of a second series of mixed crystals. From 57·0 onwards the alloys at the solidifying point consist of an eutectic (m. pt. 1100° C., 66 per cent. of nickel), together with mixed crystals of different composition, according to whether the alloy contains more or less than 66 per cent. of nickel. In these alloys a reaction between the two kinds of mixed

crystals takes place at 677° C., with formation of the compound, Ni_4Sb. The reaction is reversible; if a slowly-cooled alloy containing 65·2 per cent. of nickel and consisting almost entirely of the compound, Ni_4Sb, be heated at 700° C. and quenched in water, it is then found to consist of a mixture of the two kinds of mixed crystals previously mentioned, whilst if it be allowed to cool in the air, it is found to consist mainly of the eutectic mixture of the two kinds of mixed crystals, together with small quantities of the compound, Ni_4Sb.—A. S.

Queensland; Mineral production of ——. Bd. of Trade J., April 19, 1906.

THE following statement shows the quantities of the different minerals, other than gold, precious stones and coal, produced in Queensland in 1905, and their respective values as compared with 1904:—

——	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Copper	4,325	255,866	7,041	485,093
Lode tin	2,393	151,984	2,307	161,580
Alluvial tin	1,467	112,254	1,447	125,739
Lead	1,951	23,339	2,151	29,075
Manganese	780	3,119	1,361	5,444
Wolfram	1,123	118,974	1,314	92,740
Molybdenite	21	2,673	63	8,463
Bismuth	4	1,128	9	3,048
Bismuth and wolfram	4	369	20	1,960
Scheelite	3	300	5	341
Ironstone	4,753	1,705	4,066	3,111
Limestone	16,215	9,304	21,227	14,554
Antimony	—	—	23	169
	oz.		oz.	
Silver	597,251	64,952	535,622	61,631
Total value	—	745,967	—	992,948

The figures for coal and precious stones are not yet complete; in 1904 these products were valued at £177,000. The gold yield last year amounted to 578,364 fine oz., against 639,151 oz. in 1904, but the decrease will be lessened when the return is completed by the addition of the full returns from metallurgical works. [T.R.]

Norway; Mining industry in ——. For. Off. Ann. Series, No. 3555.

Copper.—The output of the Sulitjelma mine rose in 1905 to about 87,000 tons. A new smelting furnace, invented by the manager, is stated to reduce the expense of smelting to one-half or even one-third of the former cost. The system will also be used in the Alten copper works in Finmarken. The Bosmo mine in Nordland produced the same quantity as in former years, about 25,000 tons of pyrites. The Röros copper works have been worked under somewhat more favourable conditions than of late; about 30,000 tons were produced. Of other and more important copper mines, the Kjöli, Killingdal and Mandfield may be mentioned, the last-named being expected to produce before long about 60,000 tons annually. It is stated that there are very extensive deposits at Röstvangen that are at present not available on account of difficulties of transport. The exportation of pyrites from Norway has increased considerably within the last year or two, and the Norwegian cellulose factories now also absorb a large amount.

Silver.—The output of the Kongsberg silver mines (16,640 lb.) during the past financial year was rather less than in the preceding year, but the price of silver was higher.

Iron.—Of iron ore, 44,000 tons were exported from the Fehn mines, 14,000 tons from Meló, and smaller amounts from other mines. If the Dunderland works prove to be remunerative, a large number of other mines containing similar ore may be expected to be opened up. In South Varanger, work on a large scale is to be started before long.

Molybdenite.—The Knaben molybdenite mine produced in 1905 about 29 tons of high-class ore,

Calcium carbide.—Calcium carbide is manufactured at Hafslund, Borregaard, Notodden and Meraker; the exports rose from 5258 tons in 1904 to nearly 9000 tons in 1905. [T.R.]

ENGLISH PATENTS.

Ores; Apparatus for treating ——. W. A. Hendryx, Los Angeles, U.S.A. Eng. Pat. 1928, Jan. 31, 1905.

SEE U.S. Pat. 785,214 of 1905; this J., 1905, 447.—T.F.B.

Filter presses for separating the heavier or coarser from the lighter or finer components found in the tailings of ores or other material. W. P. Thompson, London. From C. W. Merrill, Lead, U.S.A. Eng. Pat. 5970, March 21, 1905.

SEE U.S. Pat. 798,200 of 1905; this J., 1905, 1004.—T.F.B.

Deposits or tailings from ore crushing; Method of and apparatus for separating, selecting, concentrating and securing precious matters from ——. J. Hutchings, London. Eng. Pats. 6556B and 6556C, March 28, 1905.

THE ore particles are first classified or assorted according to size by means of differently meshed sieves within a revolving screen or cylinder, and are then treated with water in a pan divided into compartments, the pan being at the same time given a swinging or oscillating movement by means of which the concentrates are separated from light and valueless matter. The concentrates are then further treated in a protective safe apparatus with locked cover by means of a magnetic separator, which separates iron pyrites, &c., from the gold, leaving the latter in a partially cleansed condition. Apparatus is also provided for forcing the fine float gold, by means of a copper wire brush, into a mercury trough for the purposes of amalgamation. The protective safe apparatus forms the subject of the separate patent 6556C.—A. G. L.

UNITED STATES PATENTS.

Lead sulphide; Process of smelting ——. A. G. Betts, Troy, N.Y. U.S. Pat. 816,772, April 3, 1906.

LEAD sulphide is smelted with substances containing iron and sodium, whereby metallic lead and an iron-sodium matte are produced. The metallic lead is separated, together with some slag, and the sulphur is eliminated from the fused matte by an air-blast, the oxidised residue being subsequently used for smelting lead ore.—A. S.

Lead sulphide; Smelting ——. A. G. Betts, Troy, N.Y. U.S. Pat. 816,773, April 3, 1906.

LEAD sulphide ore is smelted with compounds of iron and sodium, carbon, and basic compounds of iron or sodium, or both, to produce metallic lead, an iron-sodium matte, and a slag containing less than 2 per cent. of ferrous oxide. According to one claim, the charge is first smelted so as to produce a slag containing more than

2 but less than 5 per cent. of ferrous oxide, and this slag is then treated at a smelting temperature with sulphur compounds in order to form further quantities of iron-sodium matte and a slag containing less than 2 per cent. of ferrous oxide.—A. S.

Gas-producing and consuming apparatus [Zinc-distilling furnace]. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 816,973, April 3, 1906.

In an apparatus for reducing and distilling zinc or other metals, a gas-fired furnace, provided with metal-distilling retorts of refractory material, is combined with a gas-producer supplying gas to the furnace. The heat of the waste products of combustion from the furnace is transferred to the entering gas and air by means of regenerative devices. A portion of the products of combustion is abstracted by a fan and delivered through a conduit to the producer. Means for supplying air to this conduit and for regulating the proportion of air and of products of combustion are provided. The furnace may be fed with dry producer gas, substantially free from hydrogen and steam.—R. L.

Furnace; Metallurgical ——. G. H. Benjamin, New York, N.Y. U.S. Pat. 817,099, April 3, 1906.

The furnace consists of a number of receptacles together with "regenerative chambers." The receptacles have valved feed-inlets and outlets and are mounted end to end in such a manner that they can be rotated independently. Means are provided for heating the receptacles and also flues and valves, by means of which communication can be opened or closed between one or more of the receptacles and the "regenerative chambers."—A. S.

Cupola. A. Baillot, Haybes, France. U.S. Pat. 817,412, April 10, 1906.

See Fr. Pat. 349,036 of 1904; this J., 1905, 624.—T.F.B.

Ore separator. G. Moore, London. U.S. Pat. 817,655, April 10, 1906.

See Eng. Pat. 25,110 of 1904; this J., 1906, 319.—T.F.B.

French Patents.

Steel; Process of making ——. V. Defays. Fr. Pat. 360,033, Dec. 2, 1905. Under. Int. Conv., Dec. 12, 1904.

See Eng. Pat. 28,570 of 1904; this J., 1906, 125.—T.F.B.

Furnaces with movable tuyères; Process for detaching the deposits which form at the point of contact of the combustible with the walls of rotary ——. Fellner und Ziegler. Fr. Pat. 360,170, Dec. 7, 1905. Under Int. Conv., March 8, 1905.

See U.S. Pat. 801,144 of 1905; this J., 1905, 1113.—T.F.B.

Metals; Extraction of —— from minerals containing them. J. D. Wolf. Fr. Pat. 360,247, Dec. 8, 1905.

See Eng. Pat. 17,407 of 1904; this J., 1905, 1309.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 381.)

(A.)—ELECTRO-CHEMISTRY.

Sulphuric acid; Electric conductivity of dilute solutions of ——. W. C. D. Whetham. Z. physik. Chem., 1906, **55**, 200—206.

The electric conductivity of aqueous solutions of acids and alkalis increases with the dilution to a maximum and then rapidly falls again. Goodwin and Haskell (Phys. Review, 1904, **19**, 369) have stated that this decrease of conductivity is due to the contamination of the water by traces of carbonic acid. The author, from experiments with sulphuric acid dissolved in specially purified distilled water, with and without the addition of a trace of potassium chloride and of carbon dioxide respectively, find that whilst the presence of carbonic acid is probably one of the causes of the decrease in conductivity of extremely dilute solutions of acid, other causes as yet unknown must also come into play.—A. S.

Electrolysis; Analytical separation of metals by ——. A. Hollard. XXIII., page 445.

English Patents.

Catalytic combinations; Substances for effecting —— *in electrolytic electricity meters.* C. O. Bastian and G. Calvert, both of London. Eng. Pat. 6448, March 27, 1905.

A mixture of platinum or platinum black and palladium or palladium black is used as a catalytic agent for bringing about the re-formation of water from electrolytic gas in an electrolytic electricity meter. The mixture is painted on or otherwise attached to a suitable medium, or it may be mixed with glass wool and enclosed in a porous container.—B. N.

Accumulators or secondary batteries; Plates for ——. F. J. Gerard and L. Fiedler, both of London. Eng. Pat. 6786, March 30, 1905.

Plates for accumulators are made by mixing lead oxide into the form of a paste with the following solution:—350 parts of lecithin, 10 parts of lead acetate or nitrate, 10 parts of mercury sulphate and 1000 parts by weight of distilled water, the paste being afterwards forced into the interstices of grids or frames.—B. N.

Electrode; Storage battery ——. T. A. Edison, Orange, N.J., U.S.A. Eng. Pat. 1925, Jan. 25, 1906. Under Int. Conv., March 30, 1905.

The active mass of nickel hydroxide, used for electrodes of storage batteries with an alkaline electrolyte, is intimately mixed with conducting flakes, scales, films or foil of metallic cobalt, or an alloy of cobalt and nickel.
—B. N.

Electrode mass for storage batteries and process of forming the same. T. A. Edison, Orange, N.J., U.S.A. Eng. Pat. 1927, Jan. 25, 1906. Under Int. Conv., March 30, 1905.

The active mass for storage batteries employing alkaline electrolytes is composed of relatively large particles of an electrolytically active material, such as nickel hydroxide, the particles being coated with scales, flakes or foil of conducting material, such as graphite, cobalt, nickel, or cobalt-nickel alloy. The mass is first intimately associated with a sticky material, such as molasses, in order to thoroughly cover the surface of the active particles, and the conducting flakes are then thoroughly mixed with the mass until the particles of the latter are practically entirely covered with the flakes. The mass is then compressed in the pockets or receptacles for containing it, so that the flakes present a network of conductors extending in all directions through the mass. The sticky material is finally dissolved out of the mass by water rendered slightly alkaline.—B. N.

Ozonising apparatus; Impts. in [Electrical] ——. G. E. Gaiffe, Paris. Eng. Pat. 22,103, Oct. 30, 1905. Under Int. Conv., May 13, 1905.

This invention relates to an apparatus for the production of ozone, and consists of an ozoniser connected in series with a "capacity" of known value, the ozoniser being unprovided with a dielectric and fed by currents of high frequency.—B. N.

Peat and the like; Extracting moisture from —— *[electrically].* W. Simm. Eng. Pat. 4792, March 8, 1905. II., page 420.

UNITED STATES PATENTS.

Refractory material for electric insulation and other purposes; and process of producing same. D. M. Steward. U.S. Pats. 816,270 and 816,271, March 27, 1906. IX., page 428.

Electric furnace. A. G. Betts, Troy, N.Y. U.S. Pat. 816,554. April 3, 1906.

THE furnace consists of a furnace-chamber, the hearth of which contains a bath of a liquid conductor; a channel, both ends of which lead into this chamber, and which also contains the liquid conductor; and two electrodes, one connected with the liquid in the chamber, the other with the liquid in the channel. At a certain part of the channel, a magnetic field is created by an electro-magnet, and at the same part, a cross-channel, containing a conductor and intersecting the main channel, is provided. By causing an alternating current to pass through the cross-channel and to alternate synchronously with the current in the main channel, the liquid conductor is made to circulate from the hearth through the channel and back to the hearth again.—A. G. L.

Ammonia; Process of producing —— *[electrolytically].* J. A. Lyons and E. C. Broadwell. U.S. Pat. 816,928, April 3, 1906. VII., page 427.

FRENCH PATENT.

Ozonising atmospheric air; Apparatus for ——. Ozonair, Ltd. Fr. Pat. 360,227, Dec. 8, 1905. Under Int. Conv., Aug. 11, 1905.

SEE Eng. Pat. 16,392 of 1905; this J., 1905, 1115.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

ENGLISH PATENTS.

Furnaces; Electric ——. A. Reynolds, London. Eng. Pat. 7004, April 3, 1905.

THE heating resistance comprises a material, such as carbon, which is electrically conducting at furnace temperatures, and thus is contained within a casing of electrically insulating but thermally conducting material, such as "siloxicon," this substance being chemically inert to the molten furnace charge, the furnace atmosphere and the resistive material at all furnace temperatures. In some cases it is advantageous to surround the "siloxicon" with an outer casing of magnesite or basic or neutral aluminium silicate, free from or low in alkali, the magnesite being used with basic, and the silicate with acid slags. Different forms of furnaces are described in which the charge of the furnace is part of the electric circuit, the current passing from the resistive material through a conducting button, forming the bottom of the insulating casing, to the charge and thence to the crucible, which is attached to the other terminal; and also forms of furnaces in which the charge does not act as part of the electric circuit, the current being passed through several heating resistances connected in parallel, these being in electrical contact with a conducting ring or button in the base of the crucible and attached to the other terminal of the current.—B. N.

Copper; Process for the electrolytic production of ——. J. A. W. Borchers and F. E. Günther, Aachen, and P. R. Franke, Eisleben, Germany. Eng. Pat. 19,638, Sept. 28, 1905. Under Int. Conv., Oct. 4, 1904.

SEE Ger. Pat. 160,046 of 1904; this J., 1905, 897.—T. F. B.

UNITED STATES PATENT.

Lead ores; Process of smelting ——. W. Valentine and A. G. Betts, Troy, N.Y. U.S. Pat. 816,764, April 3, 1906.

LEAD-SULPHIDE ores with the accompanying gangue are fused so as to form a matte and a slag, and the lead is separated electrolytically from the matte, by bringing the latter into contact with a cathode in an electrolyte of fused sodium chloride containing sodium sulphide.—A. S.

FRENCH PATENT.

Metals; [Electrolytic] Process for separating ——. N. V. Hybinette. Fr. Pat. 360,101, Dec. 5, 1905.

SEE U.S. Pat. 805,969 of 1905; this J., 1906, 29.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 383.)

Moringa oleifera; Seeds of ——. E. Drabble. Quart. J. Inst. Commercial Research in the Tropics, Liverpool Univ., 1906, **1**, 66—67.

THIS tree, indigenous to India, Arabia and Syria, has been introduced into several tropical countries for the purpose of obtaining the seed oil (Ben oil). It grows well in any soil, and can resist drought. The decorticated seeds yield about 38 per cent. of a pale yellow or nearly colourless oil, of which about 40 per cent. is solid fat. They contain about 35 per cent. of proteids, which would render them of value for seed-cake after expression of the oil (see Lewkowitsch, this J., 1904, 25).—C. A. M.

Butyrospermum Parkii; Seeds of —— *[Shea Butter seeds].* E. Drabble. Quart. J. Inst. Commercial Research in the Tropics, Liverpool Univ., 1906, **1**, 67.

Two different samples of these seeds were examined. One resembled the West African Shea butter seeds and yielded 51·5 per cent. of fat, with iodine value 59·9 and saponification value 179, whilst a specimen of the West African seeds gave 53·5 per cent. of fat, with iodine value 56·9 and saponification value 183. The other seeds, sent under the name of "Kariti nuts," were larger and paler in colour than the West African seeds, and yielded 34 per cent. of fat, with iodine value 65·8, and saponification value 179. The fat could be used for the same purposes as ordinary Shea butter.—C. A. M.

Mucuna oil; Examination of ——. W. P. H. Van den Driessen Mareeuw. Pharm. Weekblad, 1906, **43**, 202—209. Chem. Centr., 1906, **1**, 1176—1177.

THE seeds of the leguminous plant, *Mucuna capitata*, Dc., known as "kratok" beans and in the Dutch Indies as "Bengoek," yield to petroleum ether 2·08 per cent. of a yellow fatty oil yielding the following numbers:—Oil from fresh seeds: Sp. gr., 0·865; solidifying point, 3·5° C.; m. pt., 16° C.; Zeiss butyro-refractometer reading at 25° C., 66·2 scale divisions; acid value, 6·72; saponification value, 178·22; iodine value, 103·95; Reichert-Meissl value, 0·77; m. pt. of mixed fatty acids (oleic (?), palmitic and stearic acids), 37° C.; saponification value of fatty acids, 195·6; iodine value of fatty acids, 112·9; m. pt. of acetylated fatty acids, 24° C.; acetyl-acid value of fatty acids, 145·7; acetyl-saponification value of fatty acids, 260·95. Oil from seeds two months old: Sp. gr., 0·8700; acid value, 32·75; saponification value, 184·76; iodine value, 98·6; saponification value of fatty acids, 187·7; iodine value of fatty acids, 107·53.—A. S.

Wax of Rhaphia ruffia. H. Jumelle. L'Union Pharm., 1906, **47**, 59—61.

THE leaves of *Rhaphia ruffia*, stripped of their upper epidermis to furnish the commercial raffia fibre, also yield a wax. The segments of the stripped leaves are dried, and then beaten in a fine cloth, by which means a white powder is obtained. This is sifted and thrown into boiling water, when the wax melts and is separated. This wax is dull, dry and but slightly greasy to the touch; it is brittle with a dull, smooth fracture, and is readily reduced to powder in a mortar. It resembles carnauba wax in general appearance. It is only sparingly soluble in chloroform, ether, petroleum spirit, cold alcohol and most other solvents, but is readily dissolved in boiling alcohol, from which it precipitates on cooling; the precipitate, thrown on a filter, forms an unctuous mass, becoming granular and friable on drying. Its sp. gr. is 0·950; m. pt., 82° C. The melted liquid gives a brownish

wax on cooling; if melted several times it becomes deep chestnut-brown, and has a lustrous surface and a sharp fracture. It melts in the flame without burning. The unmelted part remains hard, and the fused portion does not mould well in the fingers and is not sticky.—J. O. B.

ENGLISH PATENT.

Soap; Process for converting insoluble —— into soluble soda soap or potash soap. P. Krebitz, Munich, Germany. Eng. Pat. 4092A, Feb. 27, 1905.

INSOLUBLE soap, obtained as described in Eng. Pat. 4092 of 1905 (this J., 1906, 188), is treated with potassium or sodium carbonate in excess (2 to 6 per cent.) of the theoretical amount, which is stated to prevent soap being mechanically carried down by the subsiding calcium carbonate. The conversion is promoted by the addition of salt. The process may be carried out either by adding the insoluble soap gradually to a boiling solution of sodium carbonate, or by pouring the hot carbonate solution over the soap and boiling the mixture.—C. A. M.

FRENCH PATENT.

Cooling apparatus for soap or other material. A. E. Boardman. Fr. Pat. 360,163, Dec. 7, 1905. Under Int. Conv., Dec. 9, 1904.

SEE Eng. Pat. 24,023 of 1904; this J., 1905, 1074.—T.F.B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 384.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Paint. L. A. Dreyfus, New Brighton, U.S.A. Eng. Pat. 5872, March 20, 1905.

SEE U.S. Pat. 786,348 of 1905; this J., 1905, 506.—T. F. B.

Colours; Method of manufacturing oil ——. M. Hérisson, Paris. Eng. Pat. 9480, May 5, 1905.

SEE Fr. Pat. 342,550 of 1904; this J., 1904, 989.—T. F. B.

Silicon monoxide [Pigment, &c.]; Manufacture of ——. H. N. Potter, New York. Eng. Pat. 26,788, Dec. 22, 1905. Under Int. Conv., Dec. 30, 1904.

To effect a partial reduction of silica to silicon monoxide, a mixture of the former with the necessary proportion of carbon is heated electrically in a closed furnace of either the resistance or arc type, provision being made for withdrawing the carbon monoxide gas as it is formed. "This bursting out of the carbon monoxide gas from the point of reaction carries the silicon monoxide with it, but whether in a solid, liquid or gaseous state the inventor is not able to state;" in any case, a large portion of it, at least, "is carried out of the region of reaction." Provision is made for trapping the silicon monoxide, as it escapes, in collection chambers. The silicon monoxide thus produced is an extremely fine powder, which can be used, alone or in combination, as a pigment; or it may be pressed into bricks, with or without addition of alumina, magnesia or the like, to form abrasion wheels. A vitreous form of the silicon monoxide also sometimes occurs, which is distinguished from crystalline silicon by being a non-conductor of electricity.—E. S.

Paint; An improved ——. H. N. Potter, New York. Eng. Pat. 1279, Jan. 17, 1906. Under Int. Conv., Jan. 25, 1905.

SILICON monoxide, in powder, is mixed dry with another pigment, ground and incorporated with oil or other paint vehicle; or the order in which the ingredients are mixed may be reversed (see preceding abstract).—C. S.

UNITED STATES PATENT.

Paint and varnish remover; Non-inflammable ——. C. Ellis, Assignor to Chadeloid Chemical Co., New York. U.S. Pat. 817,141, April 3, 1906.

THE paint or varnish remover consists of a waxy body mixed with a non-inflammable volatile solvent, together with other volatile solvents of less vapour tension, so as to give a predominant evaporative tendency to the former solvent, the proportion of wax not to exceed 8 per cent. A mixture of 2 parts of wax, 15 parts of carbon tetrachloride, 10 parts of grain alcohol and 1 part of amyl acetate is specified.—J. F. B.

(*B.*)—RESINS, VARNISHES.

FRENCH PATENT.

Linoleum, oilcloth and similar material; Machine for printing designs on ——. H. C. Shaw. Fr. Pat. 360,309, Dec. 11, 1905. Under Int. Conv., Dec. 12, 1904.

SEE Eng. Pat. 27,037 of 1904; this J., 1905, 1180.—T. F.B.

(*C.*)—INDIA-RUBBER, Etc.

Rubber from Castilloa elastica. Quart. J. Inst. Commercial Research in Tropics, Liverpool Univ., 1906, 1, 101—119.

Cultivation of Castilloa.—The yield of latex is proportional to the size of a tree rather than to its age, and is dependent on the soundness of the roots. Rapid growth is favoured by large surface of leaf. As to spacing, it is recommended to set out stakes in 15—20 ft. squares and plant a circle of eight or ten trees around each. The weaklings having been cut down, there will be three or four good trees in each group when, after about six years, they are ripe for tapping. A variety of insect pests attack the trees, the most important being a borer, probably the long-horn beetle, and a small bark beetle. Both these are dealt with by means of carbon bisulphide or gasoline.

Tapping for latex.—The arrangement of cuts generally adopted, *viz.*, one at the base, one 5 ft. above the ground, and one intermediate, is uneconomical; four cuts, the highest being 6 ft. above the ground, are recommended. Three methods of tapping are in use, *viz.*, (1) making crude cuts with the machete; (2) making a ring of incisions with a chisel about 1 in. broad; and (3) cutting out V-shaped pieces of bark, stretching about half-way round, with a special tool. Cuts made right into the wood do not heal completely; but, on the other hand, the same applies to cuts which do not reach the cambium. A larger yield of latex is obtained from cuts right into the cambium than from cuts almost into it. In the author's opinion, the narrower the cuts, the better. The latex flows best during the rainy season, and in the early morning. Cups for collecting latex should not be conical, since these are difficult to wash out, and they are better fixed to the tree by pushing in the sharp edge than by means of pins; those now in use contain about 60 c.c., and are, if anything, too small. The first flow of latex—about a cupful—is followed by a slow ooze of less watery latex, which ceases in 15 minutes or so, and is removed with a spoon or with the fingers.

Manipulation of latex.—The collected latex is freed from bark and mud by washing. On shaking up latex with water and allowing to stand, solid impurities go to the bottom, the water is blackened, and the latex rises to the top. This separation is greatly delayed by the presence of mud. Repeated washing renders the rubber whiter and less sticky, but adds nothing to its strength or elasticity, whilst it introduces the risk (1) of the latex refusing to separate out, and (2) of premature coagulation of the rubber.

Coagulation and drying of rubber.—A useful method of preparing rubber from latex is to run the latter upon sheets of blotting paper and allow it to dry. Each sheet of paper serves to coagulate ten or more sheets of rubber. The author suggests, as an improvement on this process, pressure between two porous tiles. Coagulation may also be effected by boiling the latex. The resulting

rubber is apt to be uneven and contain an excessive quantity of moisture. Or, again, chemicals, *e.g.*, alcohol, sulphonaphthol, acids, &c., may be added to the latex. Alcohol is an excellent, if costly, coagulant; sulphonaphthol is certain in its action, but makes a weak rubber; sulphuric acid, lime-juice, sodium carbonate, and calcium chloride are somewhat uncertain and tend to produce weak rubbers. The coagulated rubber should be dried by artificial heat until completely translucent.

Miscellaneous observations.—Latex can be prevented from coagulating for a long time by the addition of ammonia, which imparts a yellow colour to it. The "black water" obtained in the washing process is rendered brownish-red by caustic soda and deep black by ammonia, whilst acids gradually bring down a yellow precipitate. Sugar bleaches the "black water."

The yield of rubber from good six-year-old *Castilloas* may be estimated at half-a-pound per tree annually. Young trees and young parts of old trees give rubbers containing notable proportions of resin. As compared with *Castilloa*, *Hevea* yields latex less freely, but responds better to repeated tapping. Its latex is cleaner, but coagulates much more easily; the globules are so fine that they cannot be coagulated by the blotting-paper method. *Castilloa* rubber, in the author's experience, has greater strength and elasticity than *Hevea* rubber.

—W. A. C.

India-rubber; Analyses of some different brands of ——. D. Spence. Quart. J. Inst. Commercial Research in the Tropics, Liverpool Univ., 1906, **1**, 75—77.

The rubber was finely divided, dried over calcium chloride at 55° C. until constant in weight, and extracted successively with acetone and chloroform, the latter extraction giving the amount of caoutchouc. The samples of commercial rubber had not been treated in any way.

Sample.	Duration of cure.	Breaking strain.	Elongation.
	min.	kilos.	cms.
1	1	14	3·6
2	2	15	3·9
3	3	15·2	3·0
4	4	15·62	6·5
5	5	16·25	5·0
6	6	12·0	3·8
7	7	15·0	3·7
8	8	15·25	3·8
9	9	16·5	7·4
10	10	18·5	6·2

The unvulcanised strip broke at 7·5 kilos., and had an elongation of 2·2 cm. Even the strip cured only one minute was therefore much stronger and more elastic.

—E. W. L.

Rubber exports from Manáos and Pará. Bd. of Trade J., April 19, 1906.

The following are particulars of the exports of Seringa rubber from the Ports of Manáos and Pará during the years 1904 and 1905:—

Seringa Rubber.	1904. Quantity.	1904. Value.	1905. Quantity.	1905. Value.
	Kilos.	£	Kilos.	£
Fine	14,072,000	6,645,000	16,473,000	8,460,000
Medium ..	2,471,000	988,000	2,756,000	1,269,000
Sernamby ..	7,430,000	1,910,000	7,510,000	2,108,000
Caucho	3,632,000	943,000	4,726,000	1,237,000
Total	28,505,000	10,486,000	31,475,000	13,234,000

The above figures are inclusive of rubber shipped from Itacoatiara, but exclusive of rubber from neighbouring countries shipped from the ports of Amazonas and Pará.

[T.R.]

	Name.	Origin	Plant.	Moisture.	Resin.	Rubber.	Residue.
				per cent.	per cent.	per cent.	per cent.
1	Para, hard cure	S. America	*Hevea brasiliensis*	14·30	2·73	71·09	11·71
2	Ceylon para	Ceylon	do.	0·53	3·93	90·38	5·03
3	Gold Coast, hard lump ..	Gold Coast	*Funtumia elastica*	8·74	19·72	69·22	2·37
4	Gold Coast, soft lump ..	Gold Coast	almost certainly *Ficus elastica*	10·90	17·71	67·40	4·24
5	Pará rubber	Gold Coast	*Hevea brasiliensis*	0·27	2·31	93·92	3·30
6	Gold Coast, niggers	Gold Coast	*F. elastica*	8·86	4·12	82·54	4·78
7	*Ficus Vogellii* rubber	Gold Coast (Aburi)	*Ficus Vogelii*	0·30	35·37	63·79	0·90
8	Rangoon	Burma and Annam	*Ficus elastica*	0·58	6·81	84·63	8·16
9	Lagos lump	Lagos	*Funtumia elastica*	3·40	10·56	80·88	5·39
10	Lagos root	Congo	*Landolphia Thollonі*	3·00	3·34	73·35	23·51
11	Congo root	Congo	do	2·30	7·02	83·00	7·74
12	*a* Sierra Leone niggers ..	Sierra Leone	*Funtumia elastica* (probably)	5·3	5·54	80·46	9·05
13	*b* do.	do	*Landolphia*	2·9	4·97	65·50	26·4
14	Pernambuco scrap	Pernambuco	*Hancornia speciosa*	4·8	4·35	58·75	32·31

The resins from Nos. 1, 5 and 9 were soft and glue-like or oily, whilst those from the other samples were more or less hard.—C. A. M.

Rubber; Influence of duration of cold vulcanisation upon tensile strength and elasticity of Pará ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 678—679.

Strips of Pará rubber, 5 cm. by 3 cm. by 7 mm., were carefully dried and vulcanised by immersion in a solution of sulphur chloride in 80 times its own weight of carbon bisulphide. The vulcanised strips were immediately washed with a weak solution of sodium carbonate, and then with warm water, and dried for two days in a desiccator over calcium chloride. The breaking strain and elongation of the test pieces were then determined across a section 3 cm. by 7 mm., a strip 1 cm. long between the clips of the machine being used. The variation of strength and elongation with the length of time during which the sample was immersed in the vulcanising liquor is shown by the following figures, which indicate a maximum of strength at five minutes' cure, followed by a minimum at six minutes, and maxima of elongation at three and nine minutes' cure, with a minimum at seven minutes:—

French Patents.

[*Rubber substitute*] *Material; New —— unattacked by acids, for covering metallic and other casings.* P. Lacollonge. Fr. Pat. 360,287, Feb. 18, 1905.

Stearine pitch (90 to 80 per cent.) is melted together with ceresin or ozokerite (10 to 20 per cent.) at a temperature below 110° C., after which powdered picric acid (2 to 4 per cent. on the pitch) is stirred into the mass. The temperature is then raised to 125° C., with constant stirring, and the heating continued for some time; the temperature should never rise beyond 130° C. during this time. The mass is then mixed with various powders or fibres and the heating continued at from 130° to 140° C., as in the vulcanisation of rubber. The mixture obtained is moulded into sheets or other shapes as desired.

—A. G. L.

Rubber, gutta-percha, balata, &c.; Process for treating the milks or lactiferous juices of —— to permit their transport in a liquid condition. L. Morège. Fr. Pat. 360,324, Feb. 20, 1905.

See Eng. Pat. 7694 of 1905; this J., 1906, 82.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 384.)

Tannin-containing substances; Examination of some ——. J. Sack. Inspectie van den Landbouw in West Indie. Bull., No. 5, 1—8. Chem. Centr., 1906, **1**, 1106—1107.

Mangrove (*Rhizophora Mangle*). The older plants contain more tannin than the younger ones. The dry substance of the bast contains up to 24·5 per cent. of tannin. The bast was finely ground, repeatedly extracted with cold water, and the filtered, deep red solution treated with lead acetate till a white precipitate began to be formed. After again filtering, a further quantity of lead acetate was added, and the white precipitate thus obtained was suspended in alcohol and freed from lead by means of hydrogen sulphide. The filtrate from the lead precipitate was evaporated with exclusion of air, and was found to contain the reddish-brown tannin, $C_{24}H_{26}O_{12}$, easily soluble in water and alcohol, but insoluble in ether. On heating with sodium acetate and acetic anhydride, the tannin yielded a mono acetate, $C_{24}H_{23}O_{11}.C_2H_3O$, m. pt. 205° C., the tannin probably first forming the anhydride, $C_{24}H_{24}O_{11}$, which then reacted with the acetic anhydride. On treatment with water containing hydrochloric acid, the tannin yielded a "tannin-red," according to the equation, $2C_{24}H_{26}O_{12} - 3H_2O = C_{48}H_{46}O_{21}$. *Mambarklak* (*Lecythisamara Aubl.*) from Surinam. The bast of this plant yields only a few per cent. of tannin, but contains also a white substance possessing the characters of a saponin. *Oemabarklak* (*Bigonia inaequalis*, D.C.) The bast contains 21 per cent. of matter soluble in water, 14 per cent. of tannin, and also saponins. The bast of *Krappa* (*Carapa guyanensis*) contains 11 per cent. of soluble substances and 5 per cent. of tannin. The bast of *Cassia floridu*, *Vahl* contains 54·8 per cent. of water, 3·4 per cent. of ash, 6·6 per cent. of matter soluble in water, and 2·5 per cent. of tannin. The dried husks contain 10 per cent. of tannin, and the seeds, 19·2 per cent. of water, 5·4 per cent. of ash and 44·7 per cent. of oil.—A. S.

English Patent.

Tanning of hides and skins. J. Rivière, P. Verroul and A. Bouvier, Lyons, France. Eng. Pat. 16,312, Aug. 10, 1905.

See Fr. Pat. 350,026 of 1904; this J., 1905, 1023.—T. F. B.

United States Patent.

Tanning leather; Apparatus for ——. H. de Marneffe. Liege, Belgium. U.S. Pat. 816,670, April 3, 1906.

See Fr. Pat. 339,428 of 1904; this J., 1905, 284.—T. F. B.

French Patent.

Hides, leather, &c.; Process of treating ——. F. J. Oakes. Fr. Pats. 359,838 and 359,839, Nov. 27, 1905. Under Int. Conv., Dec. 12, 1904 and March 31, 1905.

See U.S. Pats. 798,293 and 798,294 of 1905; this J., 1905, 1023.—T. F. B.

XV.—MANURES, Etc.

(*Continued from page* 384.)

Phosphate exports from Christmas Island. Bd. of Trade J., April 26, 1906.

The following particulars, taken from the Annual Report on Christmas Island for 1905, show the quantity of phosphates shipped from these Islands during the five last years:—1901, 42,125 tons; 1902, 61,179 tons; 1903, 70,096 tons; 1904, 71,757 tons; 1905, 97,952 tons. [T.R.]

United States Patent.

Nitrogen; Process of preparing, growing and distributing organisms which fix or gather atmospheric ——. G. H. Earp-Thomas, Wellington, New Zealand. U.S. Pat. 816,850, April 3, 1906.

A nodule from a leguminous plant is thoroughly cleansed and sterilised; it is then fractured under aseptic conditions, and the bacteria thus obtained are mixed with sterilised water. A portion of the milky fluid is transferred to a culture medium which is substantially free from nitrogen, the culture is developed and re-inoculated in distributing packages also containing a non-nitrogenous medium. When the bacteria have developed, the packages are sealed up. A suitable medium for these bacteria consists of 14 grms. of wood ashes, 26 grms. of shredded agar, and 35 grms. of maltose in 2210 c.c. of water.—J. F. B.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 385.)

Beetroots, Determination of sugar in Italian ——. E. Viviani and D. Galeati. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1016—1020.

On many sides there is an inclination to adopt Pellet's cold aqueous digestion process for the determination of sugar in beetroots in preference to the alcoholic process. Pellet's process consists in digesting the normal weight of rasped pulp with cold water and diluting to a total volume of 201·35 c.c. after the addition of 5—7 c.c. of basic lead acetate solution of 30° B., exhausting the air, if necessary under vacuum, filtering, and adding two or three drops of acetic acid to the filtrate. The authors have examined this process comparatively with the alcoholic processes and have obtained absolutely concordant results, even when the ratios of sugar to non-sugar were very different. They find that the objection urged against aqueous digestion, *viz.*, that optically active non-sugar components are present in the filtrate, is not valid. These substances are eliminated by the basic lead acetate as efficiently as by alcoholic digestion. In employing the "rapid" processes of Le Docte and Kruger (see Pellet, this J., 1896, 746) for Italian beetroots, the authors find a constant error of 0·20—0·35 per cent. of sugar too low. Processes of this sort are based on the assumption that the average proportion of juice in beetroots is constant; but Italian beets in the fresh state appear to contain a somewhat excessive proportion of juice. In order to obtain a total volume of liquid of 100 c.c. in these processes with Italian beets, it is necessary to add 70·32 c.c. of basic lead acetate solution to 26·048 grms. of pulp instead of 78·14 c.c. as prescribed by Krüger.—J. F. B.

Sugar cane products; Fermentation of ——. C. A. Browne, jun. J. Amer. Chem. Soc., 1906, **28**, 453—469.

The juice of the green tops of the sugar cane contains invertase, which brings about a gradual inversion of the sucrose in the cane after it is cut, unless the tops be removed at the same time. The sugar cane also contains oxydases and catalases, sometimes called reductases. If an oxidisable substance, such as quinol (hydroquinone) be added to raw cane juice, a rapid darkening, due to the oxidation of the quinol by the enzyme, takes place with absorption of oxygen; the oxidised product possesses antiseptic properties capable of preserving the juice for weeks. In the cane, the tannins play the same part as the quinol; fresh juice from raw cane darkens rapidly, and the number of bacteria per c.c. either decreases or only increases slightly during the first few hours, whereas in the juice expressed from steamed canes the number of bacteria increases rapidly from the first. When a living cane is injured, the surface of the wound gradually darkens owing to the above action, and the wound remains free from signs of fermentation; but with frost-bitten or sterilised canes, the surface of the injury is soon attacked by moulds and bacteria. In the living cane the activity of the reductases

vents the diffusion of the toxic oxidation products, borated for protective purposes at the injured surface, m diffusing into the cane. The most common fer- ntation of raw cane juice in Louisiana is the viscous, cilaginous or mannitic fermentation, produced by *uconostoc*. This is an anaërobic fermentation, and the ce is rapidly bleached. The viscous product a gum called dextran possessing a specific rotatory wer $[\alpha]_D = 201{\cdot}8°$. The presence of this gum the juice of fermented, frost-bitten canes may cause ors in analysis, and, in the case of syrups, may cause impression that starch-syrup has been added. Man- ol can generally be isolated from the fermented juices. her products of anaërobic fermentations occurring in factories are sulphuretted hydrogen, hydrogen and thane; serious explosions of these gases are not known. Among the aerobic fermentations which the thor has experienced, that due to the cellulose-producing ment, *B. xylinum*, is mentioned. The dried cell- embranes produced by this bacterium consist essentially cellulose; they contain only 0·2 per cent. of nitrogen, d, according to the author, do not contain chitine. e scums and deposits from most fermented juices ntain mannan. Chitine is a very important con- ituent of the scums which form every year on the surface molasses left over in the "hot room," and which are oduced by a species of *Citromyces*. These scums also ntain about 27 per cent. of fat, which closely resembles tter-fat in many of its characters, but which contains very high proportion of free acid, owing to lipolytic tion. The author has frequently observed the presence acetylmethylcarbinol in fermented juices; this appears be formed whenever alcoholic fermentation is arrested oxidising or acid-producing bacteria. Molasses and w sugars are not exempt from fermentative attacks, hich, however, are confined to the surface, where fficient hygroscopic moisture may be attracted to lute the liquid to an extent which permits of the develop- ent of organisms.—J. F. B.

ugar juices; Funk's process [Kieselguhr] for defecating ——. Brandt, Plötze and Schulz. Z. Ver. deutsch. Zuckerind., 1906, 90–93.

UNK'S process for defecating sugar juices effects an conomy in the lime-consumption by substituting for a ortion of the lime generally employed, a smaller pro- ortion of kieselguhr free from iron, which is cheaper. The ieselguhr is added to the crude juice, the temperature f which at the time of the addition must be about 90° C. n cases in which it has previously been necessary to use per cent. of lime for defecation in the ordinary manner, it as been found that, with the use of 0·05–0·1 per cent. f kieselguhr in the hot crude juice, 1 per cent. of lime ill suffice for the subsequent defecation. Saturation is arried out in the usual manner. No differences could be bserved in the appearance and composition of the juices nd subsequent products from the two processes. In ddition to an important economy of lime, the kieselguhr rocess offers advantages in the filtering and pressing, he quantity of scums is less, and consequently the quantity f dilute washings is reduced; there is a saving of space, wing to the smaller number of filters required, and here is an economy of filter-cloths. Owing to the smaller roportion of lime used, the time required for saturation curtailed.—J. F. B.

ugar manufacture; Unnoticed source of loss of sugar in ——. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 991–994.

HE author records a source of loss of sugar which akes place during its manufacture or refining. This loss s a kind of "volatilisation" which occurs whenever the team rising from hot juice, massecuites, or from the entrifugals escapes into the open air, the vapours from which, when inhaled, are noticed to have a sweet flavour. t can be demonstrated by holding a clean flask filled with cold water in the escaping vapour and by testing he liquid thus condensed, by the α-naphthol-sulphuric cid reaction. When it is considered that the free vaporatio" from the hot liquids in the course of manufac- ture amounts to 3—4 per cent. of the total volume, and that, at a temperature of 85° C., the condensed liquids have been found to contain as much as 2·5—5 grms. of sugar per litre, it will be understood that the losses from this cause may be very considerable. The volatilisation of the sugar probably occurs in the form of minute vesicles of juice carried in suspension in the vapours. When a 10 per cent. solution of sugar was distilled in a flask, care being taken to trap the vapours, no sugar could be detected in the distillate.—J. F. B.

Sugar; Prizes for the application of —— to industrial purposes. Bd. of Trade J., April 26, 1906.

THE French Syndicate of Sugar Manufacturers has voted a prize of 100,000 frs. (about 4000*l*.), with a view to stimulating research for new methods of employing sugar for industrial purposes. The conditions of the competition are as follows:—

1. The new application of sugar must be made solely for industrial purposes, not for the manufacture of any form of food.

2. The invention must give rise to an increased consumption in France of not less than 100,000 tons of refined sugar.

3. The prize will be awarded to the inventor as soon as the French official statistics prove that the new application of sugar has brought about an increased consumption of 100,000 tons in twelve months.

If it should appear necessary to lower or abolish the sugar tax in order to promote the success of the invention, the Syndicate will use every endeavour to obtain a rebate on the sugar used in the new industry. [T.R.]

Sugar; Reduction of German excise duty on — —. Bd. of Trade J., April 19, 1906.

A RESOLUTION has been passed by the Reichstag recommending the introduction during the present Session of a Bill to reduce the excise duty on sugar from 14 to 10 marks per 100 kilos. (from 7*s*. to 5*s*. per cwt.).

Should this measure be passed, the *import* duty on sugar (which consists of the excise duty, the "surtax" of 4 marks 40 pfg. on raw sugar and 4 marks 80 pfg. on refined sugar) will be correspondingly reduced. [T.R.]

Sugar mixtures; Analysis of ——. C. A. Browne, jun. XXIII., page 446.

UNITED STATES PATENT.

Crystallising sugar, &c.; Method of ——. V. H. Schütze, Riga, Russia. U.S. Pat. 817,010, April 3, 1906.

SEE Eng. Pat. 3792 of 1905; this J., 1905, 808.—T. F. B.

FRENCH PATENTS.

Grained sugar from syrups spun from the first-jet massecuites; Process for making ——. W. Raabe. Fr. Pat. 359,744, Nov. 24, 1905.

THE syrups spun from the massecuites of the first jet are diluted with water to a density of 60°—80° Brix., so as to bring them to the same concentration as the original syrup from which the first massecuite was boiled. The syrup is then heated and filtered and treated with a quantity of lime equal to 0·04—0·1 per cent. calculated on the beetroot equivalent of the syrup. The defecated liquor is then saturated in a continuous apparatus with sulphur dioxide until its alkalinity is reduced to the same point as that of the syrup from which the first massecuite was boiled (*i.e.*, 0·04—0·07 per cent.). The syrup is filtered and boiled to massecuite in the usual manner. This second product is stated to be of a purity equal to that of the first product.—J. F. B.

Starch ["Amyloid"] which gives liquefied pastes when heated with basic substances; Preparation of ——. J. L. Wolff. Fr. Pat. 360,091, Dec. 5, 1905.

STARCH, 25 kilos., is treated at the ordinary temperature for an hour and a half with 50 litres of a solution containing 2—4 parts per 1000 of potassium bichromate, and about 15 per cent. by weight of sulphuric acid. The

starch is then washed until the excess of acid is removed, and is dried at a temperature of about 30° C. If desired, the bichromate may be replaced by half its weight of permanganate. Starch thus treated gives a paste which, when heated in presence of traces of basic matter, *e.g.*, with ordinary water, becomes fluid and transparent. The liquefied pastes gradually gelatinise when cold, but are readily re-liquefied on heating. If the product of the oxidation be washed with distilled water instead of water containing traces of basic substances, and dried at 30° C., it may be converted into "soluble starch" by heating in the dry state at 80°—100° C. for a few hours.

—J. F. B.

GERMAN PATENT.

Sugar solutions; Process for the purification of —. I. Schetke-Raffay, geb. Hoflechner. Ger. Pat. 166,305, Jan. 22, 1905.

THE sugar solution is treated with a metallic sulphate, for example, ferrous sulphate, and then with a metal, such as zinc, in a fine state of division, the metal being of such a nature that it will cause the displacement of the iron from the sulphate in the form of hydroxide, with the evolution of hydrogen, whilst itself combining with the sulphuric acid. The metallic hydroxide thus produced forms insoluble compounds with the impurities present in the sugar solution, whilst the hydrogen exerts a bleaching effect.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 387.)

Malt-kilning; Notes on —— [*German system*]—H. Kropf. Woch. f. Brau., 1906, **23**, 169—171.

THE chief conditions for an ideal kiln are: perfect independence as regards temperature and draught of the upper and the lower hurdle-floors; uniform temperature and humidity of the air at all parts of the floor; rapid removal of moisture from the green malt at a low temperature. The author has devised a two-floor kiln answering these requirements, in combination with a Winter's withering floor in the uppermost part of the kiln. For the first six hours of the kilning, the air from the kiln proper is not passed to the withering floor, since it is too heavily laden with moisture. The withering is done at this time with fresh air from the furnace room, which is slightly warm, supplemented, if necessary, by a small proportion of hot air from the heating chamber. Afterwards, when the malt on the upper hurdle is nearly dry, the exhaust air from the kiln proper is passed through the withering hurdle, the supply of cooler air being also maintained in order to avoid a temperature above 30° C. in the withering malt. In this way the green malt retains only 20—23 per cent. of moisture after 12 hours' withering and is then loaded on the upper kilning hurdle. The independent regulation of the temperature on the upper hurdle of the kiln is effected by an arrangement of perforated pipes in the form of a net-work immediately below the hurdle. These pipes can be made to supply either cool, fresh air from the furnace room or hot air from the heating chamber, as desired. The curing process on the lower hurdle is effected generally with only a small draught, since after treatment on the upper hurdle the malt only retains 5—6 per cent. of moisture unless the evaporation has been purposely retarded.

For high-cured, pale malts, the withered malt is dried on the upper floor at a temperature not exceeding 50° C., the evaporation being accelerated by a full supply of cool air through the perforated pipes. The rapid removal of the moisture at a low temperature, both on the withering floor and on the upper kilning floor, enables the malt to withstand a higher temperature on the curing floor without loss of paleness; curing is finished at a temperature of 80°—85° C. for the last four hours. For dark, highly aromatic malts, the withered malt, containing 20—23 per cent. of moisture, is heated as soon as possible to a temperature of 67°—70° C. on the upper floor of the kiln, by closing the cool air inlets and thereby curtailing the evaporation. Under these conditions saccharification takes place, and can be regulated to any desired extent without affecting the mellowness of the endosperm. Afterwards, the cold air inlets are opened and the malt is dried off at a lower temperature, finally being cured and aromatised on the lower floor at a temperature of 100° C. By varying the temperature and rapidity of evaporation on the upper floor, any modification of the malt which may be desired can be obtained with certainty.

—J. F. B.

Malts and beers; The nitrogenous constituents of ——. R. E. Evans. J. Inst. Brewing, 1906, **12**, 209—223.

THE nitrogenous constituents of the wort are of the highest importance in determining the character and qualities of the beer, and although the nature of these is probably influenced most decisively by the nature of the barley and the process of malting, it is possible to control them to a certain extent in the mashing process. Given a wort containing a certain proportion of nitrogenous matters uncoagulated by the boiling process, the brewer has to ascertain what proportion of these is removable by the yeast during primary and secondary fermentation, and what proportion is incapable of removal. The removable nitrogenous matters or yeast nutrients may be divided into readily available nutrients and those which are only made available under starvation conditions when all the matters of the former class have been removed. The brewer can control these relations by diluting the total nitrogen supply by the addition of non-nitrogenous extract in the form of pure sugar. In this way, the author found that the percentage of the total nitrogen present, removed by the yeast during primary fermentation, could be varied between 29 and 42 per cent. under the conditions chosen. The most favourable result was obtained when the ratio of available yeast nutrient to fermentable extract was about 2:100. Further dilution tended to debilitate the yeast in consequence of the extra work entailed upon it. Moreover, when a vigorous secondary fermentation is required, it is desirable to leave some of the less readily available nutrient for the yeast at that stage. The nitrogenous matters remaining in the beer and incapable of serving as yeast nutrients, either in primary or secondary fermentation, may be of two classes: (*a*) the permanently and entirely soluble matters, which are perfectly stable, and which contribute to the flavour and "head" retaining qualities, being valuable factors in the "character" of the beer, and (*b*) the unstable, "high type" albuminoids which are very near the coagulating point, ready to be deposited as a "haze" when any change in the condition of the medium occurs. The unstable forms are capable of being measured to some extent by the addition of tannic acid to the beer previously neutralised by shaking it with chalk and determination of the nitrogen in the precipitate. Their presence is probably connected with the origin of the barley, foreign barleys being superior in this respect to English, and with faulty methods of malting and storage of the malt. The actual quantity required to produce a "haze" is probably very small, about 0·24 oz. per barrel, and it should not be impossible to find some natural means of eliminating such small quantities, other than by chilling and filtering.

—J. F. B.

Extracts [*Brewers'*]; *A study on* ——. *Part I.* W. S. Smith. J. Inst. Brewing, 1906, **12**, 229—251.

IT is well known that the finer the grist the higher is the yield of extract obtained; the only difficulty standing in the way of the utilisation of this advantage lies in the danger of "set" mashes, or clogging of the bed during the running off of the wort. For milling fine grists the author prefers smooth rolls of chilled cast iron, one of them being mounted on yielding bearings, set at distances ranging from 1/20—1/70 in. apart, the yield of extract being greater the closer the rolls. The different malts intended for the brew should be intimately mixed together, and then screened to separate the small corns, which should be ground separately in a smaller mill. A distinct advantage is gained by heating the malt to 140° F. on the kiln, 24 hours before milling. With fine grist, an efficient admixture of the grist and mashing

liquor is a prime essential requiring special care. An external mixing machine is of great utility for this purpose, the speed of travel being carefully regulated. The slower the rate, consistent with proper mashing, the better are the subsequent effects. With regard to the important question of the dimensions of the mash tun, the factors of depth of goods, drainage and yield of extract are closely allied, especially in relation to sparging. The ideal depth of goods in a 16-foot tun and at the finish of mashing with two barrels per quarter, is about 65 ins. wet dip. During the first quarter of the time occupied in filling the coppers it is best to allow the depth of goods to sink about 4 ins., making up for the contraction which occurs in the volume of the malt residues. The ratio of liquor to malt residues should be kept approximately constant, or a definite and regular rate should be adopted in the fall of the goods, violent changes being avoided. Deep mash tuns are not suitable for fine grist mashes; large, shallow tuns give thinner deposits of impervious material, though they require perhaps rather larger quantities of sparging liquor. The maintenance of a uniform depth of goods minimises the danger of "flooding" when the rakes are worked slowly at half-time; in the author's opinion half an hour's rest after raking, is beneficial, and increases the uniformity of extraction.—J. F. B.

Yeast; Mechanism of the acclimatisation of —— towards sulphurous acid. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1021—1022.

THE author expresses his disagreement with the conclusions of Gimel (this J., 1906, 192) that the acclimatisation of yeast towards the presence of sulphurous acid in the media is due to an oxidising action of the yeast. Gimel's conclusions are stated to be based on erroneous experimental results. The author maintains that "the yeast defends itself against the toxicity of sulphurous acid by a reducing action."—J. F. B.

Fermenting vats; Paraffining of ——. B. Franzl. Letters on Brewing (Hantke's), 1906, **5**, 223—224.

THE author writes favourably concerning the use of paraffined fermenting vessels, in which the beer never acquired a woody taste, whilst the clarification was always satisfactory. The beer has had no effect whatever on the paraffin, although, in some cases, a single coating has been used for five years.—T. H. P.

Alcohol Bill in the United States. Chem. and Drug., April 28, 1906.

THE Committee on Ways and Means, which sat at Washington on March 30, authorised a favourable report on the Free Alcohol Bill, which removes the internal revenue duty from denatured alcohol for use in the arts and sciences. The Bill has the approval of Commissioner Yerkes, and it is estimated that the annual loss in revenue will not exceed 500,000 dols., and may not be more than 300,000 dols. It is said that the Bill will be of great benefit to manufacturers, and will afford an enlarged market for farm-products from which alcohol is made. The sale of denatured alcohol as a beverage or for liquid medicinal purposes is forbidden by the measure, under penalty of a fine not to exceed 5,000 dols., or five years' imprisonment, or both, in the discretion of the Court. [T.R.]

ENGLISH PATENTS.

Malt; Preparation of —— by means of chloride of lime or other hypochlorite salts. J. Effront, Brussels. Eng. Pat. 1639, Jan. 22, 1906.

THE claims made are for: (1) A method of preparing malt by adding to the steeping water a neutralised solution of a hypochlorite and maintaining the proportion of chlorine in the steeping water during the whole operation at 0·5 to 0·7 grm. per litre by subsequently adding neutralised hypochlorite solution. (2) A modification of (1), consisting in treating the malt with neutralised hypochlorite solution during the germination process. (3) A further extension, which consists in moistening or washing green malt for distilling purposes, and particularly for the manufacture of artificial yeast, with neutralised hypochlorite solution, before use. —T. H. P.

Yeast; Method for the production of dry ——. H. Hahn and C. Reiser, Munich, Germany. Eng. Pat. 11,453, May 31, 1905.

SEE Fr. Pat. 348,573 of 1904; this J., 1905, 509.—T. F. B.

Brewers' worts; Apparatus for cooling ——. E. F. Daniel and G. Thornley, Burton on Trent. Eng. Pat. 19,724, Sept. 29, 1905.

THE refrigerator for brewers' worts consists of a closed casing containing a large number of superposed horizontal tubes over the external surface of which the hot wort is caused to flow in a very thin layer. The cooling medium is passed through the interior of the tubes, which are partially filled with metal cores, so as to leave only a very narrow annular space through which the cooling medium circulates. By thus reducing the body of cooling liquid presented to the heated surface a more efficient interchange of heat between the two liquids is obtained. —J. F. B.

Briquettes; Manufacture of ——. [*Utilisation of distillers' refuse.*] Baron Armstrong. Eng. Pat. 6784, March 30, 1905. II., page 420.

UNITED STATES PATENT.

Pasteurising apparatus [for beer]. C. H. Loew, Lakewood, Ohio. U.S. Pat. 817,495, April 10, 1906. (See also U.S. Pat. 808,668; this J., 1906, 131.)

THE apparatus for pasteurising beer in bottles comprises a pasteurising chamber containing perforated trays, on which the bottles are packed, a spraying mechanism within the chamber connected with a water-supply, and means for gradually heating the water without interrupting its flow until a predetermined temperature is reached and for maintaining that temperature. The sprayed water, after passing over the bottles on the trays, is collected in a drip-tank at the bottom of the apparatus, from which it is pumped to the water-heating chamber, where it is again heated to the desired temperature b means of a steam pipe controlled by a thermostat. Means are provided for again returning the heated water from the heating-chamber to the spraying devices, also for gradually lowering the temperature of the water when the process of pasteurisation is completed.—J. F. B.

FRENCH PATENTS.

Beer in bottles; Process and apparatus for pasteurising ——. C. H. Loew. Fr. Pat. 360,177, Dec. 7, 1905.

SEE U.S. Pats. 808,668 and 817,495 of 1906; this J., 1906, 131, and preceding these.—T. F. B.

Beer; Product and process for the preservation of ——. H. Canonne. Fr. Pat. 360,107, Feb. 13, 1905.

A PRODUCT, which is stated to ensure the perfect stability and preservation of beer, is composed of 90 parts of calcium carbonate, and 10 parts of ferric oxide. The mixture is used in the proportion of 50 grms. per ton of barley malt. For use, 100 grms. of the substance are suspended in 10 litres of water, and are added to the mash-tun when the mashing of the grain is three-quarters finished.—J. F. B.

Fermentable liquids, particularly wines and spirits; Apparatus for heating or cooling ——. Soc. Quelin et Perras. Fr. Pat. 360,257, Dec. 8, 1905.

THE apparatus consists of a vessel containing water beneath which is a hearth, the chimney from which rises through the vessel and is surrounded to a considerable height by the water to be heated. The wine or other liquid passes through a coil immersed in the water and surrounding the chimney of the furnace. When it is

required to cool the wine in order to arrest fermentation, the fire is extinguished and cold water is allowed to circulate through the vessel.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 388.)

(A.)—FOODS.

Bread; Alcohol in — —. O. Pohl. Z. angew. Chem., 1906, **19**. 668–669.

The distillations were effected in a Papin's digester of about 8 litres capacity, into the cover of which a pipe was fitted communicating with a Liebig condenser. The charge consisted of 2 litres of water and 990 grms. of bread, divided into small cubes. The distillate, measuring about 500 c.c., had a strong odour of new bread, an acid reaction, and required 1·15 c.c. of N/1-potassium hydroxide solution for neutralisation. The united distillates (about 2 litres) from four charges, representing 4419 grms. of bread, were saturated with sodium chloride and redistilled in a flask fitted with a Hempel still-head, until about half the volume had come over. This was again saturated with sodium chloride, reduced to half its bulk by redistillation, and this operation repeated until the final distillate measured 120 c.c. The latter was then saturated with calcium chloride and distilled. The distillate, measuring 50 c.c., had a sp. gr. of 0·9885, corresponding to 6·66 grms. of alcohol in 100 c.c., so that 100 grms. of bread contained 0·0753 grm. of alcohol.—D. B.

Acids; Detection of some — — [*Boric acid in milk*]. V. Castellana. XXIII., page 445.

(B.)—SANITATION; WATER PURIFICATION.

English Patents.

Water; Apparatus for softening and purifying — —. T. R. Wollaston, Manchester. Eng. Pat. 15,872, Aug. 3, 1905.

The crude water is delivered into the compartments of a tipping bucket or water-wheel. This bucket is mounted over a trough divided by a cross-partition, a portion of the contents of the bucket being discharged on one side and the other portion on the other side of the partition. The position of the bucket relatively to the partition is capable of accurate adjustment, so that the proportions of the contents falling on the two sides of the partition can be varied according to the hardness of the water. The water delivered on one side of the partition passes into the mixing chamber and clarifying tank, whilst the water delivered on the other side falls on a tray containing slaked lime, and thence down a pipe to the bottom of a chamber in which it is clarified by upward flow, and from which it emerges at the top in the form of clear lime water, which passes to the reaction chamber in exactly the same proportions as the bucket was adjusted to deliver. Soluble reagents are supplied, if required, by displacement of a regulated volume from a reagent tank by means of a reciprocating body operated by the movement of the bucket. Clarification, removal of froth, and final filtration of the softened water are effected in the usual manner.
—J. F. B.

Liquids [*Water*]; *Purifying apparatus for* ——. C. Schmidt, Vienna. Eng. Pat. 1158, Jan. 16, 1906.

The dry reagents for the precipitation are supplied to the water in a fine state of division and in the right proportion from a tank by means of a conveyor-worm which rotates beneath in a chamber with an outlet opening reaching not quite to the bottom. The worm-conveyor may be driven by the water to be purified, and may have threads in the opposite direction at one end, with the object of preventing precipitating substances being thrown and packed against the front wall of the vessel.
—C. A. M.

(C.)—DISINFECTANTS.

Coal-tar oils; Process for preparing dermatologically active, high-boiling ——, *which do not darken.* Knoll und Co. Ger. Pat. 166,975, May 31, 1903.

Heavy coal-tar oils, of b. pt. 300° C. and upwards, are washed with acid and alkali in the usual way, and then treated once or more with several per cent. of concentrated sulphuric acid at an elevated temperature, with or without addition of an oxidising agent: the product is then thoroughly washed with alkali, and distilled, preferably *in vacuo*, in an apparatus in which it does not come into contact with base metals; this latter precaution is necessary to prevent the oils darkening on keeping
—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 389.)

Swedish "Kraft" paper from Adansonia fibre. C. Beadle and H. P. Stevens. Paper and Pulp, 1906, **25**. 195.

The Adansonia fibre, obtained from the bast of the Baobab tree, is, next to the Japanese fibres, probably one of the most suitable for making unbleached papers of the strongest quality. The bast is chopped, boiled with dilute soda-lye under a pressure of 3–4 atmospheres for eight to ten hours, and is beaten to a "wet" pulp between blunt knives; it does not lend itself to bleaching. Since the price of the bast delivered in England amounts to about 10*s.* per cwt., and as the loss during the working up of the pulp is nearly 50 per cent. and the process of manufacture is an expensive one, this fibre can, under present conditions of collection and importation, only be employed for certain very special purposes, *e.g.*, for the manufacture of emery-papers, &c. With organised production, however, there is a prospect of lower prices in the future.—J. F. B.

Cellulose and paper industry of Sweden. For. Off. Ann. Ser. No. 3500.

The past year shows a great advance in both the prices of sulphite pulp and the amount manufactured. The former, which in 1903 were down at 6*l.* 7*s.* 9*d.* f.o.b., rose in 1905 to 8*l.* 6*s.* 8*d.* and upwards.

A number of new mills are in course of erection, but the workshop strike has probably kept back some of them. The progress made by the sulphite industry will be seen from the following figures:—1891, 24,000 tons; 1896, 62,000 tons; 1901, 140,000 tons; 1905, 270,000 tons.

Sulphate cellulose shows no corresponding increase, but as regards prices it followed pretty nearly those of sulphite.

The paper industry on the whole did well during 1905. The mills were kept fully occupied and there was some improvement in prices, especially as regards sulphate cellulose and strong papers. The better prices obtained for the above-mentioned kinds of paper are ascribed to an agreement made several years ago between the local manufacturers to prevent undue rivalry with each other, while makers of other papers, especially sulphite bag papers, paper for newspapers, and packing paper, are said to be still indulging in the keenest competition. The export of paper generally is steadily increasing. Of the amount that is exported, the United Kingdom at present takes the largest share. So many new factories are either planned or actually being erected that a very considerable increase is expected soon in the production of sulphite cellulose. Of this increase it is calculated that about 100,000 tons more pulp will be exported annually in a half-manufactured condition, while a certain amount will remain in the country to be worked up into paper.

The following table shows the amount of paper

exported from Sweden to the United Kingdom during the last three years:—

Year.	Printing Paper in Rolls.	Printing Paper not in Rolls.
	Cwts.	Cwts.
1903	472,116	742,161
1904	536,926	792,300
1905	558,996	842,452

The total value of paper exported to the United Kingdom during 1905 is estimated at over 1,000,000*l.*, to which may be added a considerable amount of pulp sent to the British markets. [T.R.]

Cellulose and paper industry of Norway For. Off. Ann. Ser. No. 3555.

The following are the figures for the exports of wood-pulp, cellulose, &c., from Norway:—

	Quantity.			Value.	
	Average for 1901–04. Tons.	1904. Tons.	1905. Tons.	1904 £	1905. £
Wood-pulp—					
Dry	19,526	18,395	21,085	66,433	90,678
Wet	326,645	335,917	321,822	578,322	689,267
Cellulose—					
Dry	109,650	113,497	130,093	851,233	1,071,872
Wet	14,438	14,928	15,203	53,905	63,828
Packing paper	32,573	33,160	33,458	307,661	317,522

The figures quoted from the official statistics include Swedish pulp and cellulose re-exported; the amount of Swedish cellulose thus treated has increased considerably of recent years from 12,774 tons in 1901 to nearly 28,000 tons in 1903, though a slight drop to 23,000 tons occurred in 1904.

The demand for cellulose has increased of late years; better prices have been realised in 1905 than for several years past, and many of the makers in the Drammen district are said to have disposed of their production over 1906 and 1907. The stocks at the end of the year are very moderate and prices keep firm. It is, however, to be questioned whether this improvement in the cellulose industry will last, as there is a tendency to build new factories. Two large new factories are reported in Norway, while old factories are being extended. Of the new production at least 40,000 tons are expected on the market in 1906, and the increase by the close of 1907 or early in 1908 is estimated at 150,000 tons.

The high prices of mechanical wood-pulp which, owing to scarcity of water power, ruled during the winter of 1904-05, proved of no stability. As soon as the spring flow enabled mills to work at full power, prices declined rapidly from 2*l.* 10*s.* to 2*l.* f.o.b. per ton moist; during the summer from 1*l.* 17*s.* to 2*l.* 7*s.* f.o.b. per ton moist, wrapped in hessians, were the best prices obtainable for ordinary brands. A recovery occurred in the autumn owing to heavy rains, thus nearly balancing the earlier reduced output. The year closed with ample stocks but few inquiries. Of late it has become more and more usual to ship wood-pulp from Norway unpacked, that is, in bales bound together with iron wire and protected by sticks, instead of in canvas or jute as formerly. This is stated to be due to difficulties in inducing the authorities to grant the same drawback on jute packing materials that is accorded in Sweden. [T.R.]

English Patents.

Paper or card; Sizing ——. F. Dobler, Paris. Eng. Pat. 14,789, July 18, 1905.

See Fr. Pat. 350,035 of 1904; this J., 1905, 984.—T.F.B.

Celluloses; Utilisation of Ulex Europeus —— for manufacturing artificial silk, celluloid, plastic matters, guncotton, and for any other uses. G. P. Horteloup, Paris. Eng. Pat. 21,505, Oct. 23, 1905. Under Int. Conv., Oct. 24, 1904.

See Fr. Pat. 347,353 of 1904; this J., 1905, 344.—T.F.B.

United States Patents.

Papermaking; Process of dissolving size for ——. B. Kniffler, Stoneham, Mass. U.S. Pat. 816,863, April 3, 1906.

The process consists in heating a measured volume of rosin size, spraying the liquefied size into a measured volume of hot water to produce an emulsion, agitating the emulsion, and adding thereto a measured volume of cold water.—J. F. B.

Papermaking; Apparatus for dissolving size for ——. B. Kniffler, Stoneham, Mass. U. S. Pat. 816,864, April 3, 1906 (see preceding abstract).

The apparatus consists of means for heating the size, and a receiver for the liquefied size; the receiver has a perforated discharging plate located at the upper end of the perforated tube of an emulsifying chamber. This emulsifying chamber consists of two concentric tubes, the inner one being perforated and attached to the outer tube at both ends. The liquefied size is discharged through a perforated plate at the top of the inner tube, whilst jets of hot water are forced through the perforations in the walls of the inner tube, so as to strike the jets of size at an angle, and thereby disintegrate them, so as to form an emulsion. The emulsion is received in a tank, which is connected with another tank in which the emulsion is mixed with cold water.—J. F. B.

Papermaking; Process for dissolving size for ——. B. Kniffler, Stoneham, Mass. U.S. Pat. 816,865, April 3, 1906. (See preceding abstracts.)

A measured volume of rosin size is heated and is then subjected in the form of small jets or streams to the action of forcibly expelled jets or streams of hot water, in predetermined relative proportions, to disintegrate the jets of size and produce an emulsion. This emulsion is then added to a measured volume of cold water.
—J. F. B.

Filaments and films; Manufacture of —— from viscose. C. N. Waite, Assignor to S. W. Pettit. U.S. Pat. 816,404, March 27, 1906. V., page 426.

Paper for lithographic prints; Process of producing ——. L. W. Noyes, Mechanicsville, N.Y. U.S. Pat. 816,497, March 27, 1906.

The web of paper is first passed through a solution of size, to fill up the pores, and to provide a homogeneous surface; the excess of size is removed and the paper is then dried. An enamel-coating composition consisting essentially of casein is then spread on the web, which is finally dried by hot air, all the operations being performed in one continuous process.—J. F. B.

French Patents.

Paper and cardboard; Apparatus for impregnating —— on the machine in the course of manufacture. F. Dobler. Fr. Pat. 359,930, Feb. 7, 1905.

In order to impregnate the moist web of paper after it leaves the press rolls, it is necessary to support it on moving bands. These bands, which also serve for applying the impregnating solution, consist of aprons made of a material possessing a smooth, impermeable surface, *e.g.*, caoutchouc, in order to avoid frothing. The lower band dips underneath the surface of the impregnating solution and carries a thin layer of the liquid to the under-side of the paper. The same solution is applied to the upper surface of the paper by spraying it over the surface of the upper band. Both bands with the paper between them then pass between a pair of press-rolls and the impregnated paper passes on to the drying cylinders.
—J. F. B.

Papermaking materials; Process for bleaching ——. A. Gagedois. Fr. Pat. 360,158, Dec. 7, 1905.

For the manufacture of white pulp from materials hitherto regarded as being incapable of being fully bleached, the materials or pulps are boiled once or several times with a lime or soda lye in the ordinary manner, and are washed.

perfectly free from the reagent. The lye-boils are followed by hypochlorite treatment, once or several times, and the hypochlorite is thoroughly removed by washing. Bleaching proper is then conducted by agitating the materials for four to six hours in a solution of alkali peroxide and silicate. This solution contains 0·5—3 kilos. of peroxide and 10—30 kilos. of liquid silicate of 35° B. per 100 kilos. of material. During the process the temperature is gradually raised to about 80° C. in order to decompose the peroxide. The material is washed and is then agitated with a solution of soap containing caustic alkali, at a temperature of 40°—50° C. for one hour. The material is drained, treated again with hypochlorite, washed, and finally neutralised with thiosulphate solution. For the manufacture of white paper from coloured rags, the rags are steeped in a very dilute solution of nitric acid for 10—12 hours, prior to treatment in the above manner.

—J. F. B.

Paper; Process of making —— impermeable. Mme. N. L. Duryea *née* Smith. Fr. Pat. 360,276, Dec. 9, 1905.

The paper is first steeped in a hot solution containing potassium caseate, 25 parts; soap, 12 parts; gelatin, 8 parts; and water, 955 parts. It is then drained and passed into a second bath composed of calcium acetate, 50 parts, and water, 950 parts. After soaking in this for a few minutes, the paper is dried, and is then coated with a solution of paraffin wax, 22 parts in petroleum benzine 928 parts, finally being dried and subjected to the action of hot rollers.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 393.)

Pinene and camphene; Action of mercuric acetate solution on ——. [*Detection of camphene in essential oils.*] L. Balbiano. Reale Accad. dei Lincei, 1905; through J. Pharm. Chim., 1906, **23**, 397.

Pinene.—When 25 grms. of pinene are agitated at intervals with a solution of 174·5 grms. of mercuric acetate in 700 grms. of water, the pinene is oxidised into Δ^6-(6-) hydroxymenthenone (2).

Camphene.—With the same reagent, under similar conditions, camphene forms an additive crystalline compound, $C_{10}H_{16}O(HgC_2H_3O_2)_2$, insoluble in water and in ether, and therefore readily purified. When suspended in water and treated with a current of hydrogen sulphide this body is decomposed, liberating camphene.

To detect camphene in an essential oil, a solution of the same in an equal volume of benzene is agitated with a 25 per cent. aqueous solution of mercuric acetate, and set aside for 30 days. The crystalline compound thus formed is collected, purified, and the terpene regenerated with hydrogen sulphide.—J. O. B.

Compounds with an allyl side chain: Differentiation of —— from isomerides with a propenyl chain, by means of mercuric acetate. L. Balbiano. Reale Accad. dei Lincei, 1905, through J. Pharm. Chim., 1906, **23**, 395—397.

With compounds having an allyl side chain, represented by the generic formula $R.CH_2.CH:CH_2$, such as methylchavicol, safrol, methyleugenol and apiol, saturated aqueous solution of mercuric acetate forms mercury compounds having the constitution, $R.C_3H_5(OH)HgC_2H_3O_2$, from which the original body may be liberated by treatment with hydrogen sulphide. With the isomeric propenyl compounds, such as anethol, isosafrol, isomethyleugenol, and isoapiol, of the general formula $R.CH:CH.CH_3$, mercuric acetate acts as an oxidising agent, and the propenyl compounds fix two hydroxyl groups to the ethylene nucleus, giving compounds with the formula $R.CHOH.CHOH.CH_3$. Mercuric acetate affords, therefore, a ready means of distinguishing these isomerides, for which, hitherto, almost the only distinctive reaction has been that of nascent hypoiodous acid, as shown by J. Bougault (Comptes rend., 1900, **132**, 561).

Safrol is taken as a type of the compounds with an allyl side chain. When 10 grms. are agitated with 100 grms. of a 20 per cent. aqueous solution of mercuric acetate, the safrol is slowly transformed into a dense syrupy liquid; after eight days, this is separated, washed with water, and dissolved in absolute alcohol. The addition of 10 or 12 vols. of anhydrous ether precipitates a trace of a solid body, which is filtered off. On distilling off the solvent from the filtrate, the syrupy residue is found to have the constitution $CH_2O_2:C_6H_3.C_3H_5(OH)HgC_2H_3O_2$. On passing hydrogen sulphide through this, safrol is regenerated.

Anethol is typical of the compounds with a propenyl chain. Twenty grms. are melted and shaken with 86 grms. of mercuric acetate dissolved in 344 grms. of water. Oxidation takes place almost immediately, with the formation of mercurous acetate; after 15 or 20 days the deposit of this salt is mixed with metallic mercury and the supernatant aqueous solution acquires a yellowish tint. The mass is then extracted with ether, the ethereal solution is washed with sodium carbonate, and the ether distilled off. The residue thus obtained is the glycol $CH_3O.C_6H_4.CHOH.CHOH.CH_3$.—J. O. B.

Urotropine (Hexamethylenetetramine); Decomposition of ——. R. Ischidzu and T. Inouye. J. Pharm. Soc., Japan, 1906, 1. Chem. Centr., 1906, **1**, 1087—1088.

The authors have investigated the decomposition of urotropine, $(CH_2)_6N_4$, especially by acids, *viz.*, boiling hydrochloric and acetic acids, dilute sulphuric, hydrochloric, acetic, lactic, succinic and salicylic acids, and Japanese saké. In the decomposition by acids, the chief products are formaldehyde, carbon dioxide, ammonia and methylamine. The beginning of decomposition and the amounts of the different products formed, depend upon the quantity of acid, its concentration, the temperature and the duration of the action. With a moderate action of hydrochloric or acetic acid for a definite period, 2 mols. each of ammonia and methylamine are formed from 1 mol. of urotropine. With increase of temperature, duration of action, and concentration of acid, the formation of ammonia increases, whilst that of methylamine diminishes. Under suitable conditions, however, the quantity of methylamine produced is so large that the reaction can be used practically for the preparation of that compound. On distilling urotropine with dilute hydrochloric or sulphuric acid, formaldehyde is found in the distillate (95 parts per 100 parts of urotropine; theoretically, 128:100). Urotropine is more stable in alkaline than in neutral solutions: even by simple boiling with water, formaldehyde is produced. A not inconsiderable quantity of formaldehyde is also produced in saké preserved by addition of urotropine.—A. S.

Phenyldimethylpyrazolone [Antipyrine] and its more important derivatives; Isonitroso-reaction of ——. F. Sperling. XXIII., page 445.

Acids; Detection of some ——. V. Castellana. XXIII., page 445.

English Patent.

ω-Alkylamino-ethylbenzoates; Manufacture of ——. A. Zimmermann, London. From Chem. Fab. vorm. E. Schering, Berlin. Eng. Pat. 15,456, July 27, 1905.

Alkylamino-ethanols or their salts are treated under suitable conditions with a benzoylating agent, such as benzoic anhydride or benzoyl chloride. The benzoylated product is isolated and purified either in the form of the free base or of one of its salts, *e.g.*, the hydrochloride or oxalate. These compounds are utilised as local anæsthetics.—J. F. B.

United States Patent.

Magnesium perborate. O. Liebknecht, Frankfort on Maine, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 816,925, April 3, 1906.

See Ger. Pat. 165,279 of 1904; following these.—T.F.B.

Dialkylbarbituric acids; Process of making ——. M. Conrad, Aschaffenburg, Germany. U.S. Pat. 817,159, April 10, 1906.

See Fr. Pat. 354,452 of 1905; this J., 1905, 1125.—T. F. B.

Benzoylalkylaminoethanols and process of making same. T. Emilewicz, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 817,164, April 10, 1906.

See Eng. Pat. 15,456 of 1905; preceding these.—T. F. B.

Acetylene chloride; Process of making ——. H. Precht, Neustassfurt, Germany. U.S. Pat. 817,188, April 10, 1906.

See Fr. Pat. 355,776 of 1905; this J., 1905, 1255.—T.F.B.

French Patents.

Dialkylbarbituric acids; Process of preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 359,820. Feb. 3, 1905.

See U.S. Pat. 790,116 of 1905; this J., 1905, 749.—T.F.B.

Dialkylmalonylureas; Process of making ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,334. Dec. 11, 1905. Under Int. Conv., Jan. 9, 1905.

See Eng. Pat. 26,275 of 1905; this J., 1906, 233.—T. F. B.

German Patents.

Morphine alkyl ethers; Process for preparing bromalkylates of ——. J. D. Riedel, A.-G. Ger. Pat. 166,362, May 28, 1904.

The alkyl ethers of morphine (*e.g.*, codeïne, &c.) are converted into the quaternary bases by means of alkyl bromides in the usual manner, or a quaternary morphine bromoalkylate is converted into its alkyl ethers in the known way, or morphine is treated with 1 mol. of alkali and 2 or more mols. of alkyl bromide; each of these methods results in the formation of the bromoalkylates of codeïne or its homologues, which are of medicinal value. (See also U.S. Pat. 780,619 of 1905, and Ger. Pat. 158,620 of 1903; this J., 1905, 209 and 750.)—T. F. B.

Eserine; Process of preparing a salt of —— which does not become coloured. E. Merck. Ger. Pat. 166,310, Feb. 24, 1905.

A suitable solution of eserine is treated with sulphurous acid, and the resulting solution evaporated. The salt thus obtained differs from the sulphate and other salts of eserine in that its aqueous solutions do not turn red, but remain colourless.—T. F. B.

Coal-tar oils; Process for preparing dermatologically active, high-boiling —— which do not darken. Knoll und Co. Ger. Pat. 166,975, May 31, 1903. XVIIIC., page 440.

Peptone preparation containing iron thiocyanate; Process for preparing ——. M. Baum. Ger. Pat. 166,361, Oct. 3, 1903.

A peptone preparation containing iron thiocyanate is obtained by treating iron thiocyanate, containing excess of ferric hydroxide, with an aqueous solution of albumin, and mixing the precipitate with pepsin-hydrochloric acid ("Pepsinsalzsäure").—T. F. B.

Tri-iminobarbituric Acids; Process for preparing ——. E. Merck. Ger. Pat. 165,692, Feb. 11, 1904.

Tri-iminobarbituric acids are obtained by condensing guanidine (or its homologues or derivatives) with malonitrile or its mono- or di-alkyl derivatives, in presence of alcoholates, alkali metals, or alkali amides, or even without condensing agents.—T. F. B.

Diiminobarbituric acids; Process for preparing ——. E. Merck. Ger. Pat. 166,448, Feb. 11, 1904.

Malonitrile, or a mono- or dialkyl malonitrile, is condensed with urea or a suitable derivative thereof, with or without the assistance of a condensing agent; the product of the reaction is a 4.6-di-iminobarbituric acid. (Compare preceding abstract.)—T. F. B.

Barbituric acid derivatives; Process for converting 5-alkylated diamino-oxy- and triaminopyrimidines into the corresponding ——. E. Merck. Ger. Pat. 165,693, Feb. 11, 1904. Addition to Ger. Pat. 156,385, July 12, 1903.

Alkylbarbituric acids are obtained by heating with dilute acids the corresponding 5-alkyl-4.6-diamino-2-oxypyrimidines or -2.4.6-triaminopyrimidines (di- or tri-iminobarbituric acids; see two preceding abstracts), 2 or 3 mols. of ammonia being eliminated.—T. F. B.

C.C-Dialkyl-2-arylimino- and -2-arylhydrazinobarbituric acids; Process for preparing ——. A. Einhorn. Ger. Pat. 166,266, Dec. 11, 1904.

Dialkylbarbituric acids are converted by condensation with aromatic amino-compounds or hydrazines, into dialkyl-2-aryliminobarbituric acids or dialkyl-2-arylhydrazinobarbituric acids respectively. These derivatives are converted into dialkylbarbituric acids by heating with mineral acids.—T. F. B.

4.5-Diamino-2.6-dioxypyrimidines; Process for preparing ——. E. Merck. Ger. Pat. 166,267, March 7, 1905. Addition to Ger. Pat. 161,493, March 3, 1904.

4-Amino-5-isonitroso-2.6-dioxypyrimidines (see Ger. Pat. 161,493; this J., 1905, 1030) are reduced electrolytically to 4.5-diamino-2.6-dioxypyrimidines; the latter are thus obtained in a much purer condition than when reduction has been effected by means of metals.—T. F. B.

Zinc perborate; Process of preparing ——. Deutsche Gold- und Silber-scheide Anstalt. vorm. Roessler. Ger. Pat. 165,278, July 14, 1904.

Zinc perborate is obtained either by the action of sodium peroxide or its hydrate, and boric acid or sodium perborate on a zinc salt, or from boric acid and zinc peroxide hydrate. For example, 287 parts of crystallised zinc sulphate are dissolved in about 600 parts of water, 102 parts of boric acid are stirred in, and then 80 parts of 97 per cent. sodium peroxide are added, the solution being kept cool, and stirred for about half an hour. The product is freed from sodium sulphate by decantation with water. It is a white, amorphous powder, applicable to dermatology. —T. F. B.

Magnesium perborate; Process of preparing ——. Deutsche Gold- und Silberscheide Anstalt vorm. Roessler. Ger. Pat. 165,279, Oct. 30, 1904. Addition to Ger. Pat. 165,278 (see preceding abstract).

The processes for preparing zinc perborate, described in the preceding abstract, are also applicable to the preparation of magnesium perborate, the magnesium salt being substituted for the zinc salt in each case. Magnesium perborate is a very stable, white, amorphous substance, and is said to be of value in bleaching processes and also medicinally.—T. F. B.

Isovaleric acid benzyl ester; Process of preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 165,897, Aug. 16, 1904.

The benzyl ester of isovaleric acid is obtained in the usual manner from benzyl alcohol and a derivative of isovaleric acid. It is said to possess sedative properties. An isomeride, prepared from methylethylacetic acid, has no definite physiological action.—T. F. B.

Tannin with formaldehyde and acid amides; Process for preparing condensation products from ——. A. Voswinkel. Ger. Pat. 165,980, Nov. 22, 1904. Addition to Ger. Pat. 160,273, Nov. 6, 1903 (this J., 1905, 1030).

Tannin and formaldehyde are condensed with acid amides other than urea and the urethanes, by the method described in the principal patent. The products have the general formula $C_{14}H_9O_9.CH_2.NH.CO.R$, and are stated to be of medicinal value.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 393.)

Development; The theory of alkaline —— with notes on the affinities of certain reducing agents. S. E. Sheppard. Chem. Soc. Trans., 1906, **89**, 530—550.

At moderate concentrations, 1 mol. of hydroxylamine reduces 1 mol. of silver salt, but, in the case of great dilutions, 2 mols. The oxidation product in the first case is nitrogen, and in the second, nitrous oxide: 1 mol. of hydrogen peroxide reduces 1 mol. of silver salt, probably according to the equation $2H_2O_2+Ag_2O=2Ag+H_2O+2O_2+H_2$, hydrogen being one of the products of the reaction. The following table gives a summary of the results obtained: R is the reducing power, *i.e.*, the number of molecules of silver bromide reduced by 1 mol. of the developer. K = velocity of development in N/10 solution at 20° C. T.C. = temperature coefficient (=K+10/K). F = energy, or concentration of bromide producing the same retardation as N/100 bromide with ferrous oxalate:—

Developer	R.	K.	T. C	F.
Ferrous oxalate	1	0·061	1·70	0·01 N
Hydroxylamine	1	0·305	2·10	0·0113 N
Hydrogen peroxide ..	1	—	—	—
Quinol	2	0·146	2·80	0·0052 N
p-Aminophenol	1—2*	0·550	1·5	0·0073 N
Methyl-*p*-aminophenol	1—2*	0·500	1·25	0·034 N

* According to concentration.

The developing equivalence of alkali hydroxides is the same as their affinity constants as bases, the effect depending only on the concentration of the hydroxyl ions. The value of carbonates and other salts in development, depends, therefore, solely on their hydrolysis and on the formation of hydroxyl ions thereby. A curious result was obtained with quinol, using N/20 alkali hydroxide; up to N/40 quinol, the velocity of development is proportional to the concentration of the quinol, but at N/40 a maximum is reached, which is maintained up to a concentration of N/20, after which the velocity declines. With N/40 quinol, increase of alkali up to N/20 increases the velocity at a greater rate than the concentration, but a maximum is attained at 1 mol. of quinol to 2 of alkali. In the case of *p*-aminophenol, the velocity of development was approximately proportional to the concentration of the alkali, and inversely to the volume when alkali and reducer were in equimolecular proportions.—T.F.B.

United States Patent.

Photography; Reducing agent or composition for use in ——. H. E. Smith, London. U.S. Pat. 816,751, April 3, 1906.

See Eng. Pat. 6276 of 1905; this J., 1905, 751.—T. F. B.

French Patent.

Photographic images; Process of obtaining ——. G. N. Pifer. Fr. Pat. 359,768, Nov. 6, 1905.

See U.S. Pat. 804,038 of 1905; this J., 1905, 1255.—T.F.B.

German Patent.

Catechol; Process for preparing alkali compounds of ——. [*Photographic developers.*] Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 164,666, Aug. 19, 1904.

Alkali salts of catechol of the general composition, $C_6H_4(OH)(OM).C_6H_4(OH)_2$, are obtained by treating catechol with a solution of the theoretical quantity of alkali hydroxide or of a salt with an alkaline reaction: the sulphites are most suitable, as they prevent oxidation of the catechol. This affords a simple method of isolating catechol from impure, coloured solutions, and obtaining it in a form suitable for photographic purposes, the new compounds being readily crystallisable.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 393.)

Explosion; Circumstances attending an —— which occurred at Nether Walstead, near Hayward's Heath, Sussex, on Oct. 26, 1905. By Capt. M. B. Lloyd, H.M. Inspector of Explosives.

A quantity of gelignite cartridges stored in a portable copper magazine for use in blasting operations in the construction of a sewer, exploded in the vicinity of a shed and killed the ganger who was standing in the doorway of the shed. Near the doorway was a "fire-devil," and the evidence indicates that the box had been placed over the fire by the ganger in order to thaw the cartridges which had frozen, owing to the cold weather prevailing at the time, suitable warming pans not having been supplied. The contractors are, it is considered, partly to blame for not having provided warming pans, for experience has shown that even as early as August, nitroglycerin explosives are liable to freeze. Had such warming pans been provided the accident could not have happened. It is recommended that action should be taken by the police to prevent the issue of certificates to persons who are not in possession of proper warming pans.—B. J. S.

Xyloidins. C. Haeussermann. Z. ges Schiess- u. Sprengstoffwesen, 1906, **1**, 39. Chem. Centr., 1906, **1**, 1196.

Ten grms. of cotton-wool were treated with 2 kilos. of nitric acid (sp. gr. 1·473) at 10°—12° C.; the honey-like mass produced, was allowed to stand for 24 hours at the ordinary temperature, filtered through gun-cotton, and poured into water. The xyloidin which separated, was washed free from acid and dried. It formed a white powder, with a somewhat greenish tinge, which decomposed at 195° C. with a slight explosion, but when ignited in the air, burned fairly rapidly but quietly. It dissolved gradually in glacial acetic acid, but only swelled in acetone and ethyl acetate. The product obtained by treating it with sodium hydrosulphide or ammonium hydrosulphide, dissolved whilst moist almost completely in a 10 per cent. solution of sodium hydroxide, but could be reprecipitated from the solution by acids, salts and alcohol; it also exhibited the other characteristic properties of acid-cellulose (see this J., 1899, 940). The product obtained by denitrating a xyloidin richer in nitrogen, prepared by precipitating with water a clear solution of gun-cotton in 40 times its weight of nitric acid (sp. gr. 1·5) was also found to be acid-cellulose. Collodion-cotton and gun-cotton dissolve in nitric acid of sp. gr. 1·473 at the ordinary temperature, but only very slowly and not completely.—A. S.

Japanese powder and explosives. A. Saposhnikow. Z. ges. Schiess- u. Sprengstoffwesen, 1906, **1**, 69—70. Chem. Centr., 1906, **1**, 1196.

The Japanese smokeless powder for field-guns is stated to consist of a mixture of about 40 per cent. of a collodion-pyroxylin containing 11 per cent. of nitrogen, and 60 per cent. of an insoluble pyroxylin containing 13·4 per cent. of nitrogen. The powder for mountain-guns contains somewhat more of the collodion-pyroxylin. The rifle-powder is an analogous mixture. "Shimose" is identical with ordinary melinite.—A.S.

English Patent.

Explosives; Manufacture of nitroglycerine ——. Deutsche Sprengstoff Act. Ges., Nobelshof, Germany. Eng. Pat. 14,958, July 20, 1905. Under Int. Conv., Dec. 12, 1904.

See Fr Pat. 355,844 of 1905; this J., 1905, 1256.—T.F.B.

UNITED STATES PATENT.

Explosive compound. M. S. Talbot, A. A. Shuter, Durban (Administrator). U.S. Pat. 816,830, April 3, 1906.

SEE Eng. Pat. 26,978 of 1903; this J., 1904, 1112.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 395.)

APPARATUS, ETC.

Calorimeter; Alcohol ——, for coal testing. W. M. Wallace. Engineering, 1906, **81** 527—528.

THE author substitutes alcohol for water as the expanding liquid in the Carpenter calorimeter, in which the coal is burned in oxygen gas in a small chamber surrounded by water, the expansion of which is used to indicate the heat value of the coal. The advantages of alcohol are: (1) its uniform expansion, which makes it unnecessary to work always at the same temperature; (2) its large coefficient of expansion; (3) its low specific heat. Time may be saved, therefore, by the use of a smaller quantity of coal, it being found that only 0·6 grm. of Welsh coal gave a rise in the tube of more than 30 ins. Instead of correcting for radiation by allowing the apparatus to cool during a period of time equal to that of combustion, a more accurate method is recommended. The rate of radiation per minute is taken before combustion, and with the oxygen flowing. During combustion the alcohol rises rapidly, but towards the end this changes suddenly to a slow crawl. The time is noted at this change, and one-minute readings are taken until the maximum is reached, and for 10 minutes afterwards, with the oxygen still flowing. The mean of the extreme rates of cooling is then used to correct the temperature after the rapid rise, and the true maximum temperature is determined by adding the highest rate of cooling successively to the subsequent readings.

A tube is fixed to the apparatus for collecting the gaseous products of combustion for measurement and analysis, and it is claimed that with this instrument a determination of calorific value, ash, water, carbon, and hydrogen, can be made in half an hour.—F. SODN.

INORGANIC—QUALITATIVE.

Acids; Detection of some ——. [*Boric acid in milk.*] V. Castellana. Gaz. chim. ital., 1906, **36**, 106—108.

MOST of the reactions for the detection of boric acid depend upon the green coloration of the flame, but such reactions are not reliable in presence of copper or halogen compounds. The author recommends carrying out the test in the following manner:—A mixture of the substance under examination, with excess of potassium-ethyl sulphate, is heated in a test-tube, and the vapour ignited. Organic substances, such as milk, are incinerated, the ash ignited with potassium nitrate, and then tested in the manner described. The test permits of the detection of 0·5 mgrm. of boric acid, it is stated.

If formic, acetic, butyric, valeric, pelargonic, oxalic, benzoic, salicylic, or cinnamic acids, or their salts, or β-naphthol be heated with potassium-ethyl sulphate, they can be identified by the characteristic odour of the esters produced. By using potassium-methyl sulphate in place of potassium-ethyl sulphate, anthranilic acid can be detected in a similar manner.—A. S.

INORGANIC—QUANTITATIVE.

Electrolysis; Analytical separation of metals by ——. A. Hollard. Bull. Soc. d'Encourag., Revue de Metall., 1906, **3**, 78—85.

THE problem of separating and successively depositing two metals by alteration of potential difference in the electrolytic cell, is in but few cases a directly soluble one; in the case of many metals the polarisation-pressure is lower than that of hydrogen, and they can only be deposited concurrently with the liberation of hydrogen. Two methods may allow the attainment of the object: 1. The conversion of one metal into a compound with complex ions, *e.g.*, arsenic into an arsenate, iron into a ferrocyanide, &c.; 2. The prevention of the evolution of gas at cathode and anode, *e.g.*, addition of a salt such as magnesium sulphate, which forms complex ions containing hydrogen, and thus raises the potential, requisite to evolve hydrogen at the cathode; also addition of sulphurous acid in the anode cell, to absorb anodic oxygen; use of a cathode coated with tin, cadmium, or lead.—J. T. D.

Chloric acid; Preparation of pure ——, and its application as an oxidising agent. V. Bernard. VII., page 426.

ORGANIC—QUALITATIVE.

Phenyldimethylpyrazolone [*Antipyrine*] *and its more important derivatives; Isonitroso-reaction of ——.* F. Sperling. Z. Oesterr. Apoth.-Ver., 1906, **44**, 51—52. Chem. Centr., 1906, **1**, 1118.

ACCORDING to the German Pharmacopœia 2 c.c. of an aqueous solution (1:100) of antipyrine are coloured green by two drops of fuming nitric acid, whilst after heating to boiling and adding more nitric acid, a red coloration is produced. The author finds that sometimes instead of the red colour with excess of hot nitric acid, a brownish tint is produced, owing to secondary reactions, and he therefore recommends the following test. 2—3 c.c. of the aqueous solution (1:100) of antipyrine are treated with two drops of fuming nitric acid, and after the green colour has appeared, about 5 c.c. of concentrated sulphuric acid are introduced so as to form a lower layer. A cherry-red colour forms at the zone of contact, and on agitation, spreads throughout the whole of the liquid. The reaction is characteristic of antipyrine and its derivatives, with the exception of aminopyrine. The behaviour of different compounds in this test are shown in the following table.

	2 c.c. of a solution of strength.	Addition of fuming nitric acid causes	Addition of concentrated sulphuric acid causes
Salicylic acid	1:500	—	golden-yellow coloration.
Quinine sulphate	1:100	—	" " "
Quinine hydrochloride	1:200	—	" " "
Cocaine hydrochloride	1:100	—	solution remains colourless.
Codeine hydrochloride	1:100	—	orange-yellow coloration.
Phenol	1:100	yellow coloration	reddish-brown coloration.*
Resorcinol	1:100	yellowish-brown coloration	" " " †
Antipyrine	1:100	green coloration	cherry-red ring.
Antipyrine salicylate	1:200	"	" " "
Migranine (antipyrine-caffeine citrate)	1:100	"	" " "
Pyramidone (dimethylaminoantipyrine)	1:100	violet coloration	yellow coloration.
Tussol (antipyrine mandelate)	1:100	green coloration	cherry-red ring.

* Turbidity. † Vigorous evolution of gas. —A. S.

Pinene and camphene; Action of mercuric acetate solution on ——. [Detection of camphene in essential oils.] L. Balbiano. XX., page 442.

ORGANIC—QUANTITATIVE.

Nitrotoluene; Detection and determination of —— in nitrobenzene, and of toluene in benzene. P. N. Raikow and F. E. Uerkewitsch. Chem.-Zeit. 1906, **30**, 205—296.

When nitrotoluene is treated with powdered potassium hydroxide, a brown coloration is developed. Nitrobenzene gives a similar reaction, although decidedly weaker in intensity. Powdered sodium hydroxide does not react with nitrobenzene in the cold; it, however, forms a yellowish-brown compound with nitrotoluene, thus rendering it possible to detect with ease the presence of the latter in nitrobenzene. The reaction between sodium hydroxide and nitrotoluene is intensified, when petroleum spirit is used as solvent, in which case it is possible to recognise 0·0025 mgrm. in 1 c.c. of the solution. In order to detect toluene in benzene, the latter is converted into the nitro compound and examined for nitrotoluene by means of sodium hydroxide. Commercial benzenes purified for use in analysis were found to contain as much as 5 per cent. of toluene, which it was not possible to completely remove even by fractional recrystallisation. To obtain pure benzene it is recommended to subject the commercial article to partial nitration. Nitrobenzene specially purified for analysis was always found to contain nitrotoluene. For the quantitative determination of nitrotoluene in nitrobenzene it is suggested to compare the coloration yielded by sodium hydroxide with that developed by the latter in nitrobenzene containing known quantities of nitrotoluene.—D. B.

Sugar mixtures; Analysis of ——. C. A. Browne, jun. J. Amer. Chem. Soc., 1906, **28**, 439—453.

The cupric-reducing power of any sugar would be constant for all concentrations if the quantity of copper remaining in solution could be maintained constant. The variation in the copper equivalent for every small increment in the weight of sugar is due to the removal of copper from solution, and can, therefore, be calculated as a function of differences determined experimentally, the tables being constructed from the expression so obtained. Consequently, the ratio of the weights of two sugars which reduce the same amount of copper is a constant at all concentrations. Thus, if the ratio of the reducing power of any sugar to that of dextrose be determined by any given method, *e.g.*, Allihn's method, the results can be calculated from one set of tables, *i.e.*, the dextrose table. The dextrose equivalent of a mixture of reducing sugars is equal to the sum of the dextrose equivalents of the components.

If x = percentage of component A with a dextrose ratio of a, and if y = percentage of component B with a dextrose ratio of b, then $ax+by=$ R = percentage of total reducing sugars as dextrose. Similarly, the polarisation of a mixture of sugars is equal to the sum of the polarisations of the components, and if all polarisations are determined on the Ventzke scale, using 26·048 grms. per 100 c.c. and a 200 mm. tube, the polarisation due to any component is equal to its percentage multiplied by a polarisation factor found by dividing the specific rotatory power of the sugar by that of sucrose (+66·5°). Then, if a' = polarisation factor of component A, and β = polarisation factor of B, and if P = polarisation (Ventzke) of the mixture, $a'x+\beta y=$ P. Hence

$$x=\frac{b\mathrm{P}-\beta\mathrm{R}}{a'b-a\beta} \text{ and } y=\frac{\mathrm{R}-ax}{b}.$$

Levulose and dextrose.—Dextrose ratio of levulose = 0·915; polarisation factors, dextrose = 0·793, levulose at 20° C. = —1·356. The variations of the rotatory power of levulose with concentration may be neglected, but corrected values must be used for the polarisation factor when the temperature is above or below 20° C. The dextrose ratio of invert sugar is 0·958, so that the dextrose equivalent of inverted sucrose is almost exactly equal to the sucrose.

Dextrose and galactose.—Dextrose ratio of galactose = 0·898; polarisation factor of galactose at 20° C. = 1·21. This factor must be corrected for variations in temperature. Owing to the slight difference between the rotatory powers of dextrose and galactose, the inherent error is rather high.

Levulose and galactose.—Temperature corrections are necessary for the polarisation factors of both sugars.

Levulose and arabinose.—Dextrose ratio of arabinose = 1·032; polarisation factor of arabinose at 20° C. = 1·571. Only the levulose factor need be corrected for temperature.

Xylose and arabinose.—Dextrose ratio of xylose = 0·983; polarisation factor of xylose = 0·283. No temperature correction necessary.

Dextrose, levulose and sucrose.—The polarisation of the mixture is S + 0·793D — 1·356 L = P_{20}°. Then if S = the percentage of sucrose according to Clerget, $L_{20}^{\circ}=\frac{0\cdot793\,R+S-P}{2\cdot08}$ and D = R — 0·915 L.

There are two sources of error which require correction:

(*a*) *Reducing action of sucrose.*—This is proportional to the concentration of sucrose and to the amount of copper remaining unreduced. It is corrected as follows:—The amount of sucrose in the 25 c.c. of solution taken for Allihn's method is divided by the mgrms. of dextrose equivalent found +40, and the quotient is subtracted from the dextrose equivalent.

(*b*) *The change in rotation of levulose in presence of acid.*—This depends on the quantity of levulose present and on the concentration of the acid in the sugar solution, the Clerget value for sucrose being too high when levulose is present. With 10 c.c. of fuming hydrochloric acid (sp. gr. 1·18) and 100 c.c. of sugar solution, the percentage of sucrose (Clerget) must be reduced by 0·036 for every 1 per cent. of levulose found.—J. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 395.)

Metallic films produced by cathodic disintegration; Dichroism, double refraction, and conductivity of ——. C. Mauram. Comptes rend., 1906, **142**, 870—872.

Films were deposited on glass plates placed tangentially to a cylinder of which the circular cathode formed the end. These films showed dichroism and double refraction; their electric conductivity varied with the direction, its maximum and minimum values coinciding respectively with the directions of the luminous vibrations most and least absorbed, these being also the directions of the principal sections as determined from the double refraction. Bismuth showed these properties most strongly of all the metals which were tried. Similar results were obtained when the glass plate was parallel to the cathode; and discharge took place through a strong magnetic field, the lines of force of which were parallel to the cathode and the glass plate; in this case the effects were shown most strongly by nickel.—J. T. D.

Osmosis and osmotic pressure; Nature of the process of ——, with observations concerning dialysis. L. Kahlenberg. Trans. Wisconsin Acad. Sciences, Arts and Letters, 1906, **15**, 209—272.

The author first describes experiments in which layers of chloroform and ether were separated by a layer of water, and shows that in such a case water acts as a semi-permeable septum, allowing ether to pass through to the chloroform, but being almost impermeable for the latter. The results obtained in these experiments and of many others with solid membranes show that whether osmosis will take place in a given case or not, depends upon the specific nature of the septum and of the liquids that bathe it; and if osmosis does occur, these factors also determine the direction of the main current and the magnitude of the pressure developed. The motive force in osmotic processes lies in the specific attractions or affinities between the liquids used, and also between the latter and the septum employed. For example, if a

rubber membrane be employed, the rubber must be capable of dissolving or absorbing one of the liquids bathing it, and, further, the other liquid must be capable of dissolving, or have an affinity for, the liquid absorbed by the rubber. If a solution of cane sugar and pure water be separated by a rubber membrane, no change takes place. With a solution of sodium chloride and toluene, the rubber swells and absorbs toluene, but no osmosis takes place, the brine being incapable of extracting toluene from the swelled rubber. If the two liquids be alcohol and water however, osmosis takes place, the main current being from the alcohol to the water; in this case the alcohol is taken up by the rubber and extracted from the latter by the water. It becomes possible, therefore, by considering the affinity between the two liquids and between these and the septum or membrane, to predict whether osmosis will take place and if it does, what the direction of the main current will be. In osmotic processes there is always a current in both directions; when a septum is termed "semi-permeable," what is meant is that the main current is so much stronger than the other that the latter becomes negligible. Vulcanised caoutchouc acts as "a semi-permeable membrane when it separates pyridine solutions of silver nitrate, lithium chloride and cane sugar from the pure solvent. To obtain accurate measurements of osmotic pressure it is necessary to well stir the contents of the osmotic cell throughout the determination, and the author has devised an apparatus for this purpose. Results obtained in this way show that the gas laws do not hold in osmotic processes. The conclusions arrived at with respect to osmosis apply also to dialysis and the passage of a substance through a membrane is quite independent of whether it is a crystalloid or a colloid. For example, if cane sugar and copper oleate be dissolved together in pyridine and the solution separated from pure pyridine by means of a vulcanised caoutchouc membrane, the copper oleate (colloid) passes through the septum and the cane sugar (crystalloid) remains behind. Also, if the copper oleate be replaced by camphor (a crystalloid), this also passes through, leaving the cane sugar behind. Indeed, in general, any substance which is soluble in both hydrocarbons (caoutchouc) and in pyridine may be separated from cane sugar by dialysis, when the pyridine solution of it and the sugar is separated from pure pyridine by a caoutchouc septum. Other analogous separations with different solvents and membranes may also be effected.—A. S.

Osmosis: Gaseous ——, through a colloidal membrane. J. Amar. Comptes rend., 1906, **142**, 872—874.

Experiments with a rubber tobacco pouch, thoroughly dried, showed that when it was exposed to dry carbon dioxide gas on the inside, the amount of gas absorbed in half an hour was inappreciable as the pressure was raised from the atmospheric pressure to an excess of 10 mm. of petrol-column, then rose rapidly till an excess of 16 mm. was reached, and more slowly up to an excess of 32 mm., the limit of the experiment. A similar membrane exposed on both surfaces to carbon dioxide at a pressure of 40 mm. of petrol-column above the atmosphere, then exposed to air, retained 30·5 mgrms. of carbon dioxide [area of membrane not given]. When the apparatus was arranged so that either surface could be exposed to the gas, and the gas was introduced below the surface, the inner surface was impermeable, while the outer surface absorbed in 45 minutes 1·2—1·4 mgrms.; when the gas was introduced above the surface the inner surface absorbed 1·6—2·5, the outer 4—6 mgrms. in 45 minutes. The nature of the surface thus plays a part in gaseous osmosis, which takes place according neither to the laws of Graham and Bunsen, nor the theories of Stefan and O. Meyer.—J. T. D.

Trade Report.

Spanish Chemical Trade in 1905.

Oil and Col. J., April 21, 1906.

The following particulars are taken from a recent return: Imports:—Alkali carbonates, 15,407,594 kilos., 172,560*l.*; artificial colours, 680,324 kilos., 217,720*l.*; dye extracts, 2,376,473 kilos., 99,800*l.*; indigo and cochineal, 135,438 kilos., 59,600*l.*; raw petroleum, 28,512,121 kilos., 228,080*l.*; oleaginous seeds, 39,536,321 kilos., 743,280*l.*; sulphates of potash and ammonia, 199,166,268 kilos., 1,593,320*l.*; tar, pitch and asphalt, &c., 25,037,366 kilos., 78,880*l.*; wax, 2,301,754 kilos., 158,480*l.* Exports:—Olive oil, 34,377,121 kilos., 1,375,080*l.*; mercury, 1,341,290 kilos., 295,000*l.*; salt, 358,873,232 kilos., 143,500*l.*; common soap, 4,750,996 kilos., 98,840*l.* Except mercury, no increase is shown by these exports. Of the imports, sulphates of potash and ammonia have increased, and the chief falling-off occurs in dye extracts.

Italian Trade in 1905.

Oil and Col. J., April 28, 1906.

The following are from the official statistics just issued: Imports:—Indigo, 535,200 kilos., 128,440*l.*; mineral and coal-tar colours, 4,509,900 kilos., 533,160*l.*; gums and resins, 15,192,300 kilos., 187,800*l.*; olive oil, 14,035,900 kilos., 533,360*l.*; cottonseed oil, 11,979,800 kilos., 311,480*l.*; heavy mineral oils, 31,494,300 kilos, 364,320*l.*; petroleum, 66,492,600 kilos., 531,960*l.*; oleaginous seeds, 64,587,400 kilos., 830,840; copper sulphate, 30,683,700 kilos., 638,240*l.*; a notable increase is recorded in all oils except petroleum, but copper sulphate shows a rather heavy falling off. Exports:—Unmacerated sumac 14,751,300 kilos., 88,520*l.*; macerated sumac, 22,520,700 kilos., 144,120*l.*; matches, 3,354,900 kilos., 195,520*l.*; olive oil, 35,475,900 kilos, 1,571,280*l.*; volatile oils and orange essence, 593,015 kilos., 475,040*l.*; mercury, 242,700 kilos., 49,520*l.*; common soap, 3,305,200 kilos., 80,760*l.*; raw and refined sulphur, 381,128,400 kilos., 1,568,120*l.* The only items which have increased are unmacerated sumac and matches.

United States: Trade of —— in 1905.

Oil and Col. J., April 28, 1906.

A summary of the imports and exports of the United States for the twelve months ending December, 1905, compiled by the Department of Commerce and Labour at Washington, supplies the following figures:—Imports: Alizarin and alizarin colours, 6,391,188 lb.; argols or crude tartar, 27,801,725 lb.; crude asphaltum or bitumen 86,798 tons; coal tar colours and dyes, 5,692,072 dols.; cochineal, 83,410 lb.; cutch and gambier, &c., 35,211,452 lb.; glue, 7,066,037 lb.; glycerin, 32,040,460 lb.; grease, 325,867 dols.; gum arabic, 3,383,399 lb.; crude camphor gum, 1,724,499 lb.; copal and kauri gum, 24,760,815 lb.; indigo, 6,397,625 lb.; bleaching powder, 104,919,402 lb.; linseed, 231,639 bushels; whale and fish oil, 856,727; other animal oil, 150,590 galls.; mineral oil, 13,725,720 galls.; olive oil, 1,055,660 galls.; other fixed oils, 5,221,248 dols.; volatile or essential oils, 2,606,327 dols.; paints and colours, 1,570,839 dols.; perfumery, cosmetics, &c., 993,575 dols.; crude phosphate, 56,021 tons; other fertilisers, 4,051,003 dols.; plumbago, 15,568 tons; potassium chlorate, 42,510 lb.; potassium chloride, 214,207,064 lb.; crude saltpetre, 9,911,534 lb.; all other potash, 82,935,632 lb.; shellac, 13,209,883 lb.; fancy, perfumed, and all toilet soap, 1,071,446 lb.; all other soap, 399,797 dols.; caustic soda, 2,245,789 lb.; sodium nitrate, 321,231 tons; "sal soda," 1,943,230 lb.; soda ash, 13,807,749 lb.; other salts of soda, 11,257,629 lb.; sponges, 612,315 dols.; crude sulphur or brimstone, 83,201 tons; ground sumac, 14,537,746 lb.

Exports: Acids, 335,534 dols.; acetate of lime, 70,816,382 lb.; wood alcohol, 891,813 gals.; pot and pearl ashes, 723,932 lb.; beeswax, 107,192 lb.; candles, 7,864,966 lb.; copper sulphate, 19,367,179 lb.; cottonseed, 23,769,164 lb.; dyes and dyestuffs, 457,990

dols.; flaxseed, 1,409,432 bushels; glue, 3,121,881 lb.; grease and all soap stock, 3,998,383 dols.; lampblack, 653,621 dols.; matches, 62,385 dols.; naphthas, including all lighter products, 28,419,930 galls.; corn oil cake, 42,454,947 lb.; cottonseed oil cake, 1,214,667,922 lb.; linseed oil cake, 604,454,483 lb.; corn oil, 3,347,827 galls.; cottonseed oil, 53,368,839 galls.; fish oil, 800,879 galls.; illuminating oil, 881,450,388 galls.; lard oil, 294,491 galls.; linseed oil, 215,667 galls.; lubricating oil, 113,730,205 galls.; crude mineral oil, 126,185,187 galls.; mineral oil residuum, 70,727,877 galls.; peppermint oil, 54,039 lb.; other essential oils, 326,881 dols.; other vegetable oil, 188,945 dols.; other animal oil, 232,823 galls.; whale oil, 10,224; "oleo oil," 182,342,771 lb.; paints and colours, 3,506,486 dols.; paraffin wax, 160,835,882 lb.; perfumery and cosmetics, 499,413 dols.; rosin, 2,258,126 lb.; toilet or fancy soap, 1,042,185 dols.; all other soap, 44,110,949 lb.; spermaceti, 82,013 lb.; spirits of turpentine, 15,614,323 galls.; starch, 68,570,460 lb.; tallow, 81,702,816 lb.; tar, 18,692 lb.; turpentine and pitch, 19,809 brls.; varnish, 775,491 galls.; washing powder, 6,308,547 lb.; oxide of zinc, 22,560,625 lb.

New Books.

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Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

List of Members Elected.

May 23rd, 1906.

Bushy, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.

Chittenden, George, The Francis Frost Co., Ltd., Toronto, Canada, Chemist.

Cowan, Geo. D., Bridge House, Bridge Road, Millwall, E., Manager, De-silverising Works.

Drew, W. Newton, Ramcliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.

Furlong, John R., 182, Commercial Road, London, E., Research Chemist.

Girtin, Thomas, H. L. Raphael's Refinery, Thomas Street, Burdett Road, London, E., Bullion Refiner,

Henning, C. I. B., P.O. Box 42, Santa Cruz, Cal., U.S.A., Chemist.

Jardine, Samuel, c/o Dallyn, Jardine & Co., 23 Scott Street, Toronto, Canada, Chemical Merchant.

Keymer, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.

Larson, Axel, 85, Gracechurch Street, London, E.C., Mining Engineer.

Monier-Williams, G. W., The Lammas, Esher, Surrey

Pafiazzoni, Charles F., Emporium, Pa., U.S.A., Chemist.

Payne, J. H., c/o Eastman Kodak Co., Kodak Park Works, Rochester, N.Y., U.S.A., Chemical Engineer.

Reed, Wm., Bridge House, Bridge Road, Millwall, E., Foreman, De-silverising Works.

Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.

Rowell, Herbert W., c/o Messrs. Locke, Lancaster & Co., Ltd., Bridge Road, Limehouse, London, E., Analytical Chemist.

Schmidt, J., Cross Street, Burton-on-Trent, Works Manager.

Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.

Smith, E. A. Cappelen, c/o Baltimore Copper Smelting and Rolling Co., Baltimore, Md., U.S.A., Metallurgical Engineer.

Tanaka, S., No. 4, Uratakashimacho Nichome, Yokohama, Japan, Chief Chemical Engineer (Electric Wire Works).

Wickens, A. M., 280, Berkeley Street, Toronto, Canada, Mechanical Engineer.

Wilkinson, John E., 71, Lombard Street, Toronto, Canada, Gold and Silver Refiner.

Wood, E. Escott, Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the journal depends.

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Baxter, John G., l/o Cliffe; 143, Milton Road, Gravesend, Kent.

Bement, A., l/o Dearborn Street; American Trust Building, Chicago, Ill., U.S.A.

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Iddings, R. P., l/o Wyman Street; Arlington Mills, Lawrence, Mass., U.S.A.

Knapp, S. A., l/o Nevada; Crocker Building, San Francisco, Cal., U.S.A.

Leuthardt-Thornton, P.; all communications to 14, Steele's Road, Hampstead, N.W.

Lucas, A., l/o Cairo; Survey Dept., Giza, Egypt.

Moignot, Réné, l/o Hotel des Arcades; 8, Rue Thierry Martens, Alost, Belgium.

Noake, Frank, l/o Dunstall Park; 20, Craddock Street, Wolverhampton.

Pickard, Glenn H., l/o Brooklyn; c/o The Spencer Kellogg Co., Buffalo, N.Y., U.S.A.

Pinnock, H. T.; Journals to Beacon House, Dudley Port, Staffordshire.

Prideaux, E. B. R., l/o Beckenham; (Journals) Heriot Watt College, and (communications) 62, Queen Street, Edinburgh, Research Chemist.

Reid, Andrew, l/o Minard Road; 37, Mount Stuart Street, Shawlands, Glasgow.

Ridge, H. M.; all communications c/o Central Zinc Co., Ltd., Finsbury House, Blomfield Street, London, E.C.

Schüpphaus, Dr. Robt. C., l/o Broadway; 175, Pearl Street, New York City, U.S.A.

Smith, Jas. F., l/o Halifax; 131, Seamer Road, Scarborough.

Swindells, Seth, l/o Lawton; The Laurels, Scholar Green, Stoke-on-Trent.

Taylor, Jas. M., l/o Sefton Park; Tynevale, Groes Road, Cressington, Liverpool.

Taylor, Wm. H., l/o Upper Clapton; 20, Baleaskie Road, Eltham Park, Kent.

Unglaub, Oscar, l/o Manchester; 1808, Edgmont Avenue, Chester, Pa., U.S.A.

Watt, H. E., l/o Birmingham; retain Journals.

Weldon, L. E., l/o Central Avenue; 154, Egypt Road, New Basford, Nottingham.

Wrampelmeier, T. J., l/o New York; San Francisco, Cal., U.S.A.

Young, A. C., l/o Ladywell; 17, Vicar's Hill, Lewisham, S.E.

Change of Address Required.

Healey, A. E.; l/o Willesden Junction, N.W.

Member Omitted from List.

1905. White, Clarence B., c/o Herringbone Metal Lath Co., 156, Fifth Avenue, New York City, U.S.A., Chemist.

Deaths.

Bateson, Percy, Cuckoo Lane, Gateacre, Liverpool. May 12.

Muir, Jas. P., 233, Camden Road, London, N. Jan. 15.

Squire, Dr. Wm. Stevens, at Taormina, Sicily. May 13.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 10,015. Wegelin and Geilenkirchen. Method of and apparatus for raising liquids.* April 30.

" 10,055. Collier. Centrifugal separators. April 30.

" 10,162. Petitpierre. Homogenising breaker to emulsify, pulverise and homogenise liquids and semi-liquids, and break fatty or albuminous cellules and nuclei.* May 1.

[A.] 10,261. Wright. *See under* III.
„ 10,313. Röck. Smokeless furnace.* May 2.
„ 10,814. Graham. Apparatus for condensing and purifying gases especially applicable to the manufacture of sulphuric and other acids. May 8.
„ 10,852. Forsbach. Muffle furnaces.* May 9.
„ 10,948. Martini and Huneke. *See under* III.
[C.S.] 9011 (1905). Spooner (Aktiebolaget Separator). Centrifugal separators for liquids. May 9.
„ 9417 (1903). Aktiebolaget Separator. Centrifugal separators for liquids. May 9.
„ 9549 (1905). Kestner. Process for laying smoke from funnels, chimneys, &c. May 9.
„ 14,572 (1905). De Laval. Process for obtaining a violent chemical reaction between materials. May 16.
„ 15,371 (1905). Covell. Distilling apparatus. May 16.
„ 16,477 (1905). Sugg. Apparatus for compressing gases. May 16.
„ 19,913 (1905). Ayres. Separating machines. May 9.
„ 20,752 (1905). Ostertag. Drying furnaces for coal, &c., with superposed shelves or hearths. May 16.
„ 20,865 (1905). Trent. Agitating and mixing apparatus. May 16.
„ 26,668 (1905). Girod. Apparatus for raising liquids by direct fluid pressure. May 9.
„ 26,724 (1905). Lorrain (American Process Co.). Continuous screw presses for drying and similar operations. May 16.
„ 2419 (1906). Critien. *See under* XVIII*B*.
„ 2755 (1906). Ruttkamp. Mixing machines. May 16.
„ 4907 (1906). Thompson. *See under* XVIII*B*.
„ 5859 (1906). De Laval and Fagerström. Centrifugal liquid separators. May 9.

II.—FUEL, GAS, AND LIGHT.

[A.] 10,024. Laurent. Manufacture of arc light carbons. April 30.
„ 10,106. Forbes. Calcium carbide preparations. April 30.
„ 10,158. Hartenstein. Manufacture of carbide.* May 1.
„ 10,159. Hartenstein. Carbide and its production.* May 1.
„ 10,160. Hartenstein. Production of carbide.* May 1.
„ 10,357. Ruffert. Manufacture of incandescent bodies for use in connection with incandescent lighting.* May 3.
„ 10,412. Koppers. Gas furnace installation.* May 3.
„ 10,751. Tolson. Gas producing apparatus used with gas engines. May 8.
„ 10,835. Lynde. Production of gas from petrol and other hydrocarbons. May 9.
„ 10,887. Tully. Manufacture of carburetted water gas. May 9.
„ 11,004. Hersey. Gas washer scrubbers. May 10.
„ 11,077. Fillunger. *See under* VII.
„ 11,099. Browne. Manufacture of gas from coal, &c. May 11.
„ 11,133. Burschell. Process of removing sulphide of hydrogen from gases.* May 12.
[C.S.] 8891 (1905). Frenot. Filaments for electric incandescent lamps. May 9.
„ 9588 (1905). Shedlock. Manufacture of coke. May 16.
[C.S.] 9705 (1905). Cousen. Vaporising and carburetting apparatus. May 9.
„ 11,956 (1905). Woodall and Duckham. Vertical retorts for the carbonisation of coal. May 16.
„ 12,289 (1905). Woodall and Duckham. Vertical retorts for the carbonisation of coal. May 16.
„ 13,914 (1905). Connell, Haldane and Thomson. *See under* XVII.
„ 14,264 (1905). Griffin. Suction gas apparatus. May 16.
„ 14,485 (1905). Coppée. Regenerative coke ovens. May 16.
„ 16,477 (1905). Sugg. *See under* I.
„ 25,466 (1905). Schatz. *See under* XXIII.
„ 1977 (1906). Wilson. Treatment of gases for gas turbines. May 16.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 10,248. Wynne and Scott. Process for purifying petroleum oils. May 2.
„ 10,261. Wright. Apparatus for distilling benzole or other liquids. May 2.
„ 10,288. Goddard and Gush. Apparatus for distilling the lighter grade oils. May 2.
„ 10,289. Goddard and Gush. Distillation or treatment of heavy mineral oils. May 2.
„ 10,290. Goddard and Gush. Distillation or treatment of heavy mineral oils. May 2.
„ 10,948. Martini and Huneke. Production of gas for use in dealing with petroleum and other combustible liquids. [Ger. Appl., May 15, 1905.]* May 10.
[C.S.] 11,893 (1905). Macalpine, Simmance and Abady. Refining petroleum and mineral oils. May 9.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 10,052. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new colouring matters. April 30.
„ 10,079. Meister, Lucius und Brüning. Manufacture of products soluble in water, fats and oils from the salts which higher fatty acids and acids of the oleic series form with organic colour bases. [Ger. Appl., May 19, 1905.]* April 30.
„ 10,323. Johnson (Badische Anilin und Soda Fabrik). Manufacture of salts of 1.2-diazonaphtholsulpho acids.* May 2.
„ 10,324. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. May 2.
„ 10,405. Imray (Soc. Chem. Ind. in Basle). Manufacture of red vat dyeing dyestuffs.* May 3.
„ 10,505. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series.* May 4.
„ 10,506. Schrottky. Substances suitable for use in the manufacture of indigo and for other purposes.* May 4.
„ 10,866. Newton (Bayer und Co.). Manufacture of new derivatives of the anthracene series. May 9.
„ 11,173. Johnson (Kalle und Co.). Manufacture of derivatives of thionapthene. May 12.
„ 11,174. Johnson (Kalle und Co.). Manufacture of *o*-carboxyphenylthioglycollic acid. May 12.
„ 11,175. Johnson (Kalle und Co.). Manufacture of sulphur containing red colouring matter from thioindoxylcarboxylic acid and thioindoxyl. May 12.

[A.] 11,196. Imray (Meister, Lucius und Brüning). Manufacture of new nitroaminophenolsulphonic acids and dyestuffs therefrom. May 12.

[C.S.] 9604 (1905). Lepetit, Dollfus and Ganser. Production of logwood dyestuffs and extract for dyeing purposes. May 16.

„ 9883 (1905). Imray (Meister, Lucius und Brüning). Manufacture of concentrated liquid dyestuffs or easily liquefiable pastes from sulphurised dyestuffs. May 16.

„ 17,540 (1905). Ris. Sulphurised colouring matters obtainable from indophenol. May 9.

„ 6198 (1906). Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of blue sulphurised dyestuffs. May 9.

„ 8077 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of certain polychloranilines. May 9.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 10,189. Kracht. Manufacture of artificial threads composed of cellulose combined with copper salts. May 1.

„ 10,250. Pickles and Pickles. Finishing fabrics. May 2.

„ 10,442. Pickles. Bowls or rollers used in machines for schreinering, calendering, embossing and the like. May 4.

„ 10,609. Abel (Act.-Ges. f. Anilinfabr.). Production of grey tints on fur, feathers, and the like. May 5.

„ 10,693. Ransford (Cassella und Co.). Method of dyeing animal fibres with sulphide colours. May 7.

„ 10,901. Brimkes. Apparatus for treating raw cotton, animal hair and like material. May 9.

„ 11,154. Calico Printers' Association, Ltd., and Dydynski. Process for producing discharge effects in the printing of textiles. May 12.

[C.S.] 9572 (1905). Lennox and Dawson. *See under* XVII.

„ 15,951 (1905). Mather and Platt, Ltd., and Smith. Apparatus for steaming, ageing, and drying fabrics. May 9.

„ 17,381 (1905). Friedrich. Apparatus for the manufacture of artificial threads. May 16.

„ 17,836 (1905). Tomlinson-Haas, Ltd. (Haas). Apparatus for drying and carbonising textile piece goods. May 16.

„ 19,205 (1905). Sunderland, and Bradford Dyers' Association. Method for dyeing khaki on vegetable fibres. May 16.

„ 1300 (1906). Cassella und Co. Printing sulphide colours on textile fabrics. May 16.

„ 3194 (1906). Wansleben and Wansleben. Machines for dyeing bobbins and the like. May 16.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 10,219. Rink. *See under* XI.

„ 10,581. Elworthy. Manufacture of carbonic acid, hydrogen and nitrogen. May 5.

„ 10,814. Graham. *See under* I.

„ 11,077. Fillunger. Method of obtaining ammonia from gas liquor.* May 11.

[C.S.] 14,573 (1905). Howorth (Soc. Anon. Metallurgique Proc. de Laval). *See under* X.

„ 16,931 (1905). Raschen, Wareing, and United Alkali Co. Treatment of arsenical sulphur ores for the obtainment of arsenious acid and of sulphuric acid deprived of arsenic. May 9.

[C.S.] 1771 (1906). Poulenc. Production and purification of hydrogen peroxide. May 16.

„ 3122 (1906). Chem. Fabr. Rhenania, and Projahn. Process of obtaining sulphur from sulphuretted hydrogen or gaseous mixtures containing the same. May 16.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 11,008. Cowper-Coles. Process for colouring pottery. May 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 10,245. Dunn. Non-conducting material for covering boilers, steam pipes, &c. May 2.

„ 10,691. Fawns and Davies. Process for the extraction of clay. May 7.

„ 10,900. Ali-Cohen. Artificial marble and other stone. May 9.

„ 11,037. Haskin. Curing or maturing and preserving wood. May 11.

„ 11,086. Spittler. Composition suitable for building purposes.* May 11.

[C.S.] 9422 (1905). Préaubert and Thubé. Product for tarring and asphalting roads. May 16.

„ 9877 (1905). Queneau. *See under* X.

„ 14,298 (1905). Propper and Bachschmid. Artificial building stone blocks. May 16.

„ 24,655 (1905). Kalinowsky. Process for disintegrating basic slag. May 9.

„ 1611 (1906). Aeberli. Method of manufacturing macadam. May 9.

X.—METALLURGY.

[A.] 10,117. Symonds. Treatment of tin ores. April 30.

„ 10,279. Metcalf. Metallic alloys. May 2.

„ 10,303. Imbert. Treatment of zinc and lead sulphide ores.* May 2.

„ 10,309. Rivière. Metallurgical digesters. [Belg. Appl., May 2, 1905.]* May 2.

„ 10,329. Savelsberg. Production of mattes of the heavy metals. May 2.

„ 10,471. MacIvor and Fradd. Treatment of sulphide auriferous ores containing antimony and antimony ores containing gold. May 4.

„ 10,536. Webb, Brettell and Adamson. Smelting, melting or heating metals, ores, &c. May 5.

„ 10,638. Hyatt. Aluminium and aluminium alloys. May 7.

„ 11,069. Machlet. Case-hardening steel and iron articles.* May 11.

„ 11,191. Schmidt and Desgraz. Furnace for obtaining zinc from zinc ores.* May 12.

[C.S.] 9007 (1905). Lake (Baker and Hearne). Treatment of ores. May 9.

„ 9877 (1905). Queneau. Manufacture of zinc retorts and other fireclay metallurgical vessels. May 16.

„ 14,573. (1905). Howorth (Soc. Anon. Metall. Proc. de Laval). Extraction of zinc or zinc oxide from its ores. May 16.

„ 14,574 (1905). De Laval. Process of extracting iron from its ores. May 9.

„ 17,370 (1905). Leggo. Furnace for roasting, desulphurising, chloridising, dehydrating or drying ores, &c. May 16.

„ 21,160 (1905). Leggo. Furnace for roasting, desulphurising, chloridising, dehydrating or drying ores, &c. May 16.

S.] 22,130 (1905). Hadfield. Manufacture of magnetic materials. May 16.
" 26,170 (1905). Goldschmid. Process for balling together pulverulent or dusty ores. May 16.

XI.—ELECTRO-CHEMISTRY, AND ELECTRO-METALLURGY.

A.] 10,156. Hartenstein. Electric furnaces.* May 1.
" 10,161. Hartenstein. Lining for electric or other furnaces.* May 1.
" 10,219. Rink. Apparatus for the electrolytic decomposition of alkali chloride solution by means of mercury cathodes.* May 1.
" 10,327. Orling. Electro-capillary apparatus. May 2.
" 10,396. Gin. Electric furnaces for the manufacture of steel. [Ger. Appl., May 3, 1905.]* May 3.
" 10,802. Cowper-Coles. Electrolytic deposition of metals. May 8.
" 11,102. British Thomson-Houston Co. (General Electric Co.). Insulating material and methods of making the same. May 11.
.S.] 12,221 (1905). Hepburn, and Mather and Platt, Ltd. Electrolytic apparatus. May 16.

II.—FATTY OILS, FATS, WAXES, AND SOAPS

A.] 10,041. Hill and Reid. Cleansing composition. April 30.
" 10,162. Petitpierre. *See under* I.
" 10,919. Duckham. Apparatus for purifying oils containing water and such like extraneous matter. May 10.
" 10,960. Field. Process for refining oils, fats, waxes or the like. May 10.
.S.] 16,406 (1905). Armstrong, Armstrong and Armstrong. Manufacture of soap and detergent compounds. May 16.

III.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A*.)—PIGMENTS, PAINTS.

.S.] 14,023 (1905). Serck. Inks for colour printing. May 16.

(*B*.)—RESINS, VARNISHES.

A.] 11,090. Elkeles and Klie. Manufacture of substances suitable for varnishing, polishing and other purposes from resins and the like.* May 11.
.S.] 26,176 (1905). Bosch. Process for treating rosin and rosin oils. May 16.

(*C*.)—INDIA-RUBBER.

A.] 10,704. Roland. Elastic substance similar to indiarubber and its method of manufacture.* May 7.

IV.—TANNING, LEATHER, GLUE, SIZE, ETC.

A.] 10,083. Sargent. Depilating process and appliances therefor. April 30.
.S.] 9779 (1905). Harger. Treatment of bones, skins, &c. May 9.
" 24,488 (1905). Oakes. Process of treating hides. May 9.
" 24,984 (1905). Sadikoff. Purification of glue. May 9.

XV.—MANURES, ETC.

[C.S.] 10,733A (1905). Hooton and Noble. Fertiliser. May 16.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 10,216. Kantorowicz. Manufacture of starch [Ger. Appl., May 2, 1905.]* May 1.
" 10,278. Schüler. Centrifugal machines for clarifying and washing sugar and similar materials.* May 2.
[C.S.] 21,072 (1905). Dorant. Process for refining sugar. May 16.
" 7705 (1906). Drittler. Starch and process of producing the same. May 9.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 10,452. Hunt. Means for maturing whiskey and other potable spirits requiring improvement by ageing. May 4.
" 10,504. Lemaire. Apparatus for collecting yeast from fermenting beer. May 4.
[C.S.] 9572 (1905). Lennox and Dawson. Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale, sewage, waste or spent dyes or the like, and concentrating the solids in the same. May 16.
" 10,435 (1905). Mislin and Lewin. Manufacture of fusel oils. May 16.
" 13,914 (1905). Connell, Haldane and Thomson. Treatment of pot ale or spent wash for the production of fuel therefrom. May 9.
" 18,658 (1905). Edwards (Pfaudler Co.). Process for fermenting beer, ale and other fermentable liquids. May 16.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A*.)—FOODS.

[A.] 10,136. Robinson and Backhouse. Process of manufacturing flour or meal. May 1.
" 10,402. Sowerbutts and Sowerbutts. Method of preserving eggs. May 3.
" 10,767. Bath and Allard. Antiseptic compound for alimentary products. May 8.
[C.S.] 13,948 (1905). Morel. Production of gluten in the dry state. May 9.
" 23,391 (1905). Lake (Nordyke and Marmon Co.). Treatment of flour or grain. May 9.
" 26,777 (1905). Eybert and Eybert. Method and apparatus for treating flour with gases. May 16.

(*B*.)—SANITATION; WATER PURIFICATION.

[A.] 10,050. Candy. Treatment of water for washing, cleansing and laundry purposes. April 30.
" 10,080. Lambert. Process for purifying water. [Fr. Appl., May 3, 1905.]* April 30.
" 10,206. Declercq. Water purifying apparatus. [Fr. Appl., May 13, 1905.]* May 1.
" 10,612. Gamble. Apparatus for purifying and regulating liquids.* May 5.
" 10,966. Gardner and Gardner. Purification of sea water for use in connection with power plants. May 10.
" 11,066. Fox. Apparatus for softening and purifying water. May 11.
[C.S.] 12,782 (1905). Friedrich. Enriching water with air or oxygen. May 9.

[S.] 2419 (1906). Critien. Solution for preventing corrosion and removing incrustation in boilers, &c. May 9.

„ 4907 (1906). Thompson. Composition for removing scale from steam boilers. May 9.

„ 9572 (1905). Lennox and Dawson. *See under* XVII.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 10,094. Müller. Manufacture of lustrous threads, bands, strips and the like of viscose. [Ger. Appl., May 1, 1905.]* April 30.

„ 10,228. Johnson (Badische Anilin und Soda Fabrik). Manufacture of substances resembling celluloid.* May 1.

„ 10,388. Woodward (Mistrellet). Manufacture of non-inflammable celluloid. May 3.

„ 10,486. Soc. Anon. Mirabet. Sizing composition for use in the manufacture of paper. [Span. Appl., May 5, 1905.]* May 4.

„ 11,103. Fleury. Preparation of paper pulp. [Belg. Appl., Oct. 6, 1905.]* May 11.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 10,407. Ellis (Chem. Fabr. von Heyden, A.-G.). Manufacture of camphor from isoborneol.* May 3.

„ 10,798. Weizmann, and The Clayton Aniline Co. Manufacture of isobornyl and isobornyl esters. May 8.

„ 10,999. Chem. Fabr. von Heyden A.-G. Manufacture of isobornyl esters. [Ger. Appl., Sept. 4, 1905.]* May 10.

„ 11,197. Rousset. Manufacture of aminoalcohols and their derivatives. [Fr. Appl., May 13, 1905.]* May 12.

[C.S.] 10,436 (1905). Mislin and Lewin. Manufacture of lactic acid for technical purposes. May 9.

„ 17,162 (1905). Imray (Meister, Lucius und Brüning). Manufacture of aminobenzoic acid alkamine esters and derivatives thereof. May 9.

„ 519 (1906). Nathan. Extraction of ethereal oils from the blooms of hops. May 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 10,030. Ord. Photography. April 30.

„ 10,051. Steudel. Self-toning silver chloride printing papers for use in photography.* April 30.

„ 10,078. Bloxam (Neue Photographische Ges.). Reproduction of pictures by aid of catalytic action.* April 30.

„ 10,284. Buisson. Photographic developer. May 2.

„ 11,033. Thornton. Photographic films and their manufacture. May 11.

„ 11,072 Ippers. Photography. [U.S. Appl., July 6, 1905.]* May 11.

[C.S.] 20,662 (1905). Powrie. Colour photography. May 16.

„ 22,735 (1905). Pifer. Photographic pictures and sensitive plates therefor. May 16.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 10,424. Volpert. Manufacture of safety explosives.* May 3.

[C.S.] 15,565 (1905). Cocking, and Kynoch, Ltd. Smokeless powders. May 16.

„ 15,566 (1905). Cocking, and Kynoch, Ltd. Smokeless powders. May 16.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 25,466 (1905). Schatz. Apparatus for use in analysing gas. May 16.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. A programme and request form accompany this issue.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see Journal for April 30th, p. 341) will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Eustace Carey has been nominated to the office of President under Rule 8; Dr. E. G. Love, Mr. A. Gordon Salamon, and Mr. Chas. Wightman have been nominated Vice-Presidents under Rule 8; and Dr. E. Divers, F.R.S., has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's office, at least one month before the date of the Annual General Meeting, at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

ALTERATION OF BY-LAWS.

With a view to facilitate the voting of members residing abroad, notice is hereby given, in accordance with Rule 35 of the By-laws, that the Council will propose to the forthcoming Annual General Meeting the amendment of the Society's By-laws as follows:—

1. Rule 18. (*a*) That the words "At least two months before the date of each Annual General Meeting," in the first and second lines thereof, be replaced by the words, "In the second issue of the Society's Journal for the month of April in each year."

(*b*) That the words "date of that meeting," in the fourth line thereof, be replaced by the words "Annual Meeting next ensuing."

(*c*) That the words "At least one month before the date of;" in the sixth line from the end thereof, be replaced by the words "not later than the last day of May prior to."

(*d*) That the words "to the election to take place at which it refers" in the fifth line from the end thereof, be replaced by the words "at which the election to which the nomination refers is to take place."

2. Rule 19.—That the words "at least five days before the commencement of the said meeting," in the two last lines thereof, be replaced by the words, "in the second issue of the Society's Journal for the month of May."

Deaths.

Bateson, Percy, Cuckoo Lane, Gateacre, Liverpool. May 12.

Muir. Jas. P., 233, Camden Road, London, N. Jan. 15.

Squire, Dr. Wm. Stevens, at Taormina, Sicily. May 13.

Birmingham Section.

Meeting held at Birmingham on Thursday, March 25th, 1906.

PROF. FRANKLAND IN THE CHAIR.

A COMPARISON OF ENGLISH AND AMERICAN METHODS IN THE REFINING AND MANUFACTURE OF COPPER.

BY FRANK PLATTEN.

The visit of the Society of Chemical Industry to the United States in the autumn of 1904, afforded me a long wished for opportunity of seeing the metallurgical works of that country. It is astonishing to contrast the willingness with which visitors are shown over these vast establishments in America, with the secrecy observed in this country—it must be due, to some extent, to the knowledge that the high tariff wall shuts out all fear of competition from this country in their market, and there appears to be no immediate prospect of any alteration in these conditions.

Tracing the course of the metal from ore to finished ingot, copper occurs for the most part as sulphide—is usually smelted in blast furnaces with or without a preliminary calcining and the sulphide, technically known as matte, is obtained, the gangue of the ore being got rid of in the form of slag.

A later form of blast furnace treatment is known as pyritic smelting—in this method, by means of a heated blast, the sulphur and iron present in the ore are utilised as fuel, and coke is almost, if not entirely, dispensed with—this process is a most important development, enabling ores occurring in out of the way districts far removed from a coalfield to be treated on the spot, which would otherwise not be dealt with owing to the cost of carriage.

The copper smelting industry some years ago borrowed from the steel trade the Bessemer idea, and now the sulphide of copper, or matte, is blown in converters to pig copper, the sulphur being consumed by the hot air blast—behaving very much like the silicon in cast iron under similar conditions. The converter pig now contains about 99 per cent. copper, with generally some silver and gold, and is cast into anodes and sent to the electro depositing plants—this process separates the precious metals, and the electro deposited copper is then refined in reverberatory furnaces and cast into wire bars, cakes and ingots.

The 75-ton copper refinery furnace is no myth—I have seen a refinery containing 10 such furnaces with the greater part of them in operation, and concede all that has been said in their praise—but when one considers fully the trade conditions obtaining in the two countries, it will be seen that, desirable as many American methods are, they are frequently inapplicable in English works.

The term "refine," as far as American practice is concerned, is a misnomer—you will find on referring to any standard dictionary the word means "to purify or separate from extraneous matter." The copper charged to American refineries being electro deposited is already as pure as it can be made, and all they have to do is to change the shape of the article from cathode plate to the form required, and there we come to the first point in the differing conditions.

The cathode plates are piled in the furnace, the doors closed, and the fire urged, and, when all is melted, practically a bath of pure copper is obtained containing at the worst a trace of sulphur taken up from the coal, and oxygen which is removed by the usual method known as poling, that is, plunging beneath the surface of the molten copper the stem of a tree; the reducing gases from which remove the oxygen from the copper in just the proportion required. The conditions are ideal for handling large quantities, and I must say, in justice to our American

cousins, that they have not been slow to avail themselves of their opportunity; their works are magnificently equipped and run with machine-like precision, to see one of these huge furnaces charged by means of a system of air lifts is a revelation, and their capacity has steadily grown until the present enormous tonnage is by no means uncommon, and attempts are shortly to be made to deal with charges of 100 tons. Where the development in size of copper refining furnaces will stop, it is hard to say, but I incline to agree with several American metallurgists, that the limit has been reached; the enormous weight of the charge and the corrosive action on the furnace walls at one stage in the refining process constitute important factors, also the length of time required to empty the furnace, during which a particular state of oxidation termed "pitch" has to be maintained, must be taken into account.

You have no doubt noticed in the English market quotations for copper, the word "standard." What an American refiner would make of 75 tons of this material in one of his furnaces cannot be imagined. Roughly, the composition and necessary treatment is as follows:—The copper percentage is 96, the balance being chiefly sulphur, iron and arsenic.

In dealing with a 15-ton charge of this material, the sulphur is the chief difficulty encountered; on melting down, some of this escapes by oxidation, but the melted bath still contains sufficient sulphur to keep the metal in a constant state of ebullition, due to the escape of sulphur dioxide from the gradual oxidation caused by the atmospheric oxygen which is now allowed to play over the surface. Treating material with 1 per cent. sulphur, a percentage that is often exceeded in standard copper, this ebullition continues frequently for two or three hours, and at the end of this period, sulphur still remains to a sufficient extent to require several hours of what is known as rabbling—that is, agitation of the bath by means of an iron tool, a form of hand labour for which no mechanical substitute has yet been invented. When the last traces of sulphur are removed, the method proceeds on the same lines as in the States, with this great difference that the treatment of this small quantity has occupied 24 hours.

It will be seen even from this short description, that so long as English refiners have to depend on standard copper and Chili bars, which are approximately of the same composition as standard, a daily charge of 15 tons is about the maximum that can be dealt with. But even supposing the days of standard copper should pass and Chili bars cease to exist and English refiners find themselves in a position to deal with electro-deposited copper in their furnaces, another obstacle has to be encountered, and this brings me to the second, and, I fear, an insuperable difficulty, one which handicaps many of our industries, and which no doubt you have noticed is periodically ventilated in the press. I refer to the lack of standardisation in specifications which confronts many of the manufacturers of this country.

It is said that if a buyer requires a locomotive from, say, the Baldwin works he has to take one of the standard patterns or nothing. This is far from being the case with English locomotive builders.

I believe the tests and inspection governing this industry are of the most exacting description, but I can only speak as regards the manufacture of the firebox, which, as you are aware, is made of copper. It is difficult to see how copper refiners are ever to use large modern furnaces in the face of the variation in specifications relating to the composition of copper. I will not now go into the question of what quality of copper is best suited for firebox work, but will give as an instance the proportions of arsenic that are commonly asked for. One engineer will require a percentage of 0·35 to 0·55, while another limits it to 0·15 per cent., while specifications reading "arsenic must not exceed 2 per cent.," "arsenic must be present in the proportion of 0·25 to 0·4 per cent." are not unusual. I can offer no explanation of this diversity of opinion, but no doubt the questions of quality of water and nature of fuel are largely concerned.

In addition to this element, limits are in some cases placed on the presence of nickel, lead, bismuth and oxygen, and, as an extreme case, I may mention that "best selected copper," which is one of the purest forms of the metal, is sometimes required.

When it is also borne in mind that the mechanical tests are of even greater variation and the same complexity extends in, perhaps, a lesser degree to the manufacture of tubes, rods, &c., it will be seen at once that large charges cannot be made, bearing in mind the high and fluctuating price of the metal which precludes makers from carrying heavier stocks than absolutely necessary.

Until greater uniformity in this matter is obtained, any considerable increase in the capacity of English refinery furnaces is out of the question, and we must continue to look with envious eyes on these magnificent metallurgical appliances with their low labour costs and regret that English makers are debarred from availing themselves of their use.

It is, perhaps, interesting to note that in no instance are these colossal furnaces heated with producer or other gas, but the waste heat is invariably utilised by erecting water-tube boilers in the flues, and in the works of the Nichols Chemical Co. the steam raised from this source is said to be equivalent to 75 tons of coal per day.

To illustrate further the advantages enjoyed by the American copper industry, I may mention copper telephone wire, such as is supplied to the British Post Office. This wire is required hard-drawn to give a high tensile strength—a course of treatment which naturally deprives the metal of some of its pliability; this particular size, somewhere about 3/32 in. must have a breaking strain of 32 per square inch, and when it is remembered that the same wire in its soft or annealed state breaks at about 14 tons, it will be seen that a large amount of work has been put on the metal. Notwithstanding this, it has to stand a torsion test, that is, twisting thirty times in a length of 3 in.—sufficiently stringent tests; but I am glad to say his Majesty's Post Office can readily obtain wire of this quality from English makers, although its preparation entails the exercise of the very greatest care on the part of the manufacturer.

The American Post Office authorities some time ago imposed similar tests on the American makers, but great difficulty was experienced in complying with them. A very simple way was found of dealing with the matter, and in response to representations from the manufacturers the tests governing tensile strains, torsion, &c., were removed, the American Post Office being content with "hard-drawn wire."

The electro-refining works dealing with copper present no novel features, complete descriptions of most of the plants having appeared in various journals; it is curious, however, to note that at the works of the Nichols Chemical Co., at New York, the series process is exclusively operated. I believe this is the only important refinery working on this principle, the multiple system having preference elsewhere, and yet these are the largest works of their kind producing one-fifth of the world's output of electro-deposited copper.

The low cost of producing the thin anode sheets necessary for working the series process must have contributed largely to the success of the plant. It was at these works that we saw a Bessemer plant at work blowing copper matte up to bars of 99 per cent. purity. As far as I know, this process has made little, if any, headway in this country and yet for rapidity and uniformity in its work it is far ahead of the older reverberatory method. I believe it is urged against it that the loss of precious metals is high, but with the recent improvements in dust and fume-catching apparatus it would seem that this should not be a matter of serious importance.

As regards the metal works where the output of rolled copper and brass reaches enormous totals, I was struck with the great advantages which the American manufacturer enjoyed, unlimited space—for these establishments are never put down very near to a great city where land is likely to be at a premium—combination of interests, so that separate works can be as far as possible concentrated on to the manufacture of one or, at any rate, a small number of articles, thus enabling specialists to be employed in every branch, and last, but not least, huge timber reserves, making it possible to use this as

fuel in annealing furnaces where, from its long, clean, non-sulphurous flame, a very high standard in the way of surface is obtained on all sheet metal.

The amount of delegation in American works is surprising when one considers the multifarious duties usually connected with similar positions in this country, and I attribute much of the success of the works I visited to the way in which the American superintendent divests himself of all routine work and devotes his energies almost exclusively to the study of his processes and methods.

At first sight it seemed to me that the chemical supervision was inadequate—a group of eight works dealing with enormous outputs situated at considerable distances from each other boasted only one laboratory between them. I suppose it would be difficult to find a metal works in this country, with any desire to be up to date, that had not its laboratory, but here again the conditions of trade come in with marked effect. For instance, in American works practically the whole of the copper for brass making is of one uniform quality—pure electro deposited—in fact, one important works admits nothing that is under 99 per cent. conductivity, and a most careful system of electrical tests is maintained to ensure this condition being carried out.

The most minute traces of arsenic and other impurities would lower the conductivity much below this figure; it will therefore be seen how certain is the question of quality in these works. This will appeal to all who are accustomed to the copper used in English metal works. Best selected ingot is the name of the article, and a requisition for a parcel of such material may bring one of a dozen different brands containing a certain amount of various impurities, all of which are liable to exert considerable modifications when alloyed with such metals as zinc, tin, aluminium, &c., and in these days of exact requirements a great deal of careful examination is necessary to deal successfully with such material.

It is obvious then that the need of the chemist is on this account not so great in American metal works although, in my opinion, many of their processes would be more efficiently carried out under his supervision—especially when dealing with by-products, slags from cupolas, &c.

America must always, I feel, reign supreme in the copper industry for the very simple reason that the metal is there. I believe the latest figures show that more than half of the world's production is mined in the States, which, in itself, is a factor of the greatest importance, but when you add to this the restless energy and ability of the people and the thousand and one natural advantages of that great country, one is bound to realise the facts of the situation.

It is, therefore, apparent that America must remain the great centre of progress and development in this industry, and I can advise nothing better for anyone interested in the chemistry and metallurgy of copper than to pay a visit to these great establishments to which I have, I fear, in this short paper done but scant justice.

Discussion.

Mr. A. H. Hiorns asked whether the 75-ton refinery referred to was an ordinary reverberatory or not? With regard to the abundance of copper ore in America as compared with this country, was it not a fact that we have practically no ore in this country, that, no doubt, made a very considerable difference in the methods of working? Another point Mr. Platten referred to was the enormous time taken up in the removal of the last traces of sulphur, amounting to several hours, entirely done by atmospheric air. Were not certain oxidising agents added to the copper bath? To him the method of standards which Mr. Platten referred to was one of the great draw-backs in England. Engineers and others specified absolutely absurd standards, the reason being they did not know sufficiently of the subject. He thought few people absolutely knew the effect of arsenic, or bismuth, or lead, or antimony, or phosphorus on copper, because nobody attempted to make a complete investigation with the pure metal. It could never be known what effect an element had upon another element until that element was used in its pure state, and pure samples of the other substance introduced. One man would say, for instance, what enormous influence antimony had on copper, and we be alarmed by the fact that there should be added, 0·2 per cent. of antimony. If 0·2 per cent. of antimony were present in pure copper, then another 0·2 per cent arsenic added to it, it would actually improve the copper instead of diminishing its malleability. Points like th required publishing, as to the effects of the differ impurities on copper; then all these absurd specificati would not be put forward by engineers.

Mr. Alex. E. Tucker asked if the author ever ca across what was practically a Wellman-Siever furna i.e., a tipping furnace for copper. He very cordi supported his views as to the necessity among engine in this country of standardisation of their specificatic He had had occasion to deal with the matter persona and, as Mr. Hiorns had said, the amount of ignora shown by the people in authority on these matters often lamentable, having regard to the very heavy su at stake. This applied not only to copper for fire-boxes, b but, practically speaking, to a great deal of gene metallurgical work. It was noticeable in the case of si Virgin spelter was contracted for; what virgin spel really was was still a disputable point. He supposed originally meant spelter which was made directly fr the ore, but at the present time there was plenty spelter made from by-products, and which could produced as pure as, and often very much purer th spelter made directly from the ore. This and simi want of uniformity in respect of trade terms and th corresponding chemical purity was a matter which mi properly be dealt with by such a society as ours. If, say, Birmingham Section, as being immediately connected w metallurgy, would deal with the subject, he should exp the London Section would co-operate and bring it bef the George Street engineers and others concerned. was certainly a matter of high importance, not o intrinsically, but also in reference to the Continen and American practices, and he would suggest th something of the sort be taken in hand with a view putting it on a proper working basis.

Mr. W. Rosenhain asked why English copper refin could not use the pure electrolytic copper that was used America. Without having any special knowledge of t copper industry, it appeared to him that if so much ti was occupied by the elimination of sulphur, and t capacity of the plant so greatly diminished thereby, t removal of the sulphur by electrolytic means might preferable.

Mr. Platten, in reply, said he regretted that the pa had been of a rather general nature. He should ha been very glad to have given greater detail in regard the points he had touched upon had it been possit He agreed with Prof. Frankland that the grea abundance of copper in the States would be less lik to lead to improvements in the refining of copper th in this country, where the metal was scarcer. He w referring chiefly to the low labour costs which obtain in the States; they were able to deal with the metal much larger masses in their huge furnaces, at a figu which could not be approached in this country, with t small furnaces. The 75-ton furnaces were reverberato furnaces of the same type as those in use in this countr They differed very slightly from those seen in all Engli works, except that the dimensions were greater in eve particular. The depth of the metal-bath was almo double what was customary in this country, but fro inspection of a great number of furnaces in the Stat he could say that practically their design was the sam As to removing the impurities by means of solid flux such fluxes were certainly used; nitrate of soda wa the most common, but its use was confined to the elim nation of arsenic and antimony. The last traces sulphur must be removed by the process he had me tioned; it was of the utmost importance that that shou be done, otherwise the metal, on being cast, expelled t sulphur in the form of gas, at the moment of solidificatio causing porosity on the surface of the ingot. He could n agree with the strictures which Mr. Hiorns passed upon t

English locomotive engineers in general. The experience of nearly all these engineers was different, because the quality of the water and fuel varied in different parts of the country, and he believed many of the specifications presented to manufacturers were drawn up actually on the working results on the respective railways. Mr. Hiorns suspected that the secrecy on the part of the English refiners was owing to their plant being so very primitive. He could only adhere to what he had said in the paper—it was impossible to enlarge the furnaces to any considerable extent, and thus bring into play the latest mechanical casting appliances, for the reasons he had stated. To elucidate that point, imagine an English manufacturer getting an order for, say, 20 tons of locomotive plates, to a certain specification, with the arsenic or some other element limited to a narrow margin. If he were using a 75-ton furnace, it would be necessary for him to make 75 tons of copper of that particular composition; that might leave him with 55 tons of copper on his hands, and, at the present price of the metal, that would be a serious matter. He was interested in what Mr. Hiorns said with regard to impurities in copper, especially as to the injurious effect of antimony being mitigated by the presence of arsenic, and agreed with him that a study of the impurities in combination was of great importance. A great deal of work had been done on this subject by the late Sir W. Roberts-Austen, and one of the most valuable results published showed that the presence of arsenic in copper could mask the effect of bismuth, which was one of the most difficult impurities with which the copper metallurgist had to deal. He did not think tilting furnaces had been used in the States for copper, but he had for some time thought that with our small furnaces, where the mass of metal was so light that it was impossible to tap, as was done in the States, it was highly likely that experiments made on the lines of the tilting furnace might meet with very great success. Electro-copper was not available for the English furnaces because it commanded a considerable premium over bar copper in England, and the question of its use in refining furnaces was entirely one of prices.

Manchester Section.

Meeting held at Manchester on Friday, April 6th, 1906.

DR. G. H. BAILEY IN THE CHAIR.

THE MECHANICS OF WATER SOFTENING.

BY JOHN J. ROYLE.

The subject of water softening is receiving increased attention in this country amongst industrial concerns. Very rarely does water exist in a sufficiently pure state for manufacturing purposes, and the increasing competition, particularly in the textile trades, is forcing attention to this subject of the purification of natural waters.

The subject of water softening is, first of all, a problem for the chemist, and, secondly, for the engineer who has to provide such mechanical means as will enable the chemist to accomplish what he knows to be necessary to bring about the desired result. It is essentially a case where the two departments of knowledge should come together if the best result is to be accomplished. It may also be laid down as axiomatic that the engineer who can effect what the chemist wants with the simplest, cheapest, and least liable to be deranged, yet efficient apparatus is most likely to succeed commercially.

I propose in this paper to deal with the subject of water softening from the standpoint of the mechanician endeavouring to carry out what is settled as the chemistry of the subject, and after briefly passing in review the more general and well-known devices, with comments on their advantages and disadvantages, pass on to notice some recent improvements which, I think, will be found to carry the subject a step further towards perfection.

I omit all reference in this paper to the use of heat—generally steam—to remove temporary hardness. Not only does it leave the problem unsolved at the most difficult point, *viz.*, the permanent hardness, but it only partially removes the temporary hardness. Nothing short of vigorous boiling by live steam, thus driving off the carbonic acid gas thoroughly, will effect the object desired, and boiling by live steam is far too costly. Exhaust steam is usually employed, and not only is this only partially efficient, but the grease from the steam adds to the subsequent difficulty of treatment.

Confining my attention, therefore, to the lime and soda treatment as the now generally recognised best method of softening, I observe that the problem of constructing a softener divides itself broadly into three stages: (1) a method of introducing the reagents (lime and soda) in proper quantity, and with regularity and certainty; (2) a reaction chamber in which the chemical reactions may take place; and (3) some efficient method of clarifying the treated water.

(1) *The supply of reagents.*—Obviously a safe and sure method is to introduce the chemicals in bulk into a measured quantity of the water to be treated, and mix the whole up by some means. This was the method adopted by the late Dr. Clark in his early investigations into this subject, and for which he took out a patent in 1841, and which has come to be universally known as the Porter-Clark process. This is also the method adopted in the "Archbutt-Deeley" process and is thoroughly effective so far as it goes, but the size of the tanks and space required to do this properly and without requiring the process to be repeated too frequently is a serious drawback, hence the resort to mechanical means for introducing the chemicals continuously into a regulated flow of the water to be softened, thus making the apparatus continuous instead of intermittent. A considerable saving of space is to be effected by a reliable device of this kind, as also in the first cost, and the cost for attention. Indeed, this matter of first cost so persistently confronts the engineer that recourse is had by some makers to what are, undoubtedly, only partially effective methods of treatment. Prominent amongst these must be mentioned the use of milk of lime instead of lime water. Not only is there a difficulty in mixing and keeping mixed the lime and the water to ensure a uniform mixture being passed over, but there is always a quantity of earthy matter with the lime which is constantly altering the mixture, and makes it impossible to be sure of its strength. Still, as before mentioned, this is a method in favour with some engineers because it keeps the apparatus compact and low in first cost, but it certainly is not reliable, nor should I think, from the standpoint of the chemist, can it for a moment compare with the method of using a saturated solution of lime water. It is also interesting to note here that the idea of using saturated lime water—not milk of lime—originated with Dr. Clark; at least it is mentioned in the patent before referred to. The well-known property of water to dissolve and hold in solution lime to a fixed amount, is a most valuable one when dealing with this problem. It is only necessary to ensure a steady flow of water through a mass of lime thoroughly stirred up and to dissolve out the maximum amount of lime with certainty, when, after allowing the water time to settle out any particles of lime in mechanical suspension, the object is accomplished.

The Reisert patent lime saturator consists of a conical vessel standing with the point downwards (see Fig. 1). Slaked lime is introduced into the bottom or pointed end of the cone through the pipe, A, and a regulated stream of the water to be softened is caused to flow through the mass by carrying a pipe, B, to the bottom of the cone. The flowing water will effectually stir up the lime, dissolving as it goes, and rising through the cone with continually reducing velocity, finally flowing over through pipe, C, as a clear stream of saturated lime water. The bottom or

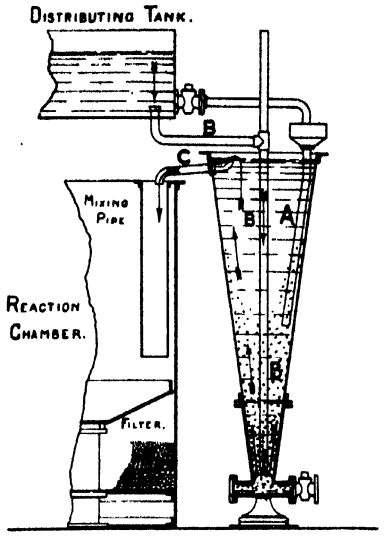


Fig. 1.

pointed end of the cone acts as a perfect mixer, whilst the ever widening upper parts acts as an efficient decanter.

With regard to the soda, the required quantity is dissolved in water and introduced by some mechanical device, such as tipping buckets of various kinds, syphons, water wheels, driven by the incoming water operating scoops or buckets, or in some cases by compound pumps with rams of different sizes which deliver the exact proportional quantities of both lime and soda. Ingenious as some of these devices are, they are liable to derangement and require constant attention to secure their good working, with the result of frequent failure, or only qualified success.

In the Reisert Softener—presently to be more particularly described—the supply of the soda solution is effected

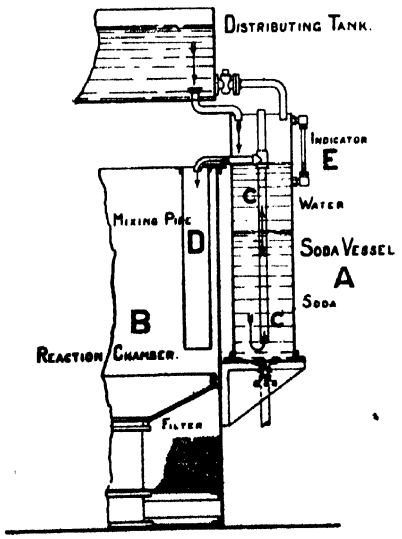


Fig. 2.

in a most simple manner without any moving mechanism at all, by taking advantage of the difference in specific gravity between a solution of soda and water. The soda solution is run into a cylindrical vessel, A (see Fig. 2), standing alongside the reaction chamber, B, and from the bottom of the vessel a pipe, C, rises to within, say, a few inches of the top, where it turns through the side of the vessel and discharges into the mixing pipe, D. It is found, that if a stream of water is allowed to flow gently on to the top of the soda solution, it will, without mixing with it, displace the soda solution—piston fashion—through the pipe, C, before mentioned, until the last drop is passed over. In so doing, the "head" of water above the pipe will be a constantly increasing one, rising more and more as the solution goes over, and by putting a gauge glass, E, or float to the upper part, one can see at once when all the solution has gone over by the water line suddenly falling. Advantage is taken of this property as a means of indicating to the attendant when the apparatus requires recharging.

Having thus briefly touched upon the mechanical supply of the chemicals, I now pass on to notice—

(2) *The reaction chamber* where the chemical reactions take place due to the mixing of the lime and soda, and the chief thing to be said about this, is that it should be of such ample dimensions as to allow the chemicals time to perform their functions. A rough but safe rule is to make it equal to the hourly duty of the plant; it cannot with safety be made less, and in some cases I have known it might, with advantage, be made much larger. Another reason for this, is that the reaction chamber is also a precipitating vessel for the carbonate of lime thrown down, a starchy looking liquid which is slow in settling, but which must be separated by some means from the water before it can be used and which brings me to stage 3, *viz.*:—

(3) *Efficient means of clarifying the treated water.*—It is found in practice, that there is a great variation in the velocity with which these precipitates fall. They are all slow and greatly hamper the engineer at this stage. In the Archbutt-Deeley process first mentioned, in which the reaction takes place in large tanks, recourse is had to mixing the newly treated water with the mud of the previous charge, and it is found that the resettling of the mud helps to carry down the finer particles from the new reaction, and so hastens the settlement of the treated water. In other cases, shelves or partitions are arranged upon which the precipitates can rest as in the Dosrumaux apparatus, so shortening the time as much as possible, but whatever device may be adopted to settle the precipitate, it is found that there is still a need for further treatment before the water can be said to be in a condition fit to use, and it is safe to say that no water softener is complete without some kind of filter. A common method is a filter of wood wool, acting upwards. This speedily gets foul, and as there is no way of cleaning it, short of taking it to pieces and washing it, it is a device peculiarly adapted to bring a softener into disfavour with the attendants. Gravel and sand filters with some device for cleansing them are the only kind that have given good results, and it is here that the excellence of the Reisert Automatic Filter appears, as it possesses the property of attending automatically to its own cleansing, and entirely removes all care and anxiety from the attendants on that score—no small relief, as those who have had practical acquaintance with water softeners can testify.

Having thus reviewed the three essential stages of water softening, I will now describe the Reisert Softener, in which these essentials are carried out in a more perfect manner than heretofore, some of the points of which have been already touched upon.

The annexed illustration, Fig. 3, is a diagramatic view, all details of staging, &c., being omitted for purposes of clearness.

It consists of a crude water distributing tank, C, E, A; a lime saturator and decanter, B; a soda vessel, D; a reaction chamber, F; and an automatic self-cleansing filter, K.

The distributing tank, C, E, A, is divided into three compartments. A is a lime slaking compartment in which the lime is slaked and run in proper quantity to

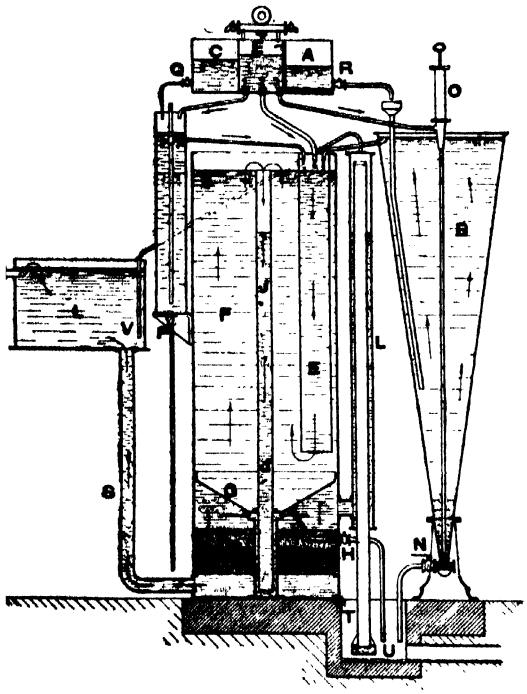


FIG. 3.

the bottom of the conical vessel, B, through the cock, R, and down pipe with funnel. C is a soda dissolving chamber in which the required quantity of soda is dissolved and run into the soda vessel, D, through cock, Q. The centre chamber, E, receives the crude water at a rate corresponding to the hourly capacity of the plant. At the bottom of this chamber are three gauged openings, 1, 2, 3, of which the centre one (2), is by far the largest, and discharges a regular quantity of crude water into the mixing pipe, E. The next in size, (3), discharges a lesser quantity of water to the bottom of the conical vessel, B, through the pipe, O. This water, in flowing through the lime, keeps it continually stirred up, and rising through the cone at a decreasing velocity drops the particles of lime in mechanical suspension, and finally runs over from the top of the cone into the mixing pipe, E, as a stream of clear saturated lime water. The size of the gauged opening (No. 3) is regulated to pass such an amount of water as will dissolve the necessary quantity of lime and keep the solution up to saturation point for a run of 12 hours (the usual limit of time). The gauged opening, (1), the smallest of these, discharges such a quantity of water into the top part of the soda vessel, D, as would fill the vessel, D, in 12 hours, but as this vessel (we assume) is already filled with a solution of soda, of the proper strength, the crude water lies on the top of the heavier solution and displaces it over by the central pipe into the mixing pipe, E. Thus we have three streams entering, E—a crude water stream, a lime water stream, and a soda stream—the three combined representing a flow equal to the hourly duty of the plant. It will be admitted, I think, that nothing could be simpler or more certain of action than three streams derived from a common head of water, and which will vary, if they vary at all, in an equal ratio if the "head" varies, and stop altogether when the supply of water stops. The size of these gauged openings is settled by trial runs in erecting the plant, and once ascertained, no further attention is needed unless the character of the crude water changes.

Following the course of the arrows, the mixed water rises through the reaction chamber, F, when the chemical reactions are completed, the resulting precipitate falling on to the conical bottom, G, whence it is periodically flushed off through the cock, H. Although a considerable quantity of the precipitate is disposed of in this manner, the finer particles—varying with the nature of the water—refuse to settle, and flow over with the water into the pipe, J, and are separated by the sand and gravel filter, K.

The water descends through the filter and issues by pipe, S, through storage tank, L, by the pipe, M, ready for use. Attention is specially directed to the perfect action of this filter. It will be obvious that the head of water available for forcing the water through the filter will be the difference between the water level in the pipe, J, and the level in the tank, L, and that as the resistance of the filter increases, owing to the deposit of carbonate of lime upon it, the height of the water in J, will increase until finally, the pipe would become full, and the reaction chamber itself would overflow were it not that, during this time, a corresponding pipe, L, in communication with the space above the filter bed has been rising in sympathy with it. It will be seen that the pipe, L, contains an inner pipe, and with a water lute, T, forms a syphon, so that as soon as the filter bed becomes so choked as to require a head of water which will bring the water well above the top of J, the inner pipe in L, overflows, and acting as a powerful syphon, reverses the current through the filter bed, drawing back the filtered water stored in, L, and so thoroughly cleanses the filter. An air pipe, U, breaks the syphon at the proper time, and the filtering action re-commences. Exactly how often this cleansing takes place depends upon the water being treated. Obviously, in the case of a water in which the precipitate settles slowly, a larger quantity will come upon the filter and the re-flush will be more frequent, but whatever the period may be, it is important to note that it can only occur as often as necessary, and is entirely automatic in action—a great advantage and an indispensable one when plants work through the night, and when the attention given is of a very ordinary kind. The daily manipulation of the plant is quite simple. The proper quantity of lime (approximately settled from the analysis), and finally decided by test, is run into, B, every 12 hours, and the spent lime is flushed off at, N. Similarly, the proper quantity and strength of soda is run into, D, the displacing water having previously been run off by tap, P. This, and the occasional opening of the mud outlet, H, is all the attention requisite, and it is quite within the compass of an ordinary labourer. The time taken should not be more than one hour per day of 12 hours, so that the cost of attention is very low. The plant works well, and the water can be softened down to a determined point with regularity and certainty.

On the subject of the cost of softening by the system, the table on next page is compiled from the results of plants recently erected.

Water softening by lime and soda, whilst satisfactory for many dyeing and manufacturing purposes, brings with it certain disadvantages when the softened water is used for boiler feeding, *viz.*, the accumulation of sodium sulphate in the boiler, causing the latter to foam or "prime" badly, unless frequently blown off, and which also attacks the gunmetal fittings, eating away gauge cocks and valves in a serious manner. The first-named drawback is most seriously felt in boilers of the locomotive or tubular type, and many attempts have been made to use some other substance than soda in its various compounds, notably barium carbonate. It will be seen at once that if this substance could be used instead of soda, the result would be the formation of barium sulphate instead of sodium sulphate, which would be separated in the filtration, and thus an end would be made of the troubles of foaming, and the waste of the fittings. Such an apparatus has been successfully designed, of which the following is a description. The annexed illustration, Fig. 4, is a diagrammatic view designed rather to show the principle upon which Messrs. Reisert have proceeded than to burden this paper with unnecessary details.

Following the lines of their lime and soda plant, they use the same system of lime supply, but instead of soda they use a suitably prepared barium carbonate introduced in bulk into the reaction chamber, D, where it lies in the

Analysis of Reisert's Patent Water Softening Plants.

Plant where situated.	Hourly capacity of plant in gallons per hour.	Hardness of water degrees Clarke.			Chemicals per 1000 gallons per hour.		Total chemicals per day of 12 hours.		Cost of chemicals per 1000 gallons per hour.	Average degrees Clarke of softened water.
		Tempy.	Perm.	Total.	Lime.	Soda.	Lime.	Soda.		
	galls.				lbs.	lbs.	lbs.	lbs.	pence	
London	2000	23·8°	21·0°	44·8°	2·9	3·4	69·6	81·6	2·06	4°
Rugby	300	8·4°	9·8°	18·2°	1·2	1·6	4·5	5·7	0·95	4°
Leicester	3500	14·7°	11·2°	25·9°	1·8	1·9	60·0	80·0	1·17	4°
,, ...	6000	14·0°	19·6°	33·6°	2·4	3·2	173·0	230·0	1·9	4°
Bournemouth....	220	11·9°	6·3°	18·2°	1·4	1·0	3·7	2·7	0·67	4°
Brighton.....	1000	11·2°	2·1°	13·3°	1·3	0·4	15·5	5·0	0·36	4°
Woodburn Green .	1000	14·0°	4·2°	18·2°	1·6	0·75	19·2	9·0	0·57	4°
Sunderland	6000	18·2°	11·2	29·4	2·1	1·85	151·2	133·2	1·18	4°
Golborne	4400	17·5°	6·3°	23·8°	1·9	1·05	83·6	46·2	0·76	4°
London	2000	11·9°	4·9°	16·8°	1·4	0·8	28·0	16·0	0·57	4°
Manchester	4000	8·4°	6·1°	14·5°	1·3	1·0	62·4	48·0	0·66	4°

Note.—Average cost of attendance, reckoning a man at 25*s.* per week, engaged on a softener one hour per day = 6*d.* per hour, or 6*s.* per week

conical bottom, D′. The crude water is caused to stream through this powder by the pipe, C, so keeping it constantly stirred up, and floating about in the reaction chamber, D, the lime water meantime entering in a manner similar to the previously described plant. It is found that the barium carbonate effectually attacks the calcium and other sulphates, decomposing them and forming barium sulphate and calcium carbonate, and that it is more active when used along with the lime. The precipitate so formed settles down in the reaction chamber, D, and mixes with the barium carbonate, and goes on accumulating, the water finally passing off through a sand filter, H.

How long this accumulation of precipitate or mud will go on depends on the nature of the water being treated, but, obviously, the reaction chamber, D, would get full in time, and cocks are placed on the shell of the chamber, so that the attendant can ascertain occasionally how the accumulation is going on. The mixture of the mud with the barium carbonate is not found to interfere in any way with its action, and the quantity added is regulated by the time that the plant will run before the mud must be flushed off. This may be several days, or even weeks, but the essential point is to so gauge the quantity of barium carbonate introduced (in bulk) that it becomes spent about the time that the plant becomes "gorged," so to speak, with the mud, when the whole is flushed off, and the plant is re-charged. The barium carbonate being expensive, it is important that none of it be lost by flushing off too early or too frequently, and for a like reason the filter, H, is cleansed by allowing a quantity of impounded clear water to stream backwards through it into the reaction vessel, so that any barium carbonate which may have got lodged in the filter may find its way back into the reaction chamber. Using the barium carbonate carefully in this way, the process compares favourably with the lime and soda treatment in cost of running.

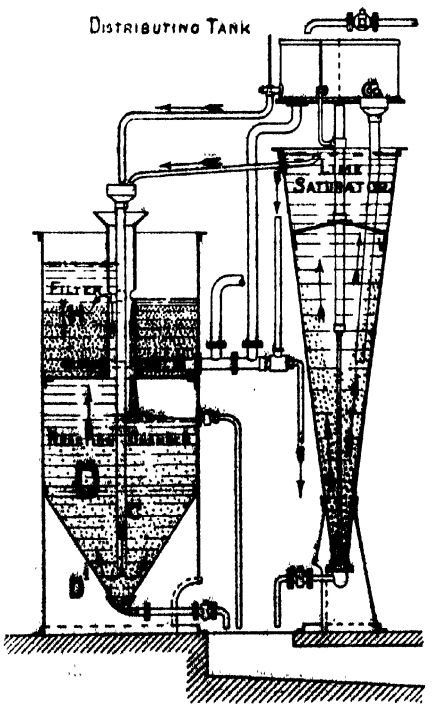


Fig. 4.

The first cost of the plant is about the same as for lime and soda, whilst the advantage of the absence of soda salts in the boilers renders the system incomparably superior for locomotives and boilers of a tubular type.

Discussion.

The Chairman said there was no doubt that in the subject of water softening we were very much behind. He was struck by the number of plants under the Reisert system said to be fixed abroad, and he doubted whether the whole number of plants of all types erected in England would equal that number. With regard to the barium carbonate system, he thought if it could be run as economically as the soda process, there would be the additional advantage that this re-agent is most efficient for removing iron from water. He understood Mr. Royle to say that the sulphate of soda in feed water was responsible for the destruction of gun metal fittings, whereas he (the Chairman) thought it was due to the alkalinity of the water itself. He thought, however, that the influence of even minute amounts of nitrogenous matters had been too much overlooked. He had experienced cases of rapid corrosion of gun-metal fittings traceable to slight sewage contamination of the water. Even with the minute amounts present in normal river waters, the ammonia carried over by the steam had a corrosive action, but where serious contamination of the water existed, the action was very pronounced. It was especially with alkaline water and during priming that the mischief was done.

Dr. W. R. Ormandy was somewhat astonished that the lecturer had dismissed with such scant attention the possibilities of the use of any chemicals, other than lime and

soda ash, for the purpose of water softening. Where the water was required for boiler feed purposes and where the bulk to be treated was not very great, there were very many arguments in favour of the use of a mixture of caustic soda and carbonate of soda in proportions suitable for the water under treatment, where the use of such a mixture was from the chemical nature of the water, possible. The great simplicity introduced by the use of a single solution was more than enough to counterbalance the slightly increased cost. Where the feed water could be warmed by means of exhaust steam, it frequently happened that the cost under these circumstances was actually not greater than where the lime-soda process was used. Although the apparatus described was very ingenious, it did not overcome many of the difficulties inherent in the use of lime-soda mixtures. The solubility of lime varied tremendously with the temperature, and it was not by any means easy to rely upon getting a saturated solution. It was stated that the presence of alkaline salts in the boiler had caused trouble with the gauge taps, gauge-glass fittings, and the blow-off cocks. This was certainly true where the process was not properly carried out, and where the amount of alkali used was excessive and allowed to accumulate and concentrate in the boiler. The use of iron fittings practically overcame this. Sand-filters were not an unmixed blessing. The fact that the majority of the makers of water-softening machines in the past had worked on unscientific lines, had enabled the sand-filter makers to obtain a strong footing. The majority of the old type of water softening plants made use of an ascending current of water through which the sediment settled. This was obviously wrong in principle, and after a considerable amount of work, his firm had succeeded in making a separator in which the path of the liquid was practically horizontal, and which resulted in an efficiency far exceeding that of the vertical type. With reference to the case at Leicester, the speaker thought that it would be interesting to have complete analyses of the water; the case was so extraordinary that further details were required to substantiate it. There were, undoubtedly, many very interesting points in the apparatus brought before their notice that evening, and apart from the inherent defects to which the process and the methods were liable, it would probably give very fair results.

Mr. FRANK SCUDDER said that many of the filters in connection with these plants were a source of trouble. In the filter shown upon the screen, the filtering material was graded, and he should like to know whether, after the self-cleansing of the filter took place, the material became mixed or settled down in layers. Water alone was not sufficient to efficiently cleanse the filtering bed. Air was used to disturb the material and loose the deposit—the water then washing away the deposit. A good sand filter with such an arrangement used only about 7 per cent. of the water filtered for washing purposes, and he wished to know what quantity was required for the filter under discussion.

Mr. ROYLE, in reply, said that it was impossible, in the brief space of time allotted for a paper of this kind, to touch upon many points of great importance in connection with water softening, some of which had been opened up in the discussion. In reply to Dr. Bailey, as to the cause of the wastage of the boiler fittings, this was a matter for the chemist, and he was much interested in Dr. Bailey's suggestion as to the cause of this waste. Replying to Dr. Ormandy, he said it was undoubtedly economical to feed boilers with hot water, but the difficulty was to so arrange the demand of the boilers that it kept pace so to speak with the softener. Boilers were intermittent in their demand, whilst a softener is best when working at a uniform speed. Storage of the treated water was, in most cases, absolutely necessary, and this defeated the idea of economy, as if the water was stored it necessarily cooled down. He failed to see how iron cocks were going to be satisfactory on high-pressure boilers. He would also say that the amount of flush water used in the Reisert plant was about 25 per cent. of the hourly duty. How often the filter flushed, varied with the nature of the precipitant, but it was a bad case if the flush water reached 5 per cent. of the duty of the plant—more often it was nearer 2 per cent.

Meeting held at Manchester on Friday, May 4th, 1906.

DR. G. H. BAILEY IN THE CHAIR.

THE BORING CAPABILITIES OF A WOOD-INSECT, WITH PARTICULAR REFERENCE TO ITS PENETRATION OF SHEET LEAD.

BY WM. BEAMONT HART, F.I.C., F.C.S.

In the year 1895 I was engaged by the Ottoman Government in the erection of plant for smokeless-powder production, at Baruthane, nine miles from Constantinople, on the Sea of Marmora. Timber was required early in the building operations, and it was necessary to contract for it at once. The supply of timber, either native or imported from the adjacent countries, is fairly plentiful, the chief varieties being: *Fil-yi-ass*, or white deal; *Tchee-de-ne*, or red deal; *Num-se-cal-agatch*, or Austrian deal; *Tchamm*, or pine; *Mey-shey*, or oak; *Gul-gen*, or beech, &c. *Tchamm* and *Num-se-cal-agatch* were chosen, chiefly on account of their resinous nature and their greater length. At this time I had no knowledge of the boring power of insects, the timber being selected from considerations of strength, dimension and quality only.

When the plumbers arrived from England, and the lead work was in fair progress, one of these men, who had been out in South Africa on similar work, mentioned the trouble they had experienced there by leakage due to holes in the lead, caused by the insect usually termed the wood-worm, though they had never been able to obtain a specimen.

About a week after this conversation, one Monday morning about 11 a.m., my attention was called to the wooden floor of one of the sulphuric acid chambers, where the sheet-lead had been laid down temporarily for strap-cutting. I saw a small hole in the upper surface of the lead, and, by the aid of a pocket glass, noticed a distinct boring movement in and below the hole. On lifting up the lead I found an insect in the timber with its head just above the wood-flooring, its augers still moving and some slight quantity of fine dust on the floor. With a piece of wire I dislodged and secured the insect, and found the hole in the wood to be about 2½ ins. deep, passing, somewhat obliquely, through the flooring board into one of the joists below—from which some wood borings were obtained—and there it ended. No trace of any other outlet could be seen, so that it seemed reasonable to conclude that the insect, as found, could not have entered into the wood from outside while the joist was in position, but had either been deposited as an egg in, or entered, in the larval stage, into the wood, and, after reaching maturity as a full-grown fly, had attempted to gain its freedom by boring through the timber and started operations on the lead.



FIG. 1.

The lead sheet was one-eighth of an inch in thickness, and the hole, as can be seen, in Fig. 1, is countersunk, the lower opening being 6·4 mm. diameter at its widest part and 5·2 mm. diameter at its narrowest part, whilst the upper opening is about 3·2 mm. diameter all round, though the openings are not concentric. The sides of the hole are scored more or less deeply by indentations, in such a manner that the action and direction of the boring organ can easily be traced, being generally in the opposite direction to that of the hands of a watch as the insect worked from the lower to the upper surface of the lead—though some boring marks are in the contrary direction—and are for the most part continuous; the whole result, when looked through from the lower to the upper surface, resembling the rifling of a gun-barrel.

From near the mouth of the insect a pair of mandibles extends, as shown in Fig. 2, each consisting of three cutters

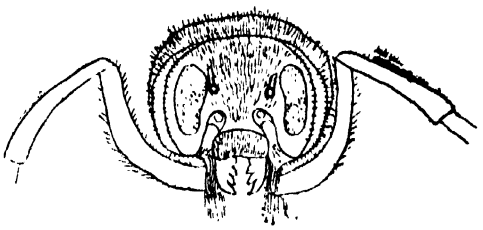


FIG. 2.
Front view of head showing mandibles.

of varying size, increasing in length but decreasing in width from the mouth outwards, each complete mandible being about 0·7 mm. in length, 0·55 mm. diameter at its widest part nearest to the head and ending in the first or largest cutter. From this examination of the mandibles, the countersunk shape of the hole in the lead can readily be understood, the attack being made initially at a point, and as the width of each mandible increases from its largest cutter, furthest from the head to the smallest cutter nearest to the head, so the diameter of the hole increased as the boring operation proceeded from the lower to the upper surface of the lead sheet. It will also be comprehended that had the insect completed its work of escape unobserved, the hole would have been cylindrical instead of countersunk.

The length of time the insect had been actually occupied in boring the hole through the lead is not known, but the maximum time can be definitely stated. The lead sheet had been laid down on the previous Saturday, so that 48 hours was the outside limit, and, judging from the hole formed, probably in a further 12 or 16 hours' time, the prisoner would have escaped.

On investigating the entomology of the subject, as regards the penetration and boring of timber by injurious insects, I find the following have the power and habit of damaging pine and fir:—

Sirex gigas, or Giant Wood-wasp—the timber wasp of Germany; *Sirex juvencus*, or Steel-blue Wasp; *Lophyrus pini*, or Pine Sawfly; *Hylobus abietis*, or Pine Weevil; *Hylurgus pineperda*, or Pine Beetle; *Tomicus typographus*, or Bark-beetle of Germany; *Pissodus notatus*.

The last mentioned has been found ravaging the Austrian pine, but, as far as I am aware, has not been seen in the British Isles. *Tomicus typographus* has repeatedly attacked the German pine forests, its ravages occurring to such an extent that its old popular name of "the Turk" was revived, a name referred to in old German liturgies. The bark-beetle calamity of Bohemia lasted from 1871 to 1875. All the others have been found in our islands infesting pine and fir trees, to a greater or less degree, according to seasons.

The insect found is undoubtedly the male *Sirex gigas* fly of the sub-group of *Sessiliventri* of the *Hymenoptera* or membranous-winged family of Mandibulata. The female bores, by its ovipositor, into the bark of the healthy tree after felling, or of the fallen tree lying in the wood—but not generally that of the growing timber, and here deposits its eggs, the larvæ from which then burrow into and feed on the solid trunk. Normally in about seven weeks, these then merge into the chrysalid stage, and finally, in about another month, transform into the complete fly. If the larva has not changed into the chrysalid before the autumn, the fly will not appear before the following summer or even until a much later period. They usually exhibit themselves singly or a few at a time, and sometimes over a period of several years from one trunk.

One curative device proposed was to strip off the outer bark, and so cause a vigorous flow of sap, which kills the larvæ. Theobald, in his "Reports on Economic Zoology to the Natural History Section of the British Museum (1903—4)," points out the fact that many larvæ of the *Sirex gigas* and *Sirex juvencus* hatch out even after the wood has been well creosoted, and states that there are no remedies against the *Sirex* flies.

With regard to the perforation of lead by insects, Hartmann, in the "Gesundsheit-Ingenieur," for 1891 (this J., 1891, 683), drew attention to the damage done to leadwork, caused by the larvæ of the wood-worm. Examining the leaks from a lead pipe, he traced the cause to a live wood-worm which was found with its head protruding through the wall of the pipe; the outer opening of the hole was 7 mm. by 4 mm., the surface of which was scratched with fine indentures.

In Kerl and Stohman's "Handbook of Technical Chemistry" mention is made of the fact that certain wood-worms (*Sirex gigas*) perforate sheet lead, the holes made showing rough surfaces with fine indentures. At the Muldener Hütte, holes up to 6·5 mm. diameter were found in sheet lead which was fastened to wood-work. In this particular case, the insect is stated to belong to the *Coleoptera* family.

Scheurer-Kestner (Comptes rend., 58, page 518) mentions a case where cylindrical holes were found in the lead lining of a beam of a new sulphuric acid chamber, and this in a few days after covering. In one hole the semi-developed body of an insect was found, partly in the lead and head first, the diameter of the hole corresponding exactly to that of the body of the insect, so that the latter could not turn round in order to escape.

From my observation, it is quite evident that the penetration of the lead was effected by the fully-developed fly and not, as stated by other observers, by the insect in its earlier or worm stage. Though the worm can penetrate into and through the wood, the capability of boring through lead is probably, therefore, only within the power of its final stage

The insect in its last stage works its way from the sap of the timber towards the bark, and it has been suggested, in order to avoid such results above related, to place the bark side of the timber furthest away from the lead. This might be done when the presence of the insect is suspected, and may be effectual, but I am afraid it would entail too much supervision and never be carried out systematically. Since the cause of the perforation was only observed and captured after the timber-work had been erected, and before any published information on the subject had been seen, this was entirely out of the question.

The main consideration, from an engineering point of view, now was, how to prevent damage to the lead plant, for it was very improbable that the insect found would be the only one present. Taking it for granted at the time that the insect worked from inside outwards in order to effect its escape, and not from outside inwards, the usual tar-coating generally adopted for the preservation of the timber would be no protection to the lead against the insect already in the timber. The lead floors and upstands of the chambers and also the lead cisterns were the chief anxiety. Practically in all other parts of the chambers the lead is never in direct contact with the timber, except at the straps, so that the insect could fairly easily escape, and even if perforation did happen, it would only be in the gaseous part of the chambers where repairs would be comparatively simple. I suggested the coating of the timber, wherever it would be covered by the lead—and before laying down the lead—with a thick

mixture of gas-tar and creosote oil, so as to form a thick viscid layer—a "tangle foot fly-paper" on a large scale—between the timber and the lead, which, being out of contact with the outer air, would remain elastic or only harden slowly. When the insect had bored through the wood, and before it could attack the lead, its mandibles would be so entangled, tired and eventually rendered so useless by this composition, that, in my opinion, perforation would be prevented.

Others suggested that a sheet of zinc might be placed between the wood and the lead, but anything thinner, though harder than lead, I deemed untrustworthy for two reasons, *viz.*:—(1) If such an insect could perforate sheet lead of one-eighth of an inch (3·2 mm.) in thickness, it might also pierce zinc, and (2) injury might be done to the lead itself, when laying it down, by the sharp corners and edges of the zinc; this was a far more practical objection.

An insect, known as *Zopherus melicanus*, has recently been found that is stated to be able to cut sheet zinc with its mandibles. A pair of these remarkable little creatures actually succeeded in biting their way out through the zinc cover of a glass jar in less than 48 hours.

My proposal of a tar layer between the wood and the lead was negatived, and reliance was placed solely on the usual tar-coating on the outside of the timber, an untrustworthy procedure as later events proved, though every care was taken by repeated coating, thinner at first so as to soak well into the wood, and ending with thicker finishing coats, crude creosote oil and gas-tar from the gas works being used for the purpose.

When the plant was completed, the chamber floors and the cisterns were flooded with water and some perforation was discovered in the first chamber floor, the same floor where the insect had first been found, and though these later holes were near one end of the chamber, they were not restricted to the region of any particular joist. After running off the water, the positions of the holes were found, repairs effected, and the chambers sealed up, except, of course, for the entrance from the burners.

Some interval of time elapsed between the completion of the plant and the commencement of work with it, but when the chamber process had been in operation for some time, further slight leakage was observed, and, as even by the most careless working of chambers—and normal working of chambers is difficult to obtain by native workmen—the lead floor is the last to be affected, it seemed that insect life was not yet exhausted in the timber of this same chamber. No other chamber was so affected, but, as far as I remember, one lead cistern had one leakage. The chamber was emptied, cleaned, examined, the perforations marked out, soldered up, and work again commenced. However, after some time, no further leakage was observed and the trouble ceased.

In all probability the insect life was confined to a few of the logs, though all the timber was examined for soundness before arrival on the works, and the repeated trouble experienced confirms the entomological statements of their irregular habits of exhibition.

My conclusions are (1) that the insect works its way from the inside of the timber outwards, and not, at least in its final stage of life, from outside inwards, though this may happen in earlier stages or later generations; (2), that though outside tarring may prevent the deposition of the egg in or the entrance of the larva into the wood, it is of no value in preventing the exit of the full-grown boring fly from the wood, and possible damage to the lead by perforation, wherever the exit hole in the timber is covered by lead; and (3), that even a thinner yet harder metal, such as sheet zinc, may be unreliable as a preventive against penetration.

Mr. J. R. Hardy, of the Manchester Museum, has been kind enough to give me some information as to the injury done to many varieties of timber by insect life in general, both in England and abroad; and in his opinion resinous woods are preferred, though harder woods such as hickory and mahogany are also affected. The thin sheet lead of tea boxes has repeatedly been found to be perforated, but the fact that sheet lead of one-eighth of an inch in thickness can be pierced through was unknown to him.

Considering the general use of timber, of all classes and from various countries, in conjunction with lead for chemical and other works purposes, it seems remarkable that such perforation as I have described has rarely been observed at home. In "Ormerod's Annual Entomological Reports" there is but one record of the perforation of lead pipe in this country, and that by the *Sirex juvencus*. This was noted in 1889 at the Manor House, Newbury, Berkshire, the lead pipe being attached to wood-framing. Perhaps our cold climate has much to do with it, but in view of the enormous amount of timber imported into this country, the possibility of damage from insect life should be realised and precautions taken by a strict examination of all timber used, in important work at least

It may be added that the *Sirex gigas* has an attacking parasite, the *Thallasa lunator*, of the Ichneumon class, not a rare insect in Norway.

Scottish Section.

Meeting held at Glasgow on Tuesday, March 27th, 1906.

MR. DAVID PERRY IN THE CHAIR.

THE DETECTION OF BEEF FAT IN LARD.

BY H. DUNLOP.

The detection of beef fat in lard has been held to be an easy matter by some analysts, whereas recent investigators have clearly shown that it is really a matter of considerable difficulty, and have thus been unable to confirm the statements made by older authorities as to the distinctive forms of crystals yielded by pure and adulterated lards respectively. The more one examines this question practically, the more one is convinced of the uncertainty of the ordinary methods of determining whether a sample of lard is genuine or not, and it is, therefore, of importance that an analyst should have substantial grounds on which to base the conclusions he has come to. With this object in view, I have carried out an investigation on pure and genuine fats rendered by myself, the observations including the determination of the constants employed generally in their analysis, as well as an examination of the structure of the crystals obtained from solutions of the fats; and in the present paper I propose to give a description of the results obtained.

The various fats were cut from the specified parts of the animal, and rendered at 90° C., the residual tissue being in all cases well pressed, in order to remove any of the harder portion of the fat which it might retain.

The results of the examination of these lards, as well as beef, mutton and cotton-seed "stearines," including the iodine value, ether washed deposit (Keating Stock's method), &c., are given in Tables A to E.

The solidifying points were determined by first liquefying the fats at about 50° C. before pouring them into the tube in which the determination was made. The melting points were in all cases determined by capillary-tube method, the tubes being allowed to stand for 24 hours after filling. The Zeiss butyro-refractometer reading was taken at 40° C. for lard, and at 45° C. in the case of beef and mutton fats.

On comparing the iodine values and refractive powers given in Tables A and B, it will be observed that the latter rises and falls with the iodine value; in fact, it would seem possible to tell within a few units what the iodine value of a sample of lard would be, from the determination of its refractive power. This relationship is also shown in the case of beef and mutton fats.

Although, generally speaking, the amount of ether washed deposit increases with the melting point, as shown by Keating Stock (Analyst, 19, 2), this is not always

TABLE A.

Lard, Beef and Mutton Fats rendered in the Laboratory.

Part of animal.	Iodine value (Wijs).	Zeiss butyro-refractometer at 40° C.	Ether washed deposit.	Solidifying point.	Melting point.	No. of sample.
			Mgrms.	°C.	°C.	
Back	67·9	50·7	5	25·8	36	1
Leg	65·4	50·0	21	27·6—27·9	—	2
Back	64·2	49·7	9	26·7—26·8	38	3
Leg	64·1	50·0	7	24·3—25·5	37	4
Head (cheek)	62·0	49·4	13	26·0—26·7	—	5
Back	58·4	49·0	40	28·0—28·3	—	6
Kidney bed	58·1	49·2	49	27·0—27·8	43	7
Leg	57·5	48·6	26	29·0—30·0	—	8
Leaf	55·9	48·4	148	30·5—32·7	—	9
Kidney bed	55·3	48·3	122	33·3—33·7	—	10
Kidney bed	53·4	48·2	190	33·7—35·0	50	11
Leaf	53·0	48·1	115	30·5—31·5	47	12
		at 45° C.				
Beef fat (from kidney suet)	45·2	44·5	—	33·3—36·0	47	13
Beef fat (from kidney suet)	42·5	44·0	—	33·8—36·5	48	14
Mutton fat (from kidney suet)	37·8	43·5	—	40·0—42·5	51	15
Beef fat (from kidney suet)	35·9	42·3	—	35·2—39·0	48	16

the case, as an examination of the figures in Table A. will show. Taking the solidifying points in preference to the melting points (the determination of which, especially in the case of soft lard, leaves much to be desired) and comparing these with the amounts of ether washed deposit, it will be observed that the latter does not always vary proportionately to the former. It is hardly necessary to point out that this fact, as also the great variation in the amount of ether washed deposit, has an important bearing on Keating Stock's method of estimating beef fat in lard.

When dealing with commercial lards, as shown by various observers, the iodine value alone generally fails to give any indication of the presence of beef fat, as vegetable oils, such as cotton-seed, are added in sufficient quantity to give a normal iodine value. Unfortunately, the detection of cotton-seed oil in lard by means of colour tests, is rendered uncertain by the well-known fact that lard from hogs fed on cotton cake gives the characteristic reaction with Halphen's test. While several writers on the subject have pointed out the danger of basing conclusions on a positive Halphen test, until quite recently no figures had been published, showing whether the iodine value of such lard is in any way abnormal. I have recently had the opportunity of testing this for Messrs. Tatlock and Thomson, who, in a recent paper read before this Society, showed the effect of cotton cake feeding on the milk of a cow.

The pig selected for experiment received daily, for six weeks previous to killing, from 1 to 1½ lb. decorticated cotton-seed meal with its other food. Portions of the fat were taken from the indicated parts of the animal, and, after rendering, the iodine value and refractive power were determined and the Halphen test applied. The results are given in Table B:—

It is somewhat interesting to note that the fat taken from the external parts gave a stronger colour than that from the internal parts. The iodine values and refractive powers are, however, quite normal, and give no indication of cotton-seed oil as such having passed into the fat.

Of the many modifications of Relfield's test, that due to Keating Stock is, perhaps, the best known, as by this method, it is claimed that a quantitative determination of beef fat in lard can be made, and also that smaller quantities of the former can be detected than by other methods. In the above method the standard mixtures of lard and beef fat employed should, according to Keating Stock, give a series of ether washed deposits, the amount increasing with the percentage of beef fat. While this is certainly the case with standards containing from 15 per cent. and upwards of beef fat, I have found that, in some cases, the addition of smaller quantities of beef fat fails to influence the amount of ether washed deposit, as the following example will show: Lard No. 4, Table A, of solidifying point 24·3°, was chosen as representing a soft lard, and mutton fat No. 15, of solidifying point 40° C. added in quantities of 10 and 20 per cent. The solidifying points and other washed deposits were then determined in the mixtures thus prepared, with the following results as shown in Table C:—

TABLE C.

	Ether washed deposit.	Solidifying point.
		°C.
Pure lard No. 4	7	24·3—25·5
With 10 per cent. of No. 15	6	25·0—26·5
With 20 per cent. of No. 15	20	26·3—no rise.

TABLE B.

Lard from Pig fed on Cotton-seed Meal.

Part of animal.	Iodine value (Wijs).	Zeiss butyro-refractometer at 40° C.	Cotton-seed oil, per cent. by Halphen's colour test.
Shoulder	67·8	50·7	10
Leg	65·1	50·3	8
Back	64·8	50·0	10
Leaf	58·3	49·0	2
Kidney bed	58·3	49·0	6

The result of the Halphen test is expressed in percentage of cotton-seed oil, an edible oil being selected as a standard. It will be, of course, understood that these figures only give an indication of the relative intensity of the colours, which, with one exception, were very distinct.

These results, as also many attempts to obtain beef crystals from mixtures containing smaller quantities of beef fat, suggested an examination of the "stearine" obtained from lard and beef fat respectively, and especially that from hard lard. Quantities of "stearine" from

fats (12, 13 and 15, Table A.) were, therefore, prepared in the following manner:—

An ethereal solution of the fat was allowed to crystallise, and after decanting off the mother liquor, the crystalline deposit was thoroughly washed by repeated agitation with ether, and collected on a filter, where it received a final washing with ether. After drying at 40° C. the iodine value and melting point of the superfused crystals was determined. To find the relative solubility in ether, the following tests were made:—

0·5 grm. of each of the "stearines" was treated in small stoppered bottles with 50 c.c. of ether of 0·7175 sp. gr., previously cooled to 12° C., and after agitating the mixtures, the bottles, contained in an insulated box, were kept for three hours at a temperature of from 12°—13° C. The amount of dissolved "stearine" was then determined by evaporation of the filtered liquid. Repeated crystallisation from ether proved that the solubilities obtained by this method were relatively correct.

A further test was also made, using petroleum ether, sp. gr. 0·648. The results are stated in Table D, which also includes cotton-seed "stearine" prepared from the commercial article and recrystallised several times from ether.

As previously stated, the melting points in above Table refer to the crystals in the superfused state, the so-called double melting point being observed in several cases and more especially in the case of the superfused crystals from lard.

It will be observed that the melting point of the crystals obtained finally by this method of crystallisation, is several degrees below that of pure tristearin which is given by Lewkowitsch at 71·6° C., and slightly above that of pure tripalmitin.

The crystals obtained finally from lard in the fifth crystallisation were considered free from unsaturated glycerides, as shown by the iodine value. I do not attempt to draw any conclusions from the melting points of these substances, as further investigation would be required to enable one to say whether certain glycerides are common to the three fats.

Coming now to the microscopical examination of the "stearine," which is certainly the most important part in the testing of lard for genuineness, it will be observed in the first place that, although the form of the crystals from normal lard and beef fat respectively are quite distinct, the "stearine" from a mixture of these fats, in place of showing well-defined "beef forms" side by side with lard crystals, generally gives a form which is a modification of the lard form.

"Stearine" from such a mixture, when examined at a magnification of, say, 30 diameters, often shows a number of "plumose groups," which at this low power may be easily mistaken for typical beef crystals. If, however, a higher power be employed, say, 300 to 400 diameters, these groups are seen to be composed of narrow plates with oblique terminals, and quite distinct from the fine rods or needles given by a first crystallisation of beef fat. The subject is further complicated by the fact that some genuine lards give, on crystallisation, abnormal forms, which at a low magnification closely resemble the "plumose grouping" of beef "stearine."

The following tests were made in order to ascertain what effect recrystallisation had on the form of the crystals from lard, beef and mutton fats. The method of recrystallisation adopted was as follows:—

From 0·1 to 0·15 grm. of the "stearines" A, B and C, Table D, was dissolved in 15 c.c. of ether 0·7175 sp. gr., and the solutions contained in stoppered tubes or "test-mixers" allowed to cool down very slowly to 13° C., the deposited crystals being examined after standing for 24 hours at this temperature, after which the deposits were redissolved in 15 c.c. of ether and treated as before. In

TABLE D.

Lard, Beef, Mutton and Cotton-seed Oil "Stearines" crystallised from Ether Solution.

"Stearine."		Iodine value.	Melting point.	Solubility test (at 12°—13° C.).	
				Petroleum ether (sp. gr. 0·648).	Methylated ether (sp. gr. 0·7175).
				per cent.	per cent.
Lard stearine	A	9·70	64·0	15·60	18·80
Beef stearine (recrystallised)	B	8·20	60·0	—	33·60
Mutton stearine	C	10·10	59·5	20·00	44·20
Beef stearine	D	10·60	58·0	22·40	45·80
Cotton-seed stearine recrystallised several times	E	6·9	59·0	—	—

That the beef "stearine" is more soluble in ether than lard "stearine" is clearly shown by these tests; even after recrystallisation, as in "stearine" B, the solubility was more than twice that of lard "stearine." With petroleum ether, however, the differene in solubility was not so marked. The high iodine values of these "stearines" is remarkable and shows the difficulty of removing the last traces of the unsaturated glycerides: in fact, many crystallisations were required in order to obtain crystals of fixed melting point. An example of this may be of some interest:—

Lard No. 11, Table A (the mixed fatty acids of which contained 19·20 per cent. of stearic acid, as determined by Hehner and Mitchell's method), was chosen for experiment, and 9 c.c. of the melted fat, dissolved in 60 c.c. of ether, and the solution allowed to cool down slowly to 13° C. After the "stearine" had crystallised out, the mother liquor was poured off, and the deposit washed and redissolved in 30 c.c. of ether, 0·720 sp. gr., and treated as before. The melting point of the superfused crystals from the 3rd, 4th and 5th crops was determined, as also the iodine value of the latter. The results are embodied in Table E, which also includes the melting points of the crystals obtained from beef and mutton fats Nos. 16 and 15, Table A, treated in a similar manner.

TABLE E.

	Beef "stearine."		Lard "stearine."		Iodine value.	Mutton "stearine." 2nd m. pt.
	1st m. pt.	2nd m. pt.	1st m. pt.	2nd m. pt.		
	°C.	°C.	°C.	°C	per cent.	°C.
1st crystallisation	—	—	—	—	—	59·5
2nd crystallisation	52·5	59·0	—	—	—	—
3rd crystallisation	—	60·5	50·5—53·0	65	—	—
4th crystallisation	—	61·0	51·5	66	—	—
5th crystallisation	—	—	51·5—53·0	66	0·30	66·5
6th crystallisation	—	66·5	—	—	—	—

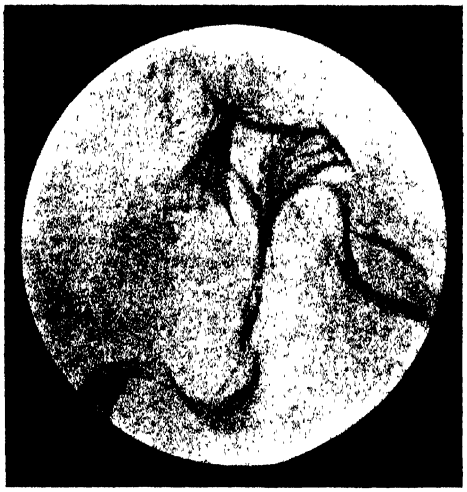


Fig. 1.—Mutton 1st—100.



Fig. 4.—Beef 1st—100.

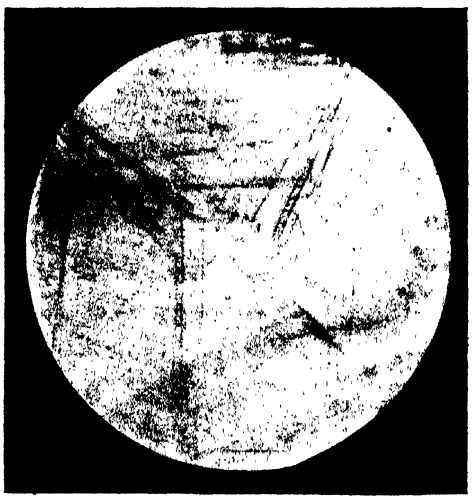


Fig. 2.—Mutton 3rd—380.

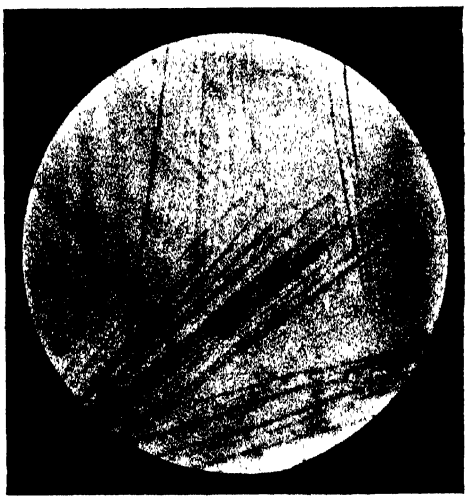
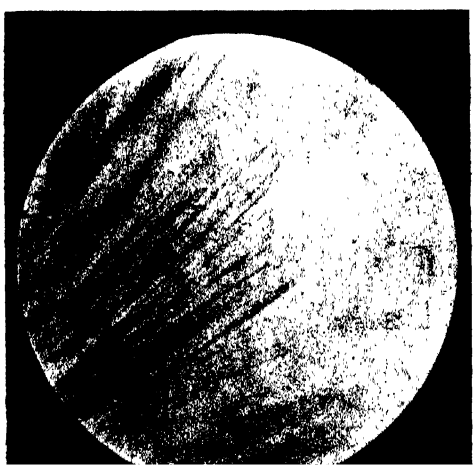
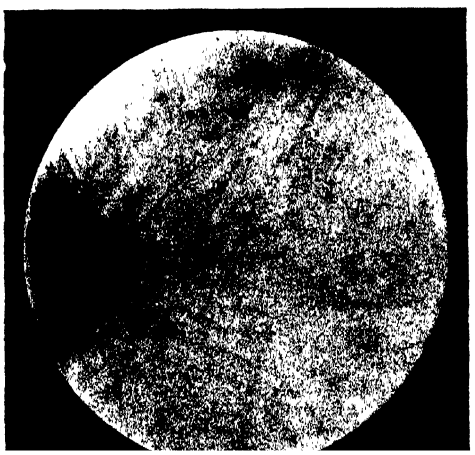


Fig. 5.—Beef 3rd—380.





this way recrystallisation was continued until only a few mgrms. of "stearine" remained.

In examining the crystals, no mountant was employed, the ether being allowed to evaporate after placing the cover glasses, care being taken not to damage the crystals by pressure. The powers employed varied from 30 to 400 diameters, and microphotographs of a number of fields were taken in each crystallisation. Commencing with mutton "stearine" the first crystallisation gave the characteristic curved tufts, the individual crystals showing sharp points at a magnification of 400 diameters. Microphotograph No. 1 shows these groups at 100 diameters.

The "stearine" from the second crystallisation also gave the "plumose groups," but the latter were less curved than in the first crystallisation, while many of the separate crystals showed what may be described as blunt ends or points. In the third crystallisation, however, a great change in the crystalline form was observed, the fine rods having given place to thin plates with, in many cases, oblique terminations as in lard crystals. Microphotograph No. 2 shows such crystals at a magnification of 380 diameters.

A fourth crystallisation was now made, the effect of which was to further develop the lard form of crystals, which could be distinctly seen at 100 diameters and in many fields at as low a power as 30 diameters. Microphotograph No. 3 shows such crystals at a magnification of 380 diameters.

In the case of beef "stearine," the forms observed in the first crystallisation closely resembled those of mutton "stearine," as shown by microphotograph No. 4. The second, and especially the third crystallisation, showed a decided change from the "beef" to the "lard" form (microphotograph No. 5, × 380), while in the fourth the change was very marked.

Here plates with chisel-shaped ends were clearly seen at 100 diameters, the plates being in several fields well formed and arranged in the form of a star, as shown in microphotograph No. 6. Although a large number of such groups was observed, the larger proportion had the "plumose" formation, the individual crystals in the latter resembling narrow lard plates and not the fine-pointed needles obtained from the first crystallisation.

This remarkable change which takes place in the form of the crystals from beef and mutton fats after repeated crystallisation from ether, can, no doubt, be explained by the greater solubility in ether of the particular glycerides giving the "beef" form of crystal, and consequently the ultimate appearance of a less soluble one, which gives the flat plates characteristic of lard.

Under the heading "Examinaton of Lard Crystals separated from Ether" ("Analyst," **21**, page 328), Hehner and Mitchell give the results obtained by the repeated crystallisation of the "stearine" from hard lard. They found that the crystals became more and more needle-like until finally they could hardly be distinguished from beef "stearine" crystals, meaning by the latter, one would suppose, the crystals from a first crystallisation of beef "stearine." After showing how the amount of stearic acid increased with each crystallisation, the authors state that "the form of the beef crystals is solely due to the larger proportion of stearic acid, than can be obtained from a pure lard by a single crystallisation." If that be so, one would expect to obtain finally, after the repeated crystallisation of lard, beef and mutton "stearines," the fine-pointed needles characteristic of a first crystallisation of beef fat. This certainly has not been my experience, as shown in the case of beef and mutton "stearines," while with lard "stearine" I have been unable to confirm the statement made by Hehner and Mitchell. The "stearine" from lards Nos. 11 and 12, Table A, was recrystallised five times by the method previously described, the crystals from each crop being examined under the microscope. While the crystals obtained finally were certainly much narrower than those from a single crystallisation of normal lard, they could not be described as rod or needle like, and fully 80 per cent. of the crystals showed oblique terminations at 100 diameters. The grouping of the crystals was also quite distinct from beef fat.

A series of crystallisations was also made with a mixture of lard and beef "stearines," the quantities employed being 0·200 grm. of each of the "stearines" (A and B, Table D) dissolved in 20 c.c. of ether, 0·7178 sp. gr.

The crystals from the first, second and third crystallisations, when examined at 100 diameters, appeared as large curved tufts, the individual crystals in the latter resembling badly-formed beef crystals; but as recrystallisation proceeded, the form was gradually modified, the crystals becoming less curved and showing at higher magnifications oblique or chisel-ends, while those obtained finally in the twelfth and thirteenth crystallisations were unmistakably lard crystals.

After having tried several methods of crystallisation, using as solvents ether, petroleum ether, fusel oil, &c., I have been led to the following conclusions, with regard to the detection of beef fat in lard.

(1) That it is necessary to employ a much higher power than 100 diameters when examining the crystals from a suspected sample of lard, as the appearance of "plumose" groups at the above power alone, without regard to the form of the individual crystals at a higher magnification, is no proof of the presence of beef "stearine."

(2) That as the "stearine" obtained from beef fat by a single crystallisation is more soluble in ether than the "stearine" from a first crystallisation of lard, it is useless to attempt to eliminate lard "stearine" from a mixture of the two, by recrystallisation, as recommended by Keating Stock.

(3) That as the weight of ether washed deposit (Keating Stock's method) from genuine lard varies, as has been shown, from 5 to nearly 200 mgrms., it is dangerous to draw conclusions either quantitative or qualitative, from such a test.

As for the more general question of the detection of beef fat in lard by means of the microscope, the conclusions to which I have come cannot be better expressed than by quoting Hehner's remarks on the Belfield test ("Analyst," 1902, **27**, 24).

"When cotton-seed or other vegetable oil can be traced, and the iodine value is high, the 'beef form' of crystals may be taken to afford evidence of the presence of beef or mutton fats."

"In the absence of vegetable oil, and with a low iodine value, the Belfield test can at most afford some reason for suspicion, but no trustworthy evidence of adulteration."

New York Section.

ERRATA.

EARTH ALKALI AND ALLIED PEROXIDES.

BY DR. R. VON FOREGGER AND HERBERT PHILIPP.

(*This J., April 16th*, 1906, 298—302.)

In all cases where the words "specific gravity" occur, the word "density" should be read. The authors desire to explain that by the "density," or, perhaps better, the "apparent density" of a powder, is mean the volume which an uncompressed body takes up, with its included air spaces. Thus, to say that calcium peroxide (60 per cent.), of sp. gr. 2·378, has an apparent density of 0·603, implies that 1 c.c. of calcium peroxide, in powder form, weighs 0·603 grm.

1 c.c. of strontium peroxide (85 per cent.) of sp. gr. 3·845, weighs 0·546 grm.; 1 c.c. magnesium peroxide (28 per cent.) of sp. gr. 1·923, weighs 0·615 grm.; 1 c.c. zinc peroxide (50 per cent.) of sp. gr. 3·384, weighs 1·571 grms.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 420.)

High temperatures; Determination of ——. H. v. Wartenberg. D. physikal. Ges. Ber., 1906, 97. Chem. Zeit., 1906, 30, Rep., 138.

NERNST has proposed making use of chemical equilibrium and the two heat laws for the measurement of high temperatures. As an example of this method the reaction $2H_2O \rightleftarrows 2H_2 + O_2$ has been examined over the range 1400°—2300° C., and the extent of dissociation, *i.e.*, the concentration of hydrogen (x) in the steam, estimated at various temperatures. At the lower temperatures x was determined by analysis of the steam after passing through a glowing tube, the temperature being measured by a thermo-electric junction controlled by the melting point of gold. At higher temperatures, since the reaction products combine on cooling, the partial pressure of the hydrogen was measured directly in the heated furnace by making use of a platinum partition porous only to the hydrogen. Iridium replaced platinum at the highest temperatures, and a Wanner pyrometer, which was compared with a thermo-electric junction, was used to measure the temperature.—F. SODN.

ENGLISH PATENTS.

Furnaces; Impts. in ——. C. B. Burdon, London. From La Soc. Anon. des Proc. Maslin-Theryc, Marseilles, France. Eng. Pat. 9056, April 29, 1905.

IN reversed-draught furnaces in which the air passes downwards through the bed of fuel, the removal of the ashes in the condition of a molten slag is claimed. The slag is maintained in a liquid condition until it reaches the tapping hole, by causing the hot products of combustion to travel with it in the same direction. Further claim is made for enclosing the furnace and slag chamber in a thin refractory casing cooled on the outside, and for water- or air-cooled tubes to form bridges over which the slag flows from the bottom of the bed of incandescent fuel.—W. H. C.

Solvents; Process and apparatus for recovering volatile ——. E. Delhotel, Paris. Eng. Pat. 9441, May 4, 1905.

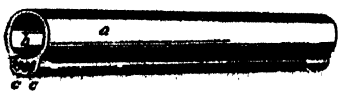
SEE Addition of May 4, 1905, to Fr. Pat. 344,848 of 1904; this J., 1905, 1169.—T. F. B.

Heating and evaporating liquids by means of steam; Apparatus for ——. D. B. Morison, Hartlepool. Eng. Pat. 10,817, May 24, 1905.

THE claim is for improvements in evaporators such as are described in Eng. Pat. 13,775 of 1900 (this J., 1901, 694). These improvements consist in connecting the outlet and inlet of successive coils by diagonal passages formed in the "header," in providing a separate outlet for the condensed water from each coil into a passage in the "header," and in hanging the "headers" on their supports in such a way that the accumulation of scale has a less binding effect on the hinges.—W. H. C.

UNITED STATES PATENTS.

Retort. R. Ziesing, Cleveland, Ohio. U.S. Pat. 818,070, April 17, 1906.



THE retort, *a*, consists of a retort-chamber, *b*, to contain the material to be treated, and provided with longitudinal ridges, *c,c*, connected by a false bottom as shown. The spaces between the ridges, *c*, serve as air or ventilating passages, and the ridges themselves strengthen the structure of the retort.—W. H. C.

Filter-press. M. Ekenberg, Stockholm, Sweden. U.S. Pat. 818,154, April 17, 1906.

THE claim is for a filter-plate for use in a filter-press, which also claimed, and composed of a number of very thin and flexible sheets of metal disposed face to face; there are means for pressing the sheets together with a pressure capable of regulation. There is also a valve-controlled inlet to the press-chamber for the fluid mixture to be filtered. The material is compressed between the sides by a reciprocating piston, acting at right angles to the laminated sides, through the interstices of which the fluid flows.—W. H. C.

Dryer. C. A. Matcham, Allentown, Pa. U.S. Pat. Reissue 12,474, April 24, 1906.

AN inclined drying cylinder, mounted so that it can be rotated by suitable mechanism, has a portion of its length, nearest the inlet end, enclosed in a chamber heated by the products of combustion from a furnace placed below. The hot gases from the heating chamber are conducted by a flue to the outlet end of the drier, pass through the latter over the material being dried, and escape, along with the vapours given off, into a stack, the lower part of which encloses the inlet end of the rotating cylinder.—W. H. C.

FRENCH PATENTS.

Furnace arranged to utilise special gases, and several applications thereof. L. C. E. Faucheux. Fr. Pat. 360,178, Feb. 15, 1905.

THE furnace of M. Perret (which is constructed of superposed slabs, on which the coal dust to be burned is placed and is caused to descend from one slab to another at each charging operation) may, by suitable regulation of the air inlets, be so worked that the gases of combustion containing nothing but nitrogen, carbon dioxide, and about 0·5 per cent. of oxygen, and may be kept steadily at any desired temperature. The patentee encloses a furnace of this type in a non-conducting material such as kieselguhr, and utilises the hot gases, freed from dust and soot, directly as a source of heat. To ensure the absence of dust and soot, the gases, immediately after charging the furnace, and so long as they contain soot, are passed into the chimney; thereafter they are passed, on their way to the point of application, through large dust-depositing chambers containing metallic gauze, broken coke, flints, &c. The hot purified gases can then, owing to their freedom from oxygen, dust, &c., be brought into direct contact with the substance to be heated. Their application to the concentration of sulphuric acid, and the drying, distillation, torrefaction, &c., of various substances, is described.—H. B.

Soluble substances in grains, pulp, &c.; Apparatus for continuous extraction of —— by means of solvents. E. Bataille. Addition dated Nov. 28, 1905, to Fr. Pat. 319,204 of March 1, 1902 (this J., 1902, 1460).

THE additional claims include the use of a false bottom in the extraction vessel, so that solvents can be heated when required; perforated buckets on the elevator chain raising the material to the drying chamber, so that the solvent may drain off; certain modifications in the arrangement of the extraction and drying chambers; and the suppression of valves in the distributing chamber and the outlet conduit.—C. A. M.

Evaporation of liquids, especially such as are liable to froth excessively; Arrangement for producing the ——. D. Grove and W. Haberland. Fr. Pat. 360,618, Dec. 2, 1905.

THE evaporation is effected from the surface of hollow

discs, mounted on a hollow horizontal shaft, and rotated in a vessel formed like a large hollow disc and partially filled with the liquid. The smaller discs are partly filled with some badly conducting body such as an oil, and are rotated so slowly that the oil remains in the lower halves of the discs, which are partially immersed in the liquid to be evaporated. The heating agent, *e.g.*, steam, is introduced into the upper halves of the discs, through the hollow shaft. When the shaft is rotated, a portion of the liquid adheres to each disc, and it is only the liquid adhering to the upper half of each disc that becomes heated; the lower parts of the discs being filled with the badly conducting material, impart but little heat to the main body of the liquid, which does not enter into ebullition, and consequently violent frothing is avoided.—W. H. C.

Liquids or mixtures of liquids; Process for rendering homogeneous mechanically ——. Deutsche Homogenisiermasch.-Ges. First Addition dated Dec. 8, 1905, to Fr. Pat. 354,943, June 5, 1905 (this J., 1905, 1162).

Before passing through the pulveriser, the liquids to be rendered homogeneous are thoroughly mixed in an agitator with vertical beaters, the mixer being surrounded by a jacket through which a heating or cooling medium can be circulated. The mixture is then passed through a system of crossed spiral tubes to the pulveriser, which is also jacketed in order that the liquids may be heated or cooled during pulverisation by circulating a heating or cooling agent through the jacket.—W. H. C.

Indicator and regulator of temperature; Thermo-electric ——. Soc. les Etablissements Poulenc Frères. Fr. Pat. 360,258, Dec. 9, 1905.

The temperature of a furnace is automatically regulated by the action of a pyrometer which causes a deflection of a galvanometer, such deflection acting in conjunction with an auxiliary circuit, serving as a relay, to alter the position of the damper in the flue of the furnace. The temperature of the furnace can in this way be maintained constant within two desired limits.—R. S. H.

Filtering or separating liquids from solids or matter from impurities; Apparatus for —— and for similar uses. The Clayton Aniline Co., Ltd. Fr. Pat. 360,533, Dec. 16, 1905. Under Int. Conv., June 7, 1905.

See Eng. Pat. 11,957 of 1905; this J., 1905, 1003.—T.F.B.

Drying-drum with central tube. L. Boltri. Fr. Pat. 360,851, Dec. 22, 1905. Under Int. Conv., Dec. 28, 1904, and Aug. 19, 1905.

The apparatus consists of a drum having an inner, coaxial, central tube, and mounted on an axis so that it can be rotated. A longitudinal slot, or opening, is formed on one side of the drum and can be closed by a gauze plate. The apparatus is charged by bringing the opening uppermost and filling in the material to be dried. The gauze plate is then placed over the opening and the drum is turned through half a revolution, the opening being now underneath. Warm air, introduced by a pipe through the upper part of one end of the drum, passes downwards through the contents and escapes through the gauze at the bottom. The presence of the central tube causes the heated air to be distributed evenly through the material, and very little "dead space" is formed.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 422.)

Coal; Spontaneous ignition of ——. V. B. Lewes. J. Gas Lighting, 1906, **94**. 33—34.

In the spontaneous ignition of coal stored in bulk, the oxidation of the pyrites present only plays a very subsidiary part, the chief factor being the surface condensation of the oxygen in the pores of the coal, and the action of the condensed gas in effecting the oxidation of the hydrocarbons present in the coal. Whilst sufficient ventilation to prevent any considerable increase of temperature within the mass is effective in preventing ignition, it is practically impossible to maintain this condition in large coal stores or in a cargo on board ship, where usually only enough air enters to lead to dangerous heating. The recent suggestion to thoroughly wet the whole mass of coal is likewise impracticable, owing to the great increase of weight brought about if sufficient water is added to be effective, and too small a quantity of water only accentuates the danger.

The extinction of coal-fires which break out on board ship is a matter of extreme difficulty, owing to the frequent impossibility of getting water to the exact seat of the fire, and to the formation of hydrogen and carbonic oxide by the action of the steam on the incandescent fuel, which results in the production of an explosive mixture in the coal bunkers. In order to extinguish at an early stage any fire which may break out, the author recommends that small cylinders of liquid carbon dioxide should be buried in different parts of the mass of coal during loading, the valve of the cylinder being open, but the delivery tube closed with fusible alloy melting at 93° C. If the temperature of the coal at any time rises above this point, the alloy fuses, and the liquid carbon dioxide is volatilised, causing great local cooling, and the cold heavy gas, which does not support combustion remains for some considerable time in contact with the coal, preventing further combustion.—H. G. C.

Furnace gases; Hydrocyanic acid in ——. K. Jurisch. Chem.-Zeit., 1906, **30**, 393—394.

The author has found small quantities of prussic acid in the boiler house furnace gases of a factory, the working conditions of which are detailed. For its detection, the gases passing upwards were met by a 25 per cent. solution of caustic soda, containing freshly precipitated ferrous hydroxide, which was sprayed downwards; 15 litres of solution were used, descending in 15 minutes, and then being pumped up again. After 4000 cb. m. of the gases had passed through in this manner, the solution was removed, boiled and tested for ferrocyanide in the usual way. A blue colour was obtained, and after long standing, a precipitate of Prussian blue.—F. Sodn.

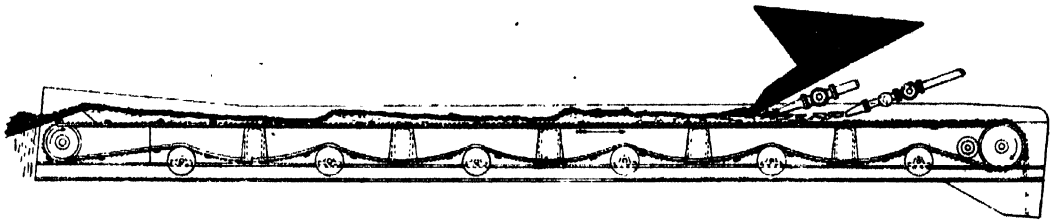
English Patents.

Filtering liquids containing fine coal or other mineral or like substances; Apparatus for ——. C. Craig, Dewsbury and W. and G. K. Craig, Sacriston. Eng. Pat. 9464, May 5, 1905.

The apparatus consists of a vertical cylindrical tank with a liner of metal gauze or perforated plate, and several vertical perforated tubes rising from the bottom of the tank. The liquid to be filtered is fed into the tank by a rotating distributor, actuated by the liquid itself on the principle of the "reaction wheel," or by a conical distributing table. The liquid passes through the perforations and is drawn off by suitable pipes, and the solids which collect in the tank are removed from time to time through openings in the bottom.—W. H. C.

Washing of coal and other minerals; Apparatus for the ——. J. Shaw, Pontefract. Eng. Pat. 13,018, June 23, 1905.

The apparatus consists of an inclined trough in which works an endless conveyor constructed of transverse slats riveted to a pair of endless chains, and having cross-dams bolted to the slats at suitable intervals. Above the conveyor is fixed a series of inclined flaps having their free ends resting on the transverse slats, and forming on the upper surface of the conveyor a series of receptacles. The coal is fed on to the upper end of the conveyor, and is carried downwards by a current of water from a nozzle. The heavier particles (mineral impurities, &c.) collect in the receptacles formed by the flaps, whence they are carried upwards, against the current of water, by the conveyor, and after being further washed by water from a second nozzle, are discharged at the upper end of the conveyor. The lighter particles of coal are carried by



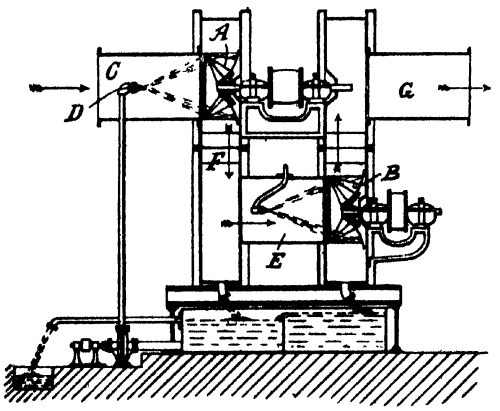
the water over the inclined flaps, and are discharged from the lower end of the conveyor on to a draining-plate.—W. H. C.

Burners for liquid fuel; Impts. in ——. N. and H. Fraser, Arbroath, N.B. Eng. Pat. 23,351, Nov. 14, 1905.

THE burner comprises a coiled vaporising pipe, which is situated over the burner proper and receives the fuel supply; a vapour chamber, which receives the vapour from the pipe and prevents "back-firing," after the manner of the air vessel of a pump; and a nozzle which directs the vapour from the chamber into a horizontal air-mixing tube, which tube admits the mixture of air and vapour tangentially into an inverted conical vessel, opening beneath a domed, perforated plate. The mixture of air and vapour, on entering the conical vessel, swirls in a circular and upward direction within it, becoming well mixed and evenly distributed under the domed plate, and ignites after passing up through the perforations in the latter.—H. B.

Gases; Method whereby furnace and other —— may be completely and rapidly freed from dust and other foreign matters held in suspension therein; and apparatus therefor. P. Kestner, Lille. Eng. Pat. 9548, May 5, 1905.

THE gases enter the apparatus by the pipe, C, and in the case of cold gases, steam, or in the case of hot gases, water



which is converted into steam, is injected through the nozzle, D. The mixture then passes through the "draught producing, atomising fan," A, and the pipe, F, to the condensing chamber, E, where it is rapidly cooled and the steam condensed by cold water injected through the nozzle shown. The particles of dust are thoroughly wetted, and fall with the condensed water, whilst the purified gas passes on through a second fan, B, where further condensation takes place, to the outlet, G.—W. H. C.

Gases; Separation of dust from ——. B. H. Thwaite, London. Eng. Pat. 23,378, Nov. 14, 1905.

THE claim is for improvements in the method of removing dust from gases described in Eng. Pat. 6837 of 1898, and comprises the use of two or more separate electrostatic dust-separating chambers, arranged in series and provided with by-pass valves; and the combination of electrostatic and centrifugal dust separators.—W. H. C.

Vaporisers for combustible liquids for use with explosion motors. L. and T. Gautreau, Paris. Eng. Pat. 995, Jan. 13, 1906. Under Int. Conv., Jan. 14, 1905.

THE vaporiser, which is adapted for use with slightly volatile combustible liquids such as heavy petroleum, mineral oils, alcohol, &c., consists of a jacketed tube, one end of which is connected to the suction port of the motor, whilst the other receives the mixture of air and combustible liquid, the hot waste gases from the motor flowing through the jacket of the tube and heating it sufficiently to vaporise the liquid. Within the main jacket the tube is surrounded by a smaller, independent jacket, having inlet and outlet ports communicating with the air; within one of these ports, when starting the motor cold, a blowpipe burner or the like is lit, and is kept burning until the vaporiser is sufficiently hot to maintain the supply of vapour to the motor. The two jackets being independent, the operation of the starting burner does not interfere with the circulation of the hot waste gases from the motor.—H. B.

Gas producers; Improved apparatus for automatically sustaining the suction influence in suction ——. B. H. Thwaite, London. Eng. Pat. 7904, April 13, 1905.

ON a hollow base, which communicates on the one hand with the gas producer and on the other with the gas engine, are erected several pipes, the upper ends of which enter a hollow chamber; from the latter a circular bellows-like device is suspended, which remains extended to its full length when the gas engine is not sucking the gas, but is capable of being drawn up at its lower end when the bellows contract during the suction. At each suction-stroke of the engine the lower end of the bellows (which is suitably weighted) is drawn up; when the suction stroke ceases, the bellows again expand, and the suction is thus maintained in the producer during the intervals between the suction strokes of the engine. A non-return valve is provided in the pipe leading from the hollow base to the gas engine.—H. B.

Gas producers: Impts. in ——. Maschinenfabrik und Mühlenbauanstalt G. Luther A.-G., Brunswick, Germany. Eng. Pat. 1295, Jan. 17, 1906. Under Int. Conv., Dec. 13, 1905.

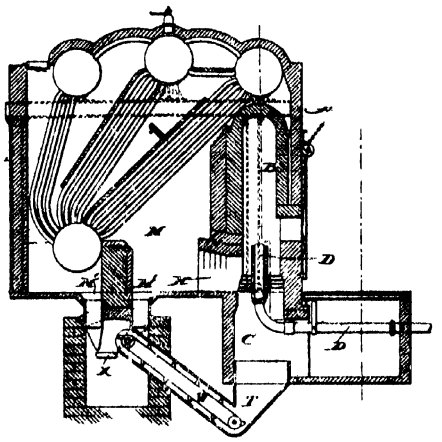
To render practicable the use of very wet fuel in a producer operating with an upper and a lower combustion zone, a hollow body, having apertures on all its free sides, is arranged within the producer so as to extend across the latter from wall to wall above the upper combustion zone. The upper sides of the body are roof-shaped, and so steeply inclined that fuel cannot remain sticking to them, but must slide down. Air enters the body through inlets at each end, and gases from the combustion zone also enter it through the apertures in its sides, burning with the air within it and thus expelling the water from the downwardly moving fuel. The steam generated may either be led downwards through suitable channels to the lower zone of combustion, or be allowed to escape through a chimney.—H. B.

United States Patents.

Fuel from peat; Process of producing —— by means of the electric current. J. B. Bessey, London. U.S. Pat. 817,899, April 17, 1906.

See Eng. Pat. 17,497 of 1904; this J., 1905, 322.—T. F. B.

Burning pulverised fuel and other substances; Process of and furnace for ——. A. M. Robeson, Johannesburg, and C. A. Bettington, Boston, Mass. U.S. Pats. 817,989 and 817,990, April 17, 1906.



A mixture of powdered fuel and air is blown through the pipe, D, into the vertical combustion chamber, B. The mixture burns and rises to the upper closed end of B, and is then deflected downwards, any particles of burning fuel being held in suspension by the rush of the incoming mixture. The products of combustion escape through the passage, H, into the heating chamber, M. The ashes are deposited in the chamber, C, and collect in the space, T, from which they are removed by the elevator, W, and are finally deposited in the space, X, along with any flue dust from the slides, M'. W. H. C.

Combustion; Method of ——. O. Bender, Treptow, Germany. U.S. Pat. 818,221, April 17, 1906.

See Fr. Pat. 351,210 of 1905; this J., 1905, 838.—T. F. B.

Gas; Apparatus for producing ——. J. S. Smith, Chicago, Ill. U.S. Pat. 817,279, April 10, 1906.

In a gas-producing apparatus, an imperforate "breaker-wall" is located within the generating chamber, and its resisting-surface is maintained in a uniformly highly heated condition. Means are provided to direct the gas-producing materials against the resisting-surface with forcible impact and at a decomposing heat whereby the initial generation of gases takes place. Additional steam may be supplied to the generating chamber in the path of discharge of the gases generated and at a temperature ensuring decomposition. Heavy hydrocarbons and other unvaporised materials are removed from the fixed gases in suitable extractors, and the gases, after drying, delivered under pressure into stationary or movable storage vessels.—R. L.

Gas; Method of producing ——. J. S. Smith, Chicago, Ill. U.S. Pat. 817,280, April 10, 1906.

Fixed gas and lubricating oils are simultaneously produced from crude petroleum by heating the latter, mixing it with an excess of steam, and passing it in the presence of air, into a generating chamber, wherein it is discharged violently and continuously against a resisting surface "at a self-sustained heat of decomposition." The resulting gases, the ash of combustion, and the excess of steam are conducted in a swiftly moving current out of this chamber and condensed hydrocarbons are discharged by their gravity into an external receptacle, whereby the volatile portion of the oil is recombined with the fixed gases and the heavy hydrocarbons are withdrawn in liquid form. The heat of decomposition in the generating chamber is controlled by the supply of steam. The production of gas and withdrawal of liquid are constant and continuous.—R. L.

Gas making apparatus. L. P. Lowe, San Francisco, Cal. U.S. Pat. 817,647, April 10, 1906.

The apparatus for generating gas consists of a casing divided into two chambers connected at the bottom by a partition wall with a bottom opening. Arches are built on the bottom of each chamber, and carry loosely-piled refractory material. Air and oil can be admitted at the top of the first chamber, another oil inlet being provided at the bottom of one of the chambers. Steam is supplied at the top of the second chamber, which also carries a stack which may be closed with a lid. The gas outlet is at the top of the first chamber, whilst the coke is withdrawn from the bottom of both chambers through suitable openings.—R. L.

Gas; Apparatus for making ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 817,648, April 10, 1906.

The apparatus for making gas comprises a casing in which a partition wall extends from the bottom to a point near the top, forming two compartments. Two arches divide these compartments into four chambers, which are filled with loosely piled refractory material. A flue and an air-blast are "selectively connected with the bottom of each lower chamber." An oil pipe discharges into the upper chambers; a steam pipe and gas outlet pipes are provided at the top of each lower chamber.—R. L.

Gas; Apparatus for manufacturing and delivering ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 817,649, April 10, 1906.

In combination with an apparatus for manufacturing gas, the gas is delivered to a compressor through a service pipe which has a branch pipe supplying an engine by which the compressor is operated. The flow of gas to the engine can be controlled by a valve, which is regulated by the pressure in the service pipe leading to the compressor with which it is connected.—R. L.

Gas purifier. L. P. Lowe, San Francisco, Cal. U.S. Pat. 817,650, April 10, 1906.

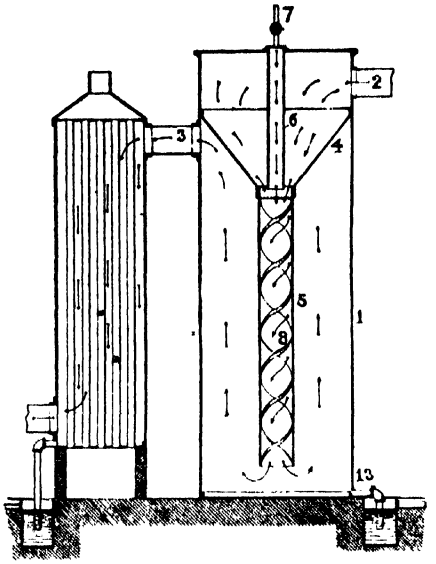
A purifier with inlet and outlet for the gas to be purified is provided with a series of trays or boxes to support the purifying material while allowing free passage to the gas. Several rows of stationary bars extend into the purifying material to disintegrate the same by their motion due to changes of temperature.—R. L.

Gas producer. F. G. Hobart, Beloit, Wis., Assignor to Fairbanks, Morse and Co., Chicago, Ill. U.S. Pat. 817,853, April 17, 1906.

An annular vaporising chamber is formed round a fuel storage and feeding hopper at the top of the producer, a space being left all round the hopper between it and the inner circular wall of the vaporiser, which has ribs that project into this space. The cover of the vaporiser extends over the annular space and is attached to the sides of the hopper. Valved poker-holes in that part of the cover which is above the annular space, and openings into the vaporiser through which the steam can pass to the lower part of the producer, are provided.—W. H. C.

Gas-purifier. E. C. Jones, San Francisco, Cal., and S. T. Wellman, Cleveland, Ohio. U.S. Pat. 818,891, April 24, 1906.

The gas to be purified enters the apparatus, 1, through the pipe, 2, and, after being mixed in the conical chamber, 4, with vapour introduced through the pipes, 7, and 6, is injected along with the vapour into the tube, 5. The mixture passes down this pipe, its passage being impeded by the spiral baffles, 8, and the purified gas then passes



upwards, as shown by the arrows, to the outlet, 3. Any condensed liquid flows away through the pipe, 13, which is sealed as shown.—W. H. C.

French Patents.

Compounds for heating; Agglomerated —— and process for manufacturing them. A. Andrieu and P. Giraud. Fr. Pat. 360,861, March 13, 1905.

Crocidolite, an asbestos-like mineral, is soaked in 15 per cent. of its weight of milk of lime and dried. It is then mixed with coal-dust and agglomerated either by heat or by pressure, after addition of 5 per cent. of magnesium chloride. The material is then impregnated with heavy oil, petroleum residues, or tar and dried on a bed of powdered alunnite and manganite. The dried mixture when burnt is said to afford an easy means of rapidly raising steam.—W. H. C.

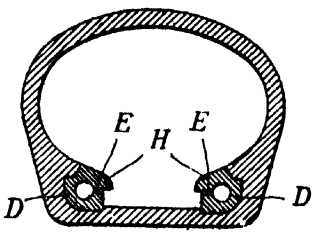
Briquettes made with an agglutinant soluble in water; Process for rendering unalterable in the air ——. R. Bock. First Addition, dated Nov. 18, 1905, to Fr. Pat. 325,708, Oct. 27, 1902 (this J., 1903, 736).

The addition relates to a method of carrying out the process described in the original patent, and consists in heating the coal, before it is briquetted, to a temperature slightly higher than that to which the briquettes are subsequently heated to carbonise the agglomerant. The object of the preliminary heating is to prevent the evolution of gas during the carbonisation of the agglomerant. W. H. C.

Gas-retort furnace. P. V. Parsy. Fr. Pat. 360,070, Feb. 11, 1905.

The retort setting is divided into a number of vertical chambers, each chamber containing only one vertical row of retorts. Each pair of chambers is heated by means of a separate generator and recuperator, which are situated upon the same floor level as the retorts and occupy a vertical compartment separating the one retort-chamber from the other. The generator gases and secondary air from each generator and recuperator are distributed between the two corresponding retort-chambers, entering the latter through orifices at the top, passing with downward combustion over one side of the retorts, and flowing up the other side to outlets at the top. These arrangements are designed to ensure the uniform heating of all the retorts in the bench, and to obviate the obstruction of the gas orifices, which is sometimes caused by falling particles of refractory material, &c., when the orifices are situated below the retorts.—H. B.

Gas or steam; Device for introducing —— into the interior of gas retorts. Stettiner Chamotte-Fabrik A.-G. vorm Didier. Fr. Pat. 360,032, Dec. 2, 1905



The channels for the introduction of steam or gas into the interior of the retort are in the form of tubular conduits made of refractory material fitted removably into the retort; as, for example, in the cross-sectional illustration given, wherein the tubular conduits D, provided with outlets, E, for the steam or gas (the overhanging projections, H, serving to keep the coal from blocking the outlets) are keyed into the retort in such a manner that they may easily be withdrawn if necessary.
—H. B.

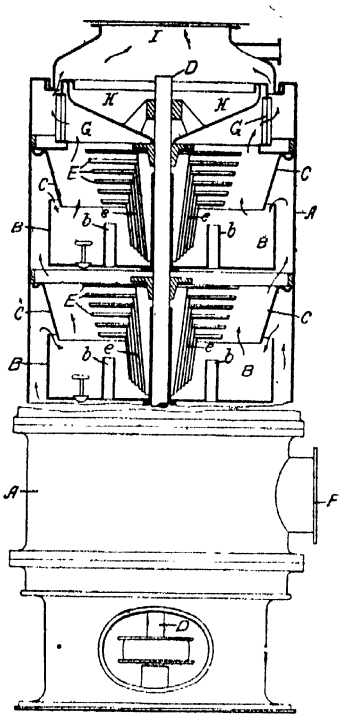
Gas producer with downward combustion. L. A. David. Fr. Pat. 360,058, Dec. 4, 1905.

The producer, which rests in a water-sealed ash-pan, is surrounded by a deep bell, suspended over it from above. Whilst the producer is in operation, the air supply flows up the annular space between the bell and the producer, taking up the heat radiated from the exterior of the latter, and enters the combustion chamber at the top. By lowering the bell until it rests upon the top of the combustion chamber, the latter can be closed, and by raising it until its lower edge is above the top of the producer, fresh fuel may be charged in. The upper portion of the bell may be formed as a reservoir for liquid, which may be allowed to drop into the fuel in the combustion chamber; or the heat may vaporise the liquid in the reservoir, the vapours being directed downwards into the incandescent fuel. The producer has two superposed, horizontal, circular grates, which can be rotated in opposite directions.
—H. B.

Gases; Process and apparatus for the [centrifugal] purification of ——. A. Elsenhans. Fr. Pat. 360,341, Dec. 12, 1905. Under Int. Conv., Dec. 13, 1904.

The gas to be purified and the washing liquid are caused to pass in the same direction from the centre to the periphery of a centrifugal purifier, comprising a series of concentric annular spaces in which the liquid is whirled and splashed about on its way to the periphery, being thus brought into intimate contact with the gas. The apparatus described consists of two horizontal discs, bolted together at a suitable distance apart, on the opposed surfaces of which are attached several concentric annular partitions or baffles, those depending from the upper disc alternating with those rising from the lower disc, and none of them extending across the whole way to the opposite disc. The discs, which are provided centrally with inlets for the gas and liquid, are rotated at high speed within a casing which has gas and water outlets at its periphery. As all the annular partitions incline outwards towards the periphery, the liquid is both whirled round and projected violently from the free edge of each partition against the inner side of the next, and so on in a zig-zag course to the periphery, being thoroughly broken up and brought into intimate contact with the gas. Various modified forms of the discs and partitions are described
—H. B.

Gases or vapours and liquids [washing gases]; Apparatus for obtaining reciprocal action between —— W. Feld Fr. Pat. 360,373, Dec. 12, 1905.



The apparatus consists of a number of superposed basins, or trays, B, which contain the liquid and which are provided with overflow pipes, *b*, and with inverted truncated cones, C, whose lower edges dip below the rims of the basins, B, the whole being enclosed in the casing, A. A number of concentric tubes, *e*, which terminate above in the superposed discs, E, are attached to and rotated by the central shaft, D, and cause the liquid contained in B, to rise between the tubes, *e*, and to be dispersed, by centrifugal force from the discs, E, in the form of spray which falls back into the basins, B. The gas enters the apparatus at F, and following the path indicated by the arrows, passes through the falling spray of liquid in each chamber, and rises to the top, where it is compelled by the partition, H, to pass through the gauze filters, G. It is here deprived of any spray which it may have carried forward, and finally escapes from the apparatus through I. —W. H. C.

Illumination by petroleum, benzine and alcohol; Compound of chemicals giving greater brilliancy to — —. E. S. Mathon. Fr. Pat. 359,798, Nov. 27, 1905.

A mixture of about 95 parts of magnesium sulphate, four parts of spermaceti, and one part of paraffin wax, all in powder, is "dissolved" in the petroleum or alcohol in order to give greater brilliancy to the light obtained.—W.H.C.

Mantles; Process of treatment of fabrics or threads for the manufacture of incandescence — —. A. I. van Vriesland. Fr. Pat. 359,945, Nov. 29, 1905.

The fabric or the thread is treated wholly, or at parts, with acids or alkaline solutions sufficiently strong to produce a contraction of the material, for the purpose, *e.g.*, of rendering the knitted stocking narrower when the meshes are too wide, or for strengthening the thread when the latter is too thin, or for strengthening the head or producing local constrictions, &c.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 423.)

Petroleum; Notes on the chemical examination of ——. K. Charitschkow. Westnik shirow, 1906, **7**, 14; Chem. Zeit., 1906, **30**, Rep. 142.

The examination of stored petroleum from Grosny by the Dehnstedt-Geisler (aniline) reaction revealed the presence of sulphuric esters. The amount varied inversely with the quantity of acid used in the acid-refining process, being equivalent to 0·00227 grm. of sulphur trioxide per litre with 0·5 per cent. of acid, but only 0·00067 grm. when 2 per cent. of acid had been used. These compounds are undesirable, since they lead to the charring of the wick when the oil is burned in lamps, but how they originate and in what form is still undetermined. Sulphur also reduces the illuminating power of the oil, even when present in but small amount. A simple method of determining the sulphur content is by distilling the oil from metallic potassium, any sulphur present combining with the metal. The author considers that the sulphur content should be taken into account when judging the purity of Russian lamp oil, and he approves Weber's suggestion that the percentage of unsaturated hydrocarbons should also be determined.—C. S.

Paraffins; Transparent and milky ——. H. Mittler and R. Lichtenstern. Chem. Rev. Fett- u. Harz-Ind., 1906, **13**, 104–105.

"Milkiness" in paraffins is attributed by the authors, not to differences in the melting points of the different constituents as asserted by Neustadtl (this J., 1906, 171), but to the presence of paraffin oil. Thus a sample of milky paraffin was found by Holde's method to contain only 94 to 96 per cent. of solid paraffin, the residue, isolated by extraction with alcohol-ether, consisting of paraffin oil. This conclusion was confirmed by experiments with paraffins of high and low melting points, which were rendered "spotted" or "milky" by the addition of 0·5 to 3 per cent. of paraffin oil. The addition of 0·2 to 0·3 per cent. had little, if any, effect. Evidence against Neustadtl's view was that transparent paraffins of the most divergent melting points (*e.g.*, 57° and 42° C. could be mixed in equal proportions without any appreciable effect on the transparency, although, in some cases, a bluish "cast" was produced.—C. A. M.

Petroleum production of California. For. Off. Ann. Series, No. 3564.

According to the figures prepared by the California Petroleum Miners' Association, the production of oil in California in 1905 was 35,671,000 galls., as against 28,476,025 galls. in 1904, 24,337,828 galls. in 1903, and 13,973,500 galls. in 1902. The Kern River district continues to be the largest producer, and is credited with 14,000,000 galls. in 1905, followed by Coalinga with 8,869,000 galls., and Santa Maria and Lompoc with 5,300,000 galls. There has been a large increase in the number of wells, and sufficient drilling operations are proceeding to insure a further increase of production for 1906. The greatest activity in drilling is noted in the vicinity of Santa Maria and Lompoc, where 42 new wells are being drilled. The total number of producing wells is 2,116; wells being drilled, 123; and new derricks, 52.

The heavy shrinkage in the consumption of coal must not be taken as an indication that the fuel demands of California have been less than in 1904. This deficiency has been more than made good by the output of fuel oil, which has increased by over 7,000,000 barrels as compared with 1904. The amount of crude oil exported during the year is estimated at 800,000 barrels, the bulk of which was sent to China and Japan by a line of tank steamers recently established by the Standard Oil Company, which sail under the British flag. The railroads

of the State are believed to be consuming about 15,000,000 barrels annually, and the low price at which it is being produced for transportation and manufacturing purposes has proved of inestimable advantage to all lines of commerce. The Standard Oil Company's pipe line from Bakersfield to Point Richmond is practically a failure. The gravity of California oil is such that pumping, heating and dilution sufficient to make it flow freely have not been found practical. The company is, therefore, resorting to water transportation, and is erecting a plant for building steel barges.

The Union Oil Company of California has developed a plan to extend its business by entering the markets of the Atlantic seaboard and Europe with crude and refined petroleum oils. Transportation facilities were the great drawback, but the difficulty has been solved by a concession to run a pipe line across the Isthmus of Panama, which has been granted to the company. Shipments of the necessary pipe have already commenced from the Eastern States, and it is expected that the line will be completed by July 1, 1906. The company has recently purchased six additional steamers which will be used in the transportation of oil, and the refinery on the Bay of San Francisco is being greatly enlarged to supply the increasing demands.

The six tank steamers owned by the company and plying in Pacific waters have a joint carrying capacity of 6,000,000 galls. It is arranged that five of these shall carry oil direct from Santa Barbara and other fields in Southern California to Panama whence the cargoes will be pumped across the Isthmus into the holds of two tank steamers for conveyance to New York and other Atlantic ports. [T. R.]

ENGLISH PATENTS.

Coke, ammonia, illuminating gas, tar, benzol and other products; Process and apparatus for the production of —— by the distillation of coal, lignite, turf and other carbonaceous materials. J. G. Aarts, Dongen, Holland. Eng. Pat. 8187, April 17, 1905.

SEE Fr. Pat. 353,128 of 1905; this J., 1905, 1008.—T. F. B.

Magnesium sulphate obtained in the known method of producing acetic acid by means of magnesium acetate, Process of separating and working up ——. J. R. Garroway. Eng. Pat. 6798, March 31, 1905. VII., page 477.

UNITED STATES PATENTS.

Gas furnace or coke-oven. H. Koppers, Essen on the Ruhr, Germany. U.S. Pat. 818,033, April 17, 1906.

SEE Fr. Pat. 351,962 of 1905; this J., 1905, 884.—T. F. B.

Coke oven. H. Koppers, Essen on the Ruhr, Germany. U.S. Pat. 818,266, April 17, 1906.

SEE Eng. Pat. 18,262 of 1904; this J., 1904, 1021.—T. F. B.

FRENCH PATENTS.

Coke-ovens; Impts. in regenerative ——. E. Coppée. Fr. Pat. 359,888, Nov. 28, 1905. Under Int. Conv., July 3, 1905.

Two regenerator chambers, common to the whole battery of ovens, communicate at either end with a valve chamber. The hot gases from the ovens enter one of these valve chambers, pass through and heat one of the regenerators and then to the second valve chamber, by which they are delivered to the place where they are utilised. At the same time air enters the second valve chamber, passes through the other regenerator, becomes heated and enters the first valve chamber. It then passes to a conduit by which it is distributed to the ovens. At appropriate intervals the valves are reversed, but, as the air always enters through the same valve chamber, the direction in which the gases and air pass through the oven flues remains the same.—W. H. C.

Soap, ointment or paste for disinfecting purposes; Process of making ——. [*Peat tar.*] J. Kessler and Co. Fr. Pat. 360,174, Dec. 7, 1905. XVIIIC., page 493.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 424.)

Catalytic substances; Influence of —— on the substitution of aromatic rings. K. Holdermann. Ber., 1906, **39**, 1250—1258.

ANTHRAQUINONE and its derivatives on sulphonation yield β-sulphonic acids almost exclusively, unless mercury is present, when the α-derivatives only are obtained (see Iljinsky, Ber., 1903, 4194; R. Schmidt, Ber., 1904, 66). The author sulphonated and nitrated various benzene, naphthalene, and anthraquinone derivatives to see whether this important technical method for the preparation of α-anthraquinonesulphonic acids was capable of general application. He finds that the catalytic action of mercury is confined to the sulphonation, and in a lesser degree to the nitration of anthraquinone derivatives. With other substances the course of the reaction is not affected by the presence of mercury or its salts, except in the case of aniline and sulphuric acid, where an addition of a small quantity of mercuric sulphate at 180° C. caused "charring" and a violent ebullition of sulphurous acid. The effect of the mercury salt in this case is to greatly further the oxidising action of the acid and to prevent sulphonation, just as in the well-known technical preparation of phthalic acid by oxidising naphthalene with fuming sulphuric acid.—H. L.

Tetramethyldiaminobenzophenone; Nitro-derivatives of ——. A. Kliegl. Ber., 1906, **39**, 1266—1275.

THE author shows that the mono and dinitro-derivatives of Michler's ketone obtained by Nathanson and Müller (see Ber., 1889, 1883), and Grimaux (see Bull. Soc. Chim., 1898, 609), respectively, are 3-nitro- and 3.3′-dinitro-4.4′-tetramethyldiaminobenzophenone. The orientation of the nitro group is thus determined by the carbonyl group. As nitration is carried out in the presence of a large quantity of concentrated sulphuric acid, Grimaux had wrongly assumed that the nitro groups entered the ring in the meta position to the amino groups, in accordance with Noelting and Collin's rule (see Ber., 1884, 261). By reducing the above mononitrotetramethyldiaminobenzophenone with stannous chloride and hydrochloric acid in the cold, 3 amino-4.4′-tetramethyldiaminobenzophenone, m. pt. 139° C., was obtained. The acetyl compound, m. pt. 153·5° 154·5° C., on reduction with zinc and hydrochloric acid in the cold yielded 3-acetamino-4.4′-tetramethyldiphenylcarbinol, m. pt. 145·5°—146° C. These substances were shown to be quite distinct from the corresponding *m*-substituted products, which were prepared for comparison. Thus 2-acetamino-4.4′-tetramethyldiaminobenzophenone obtained by oxidising 2-acetamino-4.4′-tetramethyldiaminodiphenylmethane with chloranil melts at 162° C. On saponification it yields 2-amino-4.4′-tetramethyldiaminobenzophenone, m. pt. 205·5° C., and on reduction 2-acetamino-4.4′-tetramethyldiphenylcarbinol, m. pt. 165° 169° C. H. L.

Gallacetophenone; Condensation derivatives of ——. H. Rupe and L. Veit. Zeits. f. Farben-Ind., 1906, **6**, 101—105.

CONDENSATION derivatives of gallacetophenone have been previously prepared and described by Leontjeff and one of the authors (this J., 1899, 30). The research has been continued by the present authors with the object of determining the chromophoric influence of certain groups in their molecules on compounds of the same class. To this end the following compounds were prepared:—*o-*, *m-*, *and p-Nitrobenzylidene-gallacetophenones*, $C_6H_2(OH)_3.CO.CH:CH.C_6H_4.NO_2$, crystallising respectively in greenish yellow, pale yellow, and golden-yellow needles, of m. pts. 212°, 94° and 138° C., obtained by the action of dry hydrochloric acid gas on mixtures of each of the three nitrobenzaldehydes and gallacetophenone in alcoholic solution. *Meta- and para-nitrobenzal-di-gallacetophenones*, $[C_6H_2(OH)_3.CO.CH_2]_2:CH.C_6H_4.NO_2$,

formed by condensing *m*- and *p*-nitrobenzaldehydes with triacetyl-gallacetophenone and hydrolysing the resulting products, crystallise respectively in yellow and pale yellow needles, melting with decomposition at 220°—230° and 212° C. Attempts to prepare, from gallacetophenone and protocatechuic aldehyde, a compound of the formula $C_6H_2(OH)_2.CO.CH:CH.C_6H_3(OH)_2$, resembling in constitution Maclurin, $C_6H_2(OH)_3.CO.C_6H_3(OH)_2$, were unsuccessful, but its methylene derivative:

$$(HO)_2C_6H_2.CO.CH:CH.C_6H_3:O_2CH_2$$

was obtained by condensing, in alcoholic solution by means of dry hydrochloric acid, triacetylgallacetophenone (2 parts) and piperonal (1 part) and hydrolysing the resulting compound by pouring the solution upon a mixture of ice and water, collecting the crystalline mass which separates and boiling it with alcohol. The product, *methylene - 3.4 - dioxybenzylidene - gallacetophenone*, is insoluble in water, but readily soluble in alcohol, toluene and benzene, from the last of which it crystallises in golden-yellow needles (m. pt. 208° C.). Concentrated sulphuric acid dissolves it with a deep red colour. Its dyeing powder is remarkable, 1 per cent. of it sufficing to dye alumina-mordanted cotton an intense orange, or iron-mordanted cotton black (or reddish-brown? see below), or chrome-mordanted wool brownish-orange. It also dyes from a slightly acid bath unmordanted wool in a pale yellow colour. After repeatedly crystallising it from alcohol, the dyeing power becomes reduced, presumably owing to the separation from the methylene-compound of the free dihydroxy compound formed by its decomposition, with which it is admixed. As, however, the m. pt. of the principal product remains unaltered after this treatment, it would seem that the quantity of the dihydroxy compound thus formed is very minute. The behaviour in dyeing of these compounds, in comparison with that of gallacetophenone, is shown in the following table:—

	On cotton mordanted with		On wool mordanted with
	Iron (3 per cent of dyestuff).	Chrome (3 per cent. of dyestuff).	Chrome (1 per cent. of dyestuff).
Gallacetophenone ("Alizarin Yellow C," B A S F) ...	Grey	Pale olive	Yellowish-olive
o-Nitrobenzal-gallacetophenone	Dark olive	Deep orange	Dull olive
m- " "	Greyish-black	Dull orange	Dull olive
p- " "	Black	Yellowish-green	Olive
p-Nitrobenzal-digallacetophenone	Greyish-black	Yellow	—
Methylene-3.4-dioxybenzal-gallacetophenone	Reddish-brown	Bright orange	Deep yellowish-brown

—E. B.

Amines; Introduction of the CH_2OH and CH_2 groups into primary aromatic ——, and the preparation of imine bases. E. Orloff. J. russ. phys.-chem. Ges., 1906, **37**, 1255—1269. Chem. Centr., 1906, **1**, 1413—1416.

THE imino base,

$$(6)\ (CH_2OH)C_6H_3{<}^{NH(1)}_{CH_2(2)},$$

from sodium formanilide and formalin (this J., 1905, 326), is soluble in glacial acetic acid, and on heating to 140° C. is converted, without melting, into the brown compound,

$$H_2C{<}^{HN}{>}C_6H_3.CH_2.O.CH_2.C_6H_3{<}^{NH.}_{CH_2}$$

The imino base from β-formonaphthalide yields an analogous product on heating to 140° C. Similar imine bases were prepared from *p*-anisidine, *p*-nitraniline and naphthionic acid; they are suitable for the preparation of azo dyestuffs on the fibre. The imine base from diaminodiphenylmethane has the constitution,

$$CH_2{<}^{NH}{>}C_6H_2{<}^{CH_2}{>}C_6H_2{<}^{CH_2.O.CH_2}{>}C_6H_2{<}^{NH,}_{CH_2},$$

and is slightly soluble in mineral acids. *p*-Toludine yields a mixture of the compounds,

$$(4)NH{<}^{(3)CH_2}{>}C_6H_2(CH_3).CH_2.O.CH_2.C_6H_2(CH_3){<}^{NH}_{CH_2}\text{ and}$$

$$NH{<}^{CH_2}{>}C_6H_2(CH_3).CH_2.C_6H_2(CH_3){<}^{NH.}_{CH_2}$$

On treatment with hydrochloric acid and sodium nitrite, these bases are converted into isonitroso compounds, which yield dyestuffs with alkaline β-naphthol. *o*-Toluidine yields the compound,

$$(1)\ (CH_3)C_6H_3{<}^{NH(2)}_{CH_2(3)}.$$

Since *o*-substituted bases yield compounds containing only three groups united to the benzene rings, whilst *p*-substituted bases yield compounds containing four such groups, it follows that groups in the ortho position hinder the introduction of the CH_2OH group into the benzene nucleus.—A. S.

Benzylene-imides. E. Orloff. J. russ. phys.-chem. Ges., 1906, **37**, 1272 -1277. Chem. Centr., 1906, **1**, 1416.

A MIXTURE of 1 mol. of tartaric acid and 2 mols. of formaldehyde in 35—40 per cent. solution, is heated in a closed flask and then, after cooling, 2 mols. of aniline are gradually added, cooling the mixture by water if necessary. The reaction product is dissolved in hot 70 per cent. acetic acid, the solution concentrated, the residue dissolved in water and alkali, alkali carbonate or ammonia added. A white precipitate is produced which gradually turns yellow. After drying at 100° C., the product, benzylene-imide, has the formula:

$$\left[C_6H_4{<}^{NH}_{CH_2}\right]_4.3H_2O.$$

It is soluble in hot acetic acid, insoluble in alcohol and ether. With nitrous acid it yields an isonitroso compound, which forms dyestuffs with alkaline β-naphthol, and can thus be used for the preparation of dyestuffs on the fibre.

For technical purposes, it is not necessary to isolate the imine base, the acetic acid solution being used directly for the production of the isonitroso compound. Benzylene-imide can also be obtained by first preparing anhydro-formaldehyde-aniline from formalin and aniline, and heating this with a mixture of aqueous tartaric acid and glacial acetic acid. 55 grms. of the base are obtained from 35 grms. of 35 per cent. formalin and 37 grms. of aniline. The tartaric acid may be replaced by citric acid. Imide bases were also prepared in an analogous manner from *o*-anisidine and *o*- and *p*-toluidine. The base from *o*-anisidine can be used for the production of dyestuffs on the fibre.—A. S.

Thionine and Azoxine dyestuffs; Constitution of ——. A. Hantzsch. Ber., 1906, **39**, 1365—1366.

THE author admits that Kehrmann's recent publication (see Ber., 1906, 914; this J., 1906, 423) contains experimental evidence in support of his thionium and oxonium formulæ for dyestuffs of the Methylene and Meldola Blue type. The present short notice is intended to close the discussion.

—H. L.

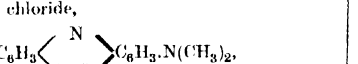
Methylene Azure. F. Kehrmann. Ber., 1906, **39**, 1403—1408.

(A) 10 grms. of Methylene Blue chloride were dissolved by warming in 1 litre of water, the solution cooled, treated

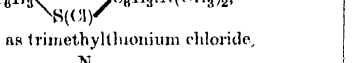
with 10 c.c. of a 40 per cent. solution of caustic soda, and allowed to stand for 24 hours. After passing a current of air through for half an hour, a further 5 c.c. of caustic soda solution were added, and the whole allowed to stand for a further 12 hours, with occasional agitation. The solution was then made faintly acid with acetic acid, diluted to 1½ litres, heated to 40°—50° C., and after filtering, if necessary, repeatedly extracted with chloroform to remove Methylene Violet. The residual aqueous solution was made strongly alkaline with caustic soda, and the Methylene Azure base extracted with chloroform. From the chloroform solution, the acetate of the colour base was obtained by shaking out twice with 50 c.c. of water containing a few drops of glacial acetic acid. The filtered solution of the acetate was treated with the necessary quantity of concentrated hydrochloric acid, and after standing for 24 hours, Methylene Azure chloride was obtained in brownish glistening needles with a faint greenish lustre.

(B) About 1 grm. of Methylene Azure iodide obtained by Bernthsen's method (Annalen, 1885, **230**, 170) by the oxidation of Methylene Blue with silver oxide, was extracted several times with hot water, the solution cooled, made strongly alkaline with caustic soda, and extracted with chloroform. From the chloroform solution, Methylene Azure acetate was obtained as described above, and from this the chloride was separated by treatment with hydrochloric acid and sodium chloride. The product was similar to but not identical with that described under (A), being somewhat more soluble, and giving a more bluish-green solution in concentrated sulphuric acid.

By comparison with synthetically prepared products, the author identified compound (A) as unsymmetrical dimethylthionium chloride,



and compound (B) as trimethylthionium chloride,



Whether the Methylene Azure obtained consists chiefly of trimethylthionine or of dimethylthionine depends upon the method of preparation and purification. If, for example, a mixture of the chlorides of the two compounds mentioned be repeatedly crystallised, the final product consists of almost pure dimethylthionine chloride, the more soluble trimethyl compound remaining in the mother liquors.—A. S.

English Patents.

Dyestuffs; Manufacture of new raw materials and of new azo —— therefrom. G. Nuth, Neuilly sur Seine, H. Hold and H. Ruegg, Paris. Eng. Pat. 14,618, July 15, 1905. Under Int. Conv., July 16, 1904.

See Fr. Pat. 344,844 of 1904; this J., 1904, 1210.—T. F. B.

Indigo paste; Manufacture of - - . J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1954, Jan. 25, 1906.

Indigo pastes for the fermentation vat, *e.g.*, those prepared according to Eng. Pat. 3108 of 1904 (this J., 1905, 24) have the disadvantage that, when used for dyeing, there is a certain delay while the indigo is being reduced. It is now found that if a reduced form of indigo, for instance indigo-white, be employed instead of indigo, stable pastes are obtained which yield at once a vat suitable for dyeing. For example: 1600 parts of a 50 per cent. indigo-white press-cake are mixed with 450 parts of bran, 200 parts of wheat flour, 200 parts of quicklime, and 1550 parts of water to form a homogeneous paste. It is stated that the proportion of quicklime should never be less than about 25 per cent. of the amount of fermentable substances present in the paste.—A. S.

Dyestuff; Manufacture of a red vat dyeing —— [Thio-Indigo Red]. O. Imray, London. From the Society of Chemical Industry, Basle, Switzerland. Eng. Pat. 4687, Feb. 26, 1906.

A red vat dyestuff having the constitution of indigo in which the imino groups have been replaced by sulphur, can be obtained from salicylthioacetic acid, $COOH.C_6H_4SCH_2.COOH$—(1) by heating it either alone or in presence of a condensing agent such as acetic anhydride, and then treating the product in alkaline solution with an oxidising agent (air, sodium hypochlorite, potassium permanganate); or (2) by heating it in presence of a suitable solvent capable of yielding oxygen, *e.g.*, a nitro derivative of an aromatic hydrocarbon.

Examples.—(1) Ten parts of salicylthioacetic acid are mixed with 50 parts of acetic anhydride and boiled under a reflux condenser for about five hours. The acetic anhydride is distilled off, the residue dissolved in dilute caustic soda lye, and the dyestuff precipitated by heating with an aqueous solution of 10 parts of potassium permanganate. To purify the dyestuff from co-precipitated manganese dioxide, it is dissolved by addition of 5 parts of sodium hydrosulphite (hyposulphite), the solution is filtered, and the dyestuff re-precipitated by a current of air. (2) Ten parts of salicylthioacetic acid are boiled for about five hours with 50 parts of nitrobenzene under a reflux condenser, the mixture is cooled, and the dyestuff which has separated in the form of lustrous, brownish-red crystals, is collected, washed free from adhering nitrobenzene by alcohol, and dried. (See also this J., 1906, 367; also Kalle und Co., Fr. Pats. 359,398, 359,399 and 359,400 of 1905; this J., 1906, 424, 426.)

—A. S

United States Patents.

Dye and process of making same; Blue —— [Anthracene dyestuff]. O. Bally, Mannheim and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 818,336, April 17, 1906.

See Seventh Addition to Fr. Pat. 349,531 of 1904, following these.

Phenylglycin salts; Process of making — —. W. Behaghel and K. Schumann, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S Pat. 818,341, April 17, 1906.

See Eng. Pat. 5564 of 1905; this J., 1905, 541.—T. F. B.

Dyestuff and process of making same; Anthracene ——. O. Bally and M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 818,992, April 24, 1906.

See Sixth Addition of June 22, 1905, to Fr. Pat. 349,531 of 1904; this J., 1906, 14.- T. F. B.

Dye and process of making same; Sulphur — [Sulphide dyestuff]. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 818,980, April 24, 1906.

See Eng. Pat. 14,543 of 1905; this J., 1906, 260.—T. F. B.

Dye and process of making same; Yellow - — [Azo dyestuff]. F. Scholl, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 818,981, April 24, 1906.

See Ger. Pat. 158,148 of 1904; this J., 1905, 542.—T. F. B.

French Patents.

Indigo; Process of making dyestuffs from chlorinated ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,477, Feb. 24, 1905.

See Eng. Pat. 3182 of 1905; this J., 1905, 964.—T. F. B.

Dyestuff suitable for the preparation of lakes; Process for making an azo ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,665, March 4, 1905.

See Ger. Pat. 163,644 of 1904; this J., 1906, 216.- T.F.B.

Indigo White; Process for obtaining preparations of —— suitable for the vat, and especially the fermentation vat. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,668, March 6, 1905.

SEE Eng. Pat. 4647 of 1905; this J., 1906, 174.—T. F. B.

Vat dyestuff; Production of a new ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,292, Dec. 9, 1905. Under Int. Conv., Jan. 30, 1905.

A NEW dyestuff which can be applied from a vat in the same way as indigo is obtained by heating with alkali the glycin formed by the action of chloracetic acid on dianthranilic acid.

Example.—31·6 kilos. of sodium dianthranilate are dissolved in water and 25 kilos. of sodium chloracetate added; the solution is heated under a reflux condenser until the yellowish-brown product which separates, no longer increases in quantity. This is filtered off, washed with water and dissolved in sodium carbonate solution to obtain a neutral solution of the sodium salt of the glycin. It is finally evaporated to dryness. Twenty kilos. of this salt are introduced into a mixture of 20 kilos. of caustic soda and 20 kilos. of caustic potash heated to 250° C. The mass is heated for a short time at 270°—280° C. The cold melt is dissolved in water and the dyestuff separated as green flocks by passing in air.

—A. B. S.

Dyestuffs; Process for making yellow to orange-yellow sulphide ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 360,780, March 10, 1905.

SEE Eng. Pat. 27,091 of 1904; this J., 1905, 1167.—T.F.B.

Dyestuffs of the anthracene series; Production of new ——. Badische Anilin und Soda Fabrik. Seventh Addition, dated Nov. 9, 1905, to Fr. Pat. 349,531 of Dec. 21, 1904. Under Int. Conv., Oct. 9, 1905.

BY treating the dyestuffs produced by the action of alkalis on the benzanthronequinolines and benzanthrones with halogens, new dyestuffs are obtained which differ slightly in shade from the original dyestuffs, and, as a rule, are more easily reduced in the dye-vat.

Example.—One kilo. of cyananthrene is suspended in 10 kilos. of nitrobenzene at 60°—70° C., and a current of dry chlorine is passed in until a sample, precipitated with alcohol, gives with an alkaline solution of hydrosulphite (hyposulphite) a vat of a greenish-blue colour. The dyestuff is then precipitated with alcohol, filtered, washed with alcohol and dried. —A. B. S.

Indigo white; Production of dry, stable alkali salts of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 360,447, Dec. 9, 1905. Under Int. Conv., Oct. 7, 1905.

SEE Eng. Pat. 23,122 of 1905; this J., 1906, 65.—T. F. B.

GERMAN PATENTS.

Dyestuffs of the cyanine series; Process of preparing sensitising ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 167,770, May 26, 1903. Addition to Ger. Pat. 167,159, March 14, 1903.

INSTEAD of using toluquinoline or toluquinaldine for the preparation of cyanine dyestuffs as described in the principal patent (see Eng. Pat. 9598 of 1903; this J., 1904, 384), methoxy- or ethoxy-quinoline or -quindaldine is employed. *p*-Toluquinaldine-*p*-methoxyquinolinecyanine ethyl iodide and *p*-methoxyquinaldine-*p*-toluquinolinecyanine ethyl iodide are specially mentioned. These new dyestuffs are stated to produce photographic emulsions possessing high red-sensitiveness; the sensitive band is very even, with no break in the green; the plates obtained are said to be stable and free from tendency to fog.—T. F. B.

Chloroindigo; Process of preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 167,830, March 5, 1904.

DRY indigo or one of its salts is suspended in an indifferent solvent (*e.g.*, carbon tetrachloride) and treated with chlorine in presence of some chlorine-carrier (*e.g.*, iodine), either at the ordinary pressure, or at increased pressure According to the extent of the chlorination, the product dyes redder and brighter shades. The dichlorinated product is said to give very similar dyeings to the product obtained synthetically from *m*-chloronitrobenzaldehyde.

—T. F. B.

Lakes [from azo dyestuffs]; Process of preparing red colour ——. Meister, Lucius und Brüning. Ger. Pat. 165,823, Aug. 20, 1904. XIIIA., page 486.

Dyestuffs; Process of preparing new blue mordant oxazine ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 166,079, Oct. 7, 1904.

GALLOCYANINES are condensed with one of the aminobenzoic acids in presence of a suitable solvent, at a high temperature; the resulting oxazine dyestuffs are soluble in water, and bluer in shade than the original gallocyanines. They are applicable directly to dyeing and printing, and produce fast lakes with chromium mordants on animal or vegetable fibres.—T. F. B.

α-β-Nitromethoxyanthraquinones; Process of preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 167,699, Nov. 8, 1904.

THE two dinitroanthraquinones (*α-β-* and *α-α'-*) obtained by nitrating anthraquinone, and separated by fractional crystallisation, behave differently when heated with alkali methylate; the *α-α'*-derivative is converted into the dimethoxyanthraquinone, whilst, if equal mols. of the methylate and dinitroanthraquinone are used, the latter is converted into *α-β*-nitromethoxyanthraquinone. It differs from the *α-β*-dinitro-compound in being easily soluble in concentrated sulphuric acid; it can also be readily crystallised.—T. F. B.

Dyestuffs; Process of preparing mordant-dyeing o-hydroxymonoazo ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 167,333, Feb. 5, 1905.

THE diazo derivative of *o*-aminophenol is combined with chromotrope acid in strong caustic alkali solution. The dyestuff dyes wool from acid baths in Fuchsin red shades, and gives fast blue shades on chrome-mordanted fibr (s.

—T F. B.

Diaminodinaphthazines; Process of preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 166,363, Feb. 8, 1905.

DINAPHTHAZINE is nitrated with 2 mols. of nitric acid in concentrated sulphuric acid solution, and the resulting dinitro-compound reduced in the usual manner to diaminodinaphthazine; this differs from the known aminoazines in that it gives no hydroxy-derivatives by heating under pressure with hydrochloric acid. By diazotisation and combining with the usual components, azo dyestuffs are obtained giving dyeings on cotton which are fast to washing.—T. F. B.

Dyestuffs susceptible to chroming; Process of preparing azo ——. L. Cassella und Co. Ger. Pat. 167,640, Oct. 22, 1903.

o-AMINO-*o*-NITRO-*p*-ACETAMINOPHENOL is diazotised and combined with aminonaphtholsulphonic acids or dihydroxynaphthalenesulphonic acids. The 2.3.6-, 2.8.6-, and 1.8.4-aminonaphtholmonosulphonic acids, 1.8.2.4- and 1.8.3.6-aminonaphtholdisulphonic acids, 1.8.4-dihydroxynaphthalenemonosulphonic acid and 1.8.3.6-dihydroxynaphthalenedisulphonic acid are specially mentioned. The dyestuffs dye wool in blue shades, converted to green by chroming; the dyeings are fast to washing and light.

—T. F. B.

Phenylglycin; Process of preparing ——. A. Wohl and O. Blank. Ger. Pat. 167,698, Nov. 25, 1903.

A SALT of chloracetic acid is treated with excess of aniline in presence of a quantity of an alkaline-earth which is sparingly soluble in water (*e.g.*, calcium or magnesium carbonate).—T. F. B.

Dyestuff; Process for preparing a disazo ——. Kalle und Co., A.-G. Ger. Pat. 166,980, Aug. 11, 1904.

THE intermediate product obtained from tetrazotised

nitrobenzidine and salicylic acid is combined with 1.2-naphtholsulphonic acid. The dyestuff produces red-brown shades on wool from sulphuric acid solutions, the shades being converted into fast orange-brown dyeings on subsequent chroming. Other naphthol-sulphonic acids only form red dyestuffs by this method. T. F. B.

p-Mono- and p-dichloroanthrarufin [Anthracene dyestuffs]; Process of preparing . R. Wedekind und Co. Ger. Pat. 167,743, Aug. 19, 1904.

ANTHRARUFIN is suspended in boiling, dilute sulphuric acid (b. pt. 140° C.) and chlorine is passed into the mixture. According to the amount of chlorine added, the *p*-mono- or *p*-dichloroanthrarufin is obtained. Both are converted into pure blue dyestuffs by condensation with aromatic amines.—T. F. B.

Dyestuffs; Process of preparing brown sulphide —. K. Oehler. Ger. Pat. 167,429, Oct. 21, 1904. See U.S. Pat. 801,598 of 1905; this J., 1905, 1167.

BESIDES *m*-phenylenediamine, other diammo- and dinitro-compounds of the benzene series may be heated with methylenediresorcinol and sodium sulphide to form brown sulphide dyestuffs. T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 426.)

Animal textile fibres; Phenomena accompanying the dyeing of —. P. Gelmo and W. Suida. Monatsh Chem., 1906, **27**, 225—235.

IN a previous communication (this J., 1905, 920) the authors, in referring to the action of cold solutions of ammonia and hydrochloric and sulphuric acids on wool, gave absorption-values, which had been erroneously stated, and should have been expressed in the following proportions:—(1) NH_3:20HCl:24H_2SO_4/2 and (2) NH_3: 20HCl:21H_2SO_4/2, so that the basic character of wool is shown to be even greater than was previously supposed. In order to determine the changes which accompany the hydrolysis of wool in the process of dyeing, a series of experiments was made, in which the wool was boiled for one hour, 21 and 60 hours respectively, with distilled water, dilute hydrochloric acid, dilute ammonia and dilute sodium carbonate solution. Each specimen was then washed with cold distilled water until the washings were free from the reagents employed, and, after drying, titrated with N/10 solutions of sulphuric acid, hydrochloric acid and ammonia, using methyl orange as indicator. The results given in the following table show that in the early stages of the treatment the acid character of wool is increased without, however, changing its basic nature:

	Proportion of		
	NH_3.	HCl	$\frac{1}{2}H_2SO_4$
Untreated wool	1	17·3	20·3
Wool treated with H_2O for 1 hour	1	8·1	9·8
" " " HCl " "	1	3·6	3·8
" " " NH_3 " "	1	8·4	9·1
" " " Na_2CO_3 "	1	9·4	9·9

By prolonging the treatment the increase in acid character is gradually lessened (except in the case in which the wool was treated with sodium carbonate), and from this result it is inferred that the hydrolytic disintegration does not proceed uniformly throughout the entire operation, but is more energetic in its action at the commencement of the treatment. The experiment in which water alone was used, shows that a considerable proportion of the wool-substance goes into solution, and that this decomposition is accompanied by an increase in the acid character of the wool. The action of dilute hydrochloric acid is similar to that of water, whilst the effect of ammonia is to dissolve a much larger amount of the wool-substance. Sodium carbonate also occasions a considerable diminution in the weight of the wool, and changes the proportion of acid and basic properties in the early part of the treatment. Specimens of untreated wool and of wool treated with water, ammonia and sodium carbonate were dyed with Crystal Violet and Crystal Ponceau in a neutral bath, washed with hot water and soaped at 70° C. The dyeings were the same in each case, the only difference being that with Crystal Violet the untreated wool was faster to soaping than the treated specimens. The colours obtained with Crystal Violet on wool treated with hydrochloric acid were weaker and more unstable to soaping than those produced with untreated wool. Although wool boiled with dilute acid is more intensely dyed by Crystal Ponceau in a neutral bath, its stability to soaping is greatly reduced. Further experiments on the treatment of wool with alcoholic sulphuric acid have shown that the fibre acquires considerable affinity for the acid, combining therewith so intimately that it cannot be removed by washing with cold water. It is, however, liberated by treatment with hot ammonium carbonate solution. This result points to the presence of a fairly stable salt in the wool. Wool, which has been treated with the above-named reagents, gives with diazonium compounds, stronger colours than when dyed therewith without previous treatment. A similar effect was produced with Millon's reagent.—D. B.

Hydrosulphites; Recent work on . A. G. Green. J. Soc. Dyers and Col., 1906, **22**, 9—11.

THE author discusses recent work on the hydrosulphites. In 1900, Bernthsen and Bazlen (this J., 1900, 244) obtained the salt, $Na_2S_2O_4.2H_2O$, in a tolerably pure form by saturating the solution of the crude compound with common salt. In 1902, the anhydrous salt, $Na_2S_2O_4$, was obtained by treating the hydrated salt with boiling strong alcohol (see Fr. Pat. 341,718 of 1904; this J., 1904, 900). It is a fine white friable powder, much more stable than the hydrated salt, and is sold under the name of "Hydrosulphite B.A.S.F." By acting on sodium hydrosulphite solution with formaline, Baumann, Thesmar and Frossard (this J., 1904, 658) obtained a product having the empirical formula, $Na_2S_2O_4.2CH_2O.4H_2O$, which they named sodium hydrosulphite-formaldehyde; it is sold under the names "Hydrosulphite N.F" and "Hyraldite A." Subsequently it was discovered that this product is not a single compound, but is a mixture in molecular proportions of sodium bisulphite-formaldehyde, $NaHSO_3.CH_2O$, and a new compound, $NaHSO_2.CH_2O$, named by Baumann, Thesmar and Frossard (this J., 1904, 1211) sodium bihydrosulphite-formaldehyde, but re-christened by Bernthsen (this J., 1905, 329) sodium sulphoxylate-formaldehyde. Sodium sulphoxylate-formaldehyde, in the pure state, forms large colourless crystals containing 2 mols. of water; it is sold under the name "Rongalite C" [also as "Hydrosulphite N.F extra" or "conc." or "extra conc.," and "Hyraldite C"], and has double the reducing power of "Hydrosulphite N.F" or "Hyraldite A." The discovery of this compound led to further controversy as to the constitution of sodium hydrosulphite (see Baumann, Thesmar and Frossard, this J., 1904, 1211; Prud'homme, this J., 1905, 89; Bernthsen, Bazlen, and Reinking, Dehnel and Labhard, this J., 1905, 329, 330). The general conclusions to be drawn appear to be that sodium hydrosulphite is an anhydride salt derived from equal molecules of sulphurous and sulphoxylic acids:

$$O\!<\!\begin{matrix}S.ONa\\SO.ONa\end{matrix}$$

This salt is stable in aqueous solution, but when treated with formaldehyde, it reacts according to the equation:—

$$O\!<\!\begin{matrix}S.ONa+2CH_2O\\SO.ONa+H_2O\end{matrix} =$$

HO.CH_2O.S.ONa (sodium sulphoxylate-formaldehyde)
and
HO.CH_2O.SO.ONa (sodium bisulphite-formaldehyde)

—A. S.

α-Naphthylamine Claret; Discharging ——. L. Baumann and G. Thesmar. Z. Farben-Ind., 1906, **6**, 121—125.

THE discharge printing-mixture, containing as active ingredients sodium sulphoxylate-formaldehyde, ferric citrate, sodium nitrite, and glycerin, particulars of which have recently been published (this J., 1906, 371), has been successfully employed for some months at the print works of E. Zündel, in Moscow. Although its cost is a little higher than that of the thickened solution of sodium sulphoxylate-formaldehyde (composed of 40 per cent. of "Hyraldite A"), which, as H. Werner points out (Z. Farben-Ind., 1906, 94), discharges dyeings of Naphthylamine Claret when printed and steamed at a relatively high temperature in Simon and Weckerlin's apparatus (this J., 1905, 1226), its use offers important advantages in practice. Thus, in the first place, deeper shades of claret are discharged by it under ordinary conditions of steaming than can be discharged by means of the simple "Hyraldite" mixture with the aid of superheated steam. At the lower temperature of steaming, again, there is little or none of the sublimation of azo dyestuff from the interior to the surface of the fibre which occurs at higher temperatures. The ground colour steamed in the ordinary manner is thus faster to rubbing than that which has been exposed in this operation to a higher temperature. Further, the "whites" obtained at the lower temperature with the mixture of ferric citrate, &c., are much purer than those produced by the unassisted "Hyraldite" at a temperature of 120°—125° C. This is due to the fact that at the higher temperatures, sodium sulphoxylate-formaldehyde (or "hydrosulphite formaldehyde") is decomposed into thioaldehyde, sodium sulphide, sulphur and other substances, some of which remain on the fibre after washing and soaping and discolour the "whites." The change which the reducing agent undergoes at the ordinary temperature of steaming is pure one of oxidation of sulphoxylate formaldehyde into sodium bisulphite-formaldehyde, without the formation of secondary products. Finally, under the influence of superheated steam, some of the basic dyestuffs employed in the production of coloured discharges are destroyed by over-reduction.

The apparatus used by the authors in effecting discharges on Claret-dyed grounds, is an ordinary Mather Platt ager. It has no special internal heating arrangements. Steam is admitted to it under a pressure of 2 kilos. The temperature within the apparatus is 102°—103° C., and the duration of the operation is three to three and a half minutes. Small chambers are recommended in preference to those of larger size.

The treatment of the tissues with dilute acid, which follows the steaming and washing operations, has for its object the removal from the tissues not only of traces of iron left in them, but also that of small quantities of reduction-compounds, resulting from the decomposition of the azo dyestuff, namely, α-naphthylamine and α-amino-β-naphthol, which are not as a rule completely removed by washing and soaping alone. If imperfectly removed, they become oxidised and soil the "whites" during the storage of the tissues.

Temperatures of 120°—125° C. would thus appear to be not only not essential, but positively harmful, in steaming tissues dyed in α-Naphthylamine Claret for the production of discharges by means of printing-mixtures containing sodium sulphoxylate-formaldehyde. The authors consider, however, that Simon and Weckerlin's apparatus may be serviceable in giving temperatures of 110°—115° C. for the steaming of this style, but think that the latter temperature cannot safely be exceeded.—E. B.

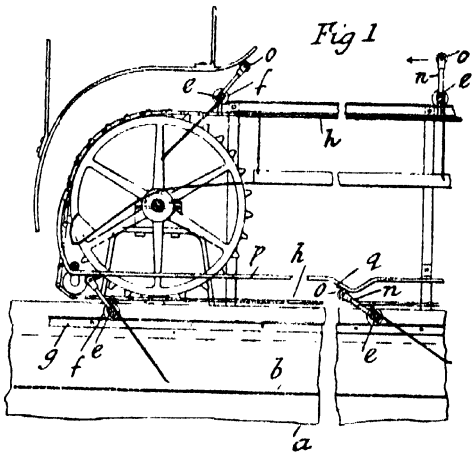
ENGLISH PATENTS.

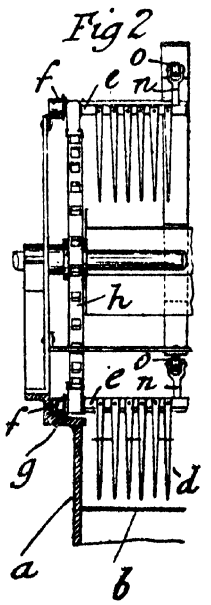
Threads; Manufacture of artificial ——. R. Linkmeyer, Herford, Germany. Eng. Pat. 4746, March 7, 1905. Under Int. Conv., April 6, 1904.

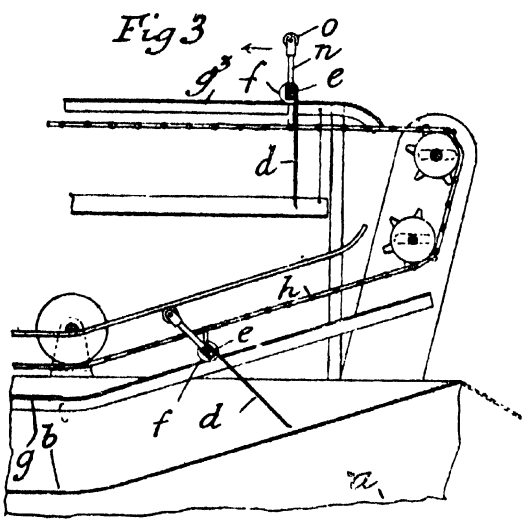
A LARGE proportion of the ammonia employed can be recovered from the solutions of cellulose-cuprammonium without causing precipitation of the cellulose; this is best effected by agitating the solution *in vacuo*, at a temperature not below 45° F., the ammonia being continually withdrawn from the apparatus. A thick liquid is thus obtained, which is stated to be easily filtered, and to solidify readily in contact with suitable precipitants.—T. F. B.

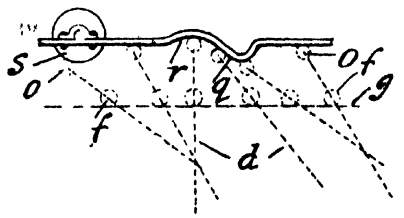
Wool scouring machines. T. A. Jones, Melbourne, Australia. Eng. Pat. 17,026, Aug. 22, 1905.

RAKES, composed of bars, *e* (see Figs.), and teeth, *d*, (Figs. 2, 3 and 4), having at their ends supporting rollers, *f*, running on rails, *g*, are conveyed by means of endless chains, *h*, through a scouring tank, *a*, provided with a false bottom, *b*. From the middle of each rake projects a shank, *n*, surmounted by an anti-friction device, such as a roller, *o*, coming into contact with a rail, *p*, so disposed as to keep the rake inclined forwards as it is carried through the tank. At intervals, devices, such as projections, *q*, from, or recesses, *r*, in the rails, *g*, or discs, *s*, mounted on the latter, are arranged in the path of the rollers, *o*, to cause the rakes to be tilted up or down. After arriving at the exit-end of the apparatus, the rakes return above the tank to the









entrance-end, the rollers, *f*, running upon an upper rail, g^3, and the rakes hanging freely downwards. The tank when in use is filled with a solution of a suitable cleansing agent, *e.g.*, soap, the scouring action of which upon the loose wool is assisted by the agitation produced by the tilting motion given to the rakes by which the wool is propelled through the tank.—E. B.

Dyeing, scouring and other treatment of textile materials by liquids; Impts. in —— and in apparatus therefor. O., J. and C. Obermaier, Lambrecht, Germany. Eng. Pat. 17,568, Aug. 30, 1905. Under Int. Conv., Aug. 30, 1904.

See Fr. Pat. 345,945 of 1904; this J., 1905, 87.—T. F. B.

Discharging dyed materials and pastes therefor. J. Y. Johnson. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,524, July 28, 1905.

Neutral or slightly alkaline pastes for discharging in pattern dyeings of Naphthylamine Bordeaux, Paranitraniline Red, Chloranisidine Orange, Orthonitrotoluidine Yellow, Dianisidine Black, Chrysoidine Bistre and analogous compounds on textile materials, are prepared from sodium hydrosulphite (hyposulphite-)formaldehyde or sodium sulphoxylate-formaldehyde, along with a metal, metallic oxide or metallic salt, which either is itself a reducing agent or is capable of acting as a carrier of "the reducing power" (the salts of iron, *e.g.*, "iron chloride" and "iron sulphate" being preferred), a nitrite, Turkey-red oil, an alkali citrate and a neutral thickening, *e.g.*, starch and gum tragacanth paste. The discharges are effected by steaming for a few minutes the tissues printed with these pastes, then washing, souring, and soaping. Colour discharges are obtained by adding suitable dyestuffs, in some instances along with mordants, to the white discharge mixtures. As the latter are neutral or only slightly alkaline, they may be employed in discharging dyeings on textile materials composed of animal fibres. (See this J., 1906, 371, also page 473.)—E. B.

Fibre; Production of brown shades on the —— with or without white or coloured discharge effects. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 17,241, Aug. 25, 1905.

See Fr. Pat. 357,472 of 1905; this J., 1906, 120.—T. F. B.

Ketone sulphoxylates; Manufacture of ——. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on Maine, Germany. Eng. Pat. 4073, Feb. 19, 1906. Under Int. Conv., Sept. 30, 1905.

Ketone-sulphoxylates are produced by subjecting to the action of reducing agents compounds or mixtures of acetone or methylethylketone with sulphurous acid, bisulphites or hydrosulphites (hyposulphites). For example, 200 parts of zinc dust, stirred into a paste with a little water, are introduced into a solution of 130 parts of acetone in 520 parts of sodium bisulphite at 20° B. and 500 parts of water. The mixture is heated at 50°–60° C. as long as an increase in its reducing power is observed to take place. It is then cooled, filtered and evaporated in a vacuum. The reaction is accelerated by the presence of a zinc salt, *e.g.*, zinc chloride. The ketone-sulphoxylates obtained by this method differ, it is stated, from formaldehyde-sulphoxylates in being less stable than the latter, being capable, for instance, of reducing indigo-sulphonic acid in the cold. They also act more powerfully than formaldehyde compounds in the discharge of dyeings of Naphthylamine Claret and similar dyestuffs.—E. B.

Textile fabrics; Manufacture of pastes for discharging dyed — . J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 26,381, Dec. 18, 1905.

Discharge printing-mixtures, stated to be of excellent stability, are prepared from hydrosulphites (hyposulphites) free from water of crystallisation, a sugar or a concentrated solution of a sugar, *e.g.*, the uncrystallisable or difficultly crystallisable syrups obtained in the manufacture of sugar, and thickening agents; a mixture is made, for example, of 2 parts of British gum, 2 parts of water, 3 parts of "sodium hydrosulphite B.A.S.F." in powder, and 3 parts of sugar syrup. The tissues printed with this are steamed for a few minutes and then washed as usual.—E. B.

United States Patent.

Bleaching composition. A. E. Nienstadt, Newark, N.J., Assignor to G. W. Kuehler, New Rochelle, N.Y. U.S. Pat. 817,267, April 10, 1906.

Claim is made for a powder consisting of 1 part of sodium peroxide mixed with 4 parts of anhydrous sodium carbonate.—A. B. S.

French Patents.

Silk; Manufacture of artificial ——. H. E. A. Vittenet. First Addition, dated Feb. 3, 1905, to Fr. Pat. 350,383, Dec. 8, 1904 (this J., 1905, 921).

The opacity of the threads formed from gun-cotton and acetone is said to be due to the presence of moisture which gives rise to a mixed hydrate of nitrocellulose and acetone. If cellulose be considered to have a ketonic group (CO), the equation can be written thus:

$$(CH_3)_2CO + (OC) : C_6H_{10-n}(NO_2)_nO_4 + H_2O = (CH_3)_2C(OH).O.C(OH) : C_6H_{10-n}(NO_2)_nO_4.$$

To obtain a clear thread this hydrate must be dissociated, and sulphur dioxide gas is employed for the purpose.—A. B. S.

Scouring machine; Inclined ——. G. Malard. Fr. Pat. 360,183, Oct. 7, 1905. Under Int. Conv., April 13, 1905.

The invention relates to a scouring machine in which the

usual horizontal trough is replaced by one at an angle of about 45 degrees. The wool is fed into a vertical portion attached to the upper end of this trough and slides by its own weight down the inclined bed, passing finally between a pair of squeezing rollers at the lower end. The trough is furnished with a perforated false bottom, which is divided into several divisions so that the scouring liquids from different portions of the trough are collected separately after passing through the wool. These various portions of liquid are run into tanks and forced by pumps through tubes ending in spray pipes which are placed along the upper surface of the tank. There is an automatic arrangement for using the various portions of liquid again in a continuous manner on the accumulator system, the portions saturated with grease, &c., being run off.
—A. B. S.

Silk; Boiling off, bleaching and dyeing of ——. Soc. Schmid Frères. First Addition, dated Jan. 21, 1905, to Fr. Pat. 345,173 of July 27, 1904.

For piece goods the machine consists of a closed tank, the upper portion of which is fitted with vertical rollers on which the pieces pass to and fro. The lower portion contains the soap bath, and is fitted with a steam coil for heating the solution, and also with a perforated coil for injecting air, which causes the soap to froth so that the foam fills the upper portion of the tank in which the pieces are moving. From this tank the pieces pass into a smaller similar one and then into another tank which contains a cone with sides inclined at about 20 degrees to the horizontal. The pieces pass over this cone and an inclined roller, and are so changed from a vertical to a horizontal position in which they pass through a number of washing tanks. For yarn, an endless chain which carries the yarn sticks is fitted in the soaping tank and has an arrangement for rotating the hanks during their passage.—A. B. S.

Silk; Process and apparatus for degumming, bleaching and dyeing ——. Soc. Schmid Frères. Second Addition, dated Feb. 3, 1905, to Fr. Pat. 345,173 of July 27, 1904 (this J., 1905, 24).

The process is essentially to carry out in one operation that described in the principal patent (*loc. cit.*). The hanks are passed over two or more horizontal rows of reels, being placed on the upper set of rollers, and removed from the lowest set. An arrangement is provided so that when the bottom set is emptied, the next higher one moves down and the empty set rises to the top and is ready for recharging.—A. B. S.

Yarns in the form of cops or on bobbins; Dyeing ——. H. L'Huillier. First Addition, dated Nov. 22, 1905, to Fr. Pat. 350,981, Jan. 24, 1905 (this J., 1905, 888).

To prevent the movement of the bobbins during the circulation of the dye liquor, a plate is placed over them with holes into which pass the closed ends of the bobbin tubes. Close to each hole is placed a flexible plate which presses down on the particular bobbin and keeps it in place. The bobbins can also be kept in place by means of a small conical cap which fits over the end of the bobbin tube and is kept pressed against the bobbin by means of a screw. Instead of a screw the conical caps can be held in place by a plate passing over all the bobbins.—A. B. S.

Hydrosulphites; Process of making ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,620, Dec. 4, 1905. Under Int. Conv., Dec. 28, 1904.

See Eng. Pat. 26,173 of 1905; this J., 1906, 177.—T. F. B.

Aldehyde-hydrosulphites [-hyposulphites]; Preparation of ——. Chem. Fabr. von Heyden, Akt.-ges. Fr. Pat. 360,306, Dec. 11, 1905.

To obtain aldehyde-hydrosulphites free from aldehyde-bisulphites, sulphurous acid is run into a mixture of the aldehyde and zinc or iron powder in a quantity just sufficient to convert the zinc or iron into the hydrosulphite compound.

Example.—Into a well-agitated mixture of 65 kilos. of zinc dust and 80 kilos. of a 40 per cent. solution of formaldehyde, enough sulphurous acid is added to convert the zinc into the hydrosulphite compound (this requires about 53 kilos. of sulphur dioxide). The reaction is as under:

$$CH_2O + Zn + SO_2 + H_2O = OH.CH_2.OSOZn(OH).$$

The difficultly soluble zinc salt is ready for use, or it may be filtered, washed and dried *in vacuo*. By double decomposition with sodium carbonate, the sodium salt of formaldehyde-hydrosulphite ($HO.CH_2.OSONa$) can be obtained. This is easily soluble in water, and the solution can be separated from the zinc carbonate by filtration. This solution can be evaporated *in vacuo* either until it crystallises or to a dry powder. The products have more than twice the indigo-reducing power of the usual double compound of formaldehyde-bisulphite.—A. B. S.

German Patent.

Fibrous substances (textiles, leather, paper, &c.); Process for waterproofing ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 166,350, May 12, 1904.

The material to be waterproofed is impregnated with an aqueous emulsion of ammonium salts of insoluble fatty or resin acids with fats, waxes, solid hydrocarbons, paraffin wax, ceresin, &c., and oils, and is afterwards dried, preferably by the aid of heat, in order to decompose the ammonium salts, and finally calendered or ironed.
—A. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 426.)

English Patent.

Printing processes [for wood, &c.]; Impts. in ——. W. E. Evans, London. From W. Goodwin, Owen Sound, Ontario, Canada. Eng. Pat. 6921, April 1, 1905.

With the object of printing upon surfaces of wood, textile fabrics, metal ware, &c., coloured patterns, in imitation of the graining of oak, mahogany and other woods, flat blocks or printing cylinders composed of, or having surfaces, *e.g.*, thin sheets or veneers, composed of these woods, are levelled and smoothed and then brushed with a stiff brush, such as a steel wire brush, to remove the softer parts of the wood and leave in the surfaces thus prepared, pits or recesses for the reception of the printing mixtures of ivory black, Vandyke brown, "japan," boiled linseed oil, &c., to be applied. Before use the blocks and cylinders are coated with oil to harden them. The printing is accomplished in the usual manner.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 427.)

Ammonia; Oxidation of —— to oxygen compounds of nitrogen. O. Schmidt and R. Böcker. Ber., 1906, **39**, 1366—1370.

Three series of experiments were made:—(1) Air or oxygen was passed through a N/10 solution of ammonia heated to 70°—90° C., and then through a combustion tube filled with platinised asbestos and heated in a furnace just to redness. The reaction products were absorbed in two vessels containing caustic soda solution (1:4). Four litres of air or oxygen were passed through in each experiment (one to two hours). (2) The second absorption flask contained an acid solution of permanganate instead of caustic soda solution. (3) Instead of platinised asbestos a platinum spiral was employed, heated just to redness by means of an electric current of 3½ ampères and 85 volts. After each experiment the ammonia taken up was determined by titration of the residual solution, the amount of ammonia oxidised by reducing a portion of the absorbing solution and titrating the ammonia

produced, and the nitrite by titrating another portion of the absorbing liquid with permanganate. The results are shown in the following table:—

SERIES I.

(*a*) *With oxygen.*

N/10 Ammonia used.	N/10 Ammonia after reduction	Ammonia oxidised	N/10 Permanganate used.	Nitrous acid, calculated from permanganate used.
26·89	13·50	64·62	23·72	87·82
41·45	31·90	75·77	39·72	62·26
33·20	25·74	77·53	47·22	91·72
41·69	26·34	63·17	38·22	72·55

(*b*) *With air.*

N/10 Ammonia used	N/10 Ammonia after reduction	Ammonia oxidised	N/10 Permanganate used.	Nitrous acid, calculated from permanganate used.
53·40	39·83	74·60	59·42	74·59
51·16	40·73	79·77	63·52	76·20
11·03	7·38	66·91	11·78	79·31
74·74	57·11	76·42	93·32	81·70

SERIES II.

N/10 Ammonia used.	N/10 Ammonia after reduction	Ammonia oxidised.	N/10 Permanganate used	Nitrous acid, calculated from permanganate used
13·07	10·13	70·62	8·79	43·39
22·63	18·45	81·53	34·04	94·69
33·72	28·36	84·10	69·26	122·10*
49·04	32·63	66·54	60·22	92·28
16·41	12·55	70·08	35·84	143·18*

* In these experiments the oxidation products contained nitric oxide.

SERIES III.

N/10 Ammonia used	N/10 Ammonia after reduction	Ammonia oxidised	N/10 Permanganate used.	Nitrous acid, calculated from permanganate used
52·52	42·86	81·61	60·12	70·40
77·13	61·08	79·29	92·22	75·49

On raising the temperature (110 volts and 3¼ amperes), the yield of oxidation products was reduced from 81·61 and 79·29 to 65·18 per cent.

About 80—90 per cent. of the total oxidation products consist of nitrogen trioxide. The author concludes that, under the present conditions, the profitable production of nitric acid from ammonia according to Ostwald's process (Eng. Pat. 698 of 1902; this J., 1902, 548; also Addition to Fr. Pat. 317,544 of 1902; this J., 1903, 93) is not possible. For the manufacture of nitrous acid from ammonia, according to Bayer und Co.'s process (Fr. Pat. 335,229 of 1903; this J., 1904, 186), however, the conditions are different, and there appears to be no reason why, if a cheap supply of ammonia (*e.g.*, in the form of gas-liquor) be available, the technical manufacture of nitrites on these lines should not be successful.

—A. S.

Copper nitride; Preparation and properties of ——. A. Guntz and H. Bassett, jun. Bull. Soc. Chim. 1906, **35**, 201—207.

A COMPOUND containing about 93 per cent of copper nitride, Cu_3N, is obtained by heating amorphous yellow cuprous oxide for two hours in a current of dry ammonia gas at a temperature of 240°—265° C. The product has a dark green colour and always contains some metallic copper. When treated with concentrated sulphuric or hydrochloric acid the whole of the nitrogen of the compound is converted into ammonia. It is rapidly oxidised by concentrated nitric acid, about one-half the nitrogen being transformed into ammonia. Copper nitride completely decomposes at a temperature of 600° C., or a little higher. Alkalis attack the nitride but slowly even at a boiling temperature, a little ammonia and cuprous oxide being formed.—W. P. S.

Potassium chromate and potassium bichromate; Action of sulphur on ——. K. Brückner. Monatsh. Chem., 1906, **27**, 199—204.

WHEN potassium chromate is heated with excess of sulphur, out of contact with air, the products are chromium sulphide (in combination with potassium sulphide), potassium sulphate and some chromic oxide. On very strong heating, with access of air, only potassium sulphate and chromic oxide are obtained. Chromic oxide, and not the sulphide, likewise results when potassium bichromate is substituted for potassium chromate. It is probable that potassium sulphide and thiosulphate are the first products, the chromic anhydride being converted partly into chromic oxide and partly into the sulphide. The thiosulphate is then decomposed by heat into polysulphide and sulphate. Oxidation effects the final change to oxide and sulphate only.

Chromic anhydride and sulphur burn on heating together to yield chiefly chromic oxide which is not affected by sulphur at any temperature. Chromium sulphate or chrome alum, when heated with sulphur, are reduced to chromium sulphide (this J., 1906, 264).

—F. SODN.

Amorphous precipitations. I. Partial co-precipitation of bivalent bases in the precipitation of aluminium and chromium hydroxides. D. Strömholm. Arkiv för Kemi, 1905, **2**, Heft II., No. 9, 1—13. Chem. Centr., 1906, **1**, 1221—1222.

SOLUTION of aluminium or chromium chloride was mixed with one of calcium, magnesium, or barium chloride and with solution of ammonium chloride and ammonia of different concentrations, and the mixtures analysed after varying periods of time. The composition of the precipitate was calculated from that of the solution. The results obtained show that the violet chromium hydroxide carries down much more magnesium than the green modification does. When magnesium sulphate is used instead of magnesium chloride, the green chromium hydroxide carries down still less magnesium, but the amount carried down by aluminium hydroxide remains the same. In none of the cases examined was a chemical compound of ter- and bi-valent metal-hydroxide formed, the co-precipitation of the bivalent metal being due in all cases to adsorption.—A. S.

Amorphous precipitations. II. Basic salts of bivalent metal oxides. D. Strömholm. Arkiv för Kemi, 1906, **2**, Heft II., No. 16, 1—13. Chem. Centr., 1906, **1**, 1222.

SOLUTIONS of salts of heavy metals (lead, copper, zinc, nickel) were treated with mixtures of solutions of sodium hydroxide, carbonate, and bicarbonate, and after a condition of equilibrium had been attained, the solutions were analysed. In solutions containing large quantities of carbonate, some of the copper, nickel, and zinc always remained dissolved. Evidence was obtained of the existence of two basic carbonates of lead, $5PbO,3CO_2$, and $3PbO,2CO_2$, a basic zinc carbonate, $5ZnO,2CO_2$, and a basic nickel carbonate, $3NiO,CO_2$. With stronger acids than carbonic acid, the following amorphous basic salts were found to be formed: $4CuO,SO_3$, $4CuO,N_2O_5$, $4ZnO,SO_3$, $6NiO,SO_3$ and $6CoO,SO_3$.—A. S.

Phosphorus; Action of hydrogen peroxide on ——. T. Weyl. Ber., 1906, **39**, 1307—1314.

BY the action of boiling water, caustic soda solution, or hydrogen peroxide on yellow phosphorus, amorphous

phosphorus or Schenck's phosphorus (this J., 1902, 368; 1903, 494, 1225; 1904, 17) hydrogen phosphide and phosphorous and phosphoric acids are produced. The action of hydrogen peroxide solution is greater on amorphous phosphorus or Schenck's phosphorus than on yellow phosphorus. The last-named is not attacked perceptibly even by 30 per cent. hydrogen peroxide solution, until the mixture is heated to 60° C. The unattacked yellow phosphorus is converted, first, into a honey-like mass, and, later, into a horny substance, which scarcely fumes in the air, but when once ignited by a flame, burns like ordinary phosphorus. With amorphous phosphorus or Schenck's phosphorus the action is so vigorous as to be dangerous, if hydrogen peroxide solution of a strength greater than 8 per cent. be used, much heat being evolved. The reaction with amorphous phosphorus and Schenck's phosphorus is not due to the presence of yellow phosphorus, as even with carefully purified products the evolution of hydrogen phosphide is just as vigorous. The author considers that the primary product of the reaction is phosphorous acid, which is afterwards decomposed into hydrogen phosphide and phosphoric acid, a portion also being oxidised to phosphoric acid by the hydrogen peroxide.

$3H_2O_2+2P=2P(OH)_3$; $4P(OH)_3=PH_3+3PO(OH)_3$.

For the removal of yellow phosphorus from amorphous phosphorus or Schenck's phosphorus, the following process proved very satisfactory: About 10 grms. of the phosphorus to be purified are finely ground under water and boiled for about two hours with 200 c.c. of a 10 per cent. solution of sodium carbonate, under a reflux condenser. A. S.

Nitrous Acid; Oxidation of —— by hydrogen peroxide. Determination of nitrate in presence of nitrite. M. Busch. XXIII., page 499.

English Patents.

Sulphuric Acid; Purification of ——. V. C. Driffield, F. W. Wright, and The United Alkali Co., Ltd., all of Liverpool. Eng. Pat. 7916, April 13, 1905.

Arsenic is removed from sulphuric acid in the form of arsenious chloride, by treating the acid with hydrochloric acid or a chloride, and blowing air through it. If the arsenic is in the arsenic state, a reducing agent, such as sulphur dioxide, must also be added. A. G. L.

Sulphuric acid; Treatment of arsenical —— for the separation of arsenic, and the obtainment of arsenious chloride. J. Raschen, A. E. Wareing, J. H. Shores, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 16,929, Aug. 21, 1905.

Arsenical sulphuric acid is subjected to the action of hydrochloric acid, preferably the dry gas, at a temperature of about 100° C. Sulphuric acid obtained from arsenical sulphur ores may be thus treated, being passed, for instance, as it leaves the Glover tower (cooled, if necessary, to the required temperature), into a suitably packed tower, where it is brought into contact with the hydrochloric acid gas. The arsenious chloride is separated from the sulphuric acid, in the receptacle at the bottom of the tower, as an oily liquid. E. S.

Arsenious acid; Treatment of arsenious chloride for the obtainment of ——. J. Raschen, A. E. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 16,930, Aug. 21, 1905.

Arsenious chloride, obtained, for instance, from arsenical sulphuric acid (see preceding abstract), is run into water containing an alkali, alkaline-earth, or carbonate thereof, a minimum proportion of water being used. The arsenious acid precipitates, and after separation from the liquid, may be sublimed, where calcium carbonate has been used as the reagent. When the reagent is sodium carbonate, so much should be dissolved in the water as may give a saturated solution of sodium chloride after precipitation of the arsenious acid.—E. S.

Arsenious acid; Treatment of arsenious chloride for the obtainment of ——. J. Raschen, J. T. Conroy, A. E. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 17,887, Sept. 4, 1905.

In the process for obtaining arsenious acid from arsenious chloride, described in Eng. Pat. 16,930 of 1905 (see preceding abstract) oxides or carbonates of the heavy metals, such as zinc oxide or carbonate, manganese-mud, or iron oxide, may be used in decomposing the arsenious chloride in presence of a minimum proportion of water, instead of the reagents there described. Eng. Pat. 16,931 of 1905 is also referred to.—E. S.

Hydrochloric acid; Manufacture of ——. I. L. Roberts, Lockport, U.S.A. Eng. Pat. 24,733, Nov. 29, 1905.

See U.S. Pat. 807,640 of 1905; this J., 1906, 218.—T.F.B.

Magnesium sulphate obtained in the known method of producing acetic acid by means of magnesium acetate; Processes of separating and working up ——. J. R. Garroway, Glasgow. Eng. Pat. 6798, March 31, 1905.

Pyroligneous acid, before or after distillation, according to whether a "brown" or "grey" salt is required, is neutralised with magnesium oxide or carbonate. To the concentrated solution in a still, sulphuric acid of about 120° T. is run in, and the distillation is proceeded with. Or, before distilling off the acetic acid, a portion of the magnesium sulphate may be crystallised out of the solution, and removed by filter-pressing or otherwise. The crude magnesium sulphate left in the still is heated in a suitable furnace, to char the tar, and the residue is worked up as Epsom salts.—E. S.

United States Patents.

Caustic alkali; [Electrolytic] Apparatus for and process of producing ——. H. S. Blackmore. U.S. Pats. 809,085 and 809,088, Jan. 2, 1906. XIA., page 483.

Caustic alkali; [Electrolytic] Process of making ——. H. S. Blackmore. U.S. Pat. 809,089, Jan. 2, 1906. XI.A., page 483.

Caustic alkalis and zinc sulphide; Process of manufacturing ——. C. Ranson, Brussels, Assignor to H. W. De Stuckle, Dieuze, Germany. U.S. Pat. 818,192, April 17, 1906.

See Fr. Pat. 353,480 of 1905; this J., 1905, 1013.—T. F. B.

Aluminate of soda; Manufacturing ——. S. S. Emery, Woodbury, N.J., Assignor to The Eastern Dynamite Co., Wilmington, Del. U.S. Pat. 818,754, April 24, 1906.

A mixture of bauxite, sodium sulphate, and carbonaceous matter is calcined in an air-blast, the air supplied being in excess, in order to produce an aluminate of soda free from impurities.—E. S.

French Patents.

Hydrochloric acid; Manufacture of ——. I. L. Roberts. Fr. Pat. 360,829, Dec. 2, 1905.

See U.S. Pat. 807,640 of 1905; this J., 1906, 218.—T.F.B.

Hydrochloric acid; Manufacture of —— by means of magnesium chloride. J. J. T. Schloesing. Fr. Pat. 360,356, Dec. 12, 1905.

Sea water or the mother liquors of salt marshes, as obtained by atmospheric exposure, are treated with a quantity of calcium chloride equivalent to the magnesium sulphate present, which is thus transformed into magnesium chloride with separation of calcium sulphate. The cleared liquor is further evaporated by exposure, and is then concentrated until it boils at a temperature of 130° C., and sufficient magnesium sulphate to transform the potassium chloride into sulphate is added. The cooled liquor is then filtered from the potassium sulphate and the sodium salts, &c., which separate, and is again heated with addition of magnesia, to transform the magnesium chloride solution into an oxychloride, which precipitates. This product is spread on superposed

ranges of acid-resisting bars in separate communicating compartments of a furnace, preferably heated by gas, in which the heated gases are successively led through the shelves and the different compartments. When the dehydration is complete, decomposition of the remaining magnesium chloride ceases; fresh portions of the oxychloride are then charged into the second compartment, and the direction of the gases is reversed, so that the dried charge in the first compartment is heated with access of steam, completing the decomposition. The flues of the furnace are arranged so as to avoid overheating any portion. The effluent acid gas is condensed in a coke tower in the usual way.—E. S.

Phosphates [*Bi-magnesium-hydrogen phosphate*]; *Manufacture of bi-basic —— by means of natural phosphates.* J. J. T. Schloesing. Fr. Pat. 360,357, Dec. 12, 1905.

Powdered native phosphates are treated with magnesium sulphate (or the mother liquors of salt marshes rich in that salt) and hydrochloric acid, in adjusted proportions. When solution of the ore is effected, as well as precipitation, partial or entire, of the calcium as sulphate, the solution is filtered and neutralised, not by milk of lime, as in the ordinary process, but by milk of magnesia, which gives a precipitate of bibasic magnesium phosphate, whilst the solution contains magnesium chloride, practically free from calcium. When it is desired that the precipitated phosphate shall contain calcium as well as magnesium, this is effected by reducing the proportion of magnesium sulphate added to the hydrochloric acid solution in the first stage of the process. The solution of magnesium chloride finally obtained, is concentrated by spontaneous evaporation on large plane surfaces, such as those of saline marshes, until the sodium chloride is deposited. The solution of magnesium chloride, containing also potassium chloride, may then be further treated, as described in the preceding abstract, to obtain hydrochloric acid and magnesia, available in treating fresh portions of native phosphates.—E. S.

Sulphuric acid; Process and apparatus for the manufacture and purification of ——. R. Cellarius. Fr. Pat. 360,634, Dec. 12, 1905.

The gases issuing from the lead chamber are drawn into the lower and central part of a closed lead tower, the sides of which are packed with a thick mass of coke, the central space being occupied by a hollow revolving shaft carrying curved arms, within which shaft is a perforated pipe conveying steam. A condensing agent is supplied to the coke, whilst the admitted gases, air, and steam are violently agitated, and dashed against the coke periphery. Such a tower may be interposed between the pyrites burner and the lead chamber (to purify the gases admitted), and also at the exit of each chamber; or it may replace the ordinary Gay-Lussac tower, in which case concentrated sulphuric acid is rained down from above, so as to moisten the coke against which the incoming gases are dashed by the centrifugal motion imparted by the revolving wings. Another form of tower, constructed of stone, has two inner walls or cylinders surrounding the central space in which wings are rotated, as in the former case. The inner walls are perforated, and the annular space between them is formed into a series of superposed compartments by a number of horizontal shelves, also perforated. The condensing agent is showered from above, and trickles through the compartments. The vertical iron rod carrying the ventilating wings is enclosed in a stoneware tube. The escape of gases from each intermediate tower, is from its side near the top to the next chamber. The same apparatus may be used for purifying and condensing hydrochloric acid gas, occurring in the manufacture of sodium sulphate; or generally in the like treatment of other gases, such as sulphur dioxide.—E. S.

Sodium dioxide and other compounds intended for the preparation of oxygen; Preservation of mixtures of —— against alteration due to atmospheric moisture. Cie. Gén. de Phonographes, Cinématographes et App. de Précision. Fr. Pat. 359,912, Nov. 29, 1905.

The compounds mentioned are coated with paraffin-wax.—E. S.

Alumina; Process for extracting —— from bauxite. G. Muth. Fr. Pat. 360,086, Dec. 5, 1905.

Bauxite is boiled with a soda lye of 27 per cent. strength in such proportion that for each molecule of alumina (Al_2O_3) in the bauxite, 1·7 molecule of soda [Na_2O] are used in the lye added. The solution obtained, after decantation, is agitated, to throw down the greater part of the aluminium hydroxide, and from the filtrate, the remainder is precipitated by milk of lime, and recovered by known means, the lye being thus obtained for re-use. —E. S.

Air; Process for the liquefaction of ——, and for obtaining oxygen. R. Mewes. Fr. Pat. 360,427, Nov. 27, 1905. Under Int. Conv., Nov. 27, 1904.

Compressed and cooled air is conducted under any desired pressure into a tube, curved upon itself at its further end, and having holes opening into a pipe enclosing the tube, except as to its curved end, which latter delivers a current or blast of the cold and compressed air in a direction contrary to that in which it arrived, into an enclosing cylinder in which a vacuum is maintained by a pump. This air flows, with more or less rapidity, over the surface of the liquid air, already formed in the cylinder, to which it thus adds continuously, whilst the unliquefied portion passes through the pump back to the atmosphere. Provision is made for tapping off the liquid air from the cylinder from time to time. The apparatus is arranged for the separation of oxygen by already known means. (See also Fr. Pat. 358,236 of 1905; this J., 1906, 180.)—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 428.)

English Patents.

Glass substitutes. J. Carl, London. Eng. Pat. 6816, March 31, 1905.

The glass substitutes described consist of fabric or gauze filled with gelatinous substances and subsequently treated with potassium bichromate. The fabric or wire gauze is steeped in an aqueous solution of chloride of lime, or ammonium chloride and ammonium sulphide, and dried. The gauze is then immersed in a heated solution of sodium silicate, alumina, and gelatin, partly cooled, and then immersed in a solution of albumin and water. The gauze thus prepared is said, by the subsequent treatment, to be rendered fire- and water-proof, and suitable for use as a glass substitute. The dried, prepared gauze is steeped in formalin, and then in a solution of potassium bichromate, and after five minutes' immersion, is dried in a dark room and then exposed to daylight. The yellow stains of the bichromate are removed by washing with a solution of alum and with water.—W. C. H.

Ceramic ware; [Electro-plated ——]. S. Heller and C. Baumgartl, of Teplitz, Austria, and Porzellanfabrik Ph. Rosenthal and Co., A. G. Filiale Kronach, Kronach, Germany. Eng. Pat. 10,833, May 24, 1905.

One part of enamel gold tombac ("an alloy consisting of copper, zinc and a small amount of gold") is mixed with 2 parts of enamel and 1 part of calcined borax, ground in oil of lavender, applied to the object and burnt at 800° C. After cooling, the coating is ground so as to render the metallic surface visible, after which the object is placed in an electro-plating bath in which the original metallic coating is reinforced by a further deposit. The object is then ground and polished.—A. G. L.

Enamelling iron or steel goods; Process for ——. R. F. Wagner, Halle-on-the-Saale, and H. L. Hermsdorf, Chemnitz, Germany. Eng. Pat. 17,292, Aug. 26, 1905.

See Fr. Pat. 356,726 of 1905; this J., 1906, 21.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page 429.*)

ENGLISH PATENTS.

Cementitious material; Process for the preliminary treatment of blast-furnace slags for the production of ——. B. Bruhn, Hamburg, Germany. Eng. Pat. 8285, April 18, 1905. Under Int Conv., April 19, 1904.

SEE Fr. Pat. 354,790 of 1905; this J., 1905, 1110.—T. F. B

Slag; Treatment of ——, *and apparatus therefor.* T. W. Ridley, Middlesbrough. Eng. Pat. 9249, May 2, 1905

THE object of the invention is to produce annealed broken lumps of slag for macadam pavement. The slag is cast in moulds of a pyramidal form, attached to an endless chain, similar to a conveyor. When the moulds are inverted, the lump of cast slag drops out on to a conveyor, which delivers the cast blocks to a crane. The crane is arranged in the centre of a ring of annealing kilns, and feeds the cast blocks into the kilns through openings in the tops. The kilns are similar to those usually employed for annealing slag bricks, except for the opening in the top and for the fact that the floor is sloped downwards towards a delivery door. After the process of annealing, the blocks are withdrawn from the kilns, broken, and, whilst still hot, are mixed, if required, with tar.—W. C. H.

Wood; Preservation of ——. A. A. V. Poulsen, Lemvig, Denmark. Eng. Pat. 1325, Jan. 17, 1906.

THIS process for the "preservation" of wood consists in "loosely applying to its surface, or driving into it plates, pieces or nails (perforated or otherwise) of a metal, which, under the action of atmospheric or other moisture, will be transformed into a soluble metallic salt, which will soak into the wood," and preserve it against decay, dry rot, insects, &c. The process is applicable to wood structures *in situ*, and to those subject to alternate moist and dry conditions. W. C. H.

UNITED STATES PATENT.

Roads or other places; Compound which forms an emulsion with water to be applied to the surfaces of ——. E. Hardcastle, Stockport. U.S. Pat. 819,012, April 24, 1906.

SEE Eng. Pat. 14,239 of 1905; this J., 1905, 1110.—T.F.B.

FRENCH PATENTS.

Binding materials; Process of making hydraulic ——. M. Reiche. Fr. Pat. 360,518, Feb. 28, 1905.

SEE Eng. Pat. 4194 of 1905; this J., 1906, 316.—T. F. B.

Alumed sulphates of lime; Manufacture of —— at an accelerated rate. L. A. E. Taté. Fr. Pat. 360,035, Dec. 2, 1905.

CALCIUM sulphate, whilst being "alumed," is mixed with sulphate of sodium, potassium, or zinc, &c., and the mixture is furnaced at a temperature of from 800° to 1200° C. An already alumed plaster may receive an addition of one or other of the salts mentioned, followed by the necessary heating.—E. S.

Building material; Process for the manufacture of agglomerated ——. A. A. Queval. Fr. Pat. 360,446, Dec. 9, 1905.

THE essential feature of the invention consists in using as binding material a mixture containing an insoluble sulphate and an oxychloride. The binding material is formed by mixing together a solid composition and a liquid composition, which react to form simultaneously an insoluble sulphate, preferably lead sulphate, and an oxychloride of zinc, magnesium or aluminium. The binding material is then added to the substances to be agglomerated (soil, gravel, powdered stone waste, sawdust, slag, &c.), and the mixture moulded into the desired form. —A. S.

X.—METALLURGY.

(*Continued from page 432.*)

Blast-furnace; Balance-sheet of the ——. J. W. Richards. Electrochem. and Metall. Ind., 1906, **4**, 129—132.

A FURNACE at Herräng is run on ore briquettes, using charcoal as fuel and limestone as flux. The analyses of ore, flux and fuel are:—

	Ore.	Limestone.	Charcoal.
Fe_2O_3	85·93	0·18	0·32
FeO	3·96	—	C 80·31
SiO_2	5·50	3·14	0·19
MnO	0·63	—	N 0·08
Al_2O_3	0·76	0·32	O 3·54
CaO	2·23	53·74	0·89
MgO	0·97	0·17	0·10
P_2O_5	0·006	0·006	0·0068
S	0·010	0·001	0·0170
Cu	0·007	CO_2 42·42	H_2O 14·04
			K_2O 0·50

The pig-iron contains phosphorus, 0·012; sulphur, 0·007; manganese, 0·025; silicon, 0·60; carbon, 2·70; iron, 96·656 per cent. The charge is, ore, 1190 lb., flux 90 lb., fuel 530 lb.; and the fuel consumption is 682 lb. per 1000 lb. of pig-iron. The furnace gases (dry) contain nitrogen, 57·3; carbon monoxide, 23·1; carbon dioxide, 14·8; hydrogen, 4·3; methane, 0·5 per cent. Assuming the blast to be dry, and the flue-dust to be negligible, there are required: (1) A balance sheet of materials entering and leaving the furnace per 1000 lb. of pig-iron; (2) the percentages of the iron, manganese, silicon, sulphur and phosphorus entering the furnace which go into the pig-iron.

The balance-sheet is shown below. There are given, in the first place, the amounts of the various constituents in the weights of ore (1530·2 lb.), flux (115·8 lb.), and fuel (682 lb.) charged per 1000 lb. of pig-iron, together with the amount of air in the blast calculated as shown below:—

Charges.		Pig iron.		Slag.		Gases.	
Ore—							
Fe_2O_3	1314·9	Fe	920·4	—		O	394·5
FeO	60·6	Fe	46·2	FeO	1·2	O	13·2
SiO_2	84·2	Si	6·0	SiO_2	69·6	O	8·6
MnO	9·6	Mn	0·25	MnO	0·3	O	0·1
Al_2O_3	11·6	—		Al_2O_3	11·6	—	
CaO	34·1	—		CaO	34·0	O	0·03
MgO	14·8	—		MgO	14·8	—	
P_2O_5	0·092	P	0·04	—		O	0·05
S	0·153	S	0·07	CaS	0·19	—	
Cu	0·11	Cu	0·11	—		—	
Limestone—							
Fe_2O_3	0·2	—		FeO	0·2	O	0·02
SiO_2	3·6	—		SiO_2	3·6	—	
Al_2O_3	0·4	—		Al_2O_3	0·4	—	
CaO	62·2	—		CaO	62·2	O	0·00
MgO	0·2	—		MgO	0·2	—	
P_2O_5	0·007	P	0·003	—		O	0·00
S	0·001	—		CaS	0·00	—	
CO_2	49·1	—		—		CO_2	49·1
Charcoal—							
C	547·7	C	27·0	—		C	520·7
N	0·5	—		—		N	0·5
O	24·1	—		—		O	24·1
Fe_2O_3	2·2	—		FeO	2·0	O	0·2
SiO_2	1·3	—		SiO_2	1·3	—	
CaO	6·1	—		CaO	5·9	O	0·06
MgO	0·7	—		MgO	0·7	—	
P_2O_5	0·046	P	0·020	—		O	0·03
S	0·116	—		CaS	0·25	—	
K_2O	3·4	—		K_2O	3·4	—	
H_2O	95·8	—		—		H_2O	95·8
Blast—							
O	557·7	—		—		O	557·7
N	1859·1	—		—		N	1859·1
	4744·6		1000·0		220·8		3523·8

Pig-iron.—The ferric oxide of the ore yields 920·4 lb. of iron, so that 46·2 lb. are wanted to make up the 966·6 lb.

it contains; this is assumed to come from the ferrous oxide of the ore, of which it takes 59·4 lb. The remainder of the iron in the ore, and all that in the flux and fuel, are, therefore, assumed as going into the slag as ferrous oxide. The 6 lb. of silicon in the pig take 14·6 lb. of silica from the ore; the rest, with the silica of flux and fuel, goes to the slag. The manganese in the pig comes from the ore, and the rest of the manganese of the ore goes to the slag as manganese protoxide. The same applies to the sulphur, the surplus of which forms calcium sulphide with 0·14 lb. of the lime in the ore, and sends the equivalent oxygen into the gases. The phosphorus from every source is barely enough to furnish that contained in the pig-iron, so the whole is assumed as going there; the copper also goes to the pig-iron, though not mentioned in the analysis. The carbon in the pig-iron comes from the fuel.

Flux and fuel.—All the constituents of these not already accounted for go direct into the slag (the sulphur as calcium sulphide, and the equivalent oxygen to the gases) except the carbon, which goes into the gases.

Blast.—The total carbon in the gases is 534·09 lb. (13·39 from the flux, 520·70 from the fuel). The carbon per *volume* [100 galls., bearing same relation to cb. m. that lb. does to kilo.] is, from analysis of the gases 0·20736 lb.; hence gas per 1000 lb. of pig-iron is 2575·6 *vols.* This contains 1475·9 *vols.* of nitrogen, weighing 1859·6 lb. Of this, the fuel supplies 0·5 lb., leaving to be supplied from the blast 1859·1 lb., and equivalent oxygen 557·7 lb.

The total iron in the charge is 969·2 lb., and that in the pig-iron 966·6 lb., or 99·7 per cent. The corresponding figures are for manganese, 7·4, 0·25, 3·4 per cent.; silicon, 41·6, 6·0, 14·4 per cent.; sulphur, 0·270, 0·07, 25·9 per cent.; phosphorus, 0·063, 0·12, 100 per cent. (the excess of phosphorus in the pig arising either from analytical errors or from segregation). J. T. D.

Blast-furnace obstructions, Use of oxygen in removing ——. C. de Schwarz. Iron and Steel Inst., May, 1906. [Advance proof.]

When a taphole closed up with iron is to be opened, the iron is first heated with an oxyhydrogen flame supplied from a properly constructed "burner," the supply of hydrogen is then turned off and oxygen alone is supplied under a pressure equal to 30 atmospheres, whereby the iron is very soon pierced. The electric current may be employed for the initial heating. J. H. C.

Steel test-pieces; Relation between type of fracture and micro-structure of . C. O. Banister. Iron and Steel Inst., May, 1906. [Advance proof.]

The author finds that there is a distinct relation between the nature of fracture and the micro-composition of steel, and that valuable conclusions may be drawn from the examination of the fractured surface. Cup-fractures are obtained with homogeneous, minutely crystalline, or granular steel free from flaws of slag and manganese sulphide. Laminated fractures always contain slag lines or minute "ghost lines" consisting of manganese silicate, usually accompanied by manganese sulphide, running in parallel straight lines in the same direction as the laminations. Steels giving very irregular fractures are generally inferior in quality and made up of irregular patches of pearlite and ferrite, mostly accompanied by slag-lines or "ghost lines" running in various directions, and sometimes curved "ghost lines" are formed by segregations of carbon, sulphur, and phosphorus accompanied or not by considerable quantities of silicon and manganese. Crystalline fractures show a distinct relationship between the size of the crystals and the micro structure of the steel, and when slag and manganese sulphide patches are present in these, they are arranged in the ferrite bands around the pearlite. Oblique fractures are frequently varieties of laminated fractures, and where laminations are entirely absent there are often indications that rupture occurs in the direction in which the ferrite bands are best developed. Although laminated fractures are always associated with slag lines or "ghosts," yet coarsely crystalline steels containing "ghosts" do not always give laminated fractures. The prevalence of manganese sulphide and manganese silicate in commercial steels fully justifies their being classed as important constituents. Stereoscopic photographs (25) are given in illustration of the several kinds of fracture.—J. H. C.

Steel sheets; Brittleness and blisters in thin ——. E. F. Law. Iron and Steel Inst., May, 1906. [Advance proof.]

The author's experiments show that (1) oxidised steel gives rise to blistered sheets, and that this defect is more liable to occur with Bessemer than with open-hearth steel; (2) steel high in sulphur and phosphorus will cause brittleness in sheets, especially if the sheets are rolled from large and slowly-cooled ingots, in which the maximum of segregation has taken place.—J. H. C.

Steel; Effect of copper in ——. F. H. Wigham. Iron and Steel Inst., May, 1906. [Advance proof.]

In the first series of trials open-hearth steel was melted and poured upon cold ingots of copper contained in a separate ladle. In other cases the copper with a little aluminium was added to the steel as it ran into moulds. The author finds: (1) Copper is very difficult to alloy with steel so as to obtain a homogeneous mass containing over 2 per cent., even with the addition of aluminium. (2) Steel alloyed with copper in the pure form with the addition of aluminium is not so perfectly mixed as it is when the copper is added to the charge of steel in the furnace, and more copper could safely be employed provided it was in the metal before the latter was completely converted into steel. (3) In steel containing 0·5 per cent. or more of carbon it is not of practical value to use more than 0·6 per cent. of copper. (4) Steel with 0·25 per cent. of copper and alloys up to 0·25 per cent. of copper with high carbon (say, 0·70 per cent.) give, with or without a high percentage of manganese, a good quality of wire. In conclusion, it may be considered as proved that copper to the extent of 0·25 per cent. is no disadvantage in the manufacture of the best classes of steel wire.—J. H. C.

Ferro-molybdenums; Properties of pure —. E. Vigouroux. Comptes rend., 1906, **142**, 928–930.

For the method of preparation, see this J., 1906, 429. The following alloys are described: The alloy, Fe_2Mo, can be separated by means of dilute hydrochloric acid from alloys containing less than 46 per cent. of molybdenum. It is a grey metallic non-magnetic substance of sp. gr. 8·9. It is acted on by chlorine slowly at ordinary temperatures and very rapidly above 250° C. It is not attacked by hydrofluoric and hydrochloric acids or by dilute sulphuric acid, but is completely dissolved by hot concentrated sulphuric acid or by nitric acid. The alloy, Fe_3Mo_2, was obtained by the treatment of alloys containing between 46 and 54 per cent. of molybdenum with 30 per cent. hydrochloric acid. It is non-magnetic, has a sp. gr. 9·16, and has similar properties to the compound Fe_2Mo. The alloy, FeMo, extracted from alloys containing 54–63 per cent. of molybdenum, after treatment with still stronger acid or with hot solutions of cuprous chloride in hydrochloric acid, has a sp. gr. 9·01. It becomes incandescent in chlorine at 285° C. and is completely dissolved by iodine solutions, hot concentrated sulphuric acid, nitric acid, or when fused with potash. The alloy, $FeMo_2$, has a sp. gr. 9·41. It is extracted by treating alloys containing 64–77 per cent. of molybdenum with hot solutions of cuprous chloride in concentrated hydrochloric acid. It becomes incandescent in chlorine at 305° C. and in oxygen at 350° C. Sulphur is without action, and iodine only attacks it slowly. Acids have the same action as on the other alloys.—E. F. A.

Gold; New solvent for —. J. Moir. Chem. Soc. Proc., 1906, **22**, 105.

The author has found that gold-leaf dissolves fairly readily when floated on an acid solution of ordinary thiocarbamide. The action becomes rapid when a suitable oxidising agent is added. For example, when a solution of thiocarbamide is acidified and treated with a little ferric chloride, potassium dichromate, or hydrogen

peroxide, the mixture dissolves gold-leaf after less than a minute's shaking. The solution is not precipitated either by ferrous sulphate or by stannous chloride (except after long standing), whence it follows that the gold is present in solution as part of a complex ion. The gold compound is identical with a compound which the author has obtained by boiling a mixture of sodium aurichloride and thiocarbamide solutions.

Thorium silicide and a thorium-aluminium alloy. O. Hönigschmid. Monatsh. Chem., 1906, 27, 205—212.

THORIUM silicide is best obtained in quantity by the reduction of a mixture of potassium-thorium fluoride and potassium fluosilicate with aluminium in the electric furnace. A regulus of aluminium containing the crystalline silicide remains in the crucible, and the crystals are obtained free from aluminium and excess of silicon by boiling with caustic potash and then with dilute hydrochloric acid. It resembles graphite in appearance, crystallising in quadratic lamellæ of sp. gr. 7·96. Its composition corresponds to the formula $ThSi_2$. Chemically it behaves very like a metal, being unaffected by hydrogen, but combining with oxygen and the halogens on heating, and dissolving in acids. It is also formed by the direct union of thorium and silicon in presence of aluminium at 1090° C., and by the reduction of thorium oxide by silicon in the electric furnace.

A crystalline alloy of thorium and aluminium results when the two metals are heated together at about 1090° C. in a vacuum, the same compound being also produced by the reduction of thorium oxide or potassium-thorium fluoride by aluminium. The alloy crystallises from the aluminium regulus in hexagonal needles. It has the colour and appearance of aluminium, but is not attacked by aqueous solutions of the alkalis. Analysis shows it to have the formula $ThAl_3$.—F. SODN.

Platinum; Russian ——. Chem. and Drug., May 5, 1906.

ACCORDING to the official "Commercial and Industrial Gazette," the Ministry of Trade and Industry proposes shortly to summon a special conference to consider the questions of (1) the prohibition of the export of raw platinum, (2) the imposition of an export-duty, and (3) the construction of Government works for refining platinum. [T.R.]

ENGLISH PATENTS.

Refractory ores; Preliminary treatment of ——. L. V. Atkinson, Carshalton, Surrey. Eng. Pat. 28,932, Dec. 30, 1904.

THE invention deals with refractory ores containing iron, copper, silver and gold. It consists in roasting the crushed and concentrated ore at a temperature below redness in an atmosphere of steam, so as to convert the iron, but not the copper, into the form of sulphate. The iron sulphate formed is then leached out by hot water, after which copper is recovered either by electrolysis or by treatment with sulphuric acid, gold and silver being extracted as usual.—A. G. L.

Arsenic; Collection of —— in the treatment of refractory ores. L. V. Atkinson, Carshalton, Surrey. Eng. Pat. 28,992A, Dec. 30, 1904.

A PIPE sloping upwards and communicating with several openings in the roof of the furnace carries the arsenical fume into a condenser in which the arsenic is deposited on loose blankets supported on wire beds. Close to the furnace the pipe is provided with a down-take, consisting of a pipe of greater diameter than the up-take, or of a wide hopper. The lower end of this down-take fits over a sump placed above a fire-grate. In this sump are collected any particles of ore, &c., mechanically carried up by the fume, whilst any arsenic deposited with the impurities is again volatilised by the heat from the fire below the sump.—A. G. L.

[Gold, silver and copper] Ores; Treating ——. W. A. Hendryx, Los Angeles, Cal. Eng. Pat. 1916, Jan. 31, 1905.

THE ore is first put through a chemical preparatory treatment, which consists in the formation of a chemical ore-pulp solution in the ore grinding machinery, which solution prepares the ore for amalgamation and for electrolytic action; as much as possible of the metals is next recovered by amalgamation and electrolytic action, after which the ore is allowed to settle and classify, the solution being used over again, after removal of any compounds which would interfere with the solvent action of the cyanide. The ore-pulp is then further treated with cyanide solution or other chemicals, whilst at the same time moving continuously in a very thin conical-shaped stream in direct contact with the atmosphere, an electric current being also passed through the liquid from suitably-placed electrodes.—A. G. L.

Brazing metals. L. R. Schaap, Denver, U.S.A. Eng. Pat. 8307, April 18, 1905. Under Int. Conv., April 18, 1904

SEE U.S. Pats. 777,546 and 777,547 of 1904; this J., 1905, 93.—T. F. B.

Refractory substance for lining crucibles for aluminothermic processes. H. Goldschmidt, Essen on the Ruhr, Germany. Eng. Pat. 9610, May 6, 1905.

SEE Fr. Pat. 354,597 of 1905; this J., 1905, 1114.—T. F. B.

Copper nickel matte; Process of refining ——. N. V. Hybinette, Westfield, U.S.A. Eng. Pat. 24,486, Nov. 27, 1905.

SEE U.S. Pat. 805,555 of 1905; this J., 1906, 26.—T. F. B.

Zinc and other metals; Process of refining ——. J. Callmann and R. Bormann, Berlin. Eng. Pat. 3252, Feb. 10, 1906. Under Int. Conv., March 20, 1905.

THE zinc to be refined, or zinc waste, &c., is run in the molten condition into an inclined pipe filled with fragments of refractory material or of coal. The upper end of this pipe is kept at a temperature not much above the melting-point of zinc; the lower end is above the boiling point of zinc, and communicates either with a receiving vessel for the impurities, or else with a retort also kept at a temperature above the boiling point of zinc. The metal is run into the pipe at such a rate that it distils off during its passage down the pipe, leaving the impurities, which flow either into the receiving vessel or into the retort, in which the last of the zinc distils off, whilst the impurities are tapped off from an opening near the bottom of the retort.—A. G. L.

UNITED STATES PATENTS.

Ores of the precious metals; Process of treating ——. A. C. Atwater, Manchester, Iowa. U.S. Pat. 817,411, April 10, 1906.

ORES containing precious metals and selenium are mixed with a suitable proportion of a carbonaceous material (say from 1 to 10 per cent.), heated to a temperature sufficient to volatilise the selenium, and then allowed to cool, the heating and cooling operations being carried out with exclusion of air.—A. S.

Ores; Process and furnace for reducing ——. H. F. Brown, Chicago, Ill. U.S. Pats. 817,414 and 817,415, April 10, 1906.

THE furnace consists essentially of a down-draught stack connected at the bottom to a reverberatory fore-hearth. The stack has an ore-feed inlet at the top and then in turn a preliminary heating chamber, enlarged upper and lower combustion chambers with a narrow passage between them, and a heat-concentrating chamber of smaller cross-section than the lower combustion chamber. The finely-divided mixture of ore and slag-making impurities is fed into the preliminary heating chamber, and descends to the combustion chamber, into which by means of a burner projecting into the chamber "at an angle to the centre thereof," a whirling reducing atmosphere is directed. The reduced ore and slag and the gaseous products pass through the heat-concentrating chamber into the reverberatory fore-hearth, in which a molten protecting layer, *e.g.*, of slag, is maintained above

the molten metal, and separation of the metal and slag takes place by gravity. The gases from the fore-hearth are led through a regenerative chamber and thence to the receptacle in which the ore is stored, in order to dehydrate the ore. Air is also passed through the regenerator and thence to the burner, and to the space above the fore-hearth, where it mingles with and furthers the combustion of the reducing gases from the stack.
—A. S.

Metallic compounds; Manufacture of ——. S. Parfitt, Cardiff. U.S. Pat. 818,044. April 17, 1906.

SEE Eng. Pat. 2612 of 1903; this J., 1904, 22.—T. F. B.

FRENCH PATENTS.

Copper-aluminium alloys. A. C. Incagnoli. Fr. Pat. 360,250. Feb. 17, 1905.

(1) COPPER, 100·00; aluminium, 5·16; silver, 0·40; tin, 0·20. (2) Copper, 100·00; aluminium, 11·10; silver, 0·205; iron (malleable), 0·869. (3) Copper, 100·00; aluminium, 11·111; silver, 0·276; iron (malleable), 0·255.—J. H. C.

Aluminium alloys; Process for improving the quality of —— by heating to redness and tempering. C. Claessen. First Addition, dated Nov. 17, 1905, to Fr. Pat. 358,028 of Sept. 25, 1905 (this J., 1906, 185).

THE heating to redness and tempering are effected within the range of temperature limited on the one hand by a temperature 10° below the solidifying point of the alloy, and on the other hand, by a temperature, characteristic for each alloy, indicated by a break in the cooling curve; this lower temperature may be overstepped by about 30° C.—A. S.

Aluminium; Process for soldering or brazing ——. A. Proisy. Fr. Pat. 360,707. March 8, 1905.

THE solder is prepared by mixing together 700 grms. of zinc and 300 grms. of aluminium which have been fused separately, and then adding about 50 grms. of tallow, the mixture being heated and agitated until a homogeneous mass is obtained, which is cast into rods. The proportions of zinc and aluminium may be varied, and the melted solder is also preferably mixed with about one-tenth of its weight of silver-brazing. The pieces of aluminium to be joined are cleaned, coated with a solution of copaïba balsam, and then soldered in the usual manner.
—A. S.

Furnaces; Arrangements for the controlling the temperature of fusion ——. L. Pilla. Fr. Pat. 360,094, Dec. 5, 1905.

THE temperature of the fusion bath or crucible is determined and controlled by a current of water which, after becoming heated by circulating within a belt which surrounds the furnace, flows into a collector furnished with a thermometer.—J. H. C.

Furnace for metallic concentrations. International Metal Co., Ltd. Fr. Pat. 360,328, Dec. 11, 1905. Under Int. Conv., Dec. 14, 1904.

THE furnace is especially designed to volatilise and collect the metallic fumes arising from the heating of mixtures of ores of zinc or lead, crude or calcined, with combustibles. The mixture is introduced by a side door into a trough-shaped furnace having an opening in the bottom, the size of which can be regulated as required, and which is kept cool by currents of water or air. The fumes as formed are drawn off by an aspirator and collected in chambers.—J. H. C.

Gun-barrels and other metallic objects; Composition for cleaning ——. Saponia-Werke F. Boehm. Fr. Pat. 360,500. Dec. 15, 1905.

THE composition claimed consists of an intimate mixture of a saturated alcoholic solution of caustic soda, with a semi-liquid hydrocarbon, as, for example, a mixture of solid and liquid paraffins.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 433.)

(A.)—ELECTRO-CHEMISTRY.

Electrolysis with alternating currents. I. Electrolysis of alkali chlorides. A. Coppadoro. Gaz. chim. ital., 1906, **35**, 604—628.

IN electrolysis with alternating currents, the reactions are, according to the author, more complex than is usually supposed. For example, in the electroylsis of potassium chloride solution, immediately after the current has been started, potassium, chlorine, hydroxyl, and hypochlorous ions are present in the solution, and the formation of chlorate ions becomes possible. In the author's experiments, an alternating current of 42 periods per second was used, with platinum electrodes. With 3N solutions of potassium chloride and sodium chloride at temperatures between 15° and 30° C., no appreciable decomposition is produced with current densities below 50 ampères per sq. dcm.; with higher current-strengths, a tolerably considerable quantity of hypochlorite is formed. The gas produced consists of hydrogen; after a time, some oxygen is evolved, whilst chlorine is formed in traces at first, but later, not at all. In certain cases after the current has been passing for some time, the formation of chlorate is observed. The platinum electrodes are attacked and partly dissolved. In potassium chloride solutions, a deposit of platinum black and potassium platino-chloride is formed, and in sodium chloride solutions, one of pure platinum black. If the current density be not too high, the electrodes become platinised, and if the coating be perfect, the evolution of gas ceases, and also the amount of hypochlorite no longer increases. The platinum black decomposes hypochlorite with formation of chloride and oxygen. When the electrodes become platinised, the P.D. sinks appreciably owing to diminution of the polarisation.

With graphite electrodes, it is necessary to use a current-density of over 1000 ampères per sq. dcm. in order to obtain an appreciable production of hypochlorite. Graphite electrodes are also attacked.—A. S.

ENGLISH PATENTS.

Electrodes for electrolytic apparatus [*Hypochlorites, &c.*]. F. W. Howorth, London. From the heirs of the late C. Kellner, Vienna, Austria. Eng. Pat. 24,538, Nov. 27, 1905.

THE electrodes described are designed for use in the manufacture of substances, *e.g.*, hypochlorites, produced by the interaction of the cathode and anode products, and which must be protected from further oxidation or reduction. To this end the electrodes are made in the form ⊓, or ⊓|⊓, the last being designed to bridge over the low division walls of the electrolytic cell. The upper part of each electrode acts as cathode, the lower as anode. The electrolyte is circulated above the cathode in a direction parallel to the electrodes, the cathode thus preventing the further oxidation at the anode of the product of the reaction, which is formed in the layer of liquid between the two electrodes. The electrodes may be made solid or in lattice form.—A. G. L.

Ceramic ware; [*Electroplated* ——]. S. Heller, C. Baumgartl and Porzellanfabr. Ph. Rosenthal and Co., A.-G., Filiale Kronach. Eng. Pat. 10,833, May 24, 1905. VIII., page 478.

UNITED STATES PATENTS.

Batteries; Process of treating alkaline storage ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 817,162, April 10, 1906.

THIS invention relates to a process of treating, prior to shipment, an alkaline storage battery, the negative mass

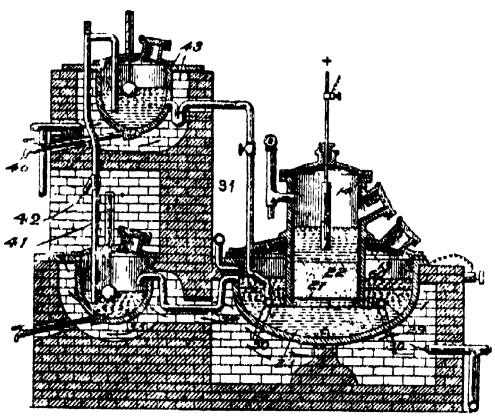
of which contains, when charged, finely-divided iron and metallic mercury. The negative mass is completely discharged by means of a "reversing-current," so as to fully oxidise the mass and prevent atmospheric oxidation. —B. N.

Furnace; Electric ——. J. F. Hammond, Brewster, N.Y. U.S. Pat. 817,767, April 17, 1906.

THE furnace comprises a muffle wound on the inside with a heat-generating wire, *e.g.*, of platinum, and contained in a casing, which is provided on the outside with grooves, and rows of separators registering with the grooves. A resistance wire, for instance, of nickel, is disposed in the grooves between the separators, and is so bent that the bend of one convolution lies within the bend of another. The heat-generating wire and the resistance wire are connected together and one wire is connected with a device for varying the resistance, consisting of a rotary shoe which travels along the bends of the resistance wire, contacting with one bend before breaking contact with another. The whole is enclosed in an outer casing.—A. S.

Caustic alkali; [Electrolytic] Apparatus for and process of producing ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pats. 809,085 and 809,088, Jan. 2, 1906.

THE electrolytic vessel, 1, contains a liquid-metal cathode,



23, such as molten lead, and into this dips the anode-chamber, 14, containing a molten alkali salt, such as sodium chloride, the electrolyte being separated from the lead cathode by a diaphragm, 22, of granulated magnetite. The latter is prevented from dropping out of the anode-chamber by the wire-gauze disc, 21. The lead-sodium alloy collecting below the diaphragm is displaced from contact with the electrolyte and rises to the surface of the lead around the anode-chamber, the level of the metal in the anode-chamber being lower than the surface of the lead in the space surrounding the chamber. Molten caustic soda is injected in a number of fine streams into the molten alloy by means of perforations, 30, in the annular pipe, 29, thus producing sodium oxide, the oxidation being facilitated by a loose layer, 60, of granulated material, such as magnetite. The sodium oxide is drawn off through the inverted siphon, 34, into the vessel, 35. The oxide may be run off from this vessel, or forced by means of a steam injector, 42, through the pipe, 41, into a vessel, 43, thus forming caustic alkali, which is run off through 46, or through the pipe with siphon bend higher up to supply the hydroxide necessary to oxidise the sodium in the alloy in 1. When mercury is used as the cathode, an aqueous solution of the salt is used as the electrolyte, and water is placed on the surface of the cathode around the anode-chamber. Carbon electrodes also dip into this liquid to assist in the solution of the sodium. Water or dilute caustic soda solution is injected in place of the molten salt through the pipe, 29.—B. N.

Caustic alkali; [Electrolytic] Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 809,089, Jan. 2, 1906.

A LIQUID metal, such as mercury, is automatically supplied as required to an electrolytic cell containing a saturated solution of an alkali salt, the alkali metal being liberated in contact with the mercury. The amalgam of decreased density accumulates on the surface of the cathode and passes by gravity into a separate oxidising vessel; caustic alkali is formed in the latter by electrolysis, and the mercury, depleted of the alkali metal, passes out, by gravity, from the oxidising vessel. The electrolytic and oxidising vessels are separated by an intermediate vessel in which the amalgam is covered with a non-conducting liquid, such as carbon tetrachloride, so that metallic connection is broken between the metal in the two cells. By providing means for heating the apparatus, molten lead may be used as the liquid-metal cathode in conjunction with a molten electrolyte, such as sodium chloride. —B. N.

FRENCH PATENTS.

Electric furnace with two electrodes and automatic deflection of the arc. C. Limb. Fr. Pat. 359,854, Feb. 4, 1905.

THE arc is maintained at the ends of two vertical and parallel electrodes by the action of an electric current traversing a conductor passing round the furnace. The principle is identical with that of the Jamin arc lamp, and is here applied to the electric furnace as utilised for various electro-thermal processes.—R. S. H.

Furnace for baking [carbon-] electrodes. C. Cuau. Fr. Pat. 360,326, Feb. 20, 1905.

CARBON electrodes formed from retort carbon mixed with tar, &c., are packed in a chamber between iron pipes, which communicate with the hearth of the furnace; through these pipes the hot gases ascend. The volatile matters which emanate from the heated electrodes are burnt at the top of the furnace by an auxiliary admission of air, after which the products of combustion, on their way to the chimney, pass down through the iron pipes and thus also communicate their heat to the electrodes. To prevent burning, the electrodes are covered with sand. —R. S. H.

Carbons; Process and apparatus for graphitising —— by incandescence. C. Cuau. Fr. Pat. 360,361, Feb. 21, 1905.

THE bar of amorphous carbon which is to be graphitised, is clamped at each end between hollow, water-cooled, metallic bodies, which serve as contact pieces for the electric leads. It is surrounded by bricks of refractory material, and the whole is placed in a chamber full of sand. A current of electricity is then passed through the bar, of sufficient intensity to raise it to the required temperature.—H. B.

Carbon for electric resistances; Process of preparing ——. Electric and Ordnance Accessories Co., Ltd., and E. G. Rivers. Fr. Pat. 360,284, Dec. 9, 1905.

POWDERED carbon is mixed with an alkali silicate solution which acts as an agglomerant. The mass is hardened by being exposed to a high temperature. In cases where a still harder material is required, the mass, after heating, is immersed in a dilute acid solution. The products so obtained are suitable for use as resistances for electric radiators, for which purpose the paste can be spread upon refractory supports before heating. It is claimed that the product is of greater uniformity and higher specific resistance than the more usual types of carbon resistance. —R. S. H.

Charge of uniform composition in electric fusion or heating processes; Production of a ——. F. A. Kjellin. Fr. Pat. 359,998, Dec. 2, 1905. Under Int. Conv., Aug. 14, 1905.

AN alternating current traversing a conductor tends to concentrate itself near the surface, and in considering the heating effect of the current the temperature is higher on the surface than in the inside of the conductor. Inconvenience is caused in such cases where uniformity in the

heating is necessary. It is claimed that the distribution of temperature can be made much more uniform by employing alternating current of low frequency in place of that of 20—50 periods usually adopted. The number of periods per second should not exceed a value obtained by dividing double the specific resistance of the conductor (measured in ohms per m. of 1 sq. mm. cross section) by the cross section of the conductor (measured in sq.m.).—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

Copper deposition; Action of organic colloids upon electrolytic —— [Brilliant deposits]. E. Müller and P. Bahntje. Z. Elektrochem., 1906, **12**, 317–321.

THE authors have investigated the effect of the addition of small quantities of colloidal solutions to the ordinary acid copper sulphate solutions used in electrolytic deposition. Gelatin, egg albumin, gum and starch were employed. Only in the two first instances was the character of the deposit materially altered. With gelatin the copper deposit with a current density of 0·0033 ampère per sq. cm. exhibits numerous vertical bright bands or stripes, just as though molten metal had flowed down the plate, solidifying on its way. If the current density be increased, the bands become wider, and with 0·035 ampère per sq. cm., provided the quantity of gelatin present be not too great, brilliant, quite homogeneous deposits of high reflecting power are obtained.

The above values for the current refer to the ordinary temperature of the room; increase of temperature has the same effect as a lowering of the current density, so that in warm solutions it is necessary to use a higher current density to obtain bright and even deposits.

The concentration of the sulphuric acid between N/1 and N/100 has little influence provided hydrogen be not evolved on the cathode surface.

Egg albumin has a less marked influence upon the deposit, the first effect being to produce a surface covered with innumerable small bright nodules.

To insure the satisfactory production of bright deposits it is in all cases essential to employ clear, well filtered solutions. The authors explain the observed phenomena by supposing that the bright deposit is formed by causing the metal to retain its amorphous condition and preventing it from becoming crystalline. The mutual protective effect of colloids upon one another, which has been noticed in other investigations, is probably the chief factor. Evidence in support of this hypothesis is adduced, as also in favour of the action of electrical endosmosis in transferring the colloidal mixture of the metal and organic substance to the cathode. Of some interest is the fact that only in acid solutions do the colloids give rise to bright deposits. The weight of copper deposited is greater than that obtained under normal conditions, owing to the presence of some 0·2 per cent. of the organic substance. The possible applications of the results are mentioned.

—R. S. H.

Chromium; Electrolytic production of metallic ——. O. Dony-Hénault and W. Gittens. Z. Elektrochem., 1906, **12**, 329–330.

WITH reference to the publications of Carveth, Mott and Curry (this J., 1905, 625 and 896) the authors mention experiments upon the electrolysis of chrome alum solutions, which lead them to consider that the conditions most suitable for the metal deposition are not necessarily the best for the preliminary treatment of the electrolyte for the purpose of improving it for the subsequent deposition of the metal.—R. S. H.

ENGLISH PATENT.

Cordite; Protection of steel guns from the erosive effects of ——, and similar gases. G. C. J. Topp, Isle of Wight. Eng. Pat. 12,635, June 19, 1905.

THE process consists in filling the gun with a suitable liquid, and electroplating the rifling with silver or other metal. It is claimed that erosion is thereby prevented, the plating alone being removed by the gases, and this can be renewed as often as necessary.—B. J. S.

UNITED STATES PATENTS.

Furnace; Electric ——. C. O. Wingren, Pasadena, Cal. U.S. Pat. 817,212, April 10, 1906.

THE furnace has a metallic air-tight casing, consisting of an outer body of heavy imperforate material with a removable cover secured to it, the cover being provided with a dome extending upwards. Electrodes are secured to, but insulated, from the body, and binding posts, which are fastened to the electrodes, project through the casing. Resistance material surrounds a smelting crucible placed between the electrodes, and the resistance material and electrodes are in turn enveloped by heat-insulating material. An observation tube is connected to the crucible, and, extending upwards through the heat-insulating material, terminates near the dome, a portion of the top of the latter being transparent. The dome is connected by a pipe to one of a number of ports in a valve-casing, a second and third pipe connecting the top and bottom of an air-pump, respectively, with two other ports in the valve-casing. Both these latter pipes are provided with clack-valves, the valve in the pipe connected to the top of the pump opening towards the latter and the other valve away from the pump. The piston of the pump has a check-valve opening in a downward direction. A valve-stopper in the valve-casing is provided with two channels, one being adapted to connect either of the pipes leading to the pump with the pipe leading to the dome, whilst the second channel simultaneously connects the other pipe from the pump with the outside air through ports in the valve-casing. The pump thus serves to exhaust the air from the crucible, or, after revolving the valve stopper, to put pressure upon the material in the crucible.—B. N.

Nickel-plating; [Electrolytic] Apparatus for ——. J. W. Aylsworth, East Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 817,152, April 10, 1906.

THIS invention relates to an apparatus for nickel-plating a continuous strip, and comprises a tank containing an electrolytic bath with a supporting beam carrying an upper and lower set of rollers, the latter being adapted to receive the strip alternately around the rollers of each set. Means are provided for raising and lowering the supporting beam, and for driving one or more rollers of the upper set, so as to move the strip through the bath, by means of a driving motor, the latter being connected by adjustable frictional connections with a supporting pulley mounted on the beam. A "take-up reel" is operated by the motor. Insulating bars for guiding the strip are carried by a series of hangers immersed in the bath. An "occluding-chamber," carried by the beam and normally partially submerged in the solution, and a cleaning tank in which the strip may be submerged are provided. The strip passes over an "idler," supported by a bracket on the beam, and removable brushes make contact with the strip on each side of the "idler." The strip is dried by passing it over two rollers, which are connected to the source of current, and by adjusting the rollers with respect to each other, the length of the heated section between the rollers may be regulated.—B. N.

Magnetic separation; Process of ——. F. T. Snyder, Oak Park, Ill., Assignor to International Separator Co., Chicago, Ill. U.S. Pat. 817,399, April 10, 1906.

A DIFFERENTIAL reciprocating movement is imparted to the ore within the influence of a magnet, which is periodically energised and de-energised, the reciprocating movement being so adjusted that the more permeable particles are attracted by the magnet and thus retarded, while the mass of ore is moving in one direction, but allowed to travel with the ore, while the latter is moving in the opposite direction. In this manner the magnetic particles are given a "net" movement in one direction and the non-magnetic particles a "net" movement in the opposite direction.—A. S

Iron and its alloys; [Electrical] Process of manufacturing ——. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 818,918, April 24, 1906.

The ore in a comminuted condition is fritted into coherent porous lumps by the action of an electric current, the lumps are collected in a confined heated atmosphere and subjected to the action of a de-oxidising gas until they are reduced without being melted, and the reduced lumps are finally melted by passing an electric current through them.—A. S.

Gold and other valuable metals; Process of reclaiming waste —— from water and other liquids. C. E. Holland, Assignor to The Holland Metal Recovery Co., New York. U.S. Pat. 818,174, April 17, 1906.

The water or other liquid is led continuously into and through a "runaway" or tank, wherein it is subjected to electrolysis in the presence of a body capable of forming a congulum. The coagulum and precipitate produced by the electrolysis are removed, evaporated, the liquid separated by decantation or filtration, and the gold or other metal extracted from the residue by a suitable process.—A. S.

French Patents.

Steel mixer; Electric ——. Soc. Electro-Métall. Française. Fr. Pat. 360,072, Feb. 11, 1905.

An electric oscillating furnace, such as that of Héroult (this J., 1902, 1237), is modified and constructed on a larger scale to serve as a "mixer" for steel, and thus ensure uniformity in the production of large masses. The apparatus is intended to receive molten steel from other furnaces and maintain its temperature by sufficient expenditure of electric energy to compensate for the thermal losses due to radiation, &c. In order to obviate the possibility of oxidation by ingress of air, the furnace is made as gas-tight as possible, and is connected to a gas producer which maintains a slight positive pressure within the furnace. The carbon electrodes are supplied with water-cooled collars which make a gas-tight joint with the cover. For a mixer of 100 tons capacity the following dimensions are given: surface of molten metal, 26 sq. m.; depth of molten metal, 1 m. Two electrodes, for single phase current, each 95 × 95 cms. cross section and 5 m. long. Such a furnace, supplied with 2500 h.p., is stated to be capable of reheating 50 tons of molten metal per hour through 50° C.—R. S. H.

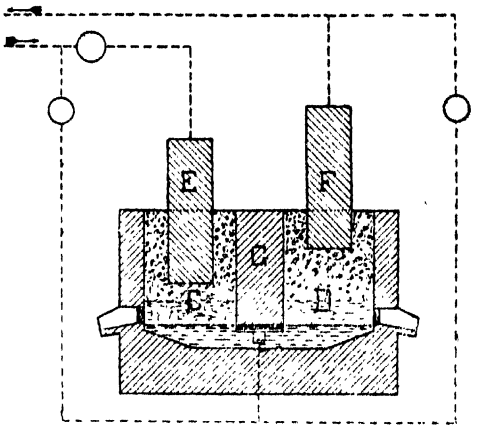
Copper; Extraction of —— from its ores [Electrolytically]. G. R. M. Sweeting. Fr. Pat. 360,071, Feb. 11, 1905.

The powdered sulphides are spread in a thin layer upon the sole of a reverberatory furnace moderately heated with coke, and in the presence of a quantity of air sufficient to supply 4 mols. of oxygen for each molecule of metal; the ore thus roasted is thrown into water contained in tanks of masonry whereby the copper is obtained in the state of sulphate solution, which is then evaporated until it reaches a proper density and finally submitted to electrolysis.—J. H. C.

Copper from its minerals; Electro-metallurgical process for the extraction of ——. L. Jumau. Fr. Pat. 359,913, Nov. 29, 1905.

The minerals are extracted with a solution of ammonia, preferably containing ammonium salts. The solution thus obtained is electrolysed directly, or the ammonia is recovered and the precipitated copper redissolved in acid and the solution submitted to electrolysis. The use of cuprous salts is preferred on account of the higher current yield, as also for the depolarising action of such solutions at the anode. The preparation of the cuprous salts can be effected by reducing the solutions with sulphurous acid. Finally, the ammonia is recovered by treating the residual liquors with lime. A subsidiary claim is made for an improvement in the diaphragms used in such a process. A porous material, *e.g.*, asbestos, is impregnated with gelatinous silica by immersion in a mixture of sulphuric acid and sodium silicate.—R. S. H.

Alloys; Production of —— in the electric furnace. M. Marchadier. Fr. Pat. 360,187, Nov. 11, 1905.



The method consists in treating separately and in suitable proportions the minerals of each metal entering into the composition of the alloy. The reduced and fused metals are mixed before their solidification or before they are tapped from the furnace. The electric furnace is divided into two compartments, C and D, by a refractory wall, G, reaching nearly to the bottom of the hearth. The current passes directly through the furnace from one electrode, E, to the other, F, but by regulating the potential in each half of the furnace, the relative expenditure of energy can be varied considerably, and thus the proportions of each metal required to form the alloy can be adjusted.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 434.)

Enzyme action; Studies on ——. *Lipase.* M. Nicloux. Roy. Soc. Proc., 1906, **77** B., 454.

The following general results have been obtained in studying the hydrolysis of fats by castor oil seeds. (Compare H. E. Armstrong, this J., 1905, 1242). It is possible by mechanical means to separate the cytoplasm of the seed from the aleurone grains and all other cellular elements; the cytoplasm alone can hydrolyse fats, acting as an enzyme and following the laws of enzyme action; its activity is considerable. The author holds that this active substance, which is destroyed by water so soon as it is no longer protected by fats, is not an enzyme, and he terms it lipaseidine.—E. F. A.

Walnut oil; Detection of foreign oils in ——. P. Balavoine. XXIII., page 499.

English Patents.

Fats and the like; Apparatus for the recovery of ——. C. Kremer and Ges. für Abwässerklärung m.b.H., Berlin. Eng. Pat. 23,670, Nov. 17, 1905.

Claim is made for a combination of a number of the fat collectors described in Eng. Pat. 14,461 of 1903 (this J., 1903, 1095), fed by a common pipe and contained in a common vessel open to each of them, so that there is a uniform current upwards and downwards, and a consequent uniform separation of fat and solid matter. All the lower edges of the walls of the fat collectors and the edges of the overflow channels may be made in a zigzag or serrated shape, so that any slight deflection of the partitions, &c., by the force of the water may not interfere with the even distribution of the liquid.—C. A. M

Soap solutions; Process and apparatus for cooling ——. F. Jürgens, Sangerhausen, Germany. Eng. Pat. 18,666, Sept. 15, 1905.

Very rapid cooling of the soap may be effected by exposing the hot solution to the action of a vacuum, whilst the walls of the vessel are meanwhile scraped with knives or scrapers. In the apparatus claimed for this process, the hot soap is introduced into a conical vessel surrounded by a cooling jacket, and having a central cooling tube, round which revolves a spiral provided on the outside and inside with scrapers which remove the solidifying soap from the wall of the cylinder and the surface of the inner cooling tube respectively. The agitation may be effected more thoroughly by making the cooling tube revolve in the opposite direction to the spiral. Nozzles are provided at the top for the exhaustion of air from the apparatus.—C. A. M.

United States Patents.

Detergent for scouring wool. S. Wohle, London. U.S. Pat. 818,648, April 24, 1906.

See Eng. Pat. 12,632 of 1904; this J., 1905, 671.—T. F. B.

Washing powders containing alkali peroxides; Vessel for packing and storing ——. J. von Königswarter, Hanover, Germany. U.S. Pat. 818,695, April 24, 1906.

See Eng. Pat. 19,809 of 1905; this J., 1906, 32.—T. F. B.

French Patents.

Olive oil; Apparatus for washing —— by decantation. V. Coq. Fr. Pat. 360,733, Dec. 21, 1905.

The apparatus claimed comprises a battery of conical decantation vessels contained in a chamber heated inside by a steam coil or otherwise, and fed by a single pipe which conveys the impure oil and the water for washing it. The separated liquids pass from the bottom of the vessels into funnels with three-way cocks communicating with separate pipes intended for the water, the *crasse*, and the pure oil respectively.—C. A. M.

Soap, ointment or paste for disinfecting purposes; Process of making ——. [*Peat tar.*] J. Kessler and Co. Fr. Pat. 360,174, Dec. 7, 1905. XVIIIC., page 493.

German Patent.

Resin soaps; Process for the removal of the resin colouring matter from ——. H. Schladitz. Ger. Pat. 167,240, June 12, 1904.

The process consists in adding before, during or after saponification of the resin, a solution of common salt, of such concentration that it will, together with the dissolved impurities, form a separate layer above the resin soap. For example, 100 parts of resin are saponified by 70—80 parts of a caustic soda lye of 25° B., in presence of 15 parts of common salt. Sufficient cold water is then added, with constant agitation, to form a salt solution of 3°—5° B. On allowing to settle, the salt solution, containing the resin colouring matter and other impurities, forms a separate layer above the resin soap, and can be removed. —A. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 435.)

(*A.*)—PIGMENTS, PAINTS.

Kermes mineral. Gabriel de la Puerta. Rev. Real. Acad. de Ciencias de Madrid, 1905, **3**, 269. Chem.-Zeit., 1906, **30**, Rep., 139—140.

A sample of Kermes mineral prepared from stibnite with sodium carbonate by Cluzel's method was found to contain, besides antimony sulphide, 20 per cent. of a mixture of sodium pyroantimoniate and amorphous antimony trioxide in about equal proportions. It also yielded 12·3 per cent. of water, indicating the presence of the sulphide as $Sb_2S_3.3H_2O$.

The following modified method is recommended for the preparation of a well coloured product:—10 grms. of finely powdered antimony sulphide, 50 grms. of crystallised sodium carbonate, and 1 grm. of sodium hydroxide, are boiled with 2 litres of water for about half an hour, until half the liquid is evaporated, the mass being kept well stirred. After allowing the filtrate to stand for 24 hours, the precipitated Kermes is filtered off, washed free from alkali, and then dried at 25°—30° C., and powdered. Yield, about 5 grms. On acidifying the mother liquor a precipitate of "golden antimony sulphide" (Sb_2S_5) is obtained.—F. Sodn.

French Patents.

Pigment, with zinc base, and process of manufacturing same. D. Lance and C. L. de Joannis. Fr. Pat. 360,215, Feb. 16, 1905.

The pigment consists of a mixture of zinc white and hydrated oxide of zinc, or of zinc carbonate and hydrated oxide, or of all three, and it is claimed that the properties of such a pigment, prepared as described, approximate to those of white lead, particularly as regards covering power and rapidity of drying. To prepare the pigment, ordinary (dry process) zinc white is subjected to a preliminary wet grinding in a tube-mill, in order to round off the edges of the angular particles, and is then mixed with a quantity of zinc hydroxide, prepared by a precipitation process in the cold or at a temperature of 50°—80° C. The proportions of the two compounds used are indicated by two general formulæ:—(1) $2ZnO + Zn(OH)_2$; (2) $6ZnO + Zn(OH)_2$, of which the first is a type of the composition of enamel pigments, the second being that of pigments suitable for matt surface paints. When the paint is required for use as a second coat for enamelling, and covering-power is not of primary importance, zinc carbonate may be substituted for a part or the whole of the zinc oxide. The superior drying properties of the pigment are conferred upon it by the hydrated oxide, which acts in a similar manner to hydroxide of lead, in partially saponifying the oil used as medium and so causing it to dry more rapidly.—E. W. L.

Zinc; Treatment of complex ores of ——. *Industrial preparation of zinc sulphite, and its application to forming a lithopone* [*paint*] *having barium sulphite as its base.* L. Brunet. Fr. Pat. 360,517, Feb. 28, 1905.

Zinc pyritic ores are so turnaced and the vapours treated with steam, as to yield zinc sulphite as a main product. To a solution of the zinc sulphite, solution of barium sulphide or hydroxide is added, to obtain as a precipitate a mixture of barium sulphite with zinc sulphide or with zinc oxide, which precipitate is applicable as a lithopone. —E. S.

Lakes [*from azo dyestuffs*]; *Process of making red* ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 360,824, March 13, 1905.

See Ger. Pat. 161,424 of 1904; this J., 1905, 1244.—T.F.B.

German Patents.

Lakes [*from azo dyestuffs*]; *Process of preparing red colour* ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 165,823, Aug. 20, 1904.

Lakes of a bright yellowish-red colour, and very fast to light, are obtained in the usual manner from the azo dyestuff prepared by combining β-naphtholdisulphonic acid R with diazotised dichloroanilinesulphonic acid, obtained either by nitrating *o*-dichlorobenzenemonosulphonic acid and then reducing, or by sulphonating 3.4-dichloroaniline.—T. F. B.

Paint, vehicle; Process for the manufacture of a ——. Norddeutsche Wollkämmerei u. Kammgarnspinnerei. Ger. Pat. 166,563, Dec. 1, 1904.

Colophony is saponified with a suitable metallic oxide, especially zinc oxide, or a mixture of zinc oxide and magnesia, then mixed with neutral wool-fat containing

a small quantity of the magnesia soaps of the wool-fat acids, and the mixture dissolved in a suitable solvent, *e.g.*, heavy coal-tar oil. The product is stated to be of use as a substitute for boiled linseed oil, being more resistant than the latter to the action of saponifying agents.—A. S.

(*B.*)—RESINS, VARNISHES.

Turpentine oil; Pinene fractions of French and American ——. B. Ahlström and O. Aschan. Ber., 1906, **39**, 1441—1446.

French and American turpentine oils were carefully fractionated, and determinations of density and specific rotation carried out on a large number of fractions boiling between 153° and 175° C.; the rotation of the hydrochloride from each fraction was also measured. The authors conclude that the pinene in these oils is mixed not only with pseudopinene, but with another or several other terpenes, which have a rotation opposite in sign to the contained pinene. By mixing inactive fractions of American and French oils, boiling at 155°—156° C., a lævo-rotatory hydrochloride was prepared. The oxidation of different fractions by a 1 per cent. solution of potassium permanganate gave varying amounts of nopinic acid, but little light was obtained in this way regarding the identity of the new terpenes. The authors suggest that cymene or limonene may be present and are continuing the work. —C. E. F.

Terpenes in Finnish crude turpentine. O. Aschan. Ber., 1906, **39**, 1447—1551.

The crude turpentines from fir and pine trees (*Pinus sylvestris* and *Pinus abies*) were distilled with steam and the turpentine oil so obtained fractionated. The turpentine oil from *Pinus abies*, as grown in Finland, contains *l*-pinene and probably *l*-limonene, but is free from sylvestrene. The oil from *Pinus sylvestris* contains *d*-pinene and *d*-sylvestrene.—C. E. F.

United States Patent.

Wood; Process of treating —— *for the production of paper pulp, terpenes and resinous substances.* G. P. Craighill and G. A. Kerr, Assignors to N. C. Manson, jun. U.S. Pat. 817,960, April 17, 1906. XIX., page 494.

(*C.*)—INDIA-RUBBER, &c.

Rubber; Relation between specific gravity and sulphur content of vulcanised Para ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 733.

The rubber used was a technical washed and dried Pará, containing 6·27 per cent. of resins and 0·27 per cent. of ash; 10-grm. samples were masticated with milk of sulphur in proportions varying from 5 to 75 per cent. of the weight of rubber, and cured, in glass moulds, by heating in an autoclave for 50 minutes at 145° C. and 4 to 5 atmospheres pressure of steam. The specific gravity at 16° C. of the vulcanised samples, determined by means of a pyknometer, varied from 0·834 with 5 per cent. to 1·130 with 75 per cent. of sulphur, but not uniformly with the sulphur content; it attained the value unity with a percentage of sulphur between 30 and 35.—E. W. L.

India-rubber; Effect of heavy magnesia as a filling material upon ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 760.

Para rubber was mixed with 10 per cent. of sulphur and rising percentages of heavy magnesia (magnesium oxide), and vulcanised for 45 minutes at 145° C. under a pressure of 4—5 atmospheres. The specimens were then tested mechanically. The breaking strain reaches a maximum at 30 per cent. of magnesia, and is throughout much greater than that of the same rubber similarly vulcanised without magnesia. The elasticity reaches a maximum at 25 per cent. of magnesia, and up to that point is considerably lower than that of the "blank." With more than 35 per cent. the mixing refuses to work coherently on the rollers.—W. A. C.

Rubber tree; New ——. For. Off. Ann. Ser., No. 3558.

A new kind of rubber tree, previously unknown in that part of Venezuela, has been discovered in the extensive forests of the Caura district, situated from 150 to 200 miles to the west and south-west of Ciudad Bolivar. Sample lots of the rubber produced from this tree have been sent to London, New York and Hamburg, and have realised from 3s. to 3s. 6d. per lb. This price is remunerative, as good facilities for transport by water exist. Unfortunately, as yet no efficient system of tapping the trees has been discovered, as by the method of tapping applied to the india-rubber trees in the Rio Negro district the milk does not exude freely. The consequence is that the collectors fell the trees to be able to tap them all along the trunk, following in this respect the system they employ for collecting balata. This, of course, will bring about the eventual exhaustion of the forests, which, in the case of the balata tree, is already beginning to be felt. [T.R.]

English Patent.

Caoutchouc, gutta-percha and balata; Process for the direct utilisation of the lactiferous juices of ——. L. P. T. Morisse, Paris. Eng. Pat. 7705, April 11, 1905.

See Fr. Pat. 360,325 of 1905; following these.—T. F. B.

French Patents.

Caoutchouc, gutta-percha and balata latices; Direct employment of —— *for manufacture of rubber articles.* L. Morisse. Fr. Pat. 360,325, Feb. 20, 1905.

The latex is poured on or into moulds, and is there coagulated by means of a suitable agent, as, for example, the following solution:—Beech-wood creosote, 2·5 grms.; guaiacol, 0·5 grm.; and alcohol, 50 grms. To this solution an amount, varying with the nature of the latex to be treated, of a solution of commercial sulphuric acid (25 grms. per litre), is added. One hundred and fifty grms. of the mixed solutions are sufficient to coagulate, sterilise and vulcanise a litre of latex, the vulcanisation being effected by the sulphuric acid. Balata and gutta latices need not be vulcanised.—E. W. L.

Rubber substitute, commonly called "Lynoxyne"; New application of the ——. A. E. Bretnacher. Fr. Pat. 360,090, Dec. 5, 1905. Under Int. Conv., Jan. 12, 1905.

Claim is made for the use of "Lynoxyne," prepared by heating oxidised linseed oil to as high a temperature as possible without decomposition—for the manufacture of articles in which its great elasticity under compression is of service, namely, cushions and buffers of various kinds. To utilise the substitute for this purpose, the mass, either hot or cold, is encased in various materials such as cloth, leather or rubber.—E. W. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 436.)

Hides; Depilation of —— *by the "sweating" process.* Palmer. Bull. Soc. chim. Belg., 1906, **19**, 280—281.

The "sweating" method for the depilation of hides consists of a superficial putrefaction, produced either by piling the hides in heaps which are covered with materials such as spent tan, straw, stable manure, &c., or else by placing them, previously moistened with water, in galleries in which a temperature of 22°—27° C. is maintained. In America the "sweating" is conducted at a temperature of 15°—21° C., by injecting a mixture of steam and atomised cold water into the chambers. The author's studies showed that ordinary methods of sterilisation cannot be applied to operations of this kind, and he had recourse to potassium xanthate, which has the advantage of restricting the development of the ordinary putrefactive bacilli, whilst favouring that of the bacteria which bring about the loosening of the hair. These bacteria are found in the form of rods and cocci,

always united in colonies and which are strongly stained by Methylene Blue. They show relationships with *B. subtilis* and *B. amylobacter*.

The author concludes that the depilation can be effected quite as well at a temperature of 17° C. as at 27° C., and there is less risk of damaging the hide at the lower temperature. The prejudicial action of darkness is less to be feared when depilation is conducted at a moderate temperature. Potassium xanthate does not act as an antiseptic but contributes to the formation of a medium favourable to the development of certain useful bacteria. The putrefactive bacteria are distinctly harmful. A microscopic examination is of great utility in following the course of depilation.—J. F. B.

French Patents.

Leather; New artificial ——. A. Sylvestre. Fr. Pat. 360,152, Dec. 7, 1905.

Felt is impregnated with a mixture of certain gums and resins by immersing it, at ordinary temperatures, in a preparation such as those described below, subjecting the wet mass to pressure, and, after allowing it to dry, passing it through warm calenders. As examples of the mixtures of gums and resins employed, the following are given:—

No. 1.		No. 2.	
Alcohol	100	Alcohol	150
Rosin	10	Mastic	30
Benzoin	40	Benzoin	40
Sandarac	15	Gomme nouvelle	15
Rubber	2	Rubber	2
Linseed oil	10	Benzine	20
		Linseed oil	10

It is claimed that the product obtained by this process is impermeable, supple and unbreakable.—E. W. L.

Leather; Artificial ——. H. Karle. First Addition, dated Nov. 17, 1905, to Fr. Pat. 342,622, April 25, 1904 (this J., 1904, 944.)

A solution of balata gum in benzene or other solvent is employed as a binding material for the fibrous layers described in the original specification. The balata gum may be partially replaced by other gums and caoutchouc. The treated sheets are then slightly tanned, calendered, dried, coloured and dressed. Gelatin may also be used as a binding material.—W. P. S.

German Patent.

Fibrous substances [textiles, leather, paper, &c.]; Process for waterproofing ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 166,350, May 12, 1904. V., page 475.

XV.—MANURES, Etc.

(*Continued from page* 436.)

Calcium and magnesium salts; Influence of —— on certain bacterial actions. S. Machida. Bull. Imp. Centr. Agric. Experim. Stn., Japan, 1905, **1**, 1—12.

The experiments show that the putrefaction of urine and peptone is retarded by calcium salts, but facilitated by those of magnesium, whilst nitrification is favoured by magnesium carbonate to a greater extent than by calcium carbonate. Certain putrefactive bacteria, such as *B. fluorescens liq.*, *Proteus vulgaris* and *B. mycoides* are able to assimilate tricalcium phosphate, thus indicating the possibility of rendering insoluble phosphates in the soil available for plant food.—C. S.

Lime factor for the tobacco plant; On the ——. G. Daikuhara. Bull. Imp. Centr. Agric. Experim. Stn., Japan, 1905, **1**, 17—22.

The original soil contained almost identical quantities of lime and magnesia, and comparative trials were made with added lime to increase the lime factor to 2:1 and 4:1. The latter, which corresponds approximately with the mean ratio in the ash of various kinds of tobacco, gave the best results, the budding, flowering and topping being accelerated by twelve, nine and three days respectively. The size of the plant was increased, and the weight by about 43 per cent. With added fertilisers the highest yield was furnished by a mixture of ammonium sulphate, superphosphate and potassium carbonate.—C. S.

Magnesia; Application of —— in the form of magnesium sulphate for the needs of the rice plant. G. Daikuhara. Bull. Imp. Centr. Agric. Experim. Stn. Japan, 1905. **1**, 23—29.

To ascertain how much magnesium sulphate can safely be employed, as a source of magnesia, in place of magnesite (which is scarce in Japan), rice was grown in pots of sand treated with a uniform ratio of nitrogen: phosphorus pentoxide. The results showed that in presence of lime as carbonate the best ratio CaO:MgO, when magnesium sulphate is used, is 30:1 in place of 1:1 with magnesium carbonate. This applies, however, only to sandy soils. Sodium nitrate is found inferior to ammonium sulphate, in the ratio of 40:100, as a source of nitrogen for the rice plant.—C. S.

Magnesia; Improvement of a soil relatively deficient in ——. T. Nakamura. Bull. Imp. Centr. Agric. Experim. Stn. Japan, 1905, **1**, 30—34.

In a light soil containing lime and magnesia in the ratio 176:11, the lime being to a large extent in the form of silicate, the most favourable effect on barley was obtained by adding magnesium sulphate to modify the ratio to 7:1, the relative value of the sulphate to the carbonate (magnesite) being found to be about 23:100 in this instance. —C. S.

French Patents.

Phosphates [Bi-magnesium-hydrogen phosphate]; Manufacture of bibasic —— by means of natural phosphates. J. J. T. Schloesing. Fr. Pat. 360,357, Dec. 12, 1905. VII., page 478.

Manure; Manufacture of dry —— by means of organic waste matters. G. Gunther. Fr. Pat. 360,479, Dec. 14, 1905. Under Int. Conv., Dec. 28, 1904.

Waste organic materials, especially woollen rags, waste hair, horn, feathers, or leather, &c., are subjected for a few minutes, or longer, according to circumstances, to the action of a highly heated vapour or gas, or a mixture of such. The process may be conducted in any suitable apparatus, and superheated steam may be used as the desiccating agent. The product obtained is stated to be brittle and easily friable, and is applicable as a manure. —E. S.

Peat; Industrial treatment of —— to increase its contents of nitrogen, in view of its application as a manure. E. V. H. Bazin. Fr. Pat. 360,484, Dec. 14, 1905.

The object of the invention is to produce by the aid of blocks of peat, a *nitrière*, or nitrate-producing ground. On a paved or cemented space, having a slight elevation on one side, to permit of drainage towards a determined point, blocks of peat, cut to a convenient size, are stacked in piles, surmounted by perforated troughs from which a liquid continuously flows on to the peat. The drainage passes into a cemented cistern from which it is continuously pumped back to the troughs. The cistern is supplied with urine or ammoniacal liquids, such as may carry nitrate-producing bacteria, which are also preferably supplied to the liquid by the addition of leguminous plants. Directions are given for removal of the enriched heaps of peat, and their preparation for manurial application, and for their replacement by fresh heaps without disturbing the continuity of the process.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 438.)

Beetroots; Simplified filtration in the analysis of ——. Nyssens. Bull. Soc. chim. Belg., 1906, **19**, 285.

In order to avoid large quantities of glass funnels and receivers in the determination of sugar in beetroot pulps, when the number of samples is very large, the author employs small cups of enamelled iron, perforated at the bottom. A folded filter-paper is bound round the outside of the bottom of each of the cups, which are then floated in the clarified extract of beet-pulp prepared according to the Le Docte method, in the special capsules or cans generally employed. As the solution filters upwards into the cups, these sink, and a sufficient quantity of clear liquid can be siphoned off for polarisation in a very short time.—J. F. B.

Starch; Acid properties of ——. E. Demoussy. Comptes rend., 1906, **142**, 933–935.

Rice starch, demineralised by dilute hydrochloric acid and washed till free from chloride, has the properties of a weak acid comparable with carbonic acid and resembles in this respect the other carbohydrates (see Ford and Guthrie; this J., 1906, 228). It forms compounds with the metallic hydroxides, ammonia and the alkali carbonates, which are dissociated by water and it is also capable of absorbing small quantities of neutral salts, *e.g.*, chlorides of sodium and potassium, potassium sulphate, copper acetate, &c.—E. F. A.

Pentoses, New method for the quantitative determination of —. A. Jolles. XXIII., page 500.

English Patent.

Inulin; Process for the complete extraction of ——, *from the tubercles containing it.* I. De Vecchis, Rome, and A. Sam. S. Giorgio di Nogaro, Italy. Eng. Pat. 5323, March 5, 1906.

The tubercles are cut into small slices and thoroughly extracted with water at a temperature of from 80° to 85° C. in a diffusion apparatus. The extract is then heated to a temperature of 95° C. to coagulate the albuminoids, filtered, and evaporated under reduced pressure at 95° C. The thick syrup obtained is filtered while still hot through animal charcoal, and the filtrate allowed to cool, when the greater part of the inulin separates out. After removing the deposited inulin, the mother-liquor is again filtered through animal charcoal, evaporated to a pulp, cooled and at the same time stirred, and finally subjected to centrifugal action. A further quantity of inulin is thus obtained; as it has a slight brown colour it may be dissolved in a subsequent supply of the thick syrup before filtration.—W. P. S.

French Patent.

Saccharine juices; Process of carbonating ——. E. J. B. Portemont. Fr. Pat. 360,743, March 9, 1905.

The carbonating is effected in a series of closed vessels in which the treatment with the gas is continuous in all except the last. The juice enters the first vessel of the series and passes out, after treatment with carbon dioxide, from the bottom through a wide pipe entering the second vessel at the upper level of the liquid, and so on through the series until the last vessel is reached. The juice is admitted to the last vessel intermittently in determined quantities by means of screw valves in the bottom. The correct degree of carbonating is then established in this vessel, the rate of previous treatment having been such that this degree is reached in a very short space of time. The juice is then discharged and a further quantity is admitted. In each vessel an oscillating agitator is provided in order to effect a complete admixture between gas and liquid.—J. F. B.

German Patent.

Gum; Process for the preparation of a soluble vegetable ——. Gerson und Sachse. Ger. Pat. 167,275, Feb. 14, 1903.

Starch and substances containing starch are macerated with a 1 per cent. solution of caustic soda, and then treated with an easily decomposable oxidising agent until the product, after neutralising with acid and washing free from soluble salts, is soluble in boiling water and cold alkali solutions.—A. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 440.)

Barley; Dependence of the extract yield on the protein content of ——. Stockmeier and Wolfs. Bayer. Brauerj., 1906, No. 13; Z. ges. Brauw., 1906, **29**, 252–254.

The authors have determined the extract contents of a large number of barleys of the current season. The barleys were ground first in a Seck's "fine grist" mill and were then finely powdered in a Dreef's mill; 25 grms. of the meal were then treated exactly in the manner prescribed by Graf (this J., 1906, 201) for the determination of the extract. In a table are given the values obtained for protein, extract, grading, weight per hectolitre and weight per 1000 corns for each of the 34 samples. The results showed, on the whole, that the extract contents diminish as the protein contents increase. The following summary of average results from the various groups, arranged according to the protein contents, illustrates this relation:—

Protein contents (dry barley)	Samples.	Mean protein contents (dry barley).	Mean extract contents (dry barley).
per cent		per cent	per cent.
10—11	5	10·60	78·8
11—12	9	11·70	77·0
12—13	5	12·51	77·1
13—14	8	13·40	77·1
14—15	4	14·21	76·3
above 15	1	15·18	75·4
,, 16	1	16·44	73·8
,, 17	1	17·95	75·7

—J. F. B.

Hydrogen peroxide; The diastatic catalysis of ——. H. van Laer. Bull. Soc. chim. Belg., 1906, **19**, 337–361.

It is generally agreed that the indirect diastatic decomposition of hydrogen peroxide in presence of readily oxidisable reagents, such as guaiacum, or Würster's "tetra-base," is a distinct phenomenon from the direct diastatic catalysis of the peroxide which is brought about by a very large number of organic tissues. The latter phenomenon is generally attributed to the action of a specific enzyme, the catalase of Loew or reductase of Pozzi-Escot, whereas the former is regarded as a property of the peroxydases. The author has studied the catalytic properties of barley, malt, hops, yeast (including living yeast and "Dauerhefe") and the juice of potatoes. These all show great variations in their catalytic powers. For malts prepared from the same barley, the catalytic power decreases as the temperature of curing is increased. A "Dauerhefe" prepared in 1901 was still very active towards hydrogen peroxide in 1905, although its fermentative power was completely lost. Kilned malt, the seeds of hops and living and dead yeast, appear only to contain one catalytic enzyme which is insoluble (the α-catalase of Loew), whilst the juice of potatoes and some barley contain also a certain quantity of a soluble catalase (β-catalase), which, however, is partly held back by filtration. The temperature at which the catalytic enzymes are destroyed by heating in the moist condition varies according to their origin. Certain of them, *e.g.*, in malt, are very much weakened even at 30° C., others,

e.g., in "Dauerhefe" only begin to be destroyed at 40°—50° C. In all cases the catalases are characterised by a relatively low temperature of destruction, whereas the peroxydases are exceptionally resistant to high temperatures. On the other hand, both malt and "Dauerhefe," may be heated at 105° C. for several hours in the dry state without losing the whole of their catalytic power.

With concentrated solutions of hydrogen peroxide, the catalysis, rapid at first, soon slackens owing to the destruction of the catalase. With dilute solutions on the other hand, the slackening of the reaction is due to the disappearance of the peroxide, and in such cases the intensity of the reaction increases as the concentration is increased. As a result of these two opposite tendencies there is in each case an optimum concentration of hydrogen peroxide at which the catalysis is most intense, and which varies with the different preparations. When the velocity constant of the reaction reaches the maximum point, the phenomenon follows for a short time the logarithmic law of monomolecular reactions. In all cases there is a destruction of the catalase, more or less rapid according to the concentration of the peroxide, but the variable value of the catalase thereby introduced may be substituted by a mean value which may be assumed to be constant during the whole reaction. If this mean value be considered, it is observed that the diastatic catalysis of hydrogen peroxide follows the law of mass action.

—J. F. B.

Bacillus lactis aerogenes; Action of —— on dextrose and mannitol. production of 2:3-butylene-glycol and acetylmethylcarbinol. A. Harden and G. S. Walpole. Roy. Soc. Proc., 1906, **77** B., 399—405.

B. lactis aerogenes was grown anaerobically in a medium containing 1 per cent. of Witte peptone and 2 per cent. of pure dextrose in the presence of chalk. Lactic, acetic, succinic and formic acids were produced along with ethyl alcohol, carbon dioxide and hydrogen, but only about two-thirds of the carbon of the dextrose were thus accounted for. An optically-active colourless liquid, of b. pt. 181°—183° C., was extracted from the neutral liquid containing the products of fermentation. This was proved to be largely 2:3-butylene-glycol. The distillate from the culture fluid contained small quantities of acetylmethylcarbinol. Mannitol yielded similar fermentation products, the deficit of carbon being only one-half of that found for dextrose. The culture fluid was found to contain butylene-glycol and acetylmethylcarbinol. The following table (selected from the author's results) shows that *B. lactis aerogenes* produces more alcohol than *B. coli communis* and that the new products are formed at the expense of that part of the molecule which in the *B. coli* fermentation yields acetic and lactic acids:—

	Dextrose.		Mannitol.	
	B lactis aerogenes.	B coli communis.	B lactis aerogenes.	B coli communis.
Alcohol	17·1	12·85	32·5	28·1
Acetic acid	5·1	18·84	2·5	9·5
Lactic acid	5·5	31·9	8·6	18·6
Succinic acid ...	2·4	5·2	3·2	8·9
Formic acid	1·0	0·0	1·5	3·0
Carbon dioxide ..	38·0	18·09	35·5	28·4

—E. F. A.

Bacteria; Voges and Proskauer's reaction for certain ——. A. Harden. Roy. Soc. Proc., 1906, **77** B., 424—425.

CERTAIN bacteria grown in a medium containing sugar give a beautiful eosin-red fluorescent colour when potash is added to the culture fluid and the tube allowed to stand for 24 hours. The author has shown (see preceding abstract) that *B. lactis aerogenes* grown on dextrose forms acetylmethylcarbinol and 2.3-butylene-glycol, neither of which substances produces the characteristic fluorescent coloration with potash alone, but, when peptone water is also added, acetylmethylcarbinol gives the reaction after 24 hours, the coloration being produced at the open end of the tube. Diacetyl yields the coloration in a few minutes. Voges and Proskauer's reaction is thus due to the formation of acetylmethylcarbinol, oxidation of this in presence of potash and air to diacetyl, which then reacts with some constituent of the peptone water.

—E. F. A.

Yeast juice; Alcoholic ferment of ——. A. Harden and W. J. Young. Roy. Soc. Proc., 1906, **77** B., 405—420.

THE total fermentation produced by yeast juice acting on excess of dextrose is doubled by the addition of an equal volume of the boiled juice and a further increase is produced when a greater volume is added, the sugar concentration being kept constant. The constituent of the boiled and filtered juice to which this effect is due is removed when the liquid is dialysed in a parchment tube, an inactive residue being left. By filtering the juice through a Martin gelatin filter it is possible to divide the yeast juice into an inactive residue and a dialysate which, although itself inert, is capable of rendering this residue active.

A comparison of the rates of evolution of carbon dioxide from (1) a solution of dextrose in yeast juice, and (2) a similar solution to which boiled and filtered yeast juice has been added, proved that two phenomena are concerned in the production of the increased fermentation:—

(*a*) An initial rapid evolution of carbon dioxide is produced, which diminishes to a nearly constant rate, and which is usually approximately equal to that given by an equal volume of the same yeast juice and dextrose, to which no addition has been made.

(*b*) The fermentation rate diminishes more slowly, so that the fermentation continues for a longer period. The greater proportion of the total increase is due to this second phenomenon.

In the initial period the extra amount of carbon dioxide produced is directly proportional to the volume of boiled juice added. A similar well-marked initial rapid evolution of carbon dioxide was produced on the addition of soluble phosphates to yeast juice. The products of fermentation in the presence of phosphates are quite normal, the ratio of alcohol to carbon dioxide being 1·13. When the fermented liquid is boiled and filtered, almost the whole of the phosphorus present is found in the filtrate, but it is nearly all in a form which is not precipitated by ammoniacal magnesium citrate mixture. It possibly exists in combination with dextrose, probably in the form of a phosphoric ester.

The question as to whether the entire phenomenon of the fermentation of dextrose by yeast juice depends on the presence of phosphates has not yet been definitely decided.—E. F. A.

Asporogenic budding fungi occurring in and around breweries. II. H. Will. Z. ges. Brauw., 1906, **29**, 241—243.

IN a previous paper (this J., 1903, 814) it was shown that most of the asporogenic budding fungi collected in the brewery were entirely suppressed during the primary fermentation by the culture yeast. On the other hand, most of these fungi were capable of developing in clarified beer with free access of air. The author has further investigated the influence of other races of culture yeasts and of the "wild" yeasts, *S. turbidans* and *S. validus*. The power of resistance of the budding fungi was found to vary somewhat according to the species of yeast concerned in the fermentation, but in all cases the power of resistance was only slight. The behaviour of the fungi in clarified beer depends on the proportion of alcohol and on the relative access of air. Nearly all the fungi grew well in small quantities of beer, *i.e.*, where the exposed surface bore a high proportion to the total volume but only a few developed in beer kept in full bottles plugged with cotton wool, whilst only two showed any signs of growth in full bottles tightly corked. Hence it is concluded that, with good bottling, infection by these budding fungi is of little practical moment, especially since, when they do develop, they appear to have no effect on the flavour of the beer.—J. F. B.

Saccharomyces apiculatus; Morphological and physiological investigations on certain races of ——. A. Röhling. Inaug. Dissert., Erlangen; Z. ges. Brauw., 1906, **29**, 257.

THE races of apiculatus yeasts form spores on gypsum blocks which can be caused to germinate, preferably in a medium composed of horse-dung extract and dextrose. These yeasts are true saccharomycetes. The production of alcohol can be stimulated to a considerable extent by passing oxygen into the cultures; at the same time there is a vigorous multiplication of cells. The apiculatus yeasts are very sensitive to the influence of chemical agents, *e.g.*, sulphurous acid and alcohol. If apiculatus yeasts and wine yeasts are present together in a fermenting liquid, initially in about equal proportions, or if the apiculatus yeasts are present in large numbers, the course of fermentation is retarded and the product is strongly flavoured by the unpleasant bouquet developed. But if the wine yeasts predominate from the beginning, the apiculatus yeasts are suppressed, and the fermentation proceeds rapidly without the development of unpleasant bouquet and with the production of relatively large quantities of volatile acids.—J. F. B.

[*Beer Worts*] *Extract tables; The official Austrian* ——. E. Jalowetz. Allg. Z. Bierbrau. u. Malzfab., 1906, 113; Woch. f. Brau., 1906, **23**, 216.

IN Austria the extract of beer worts for excise purposes is determined by a normal saccharometer which was introduced in 1888. The instrument is based on officially sanctioned cane sugar tables constructed for a temperature of 17·5/17·5 C. These tables show sugar values which are 0·10—0·12 per cent. higher than those of Balling's tables for the same densities. On the other hand they agree well with the highly accurate, official German tables, the average difference being only 0·017 per cent. Although the Austrian tables are exact, the use of the saccharometer cannot be regarded as satisfactory, and it should be replaced by the more accurate pyknometer. The author found differences between the saccharometer values and the pyknometer values amounting to as much as 0·22 per cent. of extract in worts ranging from 8·9 to 12·2 per cent. He also draws attention to the anomaly of using Balling's tables in the determination of extract in malts and the normal tables in the determination of extract in brewery worts.—J. F. B.

Fluorine in alimentary products [*and wine, beer, &c.*]; *Optical method for the detection of* ——. J. Ville and E. Derrien. XXIII., page 499.

ENGLISH PATENTS.

Kilns for drying hops or the like; Impts. in ——. H. W. Joyce, Hereford. Eng. Pat. 9264, May 2, 1905.

AN air-heating shaft, relatively narrow with respect to the area of the kiln, underneath which it is placed, has a furnace, preferably of the kind described in Eng. Pat. 10,988 of 1902, situated near the bottom. The products of combustion from the furnace pass through a zig-zag or spiral flue placed within the shaft, to an outlet on the outside of the kiln. Cold air enters the bottom of the shaft, becomes heated by contact with the flue, and rises through the floor of the kiln, even distribution being attained by placing a deflecting plate over the top of the shaft. A second current of air, heated by passing through the hollow fire-bars, passes through a vertical pipe within the shaft, and is delivered above the materials in the kiln. The furnace may also heat a boiler having circulating pipes leading to a coil in the upper part of the shaft, the radiation from the coil assisting the heating of the air.—W. H. C.

Non-intoxicating drinks; Compounds for making ——. J. H. Brodrick, Dudley, Worcester. Eng. Pat. 15,079, July 21, 1905.

THE process is an improvement on Eng. Pat. 25,149 of 1898 (this J., 1899, 1147). One bushel of malt is steeped in 9 galls. of water at a temperature of 180° F. and allowed to cool to about 150° F. The malt is then dried, its starch having been thus converted into glucose. The hops used in making the beverage are also boiled and dried. The malt and hops thus treated are substituted for the roasted malt and hops described in the previous patent and with the other ingredients are compressed into tablets which are used for making the beverage.—W. P. S.

UNITED STATES PATENT.

Drying apparatus for malt. E. Ellermann, Berlin, Germany. U.S. Pat. 817,698, April 10, 1906.

THE apparatus comprises a hollow rotatable shaft on which is fixed a worm conveyor surrounded by a perforated cylinder concentric with the shaft. A number of concentric heating coils are arranged without the cylinder and the whole apparatus is enclosed in an outer casing. The malt or other material to be dried is fed to the inner cylinder at one end, is carried along by the conveyor and returned again through the annular space between the coils and the outer casing.—W. H. C.

FRENCH PATENT.

Wines and fermented liquids; Sulphitation of —— by known quantities of sulphurous acid. J. Laborde. Fr. Pat. 360,838, Dec. 11, 1905.

ACCORDING to this invention a known quantity of wine in a cask is treated with a known quantity of liquid sulphur dioxide, which is contained in a cartridge or metallic bottle. The cartridge is inserted in a perforated cylindrical casing which carries a punch attached to a piston at the bottom. The case containing the cartridge is dropped with some force into the cask of wine. The shock of the piston striking the bottom forces the punch through the lead cap of the cartridge; the sulphur dioxide escapes in the gaseous form and is distributed through the perforations in the casing.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 440.)

(A.)—FOODS.

Cocoa; Determination of fat in ——. Tschaplowitz. XXIII., page 500.

Fluorine in alimentary products [*and wine, beer, &c.*]; *Optical method for the detection of* ——. J. Ville and E. Derrien. XXIII., page 499.

ENGLISH PATENTS.

Bread making; Yeast stimulant or nutrient for use in ——. L. Fink, Berlin. Eng. Pat. 27,081, Dec. 28, 1905.

A YEAST stimulant is made of a mixture of 20—25 parts of calcium citrate, 60—70 parts of calcium hydrogen phosphate and 5—20 parts of potassium hydrogen tartrate; 10—15 parts of the above mixture are mixed with 35—40 parts of sugar. For bread-making, one part of yeast is mixed with water at a temperature of 50° C., and 1·5 parts of the above mixture are added. After a short time the liquid is mixed with the usual proportions of flour and water. Fermentation is stated to be complete in 10—20 minutes.—J. F. B.

Alimentary product from Iceland lichen [*Cetraria islandica*]; *Process of producing an* ——. B. Hansteen, Aas, Norway. Eng. Pat. 5195, March 3, 1906. Under Int. Conv., March 7, 1905.

THE lichen is first washed and cleaned by means of hot water, and then boiled for at least 20 minutes with a 15 per cent. solution of alkali carbonates, the mixture being stirred continuously. After the alkali solution has been filtered off, the material is repeatedly boiled and washed with water until the washings are colourless, salt is added and the product pressed and sterilised.

—W. P. S.

French Patents.

Cereals; Treatment of [Bleaching] ——. Nordyke and Marmon Co. Fr. Pat. 359,771, Feb. 1, 1905.

The cereals are subjected to the action of the gas resulting from the passage of ammonia gas over metallic oxides, such as copper oxide.—W. P. S.

Flour [inferior]; Process of rendering —— more suitable for baking purposes. R. F. C. Merelle. Fr. Pat. 360,142, Feb. 14, 1905.—W. P. S.

Flour which has deteriorated on account of fermentation, &c., may be rendered fit for bread-making by heating it to a temperature of from 60° to 80° C. in a closed vessel, so that there shall be no loss of moisture. This treatment is stated to alter the composition of the gluten of the flour, the gliadin being converted into glutenin.—W.P.S.

Blood and fluid extracts of animal tissues; Process for desiccating . J. R. Hatmaker. Fr. Pat. 360,800, Nov. 17, 1905. Under Int. Conv., Nov. 18, 1904.

See Eng. Pat. 25,077 of 1904; this J., 1905, 1319.—T.F.B.

Fish extract free from oil; Manufacture of —— . P. Hagen. Fr. Pat. 359,952, Nov. 30, 1905.

Fish, preferably herrings, are cleaned, washed and ground. The mass is then boiled with water in the proportion of 1:100 and the extract strained to remove solid matters. The turbid solution is now heated with the addition of beef or mutton fat, 5 per cent. of the latter being added for each 1 per cent. of fish oil in the solution. On cooling, the animal fat separates out, carrying with it all the fish oil. After removing the fatty layer, the aqueous extract is evaporated to a paste in the usual manner.—W. P. S.

Milk and milk products, Process for the desiccation of ——. G. A. Kammermann. Fr. Pat. 360,358, Dec. 12, 1905.

The milk, or a mixture of the latter with sugar, coffee, cocoa and the like, is partially evaporated in open vessels or under reduced pressure at a temperature below 100° C. The condensed product is then dried on rotating cylinders heated to a temperature below 100° C., and is finally powdered.—W. P. S.

German Patent.

Product for baking purposes consisting of albumin and casein; Process for the preparation of a ——. Gebr. Schredelseker. Ger. Pat. 166,849, Jan. 20, 1905.

The process claimed is an improvement on that described in Ger. Pat. 103,156, and consists in adding liquid yolk of egg to skimmed or separated milk, either shortly before the addition of rennet, or after coagulation of the casein. It is stated that the baking and other properties of the product are improved.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Smoke and fumes from refuse-destroying furnaces and the like; Consumption of the ——. H. Fairbrother, London. From the Decarie Manufacturing Co., S. Minneapolis, U.S.A. Eng. Pat., 18,915, Sept. 19, 1905.

The smoke from the destructor furnace passes through openings into a gas-consuming chamber, and thence down a flue, provided with a water-tank at its bottom, into a secondary furnace. The latter consists of two separate fires, the upper one having a down-draught. After passing this furnace the fumes are led upwards and over a partition, then downwards over the surface of water contained in tanks, a stream of water falling into the first tank forming a sheet through which the fumes must pass. The washed gases finally enter the chimney-shaft.—W. P. S.

Sewage; Apparatus for the automatic destruction or bacterial treatment of ——, and for the purification of effluent or residual liquids. V. Bordigoni, Paris. Eng. Pat. 24,332, Nov. 24, 1905.

The apparatus consists of a tank divided into four chambers; two of the latter are closed and the other two open to the air. The sewage is delivered into the first closed chamber, which is divided into three compartments. Two of these are comparatively small, and serve for the intermittent reception of the sewage, whilst the third compartment extends under the other two, and is separated from the same by perforated partitions. After passing through these compartments the sewage passes into the bottom of the second chamber, which is fitted with baffle-plates, and thence into the first open chamber, entering at the top. This chamber is divided into two compartments separated by a partition perforated at the bottom; the second of these compartments is partly filled with blocks of limestone. The sewage finally passes into the last chamber, which contains a series of small tanks placed one above the other, each tank being filled with oxidising materials and divided into parallel compartments. A tipping bucket discharges the sewage alternately into the compartments. After traversing these layers the liquid flows into a receptacle, where it is treated with a mixture of permanganate, calcium chloride, and bisulphite, before being discharged. (See also Eng. Pat. 11,900 of 1904; this J., 1904, 833.)

—W. P. S.

United States Patents.

Sewage; Apparatus for treating . M. van B. Smith, New York. U.S. Pat. 817,996, April 17, 1906.

An endless band, composed of separate sheets of wire-cloth, the mesh of the outer layer being so fine as to prevent water under normal conditions passing through it, is mounted in two horizontal "runs." A number of rollers are placed in contact with the under surface of the upper part of the band so as to draw the water through the band and discharge the same. Means are provided for cleansing the band at its lower part from the solid portions of the sewage, a jet of water under high pressure serving this purpose.—W. P. S.

Distilling apparatus [for water]. L. Kleitz, Chicago, Ill. Assignor to E. C. Wagner, La Fayette, Ind. U.S. Pat. 818,831, April 24, 1906.

The claim is for a boiler or still, the vapour-pipe of which is connected by bends and a sliding joint to the upper end of a vertical condenser-tube. The latter is surrounded by a condenser-casing through which the cooling water flows and from which the still is fed by a pipe having a coupling joint so that the still may be disconnected when required. The still is supported by a separable bracket attached to the outer side of the condenser-casing.

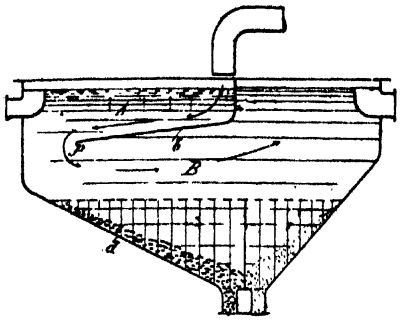
—W. H. C.

German Patents.

Water; Apparatus for the chemical, mechanical and biological purification of ——. F. W. Dünkelberg. Ger. Pat. 165,414, Aug. 9, 1904.

The apparatus consists essentially of two concentric cylinders with a filtering layer between. The outer cylinder has at the top a flange or rim projecting inwardly and forming a distributing channel for the water. To the inner surface of this outer cylinder is affixed a series of metal tubes having fine perforations and filled with superposed short drain pipes of earthenware or the like, the uppermost pipes projecting into the distributing channel. The water deposits its coarser suspended particles in the distributing channel and then flows through earthenware pipes and perforations in the metal tubes to the filtering layer, and, finally, through narrow slits into the inner collecting cylinder. The clayey impurities and dissolved salts are stated to be retained to a large extent by the earthenware pipes, whilst organic impurities are destroyed by bacterial action during the passage through the filtering layer.—A. S.

Settling-tank especially for drain-water. P. Heyer. Ger. Pat. 165,406, Dec. 11, 1904.



THE tank is provided with a partition, *b*, dividing it into two compartments, A and B, in which the water flows in opposite directions, as shown by the arrows. The wall, *d*, of the tank, opposite the turning point, *p*, of the current of water, has only a slight inclination and the cross-section of the tank at this part is increased, in order to retard the flow of the water. In this way the specifically lighter impurities rise to the surface in the compartment, A, and are drawn off, whilst the heavier particles collect on the bottom of the tank.—A. S.

(C.)—DISINFECTANTS.

Sodium phenylpropiolate; Bactericidal properties of ——. Y. Kozai. Bull. Imp. Centr. Agric. Experim. Stn., Japan, 1905, **1**, 69—72.

A 1 PER CENT. solution of sodium phenylpropiolate has a strong bactericidal effect in three hours, except in the case of sporogenic bacteria, which will continue to develop after exposure to a 3 per cent. solution for 24 hours (5 per cent. in the case of *Bac. subtilis*). Very little effect is produced by more dilute solutions, such as 0·15 per cent. The action is due to the phenyl group and triple bond, and is intensified by substituting an aldehyde group for the carboxyl group, the development of various bacteria being retarded by a 0·04 per cent. solution of phenylpropiolic aldehyde.—C. S.

ENGLISH PATENT.

Size from resin and other materials [for paper-making] and bye-products [disinfectant]; Apparatus for the manufacture of ——. A. Bigland. Eng. Pat. 14,402, July 12, 1905. See next page.

UNITED STATES PATENT.

Disinfecting compound. J. W. England, Assignor to Smith, Kline and French Co., Philadelphia, Pa. U.S. Pat. 817,166, April 10, 1906.

A COMBINATION of mercuric iodide and lithium iodide is claimed. The compound is soluble in water, alcohol and ether, without decomposition.—W. P. S.

FRENCH PATENTS.

Organic substances; Oxidation of —— by partial combustion. J. Walter. Fr. Pat. 360,785, Oct. 11, 1905. Under Int. Conv., Oct. 27, 1904.

FOR the partial combustion of gaseous organic substances, chiefly for the manufacture of formaldehyde, the gases or vapours are intimately mixed with air and steam before being introduced into the heating chamber. Means are provided for maintaining constant temperatures in the heating chamber, the temperature depending on the composition and velocity of the current of gases, the quantity of steam used and the sectional area of the chamber. The steam acts as a diluent, preventing explosions, absorbing the excess of heat of combustion and facilitating condensation of the product. In certain cases suitable catalytic agents may be used. The heating chamber may consist of a bundle of tubes heated externally.—J. F. B.

Soap, ointment or paste for disinfecting purposes; Process of making —— [Peat tar]. J. Kessler and Co., Fr. Pat. 360,174, Dec. 7, 1905.

TAR, obtained by the distillation of peat, is added to the soap, ointment, &c. —W. P. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 442.)

Sulphite wood pulp waste liquors; Contribution to the chemistry of ——. H. Krause. Chem. Ind., 1906, **29**, 217—227.

BY the Mitscherlich process the wood is boiled for a long time at a temperature of 116°—120° C. by means of closed steam coils, whereas in the Ritter-Kellner process it is boiled for a much shorter time at a temperature of 130°—135° C. by means of direct steam. The principal organic constituent of the waste lyes is the calcium salt of lignin-sulphonic acid, but, corresponding to the higher temperature of digestion, the Ritter-Kellner liquor has a darker colour and contains more furfural and generally more sugars than the Mitscherlich liquor. Fehling's solution is not suitable for the detection of sugars in the liquors, since the lignin derivatives exert a reducing action even in the cold. Nylander's bismuth solution, however, is not reduced by the lignin bodies, and can be employed for the detection of the sugars. The separation of the sugars is best effected by evaporating the liquor in presence of barium carbonate to a pasty consistency, mixing the product with sand, and extracting the sugar by exhaustion three to six times in succession with hot 90 per cent. alcohol. The author's observations showed that in both processes of digestion the liquors from wood boiled in the autumn contained about double as much sugar as those obtained in the spring. The waste liquors contain free furfural, pentosans and pentoses; the lignin constituents of the liquors yield no furfural on distillation with hydrochloric acid. In addition to the pentosans and pentoses, the liquors contain hexosans and hexoses. Amongst the sugars present, the author has identified xylose, mannose, galactose, levulose and traces of dextrose. The following table shows the results of analyses made of two liquors obtained in the autumn by the two processes:—

	Mitscherlich.	Ritter-Kellner.
	per cent.	per cent.
Furfural	0·01	0·02
Pentosans	0·40	0·29
Hexosans	0·21	0·49
Total sugars	1·48	1·47
Pentoses	0·47	0·41
Mannose	0·48	0·48
Levulose	0·28	0·25
Galactose	0·01	0·01
Dextrose	—	trace

The author has also investigated to a certain extent the lignin derivatives of the liquor. On the addition of bleaching powder to the liquor acidified with hydrochloric acid, a chloro derivative was obtained, which after purification by alcohol and ether, showed a composition corresponding with the formula, $C_{26}H_{29}ClSO_{12}$. This and other derivatives of lignin-sulphonic acid have the peculiarity of being soluble in alcohol only when acidified, whereas the presence of acid decreases their solubility in water. The author found that on boiling the liquors with dilute caustic potash, the greater portion of the combined sulphur was split off, without apparently any profound decomposition.—J. F. B.

ENGLISH PATENTS.

Paper; Coating and drying ——. S. Stephan, London. From P. V. Rolier, Paris. Eng. Pat. 7766, April 12, 1905.

THE paper is wound off the reel and is coated on a drum,

the axle of which is hollow and non-rotatory, and communicates with a vacuum chamber on the one hand, and with a perforated part of the wall of the coating-drum on the other hand. The coated paper then passes to a drying apparatus consisting of a stack of guide rolls between which hot air is circulated. The drying arrangement is so constructed that the rolls touch the paper on the uncoated side only. After passing round the drying apparatus several times, the web of paper reaches the centre of the stack sufficiently dry to be reversed by a reversing guide-roll, and it then passes with its uncoated side uppermost to a second coating machine, and thence to a second drying-stack, after which it is stretched and reeled in the usual way.—J. F. B.

Paper; Manufacture of ——. R. Binns, South Windham, Conn., U.S.A. Eng. Pat. 12,413, June 15, 1905. Under Int. Conv., June 18, 1904.

SEE U.S. Pat. 785,704 of 1905; this J., 1905, 511.—T.F.B.

Size from resin and other materials [for paper-making] and bye-products [disinfectant]; Apparatus for the manufacture of ——. A. Bigland, Liverpool. Eng. Pat. 14,402, July 12, 1905.

THE resin, or a mixture of resin, fats and oils, is mixed with a suitable quantity of alkali or alkali carbonate and boiled in a closed vessel. The latter is provided with stirrers and a tube leading from the top, through which the gases (chiefly carbon dioxide) and volatile products generated are drawn off by the action of a vacuum pump. The gases, &c., are passed through condensers, and a chamber where the liquid portion is separated. The gases are then pumped into the bottom of a vessel containing water, by which a quantity of volatile oils is separated. Means are provided for collecting the gases for further use. As soon as the saponification is finished, or nearly so, the mass is withdrawn from the bottom of the vessel and pumped into a second closed vessel where the boiling is continued until no more gases and volatile matters are evolved, the upper part of the vessel being provided with a pipe leading to the condenser, &c., for the collection of these products. The liquid portion separated from the gases may be used for disinfecting or other purposes.—W. P. S.

UNITED STATES PATENTS.

Wood; Process of treating —— for the production of paper pulp, terpenes and resinous substances. G. P. Craighill and G. A. Kerr, Assignors to N. C. Manson, jun., Lynchburg, Va. U.S. Pat. 817,960, April 17, 1906.

WOOD is "chemically treated" at a moderate temperature to fix the volatile acids and oils, and to expel the terpenes; the solution containing the resinous substances, acids, &c., is then withdrawn and worked up, and the residue is treated first with caustic soda, then with sodium carbonate, and is finally bleached with sodium hypochlorite to form paper pulp.—T. F. B.

Paper pulp; Manufacture of ——. M. le Normant des Varannes and A. R. de Vains, St. Vincent de Blanzat, France. U.S. Pat. 818,206, April 17, 1906.

SEE Eng. Pat. 505 of 1905; this J., 1906, 195.—T. F. B.

GERMAN PATENTS.

Vegetable materials of all kinds, e.g., straw, wood, &c.; Process for working up —— for paper-making. Worschen-Weissenfelser Braunkohlen A.-G. Ger. Pat. 166,411, Feb. 18, 1904.

CLAIM is made for the application to the purpose mentioned in the title of the "sodium or potassium compounds of creosote" (Kreosotnatron oder Kali), or similar substances obtained in the treatment or distillation of tars of different origin with caustic soda or caustic potash solution. It is claimed that these substances are superior to the reagents usually employed, as they dissolve the encrusting substances of the vegetable materials without attacking the cellulose; and also that owing to the presence of phenols, the ill odour produced by organic sulphur compounds is suppressed. The reagents can be employed either directly, or preferably after dilution with water and separation of the so-called "neutral creosotes," which interfere with the subsequent bleaching process.—A. S.

Fibrous substances [textiles, leather, paper, &c.]; Process for waterproofing ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 166,350, May 12, 1904. V., page 475.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 443)

Morphine. VII. Conversion of thebaine into codeinone and codeine. L. Knorr and H. Hörlein. Ber., 1906, **39**, 1409—1414.

CODEINONE, which is obtained by the oxidation of codeine by chromic acid or permanganate, is related to thebaine in the same way as morphine is to codeine, thebaine being the methylic ether of the enolic form of codeinone. One of the methoxyl groups of thebaine is very easily hydrolysed with the production of codeinone as the ketonic form. The codeinone can then be converted into codeine by reduction. This hydrolysis takes place when thebaine is boiled for a short time with dilute sulphuric acid or even on standing in the cold. Codeinone is the primary product of the hydrolysis, the conversion being analogous to the hydrolysis of alkyl-vinyl ethers of the aliphatic series, which are split up into alcohols and aldehydes or ketones. The main products of the acid hydrolysis of thebaine, *viz.*, thebenine and morphothebaine, are secondary products.
—J. F. B.

Hydroxycodeine; The splitting of —— by complete methylation. L. Knorr and W. Schneider. Ber., 1906, **39**, 1414—1420.

CODEINE yields two oxidation products, codeinone (see preceding abstract) and hydroxycodeine. Whilst the former shows a close relationship to thebaine, the latter presents a complete analogy to codeine in its reactions. Like codeine, hydroxycodeine is very stable towards boiling acetic anhydride, with which it yields a diacetyl derivative. On complete methylation by Hofmann's method it behaves like codeine. The methyliodide of hydroxycodeine, on boiling with caustic soda solution, yields a methine base, *hydroxymethylmorphimethine*, which is split up on boiling with acetic anhydride. The nitrogenous product of the decomposition is *ethanol-dimethylamine*, whilst the non-nitrogenous product is *methyldiacetyl-trihydroxyphenanthrene*. The trihydroxyphenanthrene, from which this is derived, bears the same relation to morphol as hydroxycodeine does to codeine, *i.e.*, one of its hydroxyls is the same as was attached during the oxidation of codeine to hydroxycodeine. Codeinone, when split up by boiling with acetic anhydride, yields 3-methoxy-4.6-diacetyldihydroxyphenanthrene which contains, in addition to the two hydroxyls of morphol, the alcoholic hydroxyl of codeine. The identification of the trihydroxyphenanthrene from hydroxycodeine will lead to the orientation of the hydroxyl group of codeine which is still undetermined.—J. F. B.

Essential oils; Influence of the season of distilling and hybridation on the composition of some ——. A. Bircken-stock. Monit. Scient., 1906, **20**, 352—356.

THE differences between French and Algerian oil of rue have been attributed to different botanical origin of the plants; such, however, is not the case: the differences arise entirely from the different seasons in which the oils are distilled, French rue being distilled in autumn and Algerian in spring and early summer. Algerian rue distilled in spring gave an oil of sp. gr. 0·8446; optical rotation, −4°; freezing point, −11°C.; whilst when it was distilled in autumn the oil had a sp. gr. of 0·837; optical rotation, +0° 40′; and freezing point, +9·7° C., thus

resembling the French oil fairly closely. French oil of rosemary is generally only considered pure when the head fraction (10 per cent.) is dextro-rotatory. It is shown, however, that when rosemary is distilled at the beginning of the season (April—June), the first 10 per cent. of the oil distilling over is always lævo-rotatory; it is considered highly probable that the oils contain the same amount of pinene at whatever season they are distilled: in spring it is *l*-pinene which is more abundant in the oil, whilst in autumn *d*-pinene preponderates. Spanish rosemary distilled in spring gave a dextro-rotatory oil, the rotatory power of which was considerably greater than that of the oil produced in autumn: the Spanish oil was characterised by its containing more terpenes than the French oil: the first fractions (20 per cent.) consisted almost entirely of pinene. Some specimens of lavender oil, obtained from the French and Italian Alps, showed a sp. gr. of 0·878 to 0·8829, optical rotation, $-8°$ to $-9°$; they contained about 50 per cent. of *l*-linalool and 20—30 per cent. of linalyl acetate. A series of hybrid plants was traced, linking the aspic and lavender, and essential oils were obtained from these, a series being obtained passing from the true oil of aspic (sp. gr., 0·92 and $\alpha_D = +10°$) to the true oil of lavender (sp. gr., 0·89, $\alpha_D = 7° 30'$; esters, 45 per cent.); the characteristics of these oils are given in a series of tables, showing the gradual increase of esters from 2 to 3 per cent. in the oils of aspic to 40—45 per cent. in the pure lavender oils. It is pointed out that pure oils of aspic may show an optical rotation of $-1° 10'$, the first 10 per cent. of the distillate being dextro-rotatory.—T. F. B.

Otto of rose. London Essence Co.'s Report, March, 1906, 9.

An otto of rose, distilled in a special manner in Bulgaria, was found to contain a large amount of phenylethyl alcohol. Its characteristics were: Sp. gr. $(30°/15°)$, 0·884; optical rotation, $-2°$; congealing point, 18·5° C.; m. pt., 19° C.; content of stearoptene (m. pt. 33·5° C.), 9 per cent.; ester value, 81·6; alcohol value, 236·4; iodine value, 157·2. The otto appears in no way inferior to those free from phenylethyl alcohol.—T. F. B.

Linaloe oil. London Essence Co.'s Report, March, 1906, 7.

Several samples of linaloë oil of authentic origin were found to be dextro-rotatory. Two typical samples gave the following figures:—Sp. gr., 0·8825, 0·8775; optical rotation, $+4° 30'$, $+3° 10'$; acid value, 0·9, 1·4; ester value, 11·5, 9·8; refractive index, 1·4641, 1·4608. The determination of linalool in one of the samples by acetylation gave a result equivalent to 68·5 per cent.—T. F. B.

Cardamine oil. Feist. Apoth.-Zeit., 1905, 832. London Essence Co.'s Report.

The essential oil distilled from *Cardamine amara* consists almost entirely of one of the sulphur compounds characteristic of this type of plant. It yields a crystalline thiocyanate of m. pt. 134°—135° C. The sulphur content of the oil agrees with the formula, $C_5H_{12}N_2S$, suggesting that the compound is a secondary butyl thiocyanate. The fresh herb contains about 0·35 per cent. of oil.
—T. F. B.

Copaiba oil; African ——. Kline and Fenwick. Amer. J. Pharm.; London Essence Co.'s Report, March, 1906, 5.

The specific gravity of African copaiba varies between 0·991 and 0·999, and the oil content between 43 and 45 per cent. The sp. gr. of the oil is 0·928, and the optical rotation $+5° 45'$, a figure considerably lower than that usually given.—T. F. B.

Phenacetin; Adulteration of —— with parachloro-acetanilide. C. Mannich. Ber. Pharm., 1906, 57.

A specimen of phenacetin, having the abnormal m. pt. 119°—120° C. and containing 5·89 per cent. of chlorine, was found to be adulterated with 18 per cent. of parachloro-acetanilide. The impurity was isolated by treatment with ether, and recrystallising the extracted matter several times from boiling water. The product thus obtained, m. pt. 175°—177° C., had the formula, C_8H_8ClNO, and gave a bluish-violet colour when boiled with strong sulphuric acid.—J. O. B.

Rare earths; History of the discovery of ——. C. R. Boehm. Chem. Ind., 1906, **29**, 172—176; 189—197.

The author gives a detailed bibliography of the literature relating to the discovery of rare earths from the detection of an unknown earth metal in scheelite (Schwerstein) from Bastnäs by Cronstedt in 1751 and its isolation, and naming as cerium by Berzelius and Hisinger in 1804. The bibliography is divided into the following sections:—History of cerite elements; history of ytterite elements; history of thorium; history of zirconium.—A. S.

Morphine; Characteristic colour reaction of ——. D. Radulescu. XXIII., page 499.

Ethyl glyoxylate; Characteristic reaction of ——. *Action of ammonia on the ether and its derivatives.* L. J. Simon and G. Chavanne. XXIII., page 499.

Methyl alcohol in formaldehyde solutions; Determination of ——. O. Blank and H. Finkenbeiner. XXIII., page 500.

Acetone; Determination of ——. A. Jolles. XXIII., page 500.

Butyl chloride; Exemption from duty of —— in Holland. Bd. of Trade J., May 10, 1905.

A Dutch Royal Decree, dated April 9, 1906, exempts from import duty, subject to certain conditions, butyl chloride for use in the manufacture of artificial musk. Application for exemption must be made to the Minister of Finance by the manufacturer desiring to use the substance in his factory. [T.R.]

English Patents.

Hypnotic compounds. E. C. Clemmensen and A. H. C. Heitmann, Detroit, U.S.A. Eng. Pat. 7840, April 12, 1905.

See U.S. Pat. 814,693 of 1906; this J., 1906, 392.—T.F.B.

Oxalates and oxalic acid; Process of making ——. F. A. Feldkamp, South Orange, U.S.A. Eng. Pat. 22,225, Oct. 31, 1905.

See U.S. Pat. 802,980 of 1905; this J., 1905, 1254.—T.F.B.

Borneol esters and isoborneol esters; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6606, March 19, 1906.

Pinene hydrochloride is stated to be converted into a mixture of borneol ester and isoborneol ester, containing no chlorine compounds, by boiling, under a reflux condenser, with a zinc salt of an organic acid in presence of an organic acid. The following proportions may be used:—100 parts of pinene hydrochloride, 55 parts of zinc formate and 300 parts of 90 per cent. acetic acid. After boiling for three or four hours, the mixture is allowed to stand for some time and the acetic acid is distilled off *in vacuo*. The residue is washed with water and distilled, the mixture of esters distilling over between 102° and 105° C. (12 mm.).
—T. F. B.

French Patents.

Ethyl alcohol from acetylene; Preparation of ——. M. J. A. Jouas, M. L. Desmonts, L. P. I. Deglatigny, and L. A. Dubosc. Fr. Pat. 360,180, Feb. 15, 1905.

Acetylene gas is passed into a solution of a normal mercuric salt, causing the precipitation of mercury acetylide. On boiling this liquid, the acetylide decomposes, liberating aldehyde and re-forming the mercuric salt. The aldehyde can be reduced to alcohol by sodium amalgam.—F. Shdn.

Acetic acid from acetylene; Preparation of ——. M. J. A. Jouas, M. L. Desmonts, L. P. I. Deglatigny, and L. A. Dubosc. Fr. Pat. 360,249, Feb. 17, 1905.

ALDEHYDE, prepared by the method described in the previous patent (Fr. Pat. 360,180 of 1905), is oxidised directly, or by catalytic agents, to acetic acid.—F. SHDN

FRENCH PATENTS.

α-β-Substituted glycidic esters and ketones; Synthetical preparation of ——. G. Darzens. Fr. Pat. 360,513, Feb. 25, 1905.

α-β-SUBSTITUTED glycidic esters are produced by the condensation of aldehydes or ketones with an ester of an acid containing a halogen or acetyl group in the α-position, under the influence of an alkali ethylate or of sodium amide. The reaction takes place according to the equation:

$$R.CO.R' + R''CHX.COOC_2H_5 = R.CR'(\diagup O \diagdown)CR''.COOC_2H_5 + HX.$$

The α-β-glycidic esters so produced are saponified and the free acids are said to be decomposed by heating with the production of ketones of the type $R.R'CH.C:O.CH_2.R''$ and evolution of carbon dioxide. Certain of these ketones are utilisable for the production of perfumes.—J. F. B.

Chloroform; Process for preserving ——, *from air and light and eventually indicating its decomposition.* J. P. Breteau. Second Addition, dated Nov. 18, 1905, to Fr. Pat. 353,858, June 30, 1905 (this J., 1905, 1083 and 1254).

THE "indicator" may be interposed between the chloroform and the stopper of the vessel containing it, or fixed to the stopper or even itself form the stopper. Cinnamic acid and mesite-mono-methyl ether are added to the list of preservative agents.—W. P. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 444.)

Development with diaminophenol in acid solution and in alkaline solution in presence of alkalis or their substitutes. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1906, **22**, 76. Phot. J., 1906, **46**, 108.

AN aqueous solution of amidol (diaminophenol dihydrochloride) acquires considerable developing powers when sufficient sulphite is added to saturate the hydrochloric acid, notwithstanding the presence of free sulphur dioxide. The reducing power of the developer is much increased by adding just sufficient sulphite to completely convert the sulphur dioxide into bisulphite: the increase is still greater if sufficient alkali hydroxide or carbonate is added to form the normal sulphite. The addition of further quantities of sulphite, even to saturation, does not produce an alkaline developer; when more than 6 parts of sulphite are used to one of amidol, the reducing power does not increase; in fact, above 20 parts to one, it decreases. The sulphite in the normal developer may be in great part replaced by alkali, without diminution of the reducing power. The reducing power of the "normal" developer may be considerably increased by adding alkalis or their substitutes, particularly ammonia, lithium carbonate and acetone. The acidity of amidol developers appears to be in no way connected with their reducing powers.—T. F. B.

Developers; Action of alkalis in organic ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1906, **22**, 32. Phot. J., 1906, **46**, 109.

THE three caustic alkalis (lithia, soda and potash) may be used, in equimolecular weights, with the same reducing agent, to produce developers having the same reducing power, but alkali carbonates and other substitutes for alkalis (*e.g.*, acetone or trioxymethylene) must be used in much greater quantity (see Sheppard, this J., 1906, 444). The same reducing effect can be obtained with equimolecular weights of the various reducing agents, but only by adding variable quantities of an alkali. The following list gives the reducing agents arranged according to the quantity of alkali hydroxide required, metoquinone taking the least:—Metoquinone, metol-quinol, *p*-aminophenol, *p*-phenylenediamine, hydramine, pyrogallol, quinol, catechol, metol, eikonogen, edinol, adurol, glycin. With alkali carbonates, on the other hand, the order is somewhat different, being as follows:—Metoquinone, metol-quinol, metol, pyrogallol, eikonogen, adurol, edinol, quinol, catechol, glycin. Incomplete solution was obtained with *p*-aminophenol and hydramine, and *p*-phenylenediamine is not included in the list, since it most probably combines with the hydrobromic acid liberated before the latter decomposes the sodium carbonate, and the hydrobromide thus formed is not decomposed by alkali carbonate, but only by alkali hydroxide.—T. F. B.

Gelatin; The "tanning" of —— *during development, especially with "pyro" [pyrogallol].* A. and L. Lumière. Brit. J. Phot., 1906, **53**, 285—286.

IT is generally considered that pyrogallol developers alone possess the property of rendering gelatin insoluble during development. When gelatin or a negative developed by another developer is immersed in a pyrogallol developer, no "tanning" occurs after an hour, but after several days, with access of air, both become insoluble. Aqueous solutions of pyrogallol and other developers have no tanning action on gelatin after a month's immersion, even with access of air, but solutions containing alkali carbonate and sulphite, when air is present, all produce more or less tanning: in absence of air no tanning occurs. Quinone is the cause of this tanning action, a 0·5 per cent. solution rendering gelatin insoluble, even with exclusion of air. It thus appears to be the property of the pyrogallol developer of rapidly absorbing oxygen, which favours the tanning of gelatin. It is probable that the oxidation products formed during development with other reducing agents than pyrogallol are decomposed by the sulphite present, and hence cause no tanning under the ordinary conditions.—T. F. B.

ENGLISH PATENT.

Gelatin emulsion papers; Manufacture of sensitised ——. L. Robiesek, Vienna. Eng. Pat. 7693, April 11, 1905.

SEE Fr. Pat. 353,349 of 1905; this J., 1905, 1031.—T. F. B.

FRENCH PATENT.

Photographs in colours; Production of —— *and polychrome screens for use therein.* C. L. A. Brasseur. First Addition, dated Oct. 24, 1905, to Fr. Pat. 349,742, Dec. 30, 1904.

A SHEET of glass, to which a layer of sodium silicate has been applied, is coated with a very thin film of bichromated gelatin, dried, and coated with a layer of collodion containing a solvent common to the nitrocellulose and to the gelatin (*e.g.*, glacial acetic acid), in such a quantity as to firmly cement the two layers together. The whole is now exposed to light, washed with water, and a sensitive collodion layer, containing the necessary colouring matter, is applied to it. The plate is then exposed beneath a negative, fixed (or developed and fixed), and again coated with further sensitive collodion layers and treated as before to supply the other colours. (See Eng. Pat. 21,210 of 1904; this J., 1905, 1190.)—T. F. B.

GERMAN PATENT.

Dyestuffs of the cyanine series; Process of preparing sensitising ——. Meister, Lucius und Brüning. Ger. Pat. 167,770, May 26, 1903. IV., page 471.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 445.)

Bursting of M.L.E. Rifles; Report on the —— to the Minister of Defence, Victoria. By C. W. Hake and T. R. Lyle.

A NUMBER of rifles having burst whilst being fired, the authors were requested by the Minister of Defence to enquire into the circumstances, and if possible to ascertain the cause of the accidents. Previous to this, the New South Wales Military Board and a Victoria Military Board had held enquiries, and although, on the whole, their reports were of a negative character, a certain amount of suspicion had been thrown on the design of the M.L.E. rifle. The accidents had been ascribed by them to the presence of flaws in the cartridge cases, on the strength of the base of which, they supposed, depended the direction which the force of explosion would actually take. It is shown, however, that the so-called "flaws," were effects which might be produced in any cartridge case on firing, especially with excessive pressure.

In the reports of the evidence taken by these Boards, it is shown that one of the rifles still contained a bullet, although a bull's eye had been registered on the target at which aim had been taken. Examination showed that this extra bullet in some instances had still remained in the cartridge case, that it had never engaged the rifling of the gun, and that its base had been deformed by fusion. Moreover, there were distinct marks where the bullet had been stabbed. These facts suggested to the authors the possibility of there having been two bullets in the original cartridge. Calculations showed that such an occurrence would result in excessive pressure within the explosion chamber, and a burst might be expected, although the foremost bullet might be ejected.

In order to test the "two-bullet" theory, cartridges were made with an additional bullet inside the brass case, both upright and reversed. The latter, on firing, burst the rifle, whilst the former severely strained the bolt action. In the burst rifle, the effects were identical with those produced by the accident. A quantity of the ammunition which caused the accident was accordingly procured, and on examining it, over 100 double-bulleted cartridges were found. The original cause was finally traced to an automatic machine by means of which the cartridge had been "bulleted."

It is pointed out that the error would have been avoided had some system of weighing the filled cartridges been used, and also by a more accurate system of gauging, since the faulty cartridges were all found to be too high to gauge.—B. J. S.

Nitrous acid; Oxidation of —— by hydrogen peroxide. Determination of nitrate in presence of nitrite. [*Determination of nitrogen in nitrocellulose.*] M. Busch. XXIII., page 499.

Heat-test papers; Supply of ——. Home Office Circular, May 14, 1906.

THIS circular, which is issued by the Explosives Department, states that, in consequence of certain applications that have been made for the supply by Dr. Dupré of heat-test papers, it has been decided that these papers will be supplied to any firm desiring to obtain the same, at a price of 10s. 6d. per thousand. It is necessary that heat-test papers should be kept for one month before being issued for use, and it is, therefore, desirable that requirements, if any, should be notified one month before the papers are required. In accordance with the heat-test memorandum, the papers should be kept in the dark, and will remain good for six months or more, but should be tested from time to time in the manner described.

ENGLISH PATENTS.

Smokeless powders; Impts. in ——. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 15,564, July 26, 1905.

THE object of the invention is to produce a propellant having good ballistics, which on combustion produces a solid residue which will act as a lubricant and neutralise the acid products of combustion. The explosive is made by incorporating nitroglycerin (30—40 parts) and nitrocellulose (50—60 parts) with 2·5 parts of vaseline, and 2·5 parts of olive oil, the latter being used to lower the temperature of explosion.

A carbonate of an alkali or alkaline-earth metal, or a salt which on combustion will produce a carbonate, is also introduced. In practice, it has been found best to use a mixture of a barium salt, sufficient to give 2·8 parts of barium carbonate, and a potassium salt sufficient to give 0·55 part of potassium carbonate; thus, 0·9 part of potassium tartrate may be used together with 4·0 parts of barium tartrate. The explosive is finally manufactured in the form described in Eng. Pat. 12,892 of 1905 (this J., 1906, 337).—B. J. S.

Steel guns; Protection of —— from the erosive effects of cordite and similar gases. G. C. J. Topp. Eng. Pat. 12,635, June 19, 1905. XIB., page 484.

UNITED STATES PATENT.

Explosives; Process for completely exploding high ——. H. von Dahmen, Vienna. U.S. Pat. 818,939, April 24, 1906.

THE invention consists in the use of a mixture of lead peroxide, sulphur, carbon and potassium nitrate as an exploder for high explosives, such as picric acid and gun-cotton.

The exploder is either mixed with the high explosive or enclosed in a tube and inserted into it, firing being effected by means of a gunpowder fuse.—B. J. S.

FRENCH PATENTS.

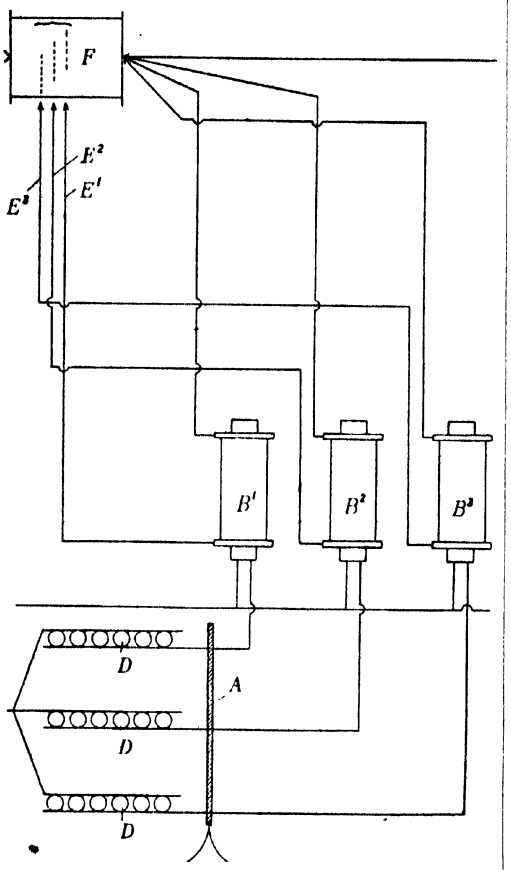
Explosives; Process for the production of new military and mining ——. Dinamite Nobel Soc. Anon. Fr. Pat. 360,787, Oct. 17, 1905. Under Int. Conv., Nov. 9, 1904.

DICYANDIAMIDINE, guanidine nitrate, nitroguanidine and nitrosoguanidine may be used as cooling agents in propellants, and result in lower temperatures of explosion without loss of ballistics. Thus 25 parts of nitroguanidine may be incorporated with 45 parts of nitroglycerin (or nitrobenzene) and 30 parts of nitrocellulose. These compounds may also be mixed with picric acid, and thus give powerful explosives which are not sensitive to shock. The following mixture is given: 30—60 parts of nitroguanidine, 0—20 parts of potassium nitrate, 20 parts of picric acid, 0—40 parts of ammonium nitrate, 0—10 parts of dinitrotoluene. Manganese dioxide, aluminium and nitronaphthalene may also be introduced, and the mixture may be protected from moisture by adding resin or shellac.

To prepare nitroguanidine, dicyandiamide is converted by dilute sulphuric acid into dicyandiamidine, and the resulting solution, after precipitation with barium carbonate and filtration, is boiled for a long time and evaporated. The guanidine carbonate thus obtained is nitrated with a mixture of fuming nitric and fuming sulphuric acids.—B. J. S.

Explosives; Method and apparatus for measuring the velocity of detonation of ——. H. Mettegang. Fr. Pat. 359,865, Nov. 27, 1905.

IN order to measure the velocity of detonation of an explosive such as dynamite, a modification of Siemens' apparatus for measuring small intervals of time is used. The apparatus consists of a series of induction coils, B^1, B^2, B^3, with one secondary terminal of each, connected to a revolving drum, F, coated with lampblack. The other secondary terminals are connected with a series of bright metallic points, E^1, E^2, E^3, which are placed close to the surface of the drum. The positive leads of the primary of each coil are made to cross the charge of explosive, A, the velocity of detonation of which is required, and may be connected through a resistance of electric lamps, D, to a main circuit. At the moment the current in the primary is interrupted, a stream of sparks is set



up in the secondary, which impinge on the black surface of the drum. By this means the time required for the explosive to burn, from the point at which one primary wire crosses it to the next, is recorded on the drum.
—B. J. S.

Explosives; Manufacture of ammonium nitrate ——. G. Reschke. Fr. Pat. 360,349, Dec. 12, 1905.

AMMONIUM nitrate can be utilised for fire-damp explosives by mixing it with a quantity of carbonaceous matter greater by 1 per cent. than the amount required to give carbon monoxide and hydrogen as products of explosion. If required, a nitro-body, except nitroglycerin, may also be added, in quantity greater by 3 per cent. than the amount necessary to give carbon monoxide and hydrogen. Suitable mixtures are as follows:—(1) Turmeric, 40·8 per cent.; ammonium nitrate, 59·2 per cent. (2) Sugar, 35 per cent; ammonium nitrate, 65 per cent. (3) Dinitrobenzene, 1 per cent.; fennel flour (farine de fenouil), 30 per cent.; ammonium nitrate, 69 per cent. (4) Dinitrobenzene, 1 per cent.; naphthalene, 12 per cent.; ammonium nitrate, 87 per cent.

The process of grinding should be carried further than with ordinary ammonium nitrate explosives. By varying the proportion of carbonaceous matter, explosives of any required degree of power can be obtained, which are cheap and not deliquescent.—B. J. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 446.)

INORGANIC—QUANTITATIVE.

Zinc: Titration of —— with potassium ferrocyanide. E. Murmann. Z. anal. Chem., 1906, **45**, 174—181.

THE author has investigated the magnitude of the errors which occur in titrating zinc with potassium ferrocyanide, using a uranium salt as indicator. He finds that the presence of large quantities of salts, in particular ammonium chloride, only slowly increases the amount of ferrocyanide required by a given quantity of zinc solution. Increasing quantities of hydrochloric acid similarly increase the ferrocyanide necessary, but the acid cannot be used in larger quantities than 20 c.c. to 100—150 c.c. of liquid. To avoid the presence of nitric acid it is advisable to use uranyl chloride instead of uranyl nitrate as indicator. Zinc salts and potassium ferrocyanide can be titrated directly, using the uranium salt indicator in the solution instead of the more lengthy drop test method. The solution is maintained almost boiling, excess of ferrocyanide is first added, giving a brown coloration and the solution is then titrated back till this changes to blue grey, the transformation being quite sharp. Molybdenum and tungsten salts were found to be unsuited for use as indicators.—E. F. A.

Cadmium: Determination of ——, in a volatile or organic salt. H. Baubigny. Comptes rend., 1906, **142**, 959—961.

IF the solution to be treated contain a chloride or bromide, the author's method (this J., 1906, 394) is no longer applicable, because the sulphide obstinately retains traces of chloride or bromide, which are volatilised during the incineration of the filter. In such cases, after thorough washing, the sulphide is rinsed off the filter, allowed to settle out, and the washings (almost free from sulphide, and practically free therefore from contained halide) decanted through the filter, which can then be incinerated without loss. The sulphide is next added, and the conversion into sulphate proceeded with.

In the case of organic salts there is no difficulty. To the solution an excess of sulphuric acid is added. If the organic acid be insoluble, it is precipitated and filtered off; if soluble, its presence in solution does not interfere with the carrying out of the process as described.—J. T. D.

Nickel; Quantitative determination of small quantities of —— in organic substances. H. W. Armit and A. Harden. Roy. Soc. Proc., 1906, **77B**, 420—423.

THE method may be divided into three stages—(1) incineration, (2) separating and (3) estimating:

Ashing.—The substance is evaporated to dryness in a porcelain crucible over a water-bath, further dried by heating in a hot air oven or with a Bunsen flame, burned over a Fletcher burner and incinerated in the blow-pipe flame. The ash is evaporated to dryness on the water-bath with 10 c.c. of pure hydrochloric acid, this process being repeated, and is then extracted with water containing a small amount of hydrochloric acid.

Separation.—The iron and the phosphates are first removed by precipitation with excess of ammonia and filtration, and the process is repeated three times, the precipitate being redissolved each time. The method of procedure varies somewhat according to the tissues investigated. The united filtrates are evaporated, the residue dissolved again in dilute hydrochloric acid and saturated hot with sulphuretted hydrogen. The filtrate from the precipitated sulphides is evaporated to dryness, redissolved in water and the nickel precipitated with pure sodium hydroxide. The nickel oxide is washed, dissolved in hydrochloric acid and the solution made up to a definite volume.

Estimation.—The best results were obtained using *a*-dimethylglyoxime, which forms a scarlet red compound with nickel in presence of ammonia, as a colorimetric indicator. To a few c.c. of the nickel solution 0·5 c.c. of

ammonia and 0·5 c.c. of dimethylglyoxime are added, and after development of the colour the whole is diluted to 30 c.c. and compared with standards. The method has the advantages over the ammonium sulphide method that small traces of iron do not interfere with the final colour, smaller quantities of nickel can be accurately estimated and it is easier to work in a bad light with the pink than with the brown coloration—E. F. A.

Nitrous acid; Oxidation of —— by hydrogen peroxide. Determination of nitrate in presence of nitrite. [*Determination of nitrogen in nitrocellulose.*] M. Busch. Ber., 1906, **39**, 1401—1402.

Nitrous acid in acid solution is oxidised quantitatively and almost instantaneously to nitric acid by hydrogen peroxide at 60°—70° C. The nitric acid may be determined gravimetrically as nitron-nitrate (see this J., 1905, 291, 458, 638). For the determination of nitrite by this method, a quantity of the substance containing 0·1—0·2 grm. of nitrite is dissolved in about 50 c.c. of water, 20 c.c. of a 3 per cent. neutral solution of hydrogen peroxide are added, and the mixture heated to 70° C.; 20 c.c. of pure 2 per cent. sulphuric acid are then introduced at the bottom of the containing vessel, by means of a dropping funnel, the liquid is heated nearly to boiling, and the nitric acid precipitated by 12 c.c. of nitron acetate solution.

For the determination of nitric acid in presence of nitrous acid, the latter is determined in a portion of the solution by titration with permanganate. In another portion the nitrous acid is oxidised by hydrogen peroxide, and the total nitric acid is then determined as nitron-nitrate.

The author also gives a preliminary note on a new method for the determination of nitrogen in nitrocellulose. By boiling nitrocellulose with caustic alkali solution in presence of hydrogen peroxide, the whole of the nitrogen is obtained in the form of nitrite and nitrate. On acidifying the solution, the nitrous acid is oxidised by the hydrogen peroxide, and the total nitrogen in the form of nitric acid can be determined by precipitation as nitron nitrate. —A. S.

ORGANIC—QUALITATIVE.

Walnut oil; Detection of foreign oils in ——. P. Balavoine. Schweiz. Woch. Chem. und Pharm. 1906, **44**, 224—226.

The author has carried out some tests with the method of Bellier (Ann. Chim. anal. appl., 1905, 52), based on the insolubility of the solid fatty acids in 70 per cent. alcohol, for the detection of admixture of other oils with walnut oil. One c.c. of the oil to be tested is treated in a test-tube with 5 c.c. of alcoholic solution of potassium hydroxide (16 grms. in 100 c.c. of 92 per cent. alcohol); a similar tube is prepared with the same quantity of walnut oil of known purity; the two tubes are heated, side by side, on the water-bath, without boiling, until the oil has dissolved; they are then corked and heated at 70° C., for 30 minutes. Exactly enough 25 per cent. acetic acid, is then added to neutralise the amount of potassium hydroxide present. The tubes are then recorked, and placed in a bath at 25° C. until their contents have reached that temperature. They are then removed to another bath at 17°—19° C. and frequently agitated, the time at immersion being noted. Under these conditions pure walnut oil requires a markedly longer cooling before showing a precipitate of fatty acids than an impure sample. Poppyseed oil approaches nearest to walnut oil in the solubility of its fatty acids, but an addition of 10 per cent. of this oil to walnut oil will hasten the formation of the precipitate by three to four minutes. An admixture of 5 per cent. of olive oil causes a precipitate six minutes before one forms in the standard with pure oil; 5 per cent. of sesamé oil, nine minutes sooner; 5 per cent. of cottonseed oil, 16 minutes; 5 per cent. of arachis oil, nine minutes sooner. It is found that walnut oil which has been kept for some time produces the precipitate sooner than that freshly prepared.—J. O. B.

Fluorine in alimentary products [*and wine, beer, &c.*]; *Optical method for the detection of ——.* J. Ville and E. Derrien. Bull. Soc. Chim., 1906, **35**, 239—246.

The method is based on the fact that fluorides when added to methæmoglobin alter the spectrum of the latter and cause a separate absorption band to appear in the orange part of the spectrum. The methæmoglobin solution used is prepared by treating defibrinised blood with four times its volume of 0·1 per cent. potassium oxalate solution, filtering the mixture and adding a trace of potassium ferricyanide to the filtrate. The reagent thus obtained is added to the solution to be tested in the proportion of 1 c.c. to 25 c.c. and the solution then examined spectroscopically; the solution under examination must be clear, colourless and deprived previously of any constituents which would precipitate the blood-reagent. In the case of wine, 100 c.c. of the latter are evaporated until all the alcohol has been removed, water is added to make up the original volume, the solution is treated with 2 grms. of freshly precipitated manganese dioxide and filtered; 50 c.c. of the filtrate are then mixed with 5 c.c. of egg-albumin dissolved in twice its volume of 1 per cent. potassium oxalate solution, the mixture is heated to boiling, cooled and filtered; 25 c.c. of the filtrate are now treated with 1 c.c. of the blood-reagent, and examined with the spectroscope. In testing beer it is sufficient to deprive the beverage of its alcohol and carbon dioxide, and then to add the reagent, whilst milk simply requires curdling and filtering before adding the reagent. To detect fluorides in butter a portion of the sample is mixed with a little water and heated, the aqueous portion filtered, and the filtrate treated with the reagent. In the case of meat, the solution, obtained on macerating the sample with water, is boiled, filtered, and the filtrate used for the test. It is stated that the method will detect the presence of 0·08 grm. of sodium fluoride per litre of wine, &c.—W. P. S.

Morphine; Characteristic colour reaction of ——. D. Radulescu. Bul. Soc. de Sciinte din Bucuresci, **14**, 602—605. Chem. Centr., 1906, **1**, 1378.

If to a solution containing morphine a fragment of sodium nitrite and some acid be added, and then before the evolution of gas has ceased, the liquid be made alkaline with a concentrated solution of potassium hydroxide, a coloration varying from pink to deep ruby red, according to the quantity of morphine present, is produced. The coloured substance is not extracted by ether, chloroform, carbon bisulphide or benzene. The coloration disappears on acidifying the solution, but reappears if alkali be added to the acid liquid, provided the latter has not been allowed to stand for too long a time. It is stated that one part of morphine in 300,000 can be detected by this reaction. —A. S.

Ethyl glyoxylate; Characteristic reaction of ——. Action of ammonia on the ether and its derivatives. L. J. Simon and G. Chavanne. Comptes rend., 1906, **142**, 930—933.

Ethyl glyoxylate treated with aqueous ammonia forms a precipitate which, at first white, passes through yellow, orange and red tints, becoming finally a bluish-black. At the same time the ammoniacal fluid assumes a dark red hue. The change takes place slowly in cold solutions, rapidly on heating, and is also brought about by ammonium carbonate, sulphate or chloride, provided alkali be also added. The precipitate forms a dull black substance, $C_4H_8O_4N_2$, which dyes cotton and silk a dirty blue violet, the colour being fast to soap, but not to light. The esters of other closely related acids do not give the coloration, which thus allows of a delicate test for ethyl glyoxylate. It is not, however, shown by the salts of glyoxylic acid or by other derivatives not containing the ester group, whilst ammonia converts derivatives obtained from the aldehydic portion of the molecule, into amides which show no such coloration. The coloration resembles in some ways the murexide test for uric acid.—E. F. A.

ORGANIC—QUANTITATIVE.

Pentoses; New method for the quantitative determination of ——. A. Jolles. Z. anal. Chem., 1906, **45**, 196—204.

The method is based on the estimation of the furfural formed on distilling pentoses, by means of bisulphite, the excess of bisulphite being determined with iodine. The adverse influence of excess of acid and salts on the titrations rendered a modification of Tollen's hydrochloric acid distillation method necessary. The pentose is heated with hydrochloric acid in a flask through which steam is driven throughout the operation, care being taken to keep at least 100 c.c. of liquid in the flask. The distillate is measured and an aliquot portion neutralised with caustic soda and left for two hours with an excess of bisulphite which is susequently titrated back with iodine solution. The presence of any large excess of acid or of inorganic salts renders the titration inaccurate.—E. F. A.

Cocoa; Determination of fat in ——. Tschaplowitz. Z. anal. Chem., 1906, **45**, 231—235.

In extracting fat from cocoa with ether, the difficulty is often experienced that the ether only percolates through the mass very slowly and but partially attacks and extracts the unbroken oil cells. The author carries out the extraction in a boiling flask, of about 80 c.c. content, with a long neck, which is graduated from 73 to 77 c.c. Enough cocoa to yield from 1 2 grms. of oil is weighed into the flask and boiled for a few minutes with 10—15 c.c. of alcohol, whereby it becomes finely divided. About as much ether is added and the boiling repeated, after which the flask is filled up with ether, well shaken and stood aside. When the solid matter has subsided, 50 c.c. of the clear liquid are removed with a pipette and evaporated to dryness. The oil is redissolved in a little ether, filtered through cotton wool and weighed after drying.—E. F. A.

Methyl alcohol in formaldehyde solutions; Determination of ——. O. Blank and H. Finkenbeiner. Ber., 1906, **39**, 1326—1327.

The commercial 40 per cent. solutions of formaldehyde generally contain 12—18 per cent. of methyl alcohol, which prevents them from becoming turbid in cold weather. The methyl alcohol is determined in an indirect manner by combustion by chromic acid. One grm. of the formaldehyde is weighed out and is then added to a mixture of 50 c.c. of a 2.N-solution of chromic acid and 20 c.c. of pure concentrated sulphuric acid. After standing for about 12 hours, or a shorter time if heat be employed, the liquid is diluted to 1 litre and 50 c.c. are titrated with N/10 thiosulphate after the addition of a crystal of potassium iodide. The total quantity of oxygen consumed being thus determined and the percentage of formaldehyde being known, the quantity of methyl alcohol can be calculated.—J. F. B.

Acetone; Determination of ——. A. Jolles. Ber., 1906, **39**, 1306—1307.

The solution of acetone is treated with three or four times the necessary quantity of a standardised solution of sodium bisulphite, and the excess of bisulphite is titrated back with iodine after 30 hours' standing. The reaction is based on the combination of 1 mol. of acetone with 1 mol. of bisulphite with the production of the sodium salt of the corresponding sulphonic acid (compare similar method for furfural, this J., 1906, 201). The reaction proceeds more slowly than in the case of aldehydes and the duration of contact cannot be curtailed; it is, therefore, advisable to conduct a blank experiment with the bisulphite solution under the same conditions, in order to correct any alterations in its value.—J. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 447.)

Carbon suboxides. Berthelot. Comptes rend., 1906, **142**, 533—537.

The analogy between carbon monoxide and methylene is pointed out and on this supposition carbon monoxide should form polymerides analogous to compounds of the acetylene series. This series of suboxides should by pyrogenetic reactions give rise to new series of compounds containing less oxygen. In conformity with this supposition the following suboxides of carbon are already known to exist (compare following abstract).

The suboxide, C_4O_3, corresponding to an anhydride of tartaric acid was first discovered by Brodie and subsequently investigated by Berthelot. On heating, this forms a compound, C_8O_3, corresponding to an anhydride of dihydroxyphthalic acid, which, in turn, when exposed to heat, forms other suboxides richer in carbon. Lastly, the existence of a compound, C_2O, corresponding to glycollic anhydride, was indicated by the author in 1891.

—E. F. A.

Carbon suboxide. I. O. Diels and B. Wolf. Ber., 1906, **39**, 689—697.

Ethyl malonate, when heated with phosphorus pentoxide, is decomposed into ethylene, carbon dioxide, and a new gas,—carbon suboxide. This is most conveniently prepared by slowly distilling ethyl malonate in a vacuum of 12 mm. over a large excess of phosphorus pentoxide heated to about 300° C. Any unattacked ester is retained in a well-cooled wide test-tube through which the products of the reaction pass to a specially constructed piece of apparatus cooled in liquid air in which ethylene, carbon dioxide, and the new product are condensed. Its contents are subsequently allowed to boil away at ordinary temperatures, when the carbon suboxide, now a colourless liquid, remains behind. The greatest care must be taken to exclude all traces of moisture.

Carbon suboxide is a colourless, refractive, mobile liquid having a pungent acrolein or mustard-oil like smell. The vapour has an irritating effect on the eyes, nose, &c. It boils at + 7° C. and burns with a smoky blue flame. It has the composition C_3O_2, is monomolecular and probably has the formula OC:C:CO; when exploded with 2 vols. of oxygen, it produces 3 vols. of carbon dioxide.

Carbon suboxide behaves as an anhydride of malonic acid and has the properties of an unsaturated substance. Both in constitution and properties it resembles the nickel tetracarbonyl described by Mond, Langer, and Quincke (this J., 1890, 808). It dissolves in water, forming malonic acid. Mixed with aniline in ethereal solution, the formation of malonanilide takes place even below 0° C. An ethereal solution of ammonia converts it almost instantaneously into malonamide. It reacts with anhydrous gaseous hydrogen chloride to form malonyl chloride.

When kept for a day of two at 15° C. the liquid at first colours yellow, then yellow flakes are formed and finally the whole is converted into a dark red solid, which, when powdered, is almost black and contains about 52 per cent. of carbon. This dissolves in cold water with a remarkable intense eosine-red coloration. The decomposition takes place much more rapidly at 37° C., a hard blackish-red product, containing about 75 per cent. of carbon, being obtained. This is only partially soluble in water and gives a dark brown solution. At 100° C. the decomposition is instantaneous. The first product is probably identical with the compound C_4O_3, and the latter with the compound C_8O_3, described by Berthelot (see preceding abstract).—E. F. A.

Prizes.

The Council of the Society of Dyers and Colourists announce that funds have been placed at their disposal for distribution, in the form of prizes for the solution of technical problems.

List of Problems and Prizes.

1.—Prize of £20 for a full investigation of the average degree of tendering brought about in cotton yarn of various qualities by—

(*a*) Cross dyeing with acid colours; and

(*b*) Dyeing Aniline Black,

with the object of fixing standards for the trade.

2.—Prize of £10 for a practical method of so treating or preparing cotton yarn as to cause it to resist direct dyeing cotton colours. (The object desired is the production of a pattern or mixed effect in the piece dyeing of all cotton goods.)

3.—Prize of £10 for a practical method of dyeing full shades of basic colours on cotton, fast to rubbing.

4.—Prize of £10 for a practical method of causing kemps, when present in yarn or piece goods, to take the dyestuff equally with the accompanying wool.

5.—Prize of £20 for a full investigation of the mordanting properties of various tannin materials, more especially

(*a*) As to the relative affinity for cotton of the tannins of galls, myrabolams, sumach, divi-divi, &c.

(*b*) As to the relative fastness of the colour lakes produced with these tannins and basic colours, in conjunction with antimony, tin, and iron.

(*c*) As to the best method of determining by volumetric analysis, or other means, their relative mordanting power.

6.—Prize of £20 for a cheap and practicable method of producing a good black on Tussur silk.

7.—Prize of £50 for a practical method of so treating with some non-deliquescent substance, cotton piece goods dyed logwood black and heavily filled, as to render them mildew proof in tropical climates without impairing either colour or finish.

Competitors may obtain further details relating to this prize on application to the hon. secretary of the Society.

Rules governing the award of the prizes and general conditions to be fulfilled by competitors.

(1) The prizes are open to all, irrespective of nationality.

(2) Papers will be accepted in English, French, or German.

(3) All papers, &c., sent in for competition must be delivered free to the Honorary Secretary of the Society, on or before December 31st, 1906.

(4) A Committee of three or five adjudicators will be appointed by the Council for each problem. No person directly or indirectly connected with the preparation of any paper sent in for competition shall accept office as an adjudicator for that problem. The names of the Committees of Adjudication will be published in the Journal of the Society immediately after appointment.

(5) The donors of any particular prize shall have the right of appointing one member of the Committee of Adjudication for that prize, such appointment to be subject to the approval of the Council. In cases in which the donors exercise this right, the number of members appointed by the Council under Rule 4 will be reduced to two or four respectively.

(6) All papers, patterns, drawings, &c., sent in for competition should be enclosed in a sealed envelope bearing outside the number of the problem, and the motto of the competitor. This envelope will not be opened until the adjudication is to be made. The paper must also be accompanied by a second sealed envelope bearing the same motto and containing the name and address of the competitor.

(7) Every competitor by submitting his work, thereby agrees to leave himself entirely in the hands of the Committee of Adjudication, whose decision must be accepted as final.

(8) If a question is not completely solved, a competitor may be awarded a portion of the prize offered, and if several competitors have at the same time solved the same problem satisfactorily, the prize may be divided amongst them in equal or unequal parts, according to the respective value of the work submitted, at the sole discretion of the Adjudicating Committee.

(9) No work already published, may be entered for competition, and no work sent in for competition may be published until after adjudication. The depositing of the work with the Society secures for the author priority of discovery from the date at which it was deposited.

(10) Every competitor has the right to take out a patent for his process or invention, but the Society reserves to itself the prior right, after the adjudication has been made, of publishing, either in whole or in part, any of the work submitted. As the patent law of most countries requires that the invention should not have been published previously to the date of application, competitors who desire to patent their inventions should do so before December 31st, 1906, the Society declining all responsibility in this matter. In cases where an inventor has been awarded a prize by the Society before it is patented, he may request that the publication of his paper be adjourned for any period not exceeding six months.

(11) The Society will endeavour, as far as possible, to return unsuccessful papers to the competitors, but they accept no responsibility under this head.

The Hon. Secretary of the Society will be glad to communicate with anyone desiring to include further problems in the above list.

ERNEST T. HOLDSWORTH, *Hon. Sec.*
10, Merton Road, Bradford.

Trade Report.

SWITZERLAND; IMPORT TRADE OF ——.

For. Off. Ann. Series, No. 3572.

THE subjoined table shows the particulars of certain imports during the years 1904-05:—

Articles.		1904.		1905.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Iron and ironware	Tons	318,000	2,612,800	349,100	3,171,400
Leather and leather goods	,,	4,700	1,164,000	6,100	1,491,000
Mineral produce	,,	3,028,800	3,507,500	3,170,400	3,607,700
Copper and brass goods	,,	9,000	730,900	8,800	784,400
Aluminium, zinc, tin, nickel and lead goods	,,	10,700	497,500	10,500	502,500
Druggists' sundries and chemicals	,,	94,400	1,423,200	103,900	1,576,600
Colouring materials	,,	12,300	292,600	13,600	322,100
Oils, soaps and fats	,,	20,800	546,100	20,900	536,000
Manure, rags and fodder	,,	137,300	532,200	143,300	537,900
Paper and paper goods	,,	16,400	477,900	20,700	550,200
Pottery and china goods	,,	50,340	274,000	50,500	308,800
Alimentary products	,,	1,056,850	11,994,800	1,070,400	12,266,400
	Galls.	29,777,100	1,454,200	49,284,400	2,407,400
Total		—		—	

Japanese Chemical Trade in 1905.

Chem. and Drug., May 5, 1906.

The following statement of the imports and exports of the more important chemicals into and from Japan during January, 1906, in comparison with the corresponding month of the previous year, is compiled from the monthly summary of the Imperial Customs at Yokohama and Kobe:—

Imports.

		Yokohama.		Kobe.	
		1906.	1905.	1906	1905.
Indigo, dry	kin	21,781	38,180	84,539	63,503
Alizarin dyes	,,	500	19,058	—	—
Aniline dyes	,,	78,564	68,790	156,323	101,528
Phosphorus	,,	—	—	59,103	54,806
Potash, chlorate	,,	—	—	309,420	679,916
Soda, caustic	,,	—	—	548,886	1,157,722

Exports.

		Yokohama.		Kobe.	
		1906.	1905	1906.	1905.
Menthol	kin	13,757	17,820	975	5,571
Peppermint oil	,,	11,768	14,233	5,422	17,992
Antimony	,,	—	—	107,990	153,286
Sulphur	,,	—	—	32,285	621,292
Vegetable wax	,,	—	—	375,020	313,692
Camphor oil	,,	—	—	99,355	169,344
Corja oil	,,	—	—	34	212,816
Fish oil	,,	—	—	322,736	237,806
Agar-agar	,,	16,431	17,006	77,684	123,894
Camphor	,,	—	—	265,729	193,685

[Kin = 1·3 lb. avoir.]

Brazil; Export Trade of ——

Bd. of Trade J., May 3, 1906.

The following particulars of the export trade of Brazil during the years 1904 and 1905 are taken from the "Brazilian Review" of the 27th March:—

Articles.		Quantity.		Value.	
		1904.	1905.	1904.	1905.
				£	£
Rubber	Kilos	31,863,491	35,392,611	11,219,393	14,415,771
Hides and skins	,,	35,847,320	29,055,406	2,382,256	1,851,384
Gold, bar	Grm.	3,871,426	3,878,698	418,309	420,128
Sugar	Kilos.	4,861,450	37,746,510	93,488	405,954
Manganese	Tons	208,260	224,377	806,799	832,827
Para nuts	Hect.	92,580	198,226	107,311	232,206
Carnauba wax	Kilos.	1,995,546	1,896,757	204,227	207,818
Cottonseed	,,	26,600,538	37,493,736	89,044	108,458
Monazite sand	,,	4,860,390	4,487,290	108,825	100,038
Flour manioc or cassava	,,	3,980,076	5,276,146	45,024	77,859
Stones, precious	—	—	—	25,958	71,816
Piassava	Kilos.	1,469,818	1,287,943	43,642	37,875
Scrap metal	,,	3,155,344	3,925,796	18 795	29,644
Castor seed	,,	7,208,886	2,646,775	24,987	24,077

New Books.

Metallurgical Calculations. By Joseph W. Richards, A.C., Ph.D., Professor of Metallurgy in Lehigh University, &c. Part I. Introduction, Chemical and Thermal Principles. Problems in Combustion. McGraw Publishing Co., New York. 1906. Price, 2 dols. net. E. and F. N. Spon, London.

vo volume, containing 201 pages of subject matter and he alphabetical index. The text is subdivided under the following heads:—I. The Chemical Equation. II. Applications of Thermochemistry. III. Use of the Thermochemical Data. IV. The Thermochemistry of High Temperatures and Thermophysics of Elements and Alloys. V. Thermophysics of Chemical Compounds. VI. Artificial Furnace Gas. VII. Chimney Draft and Forced Draft. VIII. Conduction and Radiation of Heat. IX. Appendix with a Series of Problems.

On the Analysis and Valuation of Oxide of Iron and Lime for Purposes of Gas Purification, with Notes on the Determination of Sulphuretted Hydrogen and Carbon Dioxide in Gas Liquor. By H. Leicester Greville. Walter King, 11, Bolt Court, Fleet Street, London, E.C. 1906. Price, 2s. 6d.

Pamphlet of 8vo size, containing 32 pages of subject matter, and treating of the following points in connection with the above subject:—I. Oxide of Iron as a purifying agent, and its valuation as a raw material and in a spent condition. II. Analysis of oxide of iron supplied for the purposes of Gas Purification. III. Spent Oxide. IV. Estimation of "Blue" in Spent Oxide. V. Analysis of Raw and Spent Lime. VI. Analysis of Spent Lime. VII. Estimation of Sulphuretted Hydrogen and Carbonic Acid in Gas Liquor.

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1905. Volume 1. Wyman and Sons, Fetter Lane, E.C. [Cd. 2928.] Price 7s. 8d.

Foap. volume of 945 pages, consisting of an introduction, summary statements of British, Foreign and Colonial exports and imports; abstract tables relating to British and colonial trade; detailed statement of imports (*a*) free of duty, (*b*) subject to duty; detailed statement of exports (*a*) manufactured or produced in the United Kingdom, (*b*) foreign and colonial merchandise; coin and bullion, imports from and exports to each country.

Austria-Hungary.—New Customs Tariff (Interim Statement). [Cd. 2917.] Price 1s. 3d.

This return contains a translation of the new Customs tariff of Austria-Hungary as modified by commercial treaties with Germany, Russia, Italy, Belgium and Switzerland. This tariff came into force on the 1st of March last, but it is reported that the Austro-Hungarian Government contemplate negotiations with countries other than those specified, and in that case it is possible that the tariff may be still further modified as a result of such negotiations. In view, however, of the tariff being already in force, the Board of Trade have thought it desirable to issue the present interim return for the immediate information of those interested.

The advantage of all concessions which Austria-Hungary may accord to other countries, as well as the concessions already made to Germany, Russia, Italy, Belgium, and Switzerland, will be extended to the United Kingdom in virtue of the most-favoured-nation clause of the Treaty between the United Kingdom and Austria-Hungary of 5th December, 1876.

JOURNAL OF THE
Society of Chemical Industry.

No. 11.—Vol. XXV. **SUPPLEMENT.** **JUNE 15, 1906.**

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English—8*d* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States—1*s* each, to the Secretary of the Society.
French—1 fr. 25 c. each, to Belin et Cie., 59, Rue des Francs-Bourgeois, Paris (3e).

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

Adamson, G. P.; Journals to c/o The Baker and Adamson Chemical Co., Easton, Pa., U.S.A.

Barnes, E. A.; Journals to Sundaden, Aasenfjorden, Norway.

Curtis, Marvin, l/o California Street; 2506, Union Street, San Francisco, Cal., U.S.A.

Dearman, E.; Journals to c/o The Lavers Manufacturing Co., Ltd., Woolwich, N.S.W., Australia.

Dick, W. D., l/o West George Street; Messrs. Hugh Baird and Sons, 29, St. Vincent Street, Glasgow.

Doolittle, O. S., l/o Battery Place; c/o Semet-Solvay Co., 100, William Street, New York City, U.S.A.

Fahrig, Dr. Ernst; all communications to 3642, Old York Road, Philadelphia, Pa., U.S.A., Consulting Chemical Engineer.

Grimwood, R.; all communications to 60, Woodland Rise, Highgate, N.

Haas, Herbert, l/o San Francisco; 1535, Santa Clara Avenue, Alameda, Cal., U.S.A.

Hildebrand, Charles C., l/o Ridgway; Costello, Pa., U.S.A.

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Kirkpatrick, Prof. S. F., l/o Barrie Street; School of Mining, Kingston, Ont., Canada, Professor of Metallurgy.

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Marriott, F. Grant, l/o Freiburg; 14, Selby Street, Toronto, Canada.

Marx, Dr. E., l/o London; Ruckerstrasse 17, Schweinfurth a/M., Bavaria.

Mooney, G. A., l/o St. Catherine Street; 310, St. Paul Street, Montreal, Canada.

Parker, Chas. E., l/o Fairmount Street, U.S. Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A.

Proctor, W. W., l/o Portland Road; 100, Rye Hill, Newcastle-on-Tyne.

Rouse, Wm., l/o King Edward Street, 20, Albert Street, Alexandria, Dumbartonshire.

Deaths.

Royle, Thos., of 329, Upton Lane, E.; at St. Bartholomew's Hospital. June 1.

Tennant, Sir Charles, Bart., at Broadoaks, West Byfleet, Surrey. June 4.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 11,325. Pickering (Dixon). *See under* XVI.
" 11,434. Morison. Condensing apparatus. May 16.
" 11,475. Guillaume. Baffle plates for column stills. [Fr. Appl., May 26, 1905.]* May 16.
" 11,517. Henderson and Simon, Ltd. Separation of dust and other impurities from air and gases. May 17.
" 11,621. Stevens and Hughes. Filter presses. May 18.
" 11,724. Boult (Manvers and Phillips). Apparatus for creating and maintaining a vacuum.* May 19.
" 11,993. Scheibe. Separation of admixtures from gases and vapours.* May 22.
" 12,210. Potter. Cleansing gases. [U.S. Appl., June 10, 1905.]* May 26.
" 12,223. Haddan (Aktiebolaget Separator). Centrifugal machines.* May 25.
[C.S.] 9952 (1905). Andrews. Furnaces. May 23.
" 10,560 (1905). Hargreaves. Concentrating solutions and obtaining and conveying salts. May 23.
" 13,614 (1905). Gibbons, Masters and Baeddicker. Furnaces, muffles and kilns. May 23.
" 15,119 (1905). Macquisten. Separation of solid particles from each other. May 23.
" 19,795 (1905). Evans (Ges. f. Trockenverfahren). Process for drying by means of rays of light. May 30.
" 20,381 (1905). Theryc. Systems of concentration. May 23.
" 23,424 (1905). Porges and Neumann. Separation of solid bodies from liquids by cooling and apparatus therefor. May 30.
" 4824 (1906). Boas, Rodrigues-Ely and Gauthier. Vessels for containing gas under pressure. May 30.

II.—FUEL, GAS, AND LIGHT.

[A.] 11,279. Bourdos, Rothschild and Sutcliffe. Filaments of incandescent electric lamps. May 14.
" 11,311. Lynde. Production of gas from petrol and other hydrocarbons. May 15.
" 11,409. British Thomson-Houston Co. (General Electric Co.). *See under* VII.
" 11,572. Laycock. Incandescent gas mantles. May 17.
" 11,639. Bloxam (Lux). Metallic incandescence filaments for electric glow lamps. May 18.
" 11,660. Jones. Coke ovens.* May 18.
" 11,797. Schöndeling. Process and device for cleaning coal. May 21.
" 11,810. Lee. Metallic filaments for electric incandescent lamps. May 21.
" 11,925. Allison (Amer. Chemical Eduction Co.). Process of distilling coals and other hydrocarbonaceous substances.* May 22.
[A.] 11,926. Allison (Amer. Chemical Eduction Co.). Apparatus for distilling coals and other hydrocarbonaceous substances.* May 22.
" 11,944. Just, Hanaman, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. May 22.
" 12,055. Cruyt. Apparatus for use in the combustion of hydrocarbons. [Belg. Appl., June 3, 1905.]* May 23.
" 12,127. Grünewald. Carburetting process and apparatus.* May 24.
" 12,128. Grünewald. Carburetting apparatus.* May 24.
" 12,129. Grünewald. Carburetting apparatus.* May 24.
" 12,132. Guttmann. *See under* VII.
" 12,225. Sodeau, and Brady and Martin, Ltd. *See under* XXIII.
" 12,270. Mason's Gas Power Co., and Bentley. Suction gas producers. May 25.
[C.S.] 9864 (1905). Hirsch. Manufacture of incandescing bodies for incandescent lighting. May 23.
" 10,075 (1905). Radcliffe. *See under* VII.
" 10,616 (1905). Fleming. Generating and utilising hydrocarbon vapours for heating and lighting purposes. May 30.
" 10,733 (1905). Hooton and Noble. Producing or enriching coal gas. May 23.
" 10,954 (1905). Woodall and Duckham. Carbonisation of coal in vertical or inclined retorts. May 30.
" 12,176 (1905). Körting. Gas retort settings and regenerator furnaces. May 23.
" 26,108 (1905). Harry. Mantles for incandescent gas burners. May 23.
" 3006 (1906). Winand. Production of a working medium for internal combustion motors. May 23.
" 4230 (1906). Holmes, Holmes and Cameron. Apparatus for extracting tar from illuminating gas. May 30.
" 8866 (1906). Page (Doherty). Gas calorimeters. May 30.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 11,311. Lynde. *See under* II.
[C.S.] 4230 (1906). Holmes, Holmes and Cameron. *See under* II.
" 4427 (1906). Coulson. Process for solidifying tar. May 30.
" 8757 (1906). Pagès and Camus. Manufacture of acetone. May 30.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 11,479. Johnson (Kalle und Co.). Manufacture of leuco compound of thio-indigo-red. May 16.
" 11,480. Johnson (Kalle und Co.). Manufacture of a condensation product from thioindoxyl derivatives with isatin, and its employment in dyeing and printing. May 16.
" 11,759. Meister, Lucius und Brüning. Manufacture of an azo dyestuff and of colour lakes therefrom. [Ger. Appl., July 12, 1905.]* May 19.
" 11,760. Imray (Soc. Chem. Ind. in Basle). Manufacture of red, violet and blue vat dyeing dyestuffs.* May 19.
" 12,243. Johnson (Badische Anilin und Soda Fabrik). Production of indoxylic compounds. May 25.
[C.S.] 19,100 (1905). Newton (Bayer und Co.). *See under* XIII*A*.

[C.S.] 20,359 (1905). Cooper (Bayer und Co.). Manufacture of a dyestuff of the anthraquinone series and of intermediate products for use therein. May 23.

„ 22,412 (1905). Sachs. Manufacture of aminophenols. May 23.

„ 22,519 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing halogen. May 30.

„ 22,697 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of disulphonic acids of dianisidine and diphenetidine. May 30.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 11,254. Hansdorf. Apparatus for treating fabrics with liquids.* May 14.

„ 11,285. Möller-Holtkamp. *See under* XIV.

„ 11,480. Johnson (Kalle und Co.). *See under* IV.

„ 11,669. Taghani. Process for dyeing indigo resist articles in the continuous vat. May 18.

„ 11,758. Imray (Meister, Lucius und Brüning). Machines for dyeing or printing in shaded colours or prints. May 19.

„ 11,836. Wagstaff. Machines for washing fibres. May 21.

„ 11,876. Abel (Act.-Ges. f. Anilinfabr.). Dyeing furs, hairs, feathers, or the like, and a material therefor. May 21.

„ 12,017. Smith. Apparatus for carbonising vegetable matter in animal fibres, rags, and the like. May 23.

„ 12,080. Weiss. Process and composition for dry cleaning fabrics.* May 23.

„ 12,117. Wilkinson. Apparatus for bleaching or dyeing hanks, cops, and other fibrous materials.* May 24.

[C.S.] 22,940 (1905). Mann. Glossing and gassing machine for silk and other fine threads. May 23.

VI.—COLOURING WOOD, LEATHER, PAPER, ETC.

[C.S.] 11,040 (1906). Lamb and Rennie. Printing on leather. May 30.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 11,371. Tchernac. Process for separating alkali cyanides from their solutions in water.* May 15.

„ 11,409. British Thomson-Houston Co. (General Electric Co.). Manufacture of tungsten compounds and the production of lamp filaments therefrom. May 16.

„ 11,565. Imray (Meister, Lucius und Brüning). Process for dehydrating sodium hydrosulphite containing water of crystallisation. May 17.

„ 11,767. Consortium f. Electrochem. Ind. Production of calcium hydride. [Ger. Appl., May 19, 1905.]* May 19.

„ 11,770. Fairweather (Chem. Fabr. in Billwärder vorm. Heil und Sthamer). Method of decomposing chrome iron ore to form chromates. May 19.

„ 11,800. Hill. Revolving black ash furnaces. May 21.

„ 11,820. Benton. Kilns for burning lime. May 21.

„ 11,902. Leslie. Manufacture and recovery of carbonic acid. May 22.

„ 11,979. Von Foregger. Apparatus for generating oxygen gas. [U.S. Appl., Feb. 8, 1906.]* May 22.

„ 11,981. Brindley. Generation of oxygen gas. [U.S. Appl., April 14, 1906.]* May 22.

[A.] 12,132. Guttmann. Utilising waste nitrate of soda and the preparation of an improved fuel. May 24.

„ 12,209. Potter. Treatment of silicon monoxide. [U.S. Appl., June 14, 1905.]* May 25.

„ 12,246. Jaubert. Preparation of oxygen by decomposition of oxygenated salts. [Fr. Appl., May 29, 1905.]* May 25.

„ 12,262. Jaubert. Manufacture of oxygen briquettes. [Fr. Appl., May 29, 1905.]* May 25.

[C.S.] 10,075 (1905). Radcliffe. Treatment of certain products of ammoniacal liquor. May 23.

„ 11,347 (1905). Thompson (Goldschmidt and Polzinius?.) *See under* XIIIA.

„ 26,728 (1905). Pawlikowski. Production of endothermic chemical compounds. May 30.

„ 1764 (1906). Noerdlinger and Noerdlinger. Recovery of cyanogen from waste waters, solutions, &c., and rendering the liquids innocuous. May 30.

„ 3121 (1906). Winand. Production of oxygen for internal combustion engines. May 30.

„ 5428 (1906). Ray. Manufacture of common salt. May 23.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 12,159. Slingluff. Glass furnaces. [U.S. Appl., June 29, 1905.]* May 24.

[C.S.] 15,630 (1905). Bredel. Production of a molten mass of rock quartz at a relatively low temperature. May 30.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 11,361. Jones. Heat insulating material. May 15.

[C.S.] 10,902 (1905). Smith and Atherton. Asphalt composition for road making, &c. May 30.

„ 5955 (1906). Klee. Manufacture of artificial stone plates. May 23.

X.—METALLURGY.

[A.] 11,486. Fletcher and Digby. Manufacture of a metallic alloy. May 16.

„ 11,586. Penn. Metallic alloy. May 18.

„ 11,698. Swain. Method of coating iron or steel with tin. May 19.

„ 11,709. Prescott. Method of coating cast iron or steel with non-corrosive metals. May 19.

„ 11,770. Fairweather (Chem. Fabr. in Billwärder). *See under* VII.

„ 11,974. Hadfield. Manufacture of magnetic material. May 22.

„ 12,130. Grünewald. Case-hardening iron or steel.* May 24.

„ 12,185. Cowper-Coles. Manufacture of silver alloys. May 25.

„ 12,266. Cowper-Coles. Production of metals with special physical properties. May 26.

[C.S.] 10,869 (1905). MacIvor and Fradd. Treatment of nickel ores or oxidised nickel mattes. May 23.

„ 24,002 (1905). Walker. Means for neutralising noxious fumes or gases in blasting operations. May 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 11,498. Trunkhahn. Process of obtaining electrolytic metallic deposits.* May 16.

„ 11,675. Brindley. Effecting fusion of materials by electricity.* May 18.

[A.] 11,865. Cowper-Coles. Anodes. May 21.
„ 11,950. Hess. Insulating material. May 22.
„ 11,998. Whitehead and Marino. Agglutinant for consolidating active accumulator material. May 23.
„ 12,205. Möllenbruck and Dielmann. Carbon electrodes. May 25.
„ 12,329. Röchling and Rodenhauser. Electric furnaces.* May 26.
[C.S.] 7133 (1905). Fellows, and Pickup and Tice. Electric regenerative battery. May 23.
„ 11,654 (1905). Schanschieff. Accumulator plates. May 30.
„ 4579 (1906). Ozonair, Ltd., and Joseph. Apparatus for ozonising air. May 23.
„ 9164 (1906). Petersson. Electric furnaces for treating gases. May 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 11,622. Iveson and Wilson. Apparatus for pressing and varying the temperature of soap, fat, or like substances. May 18.
„ 11,877. Lanza. Filtering apparatus for extracting stearine from fatty acids in sulpholeic acid solution.* May 21.
„ 11,983. Metz and Clarkson. Process of bleaching oils and fats.* May 22.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A.)—PIGMENTS, PAINTS.

[A.] 11,230. Griffiths. Pigments. May 14.
„ 11,759. Meister, Lucius und Brüning. *See under* IV.
[C.S.] 11,347 (1905). Thompson (Goldschmidt and Polzinusz). Manufacture of white lead and mixtures of the same with oxide of lead. May 30.
„ 10,100 (1905). Newton (Bayer und Co.). Manufacture of colouring matter lakes. May 30.

(C.)—INDIA-RUBBER.

[C.S.] 25,846 (1905). De Laski and Thropp. Manufacture of rubber cloth. May 30.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 11,285. Möller-Holtkamp. Manufacture of clear neutral size suitable for all kinds of yarn.* May 14.
[C.S.] 10,227 (1905). Calico Printers' Association, and Warr. Treatment of serum or blood albumen. May 23.
„ 7010 (1906). Lobb. Process and composition for treating leather. May 30.

XV.—MANURES, ETC.

[A.] 11,215. Allibon. Apparatus for the manufacture of artificial manures. May 14.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 11,325. Pickering (Dixon). Continuous centrifugal separator for treating sugar and other materials. May 15.
„ 12,291. Jowson. Manufacture of starch hydrolytic products. May 26.
[C.S.] 8661 (1905). Thomas and Howe. Method of clarifying juices in the manufacture of sugar. May 23.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 12,227. Takamine. Diastatic substance and method of producing the same.* May 25.
[C.S.] 10,783 (1905). Hyde. Process of brewing and appliances employed therewith. May 30.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

[C.S.] 14,794 (1905). Haaman and Diamant. System of sterilisation. May 30.

(B.) SANITATION; WATER PURIFICATION.

[A.] 11,848. Schmidt. Process of purifying water. [Ger. Appl., May 21, 1905.]* May 21.
„ 11,980. Brindley and von Foregger. Regenerating and purifying vitiated air. [U.S. Appl., March 9, 1906.]* May 22.
[C.S.] 16,204 (1905). Aslatt. Process for promoting combustion of towns' refuse in destructor furnaces. May 30
„ 1764 (1906). Noerdlinger and Noerdlinger. *See under* VII.

(C.)—DISINFECTANTS.

[A.] 11,445. Rosenberg. Treatment of materials for rendering them aseptic. May 16.
„ 11,555. Gronwald. Sterilisation of corks. [Ger. Appl., May 18, 1905.]* May 17.
„ 12,299. Lehmann. Disinfecting process.* May 26.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 11,632. Coale. Manufacture of artificial cork.* May 18.
[C.S.] 1377 (1906). Armengaud. Manufacture of paper by the web machine. May 30.
„ 5851 (1906). Erfurt. Direct utilisation of the waste water of a paper machine. May 30.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 11,574. Johnson (Verein. Chinnfabr. Zimmer und Co.). Manufacture of boracic acid esters. May 17.
„ 11,725. Fritzsche und Co. Manufacture of neutral oxychinolin salts. [Ger. Appl., June 2, 1905.]* May 19.
[C.S.] 11,219 (1905). Ellis (Merck). Manufacture of dialkylbarbituric acids. May 30.
„ 15,118 (1905). Nicolaidi. Manufacture of an officinal preparation of phosphoric acid. May 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 11,304. Schreiber. Impts. in the carbon process by enhancing the keeping properties of the tissue. May 15.
[C.S.] 16,999 (1905). Smith. Photographic film. May 30.
„ 27,088 (1905). Dischner. Production of photographs. May 23.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 11,938. Seip, and Curtis's and Harvey, Ltd. Smokeless propellant powders. May 22.
„ 12,131. Muir and Boor. Igniting compositions for match heads and the like. May 24.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 12,225. Sodeau, and Brady and Martin, Ltd. Apparatus for gas analysis.* May 25.

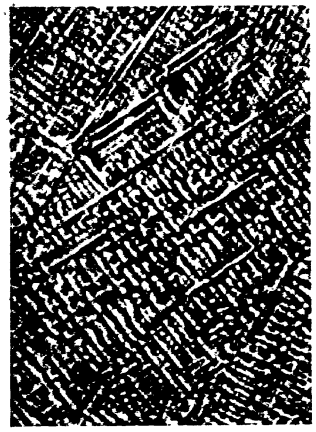


FIG. 2.
73 per cent. copper. cast × 90 V (α).



FIG. 3.
73 per cent. copper, cast and annealed × 20 O (α)



FIG 4.
73 per cent. copper, annealed after straining × 35 O (α).



FIG 5.
66 3 per cent. copper, quenched from molten state × 120 V (α and complex of α and β)



FIG. 6.
66·7 per cent. copper, annealed near 900° C. and then quenched × 120 V (α and complex of α and β).

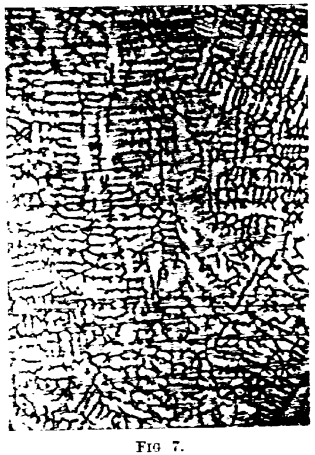


FIG 7.
66·4 per cent. copper. cast × 50 V (α with a little β).

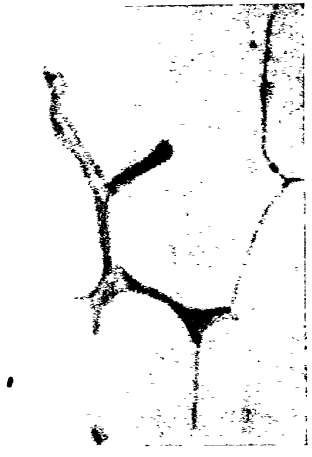


FIG. 8.
65 4 per cent copper, cast and slowly cooled × 250 V (α with a little β).



FIG. 9
57 9 per cent copper, cast and slowly cooled × 120 V (β and α).

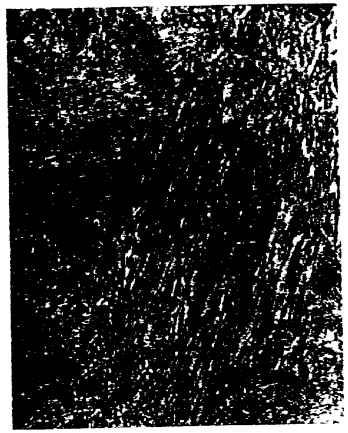


FIG. 10.
61 9 per cent. copper, cast and slowly cooled × 20 V (α and β).



FIG. 11.
51 8 per cent. copper, annealed at 650° C. × 20 O (β)

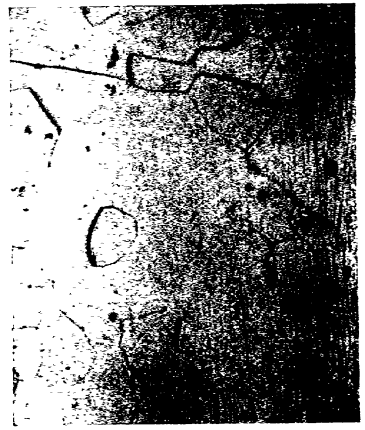


FIG. 12
50 per cent. copper, quenched from molten state × 35 V (β).



FIG 13.
61·2 per cent. copper, annealed × 250 V



FIG. 14.
49 per cent. copper, cast × 60 V (β and γ).



FIG. 15.
49 per cent. copper, cast and slowly cooled × 90 V (δ and γ).

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. A programme and request form accompanied the May 31st issue of the Journal.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see Journal for April 30th, p. 341) will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Eustace Carey has been nominated to the office of President under Rule 8; Dr. E. G. Love, Mr. A. Gordon Salamon, and Mr. Chas. Wightman have been nominated Vice-Presidents under Rule 8; and Dr. E. Divers, F.R.S., has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Dr. F. J. Smale, Mr. Thos. Tyrer, Sir Thos. Wardle, and Mr. R. C. Woodcock have been nominated, under Rule 18, to fill four vacancies among the Ordinary Members of Council. No ballot will be required. The member's ticket accompanies this issue of the Journal.

ALTERATION OF BY-LAWS.

With a view to facilitate the voting of members residing abroad, notice is hereby given, in accordance with Rule 35 of the By-laws, that the Council will propose to the forthcoming Annual General Meeting the amendment of the Society's By-laws as follows:—

1. Rule 18. (*a*) That the words "At least two months before the date of each Annual General Meeting," in the first and second lines thereof, be replaced by the words, "In the second issue of the Society's Journal for the month of April in each year."

(*b*) That the words "date of that meeting," in the fourth line thereof, be replaced by the words "Annual Meeting next ensuing."

(*c*) That the words "At least one month before the date of;" in the sixth line from the end thereof, be replaced by the words "not later than the last day of May prior to."

(*d*) That the words "to the election to take place at which it refers" in the fifth line from the end thereof, be replaced by the words "at which the election to which the nomination refers is to take place."

2. Rule 19.—That the words "at least five days before the commencement of the said meeting," in the two last lines thereof, be replaced by the words, "in the second issue of the Society's Journal for the month of May."

Deaths.

Royle, Thos., of 329, Upton Lane, E.; at St. Bartholomew's Hospital. June 1.

Tennant, Sir Charles, Bart., at Broadoaks, West Byfleet, Surrey. June 4.

Birmingham Section.

Meeting held at Birmingham on Thursday, February 15th, 1906.

PROF. FRANKLAND, F.R.S., IN THE CHAIR.

THE MICROSTRUCTURE OF BRASS.

BY O. F. HUDSON, A.R.C.S.

(Lecturer in Metallurgy in the University of Birmingham.)

The object of this paper is to give an explanation of the microscopic structure of the copper-zinc alloys with more than 50 per cent. of copper, in the light of a recently-published research on "The Constitution of the Copper-Zinc Alloys," by E. S. Shepherd (Journal of Physical Chemistry, June, 1904). In 1904, Mr. G. D. Ricketts and the author projected and commenced a research on this subject on lines similar to those adopted by Shepherd, and although much of the proposed research was abandoned on Shepherd's paper coming to our notice, the microstructure of the brasses has been carefully examined and our results compared with those of Shepherd. Shepherd gives a complete equilibrium curve for the whole series of copper-zinc alloys. This curve agrees in the main with that published by Roberts-Austen in the 4th Report of the Alloys Research Committee in 1897. Shepherd, however, considers there is no evidence in support of the view held by many workers that copper and zinc combine to form definite chemical compounds, and states that the six solid phases indicated by the equilibrium curve are all solid solutions of copper and zinc.

Referring to Shepherd's curve (Fig. 1), it is seen that

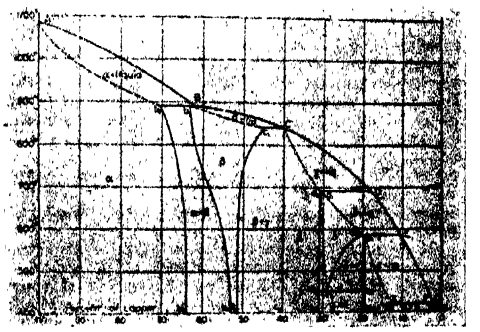


FIG. 1.

Equilibrium curve of zinc-copper alloys
(E. S. Shepherd, Journal of Physical Chemistry, June, 1904.)

for the range of composition of the alloys to be considered we have only to deal with three of these phases, which are distinguished as α, β, and γ, and whose limits of concentration vary with the temperature as indicated. It will also be seen that the alloys composed of one or two of these three phases may be divided into six groups, as follows:—

I. Alloys containing 71—100 per cent. copper, consisting entirely of α at all temperatures.

II. Alloys containing 64—71 per cent copper, consisting of only α at 400° C. and below, but composed of α and β at some higher temperature.

III. Alloys containing 63—64 per cent. copper consisting of mixed α and β at all temperatures.

IV. Alloys containing 53·5—63 per cent. copper, consisting of mixed α and β at low temperatures, and only β at some higher temperature.

V. Alloys containing 51—53·5 per cent. copper, consisting entirely of β at all temperatures.

VI. Alloys containing 40—51 per cent. copper, consisting of mixed β and γ at low temperatures, and only β at higher temperatures.

The microstructure of each of these groups will now be considered:—

I. Brass containing 71 per cent. copper or more, independently of the rate of cooling, consists of only one constituent, α, a solid solution of zinc in copper. The microstructure varies, however, according to the treatment the alloy has received. The ordinary cast metal, *i.e.*, moderately quickly cooled, has a well marked dendritic structure (Fig. 2), due to the non-homogeneous nature of the crystals: the solid which first solidifies is richer in copper than the still molten alloy, and the cooling is too rapid to allow diffusion to give complete uniformity. Annealing the cast metal allows diffusion to take place so that the crystals become quite homogeneous, and the structure is the usual polygonal one associated with a material consisting only of one homogeneous constituent (cf. pure metals) (Fig. 3). When the cast metal is rolled the original crystalline structure is broken down and becomes more or less finely granular. Annealing the rolled brass causes a regrowth of the crystals, with complete uniformity of composition as in the case of the unworked material after annealing, but with this difference that the

majority of the crystals show pronounced twinning (Fig. 4). The twinning of the crystals of α is characteristic of that constituent when annealed after straining; indeed, a specimen of cast brass that has been merely strongly gripped in the vice will show abundant twinning on annealing.

On cooling alloys of the second group (64—71 per cent. copper), crystals of α first separate until the temperature and composition reach B (of Shepherd's curve) when the still molten portion solidifies and splits up into a mixture of α and β (Figs. 5 and 6). During very slow cooling the β is redissolved by the α first formed and the brass consists entirely of α. The structure of the cast alloy, although resembling the cast structure of brass of the first group, usually shows the presence of a small amount of β (Figs. 7 and 8). The annealed structure is also similar, provided the annealing temperature is not above the line b_2b_3. Annealing above this point leads to the separation of β, which is not reabsorbed unless the cooling is very slow. This fact, as Shepherd points out, may have some bearing upon the question of the burning of brass: annealing should be conducted at a temperature well below the line b_2b_3.

The alloys of Group III. (63—64 per cent. copper) consist of a mixture of α and β, however cooled or annealed, and the structure resembles those of alloys in the next group.

Alloys containing between 53·5 and 63 per cent. copper, on first solidifying, consist entirely of β, which, on cooling, changes in composition, the excess of copper giving rise to a separation of α (Fig. 9). The cast alloy consists of a mixture of α and β (Fig. 10), and on annealing at temperatures above the line b_1b_1, the α is redissolved in the β. If the alloy be now quickly cooled, it will be seen to consist only of β (cf. Fig. 12).

The alloys of Group V., containing 51—53·5 per cent. copper, consist, however cooled, only of β. β differs from α in showing no dendritic structure in the cast state and no twinning on annealing (Figs. 11 and 12). Shepherd describes it as being of a more reddish colour than α with high percentages of zinc, and attributes the return of the red colour in brasses to this fact.

Group VI.—With less than 51 per cent. copper the third constituent γ first makes its appearance. It is white and exceedingly brittle and separates as an envelope to the β crystals (Fig. 14) (also in the form of secondary crystals in the β crystals), with the result that alloys with more than 49 per cent. zinc are very fragile.

All the specimens from which these photographs were taken were etched by gently rubbing on parchment moistened with dilute ammonia.

The letters, V and O, after the numbers, representing the magnifications, indicate vertical and oblique illumination respectively.

Discussion.

Mr. H. Silvester asked if it was possible to detect accurately by means of the microscope whether the metal had been burnt or not.

Mr. Rosenhain said it was pointed out some years ago by Prof. Ewing and himself that the existence of twin crystals in cast metals of the copper type—*i.e.*, metals consisting of copper or a solid solution of zinc or tin or any other substance in copper, never showed twin crystals in the cast state, but that they developed them as the immediate effect of a strain. The twin crystals were not, therefore, at any rate not entirely, the product of the annealing, as one would have gathered from Mr. Hudson's remarks, but were already formed mechanically from the deformation. It was probable that they were formed to a still greater extent, and probably still more clearly defined after annealing, but it was really the strain that set up twinning. Probably if Mr. Hudson had examined the strained metal before annealing, he would have found the twinning in it already.

Mr. A. T. Cocking asked if Mr. Hudson had considered the influence of time and temperature in the annealing upon the structures. In the course of several hundreds of micro-photographs of brass in varying conditions, taken during the last year, he had prepared a very complete diagram, showing the cycle of changes in the structure of the metal as it passed from the cast state to the rolled state, and then through the varying crystalline structures induced by the progressive annealing, until the metal was brought back again to the melted state; a very striking point in the series was the complete change in appearance not only in the regularity of the structure, but also of the individual crystals, by a very slight alteration in the time of annealing, and also by a slight alteration in the temperature employed. Varying the time in periods of five minutes and the temperature in 10°, and, taking the mechanical tests of a strip of metal at each period and each temperature, a very striking record was obtained. It showed a uniformity of better work at 15 minutes' duration at each alteration of temperature of the annealing throughout the whole system. At that time, the size of the crystal was correct, and there was a uniformity in the crystals which was not apparent at other times. Then the twinning of the crystals was seen to perfection. As the temperature was increased beyond the period which gave the best tests, the uniformity decreased until a temperature of about 850° was reached, when the spots, so very well illustrated on one of the diagrams referred to as showing the twinning of the crystals, were produced. A gradual increase in the temperature beyond that point caused the spots to gradually develop into the dendritic form of structure, which marks the original or cast structure, and so completes the cycle, commencing and terminating with the ordinary cast structure. A great deal in the appearance depended upon the way in which the light struck the plate of crystals under the microscope, and so much depended upon the way in which the metal had been etched. The best method of etching the surface for high power work was to use a solution of ammonia in hydrogen peroxide solution; the photographs then came out like engravings, if carefully taken; that was the only way in which consistent photographs of the same object could be obtained. He was inclined to think that some of the crystals which Mr. Hudson referred to and described as due to "twinning" were rather due to the "slipping" of one large crystal, which broke by a slight strain upon it. If more work were done upon that individual crystal, it would probably be found to be a mass of very tiny layers, a few of which etched out from the others. Probably Mr. Hudson would have observed that same fact for himself. He had never gone so far as Mr. Hudson to recognise in these photographs the actual individual eutectics, so much variation was due to the way in which the lights met the surface, and to the action of various etching solutions. Had Mr. Hudson found that difficulty and examined the same structure etched by different solutions?

Prof. Turner wrote, "No doubt the more we know of the internal structure and physical properties of the zinc-copper series, the more regular and uniform would be the material which was produced. This is particularly so in respect of sheet brass, and other similar material which has to be frequently annealed during its preparation. The work of Shepherd appears to be the most important, and the most revolutionary, which has appeared for a number of years, though numerous observers have worked on brass. Among these, Charpy calls for special recognition. It should be mentioned that, in preparing these alloys, the purest obtainable electrolytic copper and distilled zinc were employed, and every care taken to ensure that the alloys were really as represented. It is interesting to find that in so far as the two series of researches had covered the same ground, the observations of Mr. Hudson supported and confirmed the suggestions of Shepherd.

"This work would entail a revision of our conceptions of the constitution of brass. It would not, of course, in any way invalidate the facts observed by Laurie and others; but instead of explaining these results as being due to definite compounds which are formed with certain proportions of the constituent metals, we shall have to explain the changes in melting point, in electro-motive force, and in other physical properties as being due to the appearance or the preponderance of one or other of the solid solutions of zinc in copper, or of copper in zinc, which have been described by Shepherd."

Mr. L. Archbutt asked how the surfaces were prepared. He presumed all the slides were etched. How were they etched? There was not a really satisfactory way of etching these alloys of copper. He generally used for copper and its alloys dilute ammonia containing a few drops of peroxide of hydrogen, but the results were not satisfactory. One speaker referred to the importance of the time as well as the temperature in annealing. That was a matter of great importance. Had Mr. Hudson ever found, after annealing, it made any difference whether the specimen was quenched in cold water or allowed to cool naturally? He asked that question, because he made an observation lately which led him to think it did make a difference in the structure of the metal. He had heated small pieces of copper in a muffle and gradually increased the temperature with the object of ascertaining the effect it had on the growth of the crystals. The piece of copper had been heated to a temperature of about 1100°, just over the melting point. As soon as it was brought out of the muffle it re-calesced quite vividly. No doubt the copper had melted in the skin of oxide without changing its shape, and immediately solidified on removing from the muffle. The structure showed quite clearly that was the case, and that some of the oxide dissolved in the copper. He had obtained a beautiful specimen, accidentally, in that way.

Mr. Hudson said that burnt brass was characterised by a coarse crystalline structure, and frequently by the presence of small holes like bubbles of gas. With regard to the twinning referred to by Mr. Rosenhain, the effect of straining cast brass was made evident under the microscope by many series of parallel lines which he took to be slip bands; although the twinning was developed by the straining, it was made evident by annealing. Also, when very severely strained, the crystals were distorted and broken up, and, on annealing, recrystallisation took place with very obvious twinning. In reply to the question as to the relative importance of time and temperature in giving the best results in annealing brass, he could not speak from much personal experience, but he should say that, provided the temperature was not high enough to produce burning, a short annealing at a high temperature should give similar results to a longer annealing at a lower temperature. He had never noticed more than one constituent in brass containing over 70 per cent. of copper. The method of etching adopted, which was that of gently rubbing the specimen on parchment moistened with a diluted solution of ammonia, gave very good results, although the colours of the constituents of the etched sections as seen under the microscope might not always be the true ones. Thus the constituent β under these conditions appeared greenish-yellow in colour, although on a freshly filed surface it had a distinctly reddish tinge.

Canadian Section.

Meeting held at Toronto on Thursday, May 10th, 1906.

PROF. W. HODGSON ELLIS IN THE CHAIR.

A RECORDING CALORIMETER FOR GAS.

THE RELATION OF FLAME TEMPERATURE TO CALORIFIC POWER.

BY J. WATSON BAIN, B.A.Sc. AND J. W. BATTEN.

The work which gave the experimental data of this paper was first suggested by the need of a recording calorimeter in the larger gas works. Undoubtedly before long cities will require the maintenance of a minimum calorific value rather than a minimum candle power as at present; hence a method of automatically and constantly registering the calorific power may soon become an urgent necessity. The relation between the number of heat units in a gas and the temperature of the flame produced when burned seemed to offer a solution of the problem.

At the outset it was recognised that both the flame temperature and the calorific power were dependent, fundamentally, on the composition of the gas, *e.g.*, an increase in the percentage of carbon dioxide or nitrogen would decrease both. It was also recognised that the temperature of the flame varied very materially, depending upon the relative point in the flame.

The apparatus used for finding flame temperatures consisted essentially in a Le Chatelier thermo-junction, previously calibrated for the melting points of pure tin, lead, zinc and aluminium, which was placed in an iron sheath, and thus exposed to the flame. The two wires leading from it were attached to a galvanometer reading directly in degrees centigrade.

The gas was burned in a small asbestos house (to prevent draughts upon the flame) having a hole in the side at the proper height to admit the thermocouple. Calorific power was measured by an ordinary Junker's calorimeter: from whatever source, the gas was drawn off and branched, one part going to the calorimeter and the other to the burner.

For the establishment of a relation it was found advisable to obtain a gas whose calorific power could be varied at will. For that purpose a gasolene gas was made by using a water blast, passing the air through a calcium chloride tower, then through a small reservoir of gasolene, and finally to the burners, after passing a tower filled with cotton wool, to prevent any possibility of the flame striking back to the gasolene.

Galvanometer readings and calorimetric determinations were made every three minutes and plotted, the result being as shown in Fig. 1.

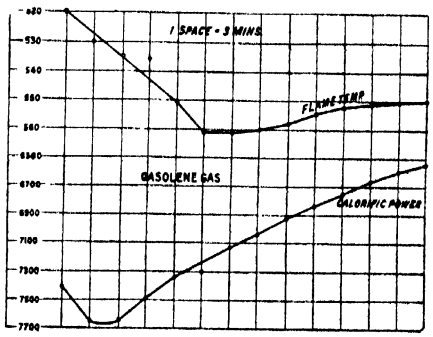


FIG 1.

It will be noted that there is a lag of about 18 minutes of the flame temperature behind the calorific power, due to the presence of the iron tube. This lag was also verified by several successive experiments. In order to overcome this a thick paste was made of powdered silica, fireclay and soluble glass, and placed around the

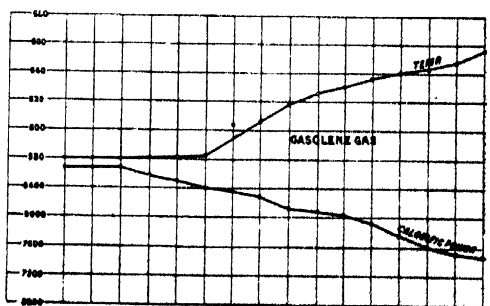


FIG 2

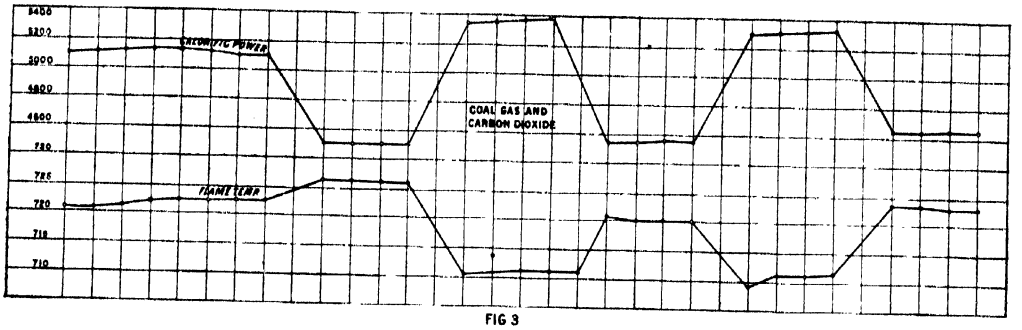


FIG 3

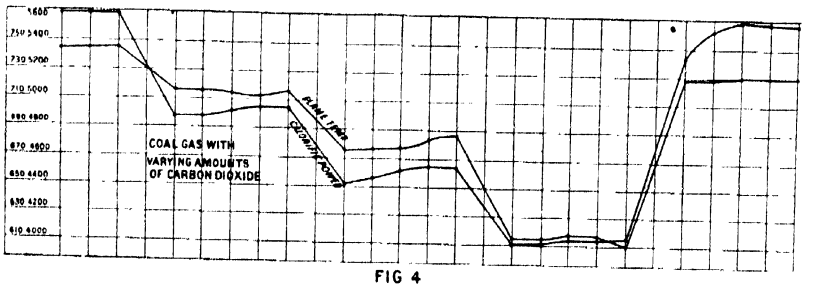


FIG 4

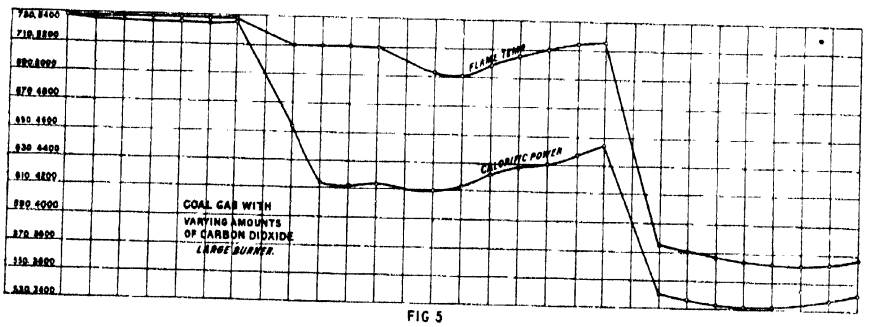


FIG 5

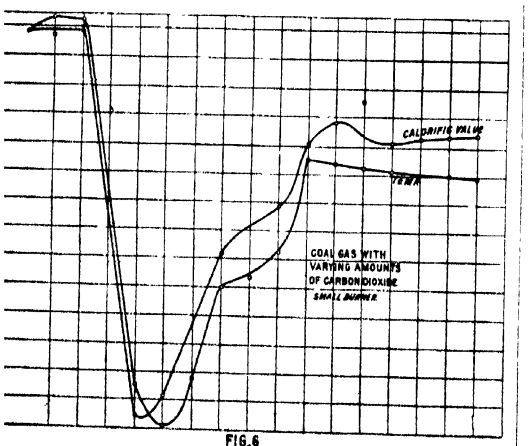


FIG. 6

junction. This was then rapidly calcined and used in the succeeding trials.

The first curve obtained (Fig. 2), here submitted, shows a relation between the two, but the reverse of what one would expect; the calorific power falls while the temperature rises. It is evident that this is possible if the thermo-junction is placed at first within the inner cone and then the flame shortened. In that case the calorific value would decrease while the galvanometer would show an increasing temperature.

For various reasons, the chief being that coal gas is the one most used in practice, the gasolene gas was replaced by it, and diluted by carbon dioxide obtained from a cylinder, to which a reducing valve was attached, to bring it in contact with the coal gas at low pressure. The peculiarity noted above is clearly shown in Fig. 3.

The position of the thermo-junction was then raised to a point higher than the top of the flame at any time, and Fig. 4 produced, which shows a fairly good conformation of the one curve with the other.

The next curve (Fig. 5) shows a similar conformation in general, though the relative falling off and increase in both varies widely at different times.

Curve 6 was made using a smaller burner, and indicates

a maximum variation of flame temperature from calorific power of about 2 per cent., an error which might quite readily be made in reading the calorimeter.

It will be noted in Fig. 5 that at A the fall of flame-temperature is much less comparatively than that of calorific power, while at B, the reverse is the case.

Evidently for a calorific value slightly less than that shown at B, we would have a position where both decrease at equal rates.

The net conclusion then is that there is undoubtedly a direct relation of flame-temperature to calorific value. It is impossible to keep the pyrometer always in the same relative position, but for a given burner, with a given amount of air supply, and for a gas varying in calorific power between certain fairly wide limits, a position may be found for the pyrometer, such that the relation between flame-temperature and calorific value will be a simple one.

In any particular case the whole apparatus would require before use calibration against a calorimeter.

London Section.

Meeting held at Burlington House on Monday, May 7th, 1906.

MR. A. G. SALAMON IN THE CHAIR.

NOTES ON THE GUTZEIT TEST FOR ARSENIC.

BY J. A. GOODE AND F. M. PERKIN, PH.D.

Having been engaged for some months past in testing the electrolytic and other methods for arsenic analysis, we undertook a long series of experiments in order to ascertain whether it might be possible to render the Gutzeit test absolutely quantitative, and to see whether it might be possible to prepare standards which were quite permanent or at least as permanent as the standard mirrors employed in the Marsh-Berzelius method.

The chief objection to the Gutzeit method is the difficulty, or one should say the impossibility, of preparing standards which are permanent. Recently T. F. Harvey* suggested painting standards to match the stain produced by given quantities of arsenic and using the series thus prepared as a standard. We have not heard whether the idea has been adopted by other authorities and we have not tried it ourselves. There seems no obvious objection to this method, except the difficulty in first matching the tints, and it would be of interest if some firm would place such a standard on the market, as it is only by continued trials by different observers that the applicability of such a method can be proved.

Before trying to obtain permanent standards, we tested various methods for evolving hydrogen from zinc and other metals in order to see which would be the most sensitive. Our first endeavour was to obtain materials which were free from arsenic or were, at any rate, readily freed from it, so that a blank could be easily obtained. In the first place, we tried magnesium, which being a metal manufactured by the electrolysis of its fused chloride, should be free from arsenic, and on trial we found this to be the case. Now magnesium is a metal which is acted upon with great vigour by acids, and therefore it is rather difficult to keep the reaction within bounds. Even with N/1 sulphuric or hydrochloric acid the evolution of the gas is extremely violent, and is only modified to a slight extent by placing the flask in which the reaction is taking place in a basin of cold water. Owing to this fact, magnesium is not a very satisfactory metal to use in acid solutions. It then occurred to us to use ammonium salts as magnesium reacts readily with solutions of these salts according to the equation,

$$Mg + 2NH_4^{\cdot} = Mg^{\cdot\cdot} + 2NH_3 + H_2.$$

* Chemist and Druggist, 1905, 168.

Although magnesium reacts with all ammonium salts, therefore the equation has been expressed ionically—the best results were obtained by employing the chloride. That is to say, we found that from the all-important point of sensitiveness better results were obtained with ammonium chloride than with other salts of ammonium. Even with ammonium salts, unless care is taken, the reaction becomes much too vigorous, but there is no difficulty in keeping it in bounds by placing the apparatus in cold water when a steady and constant evolution of hydrogen takes place.

In our first experiments we used for generating the gas a Schroetter carbon dioxide apparatus, and with this we got excellent results. The wash tube which in carbon dioxide determinations contains concentrated sulphuric acid, contained in our experiments a solution of cuprous chloride (acid or ammoniacal) or a solution of lead acetate, to keep back traces of phosphine or hydrogen sulphide.

In carrying out the experiment, the ammonium chloride (about 5 grms.) was first placed in the apparatus and then about 1—2 grms. of magnesium turnings, wire or ribbon added, with magnesium powder the reaction is inclined to be too vigorous. The side stopper was then put in and about 10 c.c. of water run on to the mixture. The apparatus was gently shaken and then placed in a basin of cold water. As soon as an even evolution of gas was obtained—about one to two bubbles to the second—a piece of filter paper, previously soaked in a strong alcoholic solution of mercuric chloride and dried, was fixed over the outlet tube, and held in position with a rubber band, or by placing a glass tube slightly wider than the outlet tube over it. If at the end of 30 minutes a blank was obtained, then the required amount of arsenic was added. Working in this way there is no difficulty in showing the presence of 0·002 mgrm. of arsenious oxide, in fact, 0·001 mgrm. gives a marked stain. The evolution of the hydrogen gas should be checked at the commencement of the experiment, because it is difficult to control it should the action once get too vigorous.

There is one objection to the Schroetter apparatus, it is rather too small. We originally employed it because we did not wish to design a new apparatus which no one would buy, and because it is to be obtained in every laboratory. We now, however, use the apparatus depicted in Fig. 1, which, if not to be obtained in every laboratory, at any rate is readily made up from materials present in every laboratory.

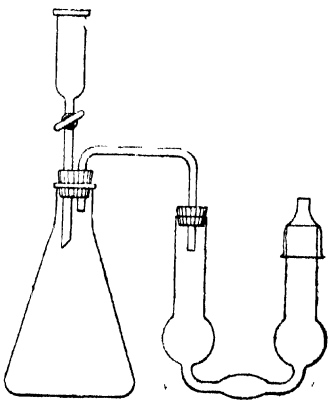


FIG. 1.

It consists of a conical flask of Jena glass, having a capacity of 250 c.c. and fitted with a dropping funnel for adding the solutions, also with a tube connected with a U-tube containing a 10 per cent. solution of acid cuprous chloride. The paper is held in position on the U-tube by means of a glass tube slightly wider than the U-tube itself. The cuprous chloride is to retain any sulphuretted hydrogen and some other gas which also, when magnesium

is used, causes a stain on the mercuric chloride paper. At first we thought that this gas was acetylene (we, therefore, then used ammoniacal cuprous chloride) produced from a trace of carbon in the magnesium, and on putting a little calcium carbide into the apparatus and running in water we found that the paper was likewise stained. In order to make certain, however, whether this gas was due to acetylene, pure acetylene was prepared by acting upon copper acetylide with hydrochloric acid, and it was then found that the pure gas, so obtained, had no action upon mercuric chloride. We found, further, that the compound obtained by passing pure acetylene into a solution of mercuric chloride is white. Furthermore, there is no stain produced when the gas is passed through an acid solution of cuprous chloride. But if cuprous chloride is not employed, and if the evolution of gas becomes too vigorous—when magnesium and ammonium chloride is used—it is impossible to obtain a blank, because a black or yellowish black stain is invariably obtained. The odour of the gas in these circumstances is similar to that produced when dilute sulphuric acid acts upon iron.

It ought at this place to be mentioned that we did not find it possible to completely arrest phosphine with cuprous chloride. On the other hand, Dowzard* states that phosphoretted hydrogen is completely absorbed by cuprous chloride, although further on in the same paper he says, "if phosphites or hypophosphites are present, the sample should be treated with bromine before examination," the bromine, of course, oxidising to phosphates, which are not reduced under the conditions of the experiment. If the cuprous chloride solution is concentrated, it does indeed prevent the phosphine passing forward, but it also prevents the arsenic hydride. Knowing that phosphine forms compounds with stannic chloride, aluminium chloride and antimony pentachloride, we tried passing the gas through solutions of stannic chloride in hydrochloric acid, but the phosphine passed through as before. Pure liquid stannic chloride appears to stop it, but, owing to the unpleasant character of this liquid, it is obviously out of the question to employ it. A tube packed with anhydrous aluminium chloride also failed to hold back the phosphine. Therefore, when readily reducible, phosphorous compounds such as hypophosphites or phosphites are being dealt with, the only thing to be done is to oxidise the solution with a little bromine. This also oxidises arsenites to arsenates, and then the arsenic determination should be carried on for about 15 minutes longer. Or else, if the gas is to be generated with zinc and acid, the arsenate may be reduced by the addition of stannous chloride as recommended by Hill and Collins.†

It is a point worthy of note that the yellow colour produced by the arsenic hydride on the mercuric chloride paper is turned black by the addition of ammonia; in fact, when the yellow stain is so slight as to be hardly distinguishable, the addition of ammonia will cause quite a marked black stain. This points to the reduction of the mercuric salt to the mercurous condition, Lohmann‡ gives the formula of the yellow compound as $As(HgCl)_3$, from which one would get the equation:

$$AsH_3 + 3HgCl_2 = As(HgCl)_3 + 3HCl.$$

We hoped at one time to be able to use this as a method for determining the quantities of arsenic, but owing to the difficulty of judging between different intensities of black stains we had to give it up. The black stain also is fugitive like the yellow one. The only advantage which it has over the yellow stain is that it enables one to work at night; because it is often impossible to see slight yellow stains by artificial light, but there is no difficulty in recognising a black one.

It has already been stated that there is no difficulty in distinguishing $\frac{1}{1000}$ mgrm. of arsenious oxide when magnesium and ammonium chloride is used. Parallel experiments with zinc and sulphuric or hydrochloric acid show that zinc and acid is slightly more sensitive than magnesium with ammonium salts, because with zinc and acids it is possible to estimate $\frac{1}{2000}$ mgrm. with a mercuric bromide paper. Chapman and Law* find that there is considerable difference in the sensitiveness of zinc, but that if the zinc is insensitive the addition of small quantities of a pure cadmium, lead, or tin salt increases the sensitiveness. Experiments were, therefore, carried out to see whether the sensitiveness of the magnesium would be increased by means of the addition of cadmium salts. We found, however, that the addition of cadmium salts decreased the sensibility. In one experiment, for example, with magnesium and ammonium chloride, to which cadmium chloride had been added, we failed to obtain a stain with 0·002 mgrm. of arsenious oxide, but the stain was distinct with 0·005. It has already been pointed out that we can detect 0·001 mgrm. with pure magnesium and ammonium chloride.

With acid and zinc, 1 c.c. of a 10 per cent. solution of copper sulphate decreased the sensitiveness considerably, the same quantity of a 10 per cent. solution of iron was much less marked, nickel had almost the same effect as copper, and cadmium did not improve the sensibility. It is, therefore, advisable to have all foreign metals absent.

Chapman and Law measured the potential upon a potentiometer of the cells, zinc-sulphuric acid and zinc-cadmium-sulphuric acid against a hydrogen normal electrode and found the following numbers:—

Solution.	Metal	Potential.
Sulphuric acid	Zinc	1·398
" "	Zinc + cadmium (20 grms. $CdSO_4$)	1·419
" "	Zinc	1·403
" "	Zinc + cadmium (20 grms. $CdSO_4$)	1·372

It occurred to us that it would be interesting to measure the potential of the magnesium cell in a similar manner. The magnesium electrode consisted of a carefully cleaned ingot of the metal 1·5 cm. diameter and 7 cm. long. The volume of the solution in each case was 150 c.c., and to obtain the Mg/Cd electrode 5 c.c. of a 10 per cent. solution of cadmium sulphate was added. The potential of the hydrogen electrode was 1·065. The following numbers were obtained:—

Solution	Metal.	Potential.
$N/1$ NH_4Cl	Mg	1·854
$N/1$ NH_4Cl	Mg + Cd	1·664
$N/1$ HCl	Mg	1·932
$N/1$ HCl	Mg + Cd	1·684
$N/1$ H_2SO_4	Mg	1·993
$N/1$ H_2SO_4	Mg + Cd	1·570

If the potential of the electrode alone determines the reducing power of the metal, then it would follow from the numbers obtained that magnesium is a much more powerful reducing agent than zinc and that the addition of cadmium should render it less active. It will be noticed from the experiments of Chapman and Law that in one case they find that the addition of cadmium (when small quantities are added) increases the potential. But that in the other case (where large quantities are added) a decrease in potential is produced. Yet they find that when the zinc is insensitive it becomes more sensitive on the addition of cadmium. It should be pointed out that with magnesium the evolution of gas was exceedingly rapid, and this may perhaps to some extent account for the very high numbers obtained in our experiments. But still the lowering of potential on the addition of the cadmium salt is very great, especially in the case of the sulphuric acid solution; but even here the numbers obtained from the cadmium and magnesium are higher than with the zinc electrode alone.

When reducing with the electric current, if the substance to be reduced is a difficultly reducible one, endeavour is always made to work with an electrode which will allow of as high a super-tension (over potential)

* Chem. Soc., 1901, 715.

† Chem. and Drug., Sept., 1905.

‡ Pharm. Zeit., 1891, 748—756.

* Analyst, 1906.

as possible. For example, Tafel* found that with lead electrodes he could reduce uric acid, but that he failed when other electrodes were employed. Similarly Hackford and Sand† claim that by using lead electrodes they obtain a more thorough reduction of arsenic compounds than by using platinum electrodes. Our own experiments confirm this contention. We did not determine the potential or drop in potential produced by the addition of other metals We hope, however, to study the matter in detail at a future date. We might mention, however, that Chapman and Law, *loc. cit.*, found that platinum, cobalt, copper and iron all caused a drop in potential. Now all these metals retard reduction; therefore, magnesium, with its high potential, should be a much more powerful reducing agent than zinc. The potential of the electrode alone does not seem to be the only factor which determines the reduction. Before the matter can be thoroughly understood probably a great deal more experimental work will be necessary.

Too much weight must not be placed on the potential numbers obtained, which it must be remembered are not super-tension numbers, but the solution tension of the metals.

Probably the explanation of the lowering of the potential of the magnesium on the addition of cadmium salts, is to be found in the behaviour of magnesium with solutions of cadmium salts. When magnesium is added to a solution of cadmium sulphate or chloride, a vigorous evolution of hydrogen ensues and metallic cadmium is thrown out. Probably the cause of this evolution of hydrogen is due to the tendency of magnesium salts to hydrolyse. The first reaction will be the replacement of the cadmium and formation of a magnesium salt, the magnesium salt will then be hydrolysed and a basic salt be produced. This is, we think, proved by the following example. If powdered magnesium is added to a neutral solution of magnesium chloride or sulphate a very vigorous reaction ensues, hydrogen is evolved and a basic salt separates out :—

$$Mg + MgSO_4 + 2H_2O = \begin{matrix} Mg\langle OH \\ Mg\langle OH \end{matrix} SO_4 + H_2.$$

The reaction between cadmium salts and magnesium can thus be represented :

(*a*) $Mg + CdSO_4 = Cd + MgSO_4$.
(*b*) $Mg + MgSO_4 + 2HOH = Mg_2SO_4(OH)_2 + H_2$.

Experiments were also made with aluminium both in alkaline and acid solution, the strength of the solution in each case being 4N. It was found, however, that when the reduction was carried out with aluminium that even with $\frac{1}{250}$ mgrm. of arsenious oxide no stain was obtained, therefore no further experiments were carried out with this metal.

Not having succeeded in obtaining stains which were permanent on keeping, we turned our attention to the formation of the stain itself. It occurred to us that it might be possible to employ some other substance than mercuric chloride. Silver appears to be out of the question for reasons given by August Gotthelf‡; also because, as Dr. Tilden pointed out when discussing the paper of Chapman and Law, *loc. cit.*, silver nitrate is reduced by molecular hydrogen.

Paper soaked in hydrogen aurichloride was tried and intense pink or purple stains were obtained. We found, however, that it was practically impossible to obtain a blank. Also, the paper soaked in the gold solution very soon became purple on keeping, the mere fact of drying it in the steam oven was often sufficient to turn the paper a purple colour. But we found that by preparing a $\frac{1}{2}$ per cent. solution of hydrogen aurichloride in absolute alcohol, soaking the paper in this solution, pressing it between dry filter paper to take out the excess of solution and drying in the steam oven for from five to 10 minutes, that the paper was much more permanent. If this paper was employed at once it was possible to obtain a blank, but after keeping for a few hours it was no longer reliable. The stains obtained, after washing with hydrochloric acid, are quite permanent, but the method, unfortunately, is much too unreliable to be of any use. Platinum salts are not reduced with relatively large quantities of arsenic. Vanadium salts are not reduced, although acid solutions of vanadium give a magnificent blue on reduction with sulphur dioxide.

We then tried paper soaked in a strong alcoholic solution of mercuric bromide. In this case, although the stain produced is not permanent, it is more intense than when mercuric chloride is employed and, therefore, the test is more delicate. After the stain has been obtained the paper is placed on a watch glass and moistened with a few drops of concentrated hydrochloric acid, as recommended by Bird* for mercuric chloride papers. The watch glass is then warmed for a minute, and the acid poured off. The paper is then washed with a little water and slipped off the glass on to a clean piece of white paper, where it is allowed to dry. Care must be taken not to add too much acid or to heat too long, or else this stain will become fainter and can be made to disappear completely. But by careful treatment with hydrochloric acid, stains become visible which could be hardly seen without it. By using the mercuric bromide paper $\frac{1}{2000}$ mgrm. of arsenious oxide is quite readily recognised. The papers used for soaking the mercuric salt were smooth English filter papers. The diameter of the paper in contact with the gas was 14—15 mm. The stain may be obtained in a more concentrated manner by placing a rubber stopper in the apparatus and fixing in a glass tube of 5 mm. internal diameter, as shown in Fig. 2. When dealing with very small quantities of arsenic, it is advisable to modify the apparatus in this manner. In fact we prefer this form of the apparatus rather than that shown in Fig. 1.

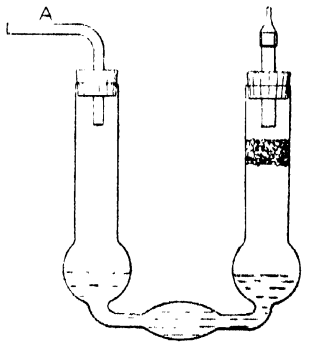


FIG. 2.

When experimenting on the permanency of the stain, we prepared little discs of plaster of Paris soaked in the mercuric salt, but although they showed the stain very well, we were unable to wash them with hydrochloric acid and it was a difficult matter to fix them on to the apparatus; we, therefore, came back to the paper discs.

For smoothness of working we prefer to use magnesium and ammonium chloride, because when once started the apparatus will go on gently evolving hydrogen for about two hours without further attention. With zinc and acids the reaction is sometimes rather intermittent. It is interesting to note the different appearance of the zinc in different experiments. Sometimes the whole solution becomes milky from the evolved gas. When this happens the action is generally the reverse of smooth and the gas comes off intermittently. At other times the individual pieces of zinc become of a spongy appearance from the hydrogen clinging on to them; when this is the case the reaction goes on smoothly and very little attention is required.

The time element is also of importance. Most observers

* Ber., 24, 258.
† Chem. Soc., 85, 1068.
‡ Analyst, 1901, 181.

* J. Soc. Chem. Ind., 1903, 1791.

seem to consider that half-an-hour is sufficiently long for each determination. We find that it requires 45 minutes to drive out all the arsenic when 0·002 mgrm. is used, and therefore consider it better to take one hour to each determination and with arsenates 1½ hours. If the arsenic is not all got rid of in the Gutzeit apparatus when zinc and acid is used, it must follow that it is also *not* got rid of in the Marsh apparatus. This fact would not necessarily matter if all the tests were invariably carried out in the same time, because it is probable that $\frac{1}{100}$ mgrm. As_2O_3, for example, would always give the same intensity of mirror in, say, 30 minutes and, therefore, the estimations would be correct, as the comparison in each case would be the same. The same line of reasoning applies to the electrolytic method. With reference to the electrolytic method, we have found the apparatus of Hackford and Sand, or a modification of this, to give very satisfactory results for arsenites.

Now as to the reliability of the Gutzeit test. It is not possible to prepare permanent standards, therefore, all determinations must be done in parallel. The apparatus required is simple, there is no reason why one should not start four or five going at one time: one the actual determination and the others standard quantities. We found exactly the same quantities of arsenic in commercial samples of borax and cream of tartar, which had been examined on the Marsh apparatus, from an outside source. With reference to the different methods of detecting arsenic, the Marsh-Berzelius apparatus requires a lot of experience, but in the hands of an experienced manipulator may be said to be practically infallible. The same remarks apply to the electrolytic method when a lead cathode is used, although this is not quite so delicate as the Marsh-Berzelius apparatus. The Gutzeit test requires care and experience and then leaves little to be desired. In all the methods the samples to be tested should be as free as possible from foreign substances especially metallic impurities. For general testing purposes we think the Gutzeit test has decided advantages over the Marsh-Berzelius. But for cases of poisoning, of course, the Marsh-Berzelius is the apparatus which would be employed.

In conclusion, we may state that experiments are being made with the electrolytic apparatus and its applications to the Gutzeit method of testing—so far the results have been very satisfactory.

Discussion.

The Chairman said he hoped the discussion would trend in the direction of showing the value of this process as compared with the Marsh-Berzelius, its quantitative value and the accuracy and speed with which the determinations could be conducted, more particularly in reference to the complications which it appeared to him would be introduced by subsidiary reactions in respect of the material introduced to be tested, and the condition, acid or otherwise, in which that material was.

Dr. Divers said he had been much interested by the series of unsolved problems in inorganic chemistry contained in the first part of the paper. Certainly organic chemistry was now much easier to develop than inorganic chemistry.

Mr. A. C. Chapman said the paper appeared to resolve itself in the first place into a plea for the Gutzeit test, and in the second place into a criticism of some results obtained by Mr. Law and himself and set out in a paper, dealing with the reducing action of hydrogen, recently communicated to the Society of Public Analysts. The Gützeit test suffered from many serious disadvantages. In the first place, as the authors had pointed out, it was impossible to prepare standards which were in any way permanent. In the second place the stains were seriously affected by light and also by certain vapours which were frequently present in the laboratory atmosphere. In the third place—and this was perhaps one of the most important objections—it was not, strictly speaking, diagnostic of arsenic and did not yield results which were characteristic and definite. In the Marsh test an arsenic mirror was obtained from which arsenious oxide crystals could be prepared, and could be used for confirmatory purposes. In work which was so important as the estimation of traces of arsenic in food products, it seemed to him that that should be a *sine-qua-non* in any process employed, and in that respect the Gutzeit test laboured under a grave disadvantage. There was also the fact that hydrogen phosphide, hydrogen sulphide, and apparently some hydrocarbons which the authors had not been able to identify, also produced stains which were not easily distinguishable from those produced by arsenic. A final further objection was that it was impossible to assess the stains produced by artificial light. Bearing all these points in mind, it seemed to him that the time was far distant when the Gutzeit method could, save in a limited degree, replace the Marsh-Berzelius method for the estimation of traces of arsenic. Turning to the question of the relationship between the reducing efficiency of hydrogen and the source from which it was obtained, it seemed to him the authors' experiments in every way confirmed the conclusions he (the speaker) and Mr. Law had put forward. In the first place, if it were a fact that the potential of hydrogen obtained from magnesium was much higher than of that obtained from zinc or cadmium, it was only what might have been expected from Mr. Law's and his own results, that the addition of cadmium salts would reduce the potential and diminish the reducing activity, and that appeared to be the case. But he would go a good deal beyond that. As a matter of fact, the authors had not measured the potential of the hydrogen obtained in these experiments. They had merely measured the solution-tension of the magnesium in ammonium chloride solution, and, judging from the rate at which the gas came off in the experiments shown, the difference between the solution tension of the metal and the potential of the hydrogen must be very great indeed. In fact, the one magnitude only approached the other when the rate of hydrogen evolution was very small, as in the case of pure zinc or pure cadmium; so that the numbers put on the board really had little or no meaning as a criticism of their results. There really was no *a priori* reason for supposing that the introduction of cadmium into the flask in the magnesium experiment should either diminish or increase the reducing activity of the evolved hydrogen; or, which came to the same thing, that it should diminish or increase its potential. As a matter of fact they had no knowledge whatever of the potential of the hydrogen from magnesium dissolving in ammonium choride, but they had certain other information which lead them to suppose that magnesium, zinc and cadmium all stood somewhere near together with regard to hydrogen-potential, and that being so—it certainly was so with zinc and cadmium—whether cadmium increased the reducing activity of a sample of zinc or of magnesium would depend, in the first place, on the purity or impurity of the zinc and magnesium in question; and in the second place—and this was more important—on the way in which the cadmium was deposited on the surface. On neither of these points had the authors given any information at all. That being so, there was no reason why they should anticipate any particular result from the introduction of cadmium into the evolution flasks. One thing was pretty certain, and was supported by an immense number of his own experiments (because he had used cadmium in every Marsh experiment which he had made for many months), and this was that the potential of the hydrogen given off in the case of zinc depended very largely on whether one obtained a uniform coating of cadmium over the metal to be treated or whether it was deposited in an uneven and spongy form. In the experiments described, he thought the cadmium must have been deposited very unevenly. It was in fact a very difficult matter to obtain a uniform coating of cadmium over magnesium, but that really was one of the most important points in determining whether cadmium would produce an effect or not. The authors said that he and Mr. Law had recommended the use of cadmium for sensitising pure zinc, but that was what they had carefully refrained from doing. They only gave the results of their experiments, leaving chemists to draw their own conclusions. They made no recommendation

simply because there were some cases in which cadmium did not produce increased sensitiveness for reasons not yet ascertained, and they did not desire to mislead anybody working on this very intricate subject. As stated, however, in the paper he had referred to, the potential of hydrogen was one factor in reducing efficiency and an extremely important one, but they recognised that there must be other factors. They had also made experiments with aluminium, which went to confirm those of Dr. Perkin. Using it in the Marsh test they observed the formation of a white deposit in the combustion tube which they could not explain. Aluminium was apparently quite unfitted for use in the Marsh-Berzelius test. With regard to the quantities which had been mentioned, he thought the time had now come when what they had to do was to take as a minimum, say, 1/500 mgrm. and endeavour to find that with absolute certainty. It was far more important to work with certainty to 1/500th, which was surely as far as anyone could desire to go, than to sometimes be able to detect 1/2000 mgrm. He had recently been making experiments on the electrolytic method, using pure tin cathodes, and had got results which were rather encouraging. Reduction took place much more readily than with platinum, and tin was for several reasons not quite so difficult to work with as lead.

Mr. T. TYRER said the Gutzeit test was even now by no means perfect. He had made experiments with the stains, and it was interesting to hear that the bromide test was, on the whole, more precise as to colour. There was no doubt that the stain of arseniuretted hydrogen upon mercuric chloride paper was mercurous, which turned black on the addition of ammonia, but it was necessary to take various precautions and adopt suggestions which had been made by Messrs. Hill and Collins, Kirkby, Charles Tyrer and Bird, all with the definite object of absorbing interfering agents, and when these suggestions were combined, one was enabled to make comparisons about which no doubt could exist. While the stain of mercuric chloride was affected by light and age, it was undoubtedly blackened (and to that extent it was confirmatory) by ammonia; but the phosphoretted hydrogen stain, which could scarcely be seen even with known quantities of arsenic, was less affected, and the sulphuretted hydrogen stain was slightly affected; under these circumstances what was to be done? It was a question of comparison, with colours which were in themselves delicate and requiring considerable judgment to differentiate. He regretted that Dr. Perkin was not able to give a working illustration with magnesium, but the reactions exhibited were certainly surprising, and showed that there were certain points against which precaution ought to be taken. He had tried ammonium chloride with magnesium, but the rate of evolution of hydrogen depended not only on the state of division, but also on the concentration of the ammonium chloride solution. If this method were adopted for the evolution of the hydrogen, then the precautions would have to be increased. But the reaction was certainly worth considering, and working out to definite conclusions. From the appearance of the magnesium with magnesium chloride and sulphate, it was clear the reactions were scarcely so simple as described by the authors. Of course, in using ammonium chloride, provision must be made for absorbing the ammonia vapours evolved so copiously.

Mr. C. A. HILL said the use of stannous chloride had a distinct advantage, as it reduced arsenates to arsenites, and, therefore, made the test more completely comparative, and also because it made the evolution of gas steady and regular. It was usual to compare the stains obtained in any test with the stain obtained from a solution containing a known amount of arsenite. The presence of stannous chloride also reduced the time necessary for the operation. In his experiments, this time varied according to the condition in which the arsenic was present to start with, but he could confirm Dr. Perkin that in some cases it was necessary to run for an hour. The question of the fading of the standards was not so important as might appear, owing to the ease with which fresh standards were prepared. They usually prepared them two or three times a week. He congratulated Dr. Perkin on the use of bromide; he had found it at least four times as delicate as the mercuric chloride.

Mr. JULIAN L. BAKER asked how the authors would deal with a solution of organic compounds containing arsenic, such as an ordinary malt extract or sugar solution. The varying proportion of acid to be introduced into the ammonium chloride solution and magnesium would materially affect the rapidity of the flow of gas, and, consequently, the resulting stain; this would not be comparable with the four or five standards which were simultaneously being made.

Dr. L. T. THORNE said the difficulties in the way of the Gutzeit test were very great as a quantitative test. There was one other point which occurred to him during the reading of the paper, and that was the need for the further manipulation of the stain by means of hydrochloric acid or otherwise, to get it more fully shown up, and that the manipulation required very great care or it might affect the result. Dr. Perkin himself mentioned that if the hydrochloric acid was used too strong, or the heat was too much, the stain was reduced; so that his own feeling was that the Gutzeit test could not compare for accuracy, delicacy and reliability with the Marsh-Berzelius test as now carried out. With regard to the addition of cadmium to zinc to increase its activity, he should like to confirm the results given in Messrs. Chapman and Law's recent paper (Analyst, 1906, 3). He had been in the habit of using electrolytic zinc for a long time past and had very good results without any admixture, but a short time ago a new batch of electrolytic zinc came in, the sensitiveness of which was very much reduced. The electrolytic zinc was always purified by the sodium process and then gave very good results, but in the batch referred to, the sensitiveness, even after treatment with sodium, was not quite satisfactory. The effect of cadmium was tried. About 2 per cent. of cadmium metal was alloyed with the zinc, with the result that the sensitiveness was much increased, but at the same time traces of arsenic showed up, probably from the cadmium not being quite pure. The cadmiumised zinc was therefore submitted to the sodium process, and reacted even more readily to this sodium treatment than the zinc itself, and a cadmium-zinc was obtained which was perfectly free from arsenic, and which showed great sensitiveness and reliability. That was an interesting point, not only as confirming Chapman and Law's results, but also as showing that in an alloy, which was a very intimate mixture, the effect seemed almost more definite than where by using a cadmium salt in the Marsh apparatus only a deposit of cadmium was obtained on the surface of the zinc.

Mr. E. GRANT HOOPER said his experience had shown that there was a distinctly useful application of the Gutzeit test in a direction that had not been quite presented to the meeting. It was not so much in determinations of actual quantities of arsenic that the Gutzeit test was, in his opinion, most useful, but rather where it was required to show whether or not a minimum quantity was present in the substance under examination; and with reference to that he was rather surprised that no reference had been made to the work of the Pharmacopœia Special Committee, which had, under the direction of Professor Dunstan, to his mind, considerably improved the Gutzeit test in the way of systematising the procedure. In connection with one point which had been referred to by Dr. Perkin, the question of time; those familiar with this later pharmacopœia practice would remember that it was proposed the test should run for two hours, and that he thought was a distinct advantage. With reference to the fading effect, to which reference had been made as one of the difficulties connected with the test, he would suggest that in the application of the method, in the particular direction to which he had alluded, there was no real difficulty in setting three experiments going at the same time—one a blank, one with the standard minimum you were searching for, and one with the substance under examination. If the Gutzeit test were used in that way and under those conditions, systematised, as it had been in the report to which he had referred, then the Gutzeit test had distinct advantages and would be useful to many who had not the opportunity, and

probably were not inclined to devote the time necessary for an electrolytic determination.

Dr. F. B. Power said the Gutzeit test had been in more or less general use for a number of years, and he recalled particularly a very lengthy investigation of the subject by the late Prof. Flueckiger of Strasburg, which was published in the *Archiv der Pharmacie* in 1880. That investigation was principally confined to the sensitiveness of the test, and the conditions under which it could be most usefully carried out. Comparisons were instituted, especially between the Gutzeit and the Marsh-Berzelius test, and the author came to the conclusion that the former should be given the preference for the testing of medicinal chemicals. That gave an impulse at the time to the use of the test which was very marked, and which led to its general introduction for that specific purpose. It was of interest to observe the consideration given to it in the new *United States Pharmacopœia*, only recently issued, where two or three pages were devoted to the conditions for obtaining accurate results, especially with regard to the presence of hydrogen phosphide, hydrogen sulphide, &c. He was not quite prepared to agree with the opinions expressed by some of the preceding speakers, which were somewhat depreciatory of the test, because he thought it fulfilled a very important and useful purpose, especially for the detection of arsenic in medicinal chemicals, which required to be so frequently tested for this impurity.

Mr. H. D. Law wrote:—"The potential of hydrogen set free from metallic surfaces unquestionably plays a very important part in reduction processes. This has been amply demonstrated by Tafel in the case of refractory organic substances and later by Sand and Hackford, Chapman and Law for the oxides of arsenic. It is not the only force influencing these reactions, for in many cases catalysis becomes the determining factor. In the reduction of arsenious oxide this latter may be left out of consideration, for its action is only a subordinate one. The seemingly anomalous behaviour of cadmium surfaces observed by the authors needs, therefore, careful consideration, and certainly a more detailed study than has been given. The work set forth in the present paper in no way disproves the theory enunciated by Chapman and Law; on the contrary, most of the examples confirm the view already given. The measurement of the potential of magnesium is interesting, but throws no light on the nature of the hydrogen liberated from the metal. The figures given represent the solution tension of magnesium, which is considerably higher than the potential of the hydrogen set free, as may be inferred from the very energetic reaction taking place. The solution tension of a metal can approach the potential of the hydrogen formed in the metallic surface only when a very moderate action is taking place. On the addition of a salt of cadmium, this latter metal becomes deposited in the magnesium and partially covers it. The solution tension is then lowered somewhat and the super-tension of the hydrogen is increased. Consequently, the reaction is less energetic and the figures given are nearer the actual potential of the hydrogen. The figures given by Chapman and Law also do not represent the true potential of the hydrogen, but the approximation is very close, for the action was only slight. The authors have found that the addition of cadmium chloride to the Gutzeit apparatus in no way increases the sensitiveness of the magnesium used—on the contrary, a brisk reaction takes place with a solution of cadmium chloride without any addition of ammonium chloride. This is undoubtedly due to the formation of magnesium chloride. The magnesium chloride is hydrolysed by water setting free hydrochloric acid, which in turn attacks the magnesium to form hydrogen. This hydrogen prevents the formation of metallic cadmium in a compact mass round the magnesium, but causes the deposited metal to break away. The action of cadmium sulphate on magnesium is, however, very slight, and in this case the cadmium completely covers the surface of the magnesium. If now ammonium chloride is added, hardly any action takes place at all, due chiefly to the increased super-tension of the hydrogen, but also to the diminished solution tension of the metal. It will, however, reduce arsenious oxide to the hydride. The solution of this problem is still very incomplete and until more work is done it is quite impossible to predict results. The action of salts of iron, nickel and copper clearly show the influence of super-tension on the sensitiveness of the source of the hydrogen, confirming the experiments already published by Chapman and Law. The authors have succeeded in considerably improving the Gutzeit method of estimating arsenic. In their hands, this method has become equal in sensitiveness to that of Marsh-Berzelius, and no more difficult to manipulate. The greatest disadvantage to its use is the impossibility of preserving the standards. When this difficulty has been overcome there is no reason why this method should not be adopted in preference to the one now generally used for accurate determinations of arsenic."

Dr. Perkin, in reply, said the discussion showed rather a tendency to take sides, as if it were the Marsh-Berzelius *v.* the Gutzeit. They had not taken any side, they approached the subject with an absolutely open mind and did so by accident. As a matter of fact, they were working with various electrolytic methods, and it so happened that someone wanted to carry out the Gutzeit method. The results obtained were not very comparable, and, therefore, the matter was taken up and investigated simply to get more knowledge of the subject. Speaking, generally, they thought that for a method of general applicability to discover whether a given substance contained arsenic in which a minimum was allowed, or a given quantity of arsenic, the Gutzeit test was preferable to the Marsh-Berzelius. Their own practice in making an estimation was to run three in parallel—one a blank, one with a given quantity, and the other the substance to be tested, and if necessary they could put another one with another quantity if they wished to know exactly the amount. Stains, if kept in the dark, would last for two or three days quite well. Mr. Bird gave the time for the test as half-an-hour, and possibly with a boiling solution that might be sufficient, but under ordinary conditions it was not. It did not matter when one was always doing something else, if the apparatus was running for one hour or more, though he did not consider two hours was necessary. The hydrochloric acid treatment of the paper was taken from Mr. Bird, who first suggested it. They certainly did not go quite so far as he did in actually getting arsenic from it but they found the stain much more permanent, and it was easier to determine the exact amount if they treated it first of all with hydrochloric acid.

With reference to Mr. Baker's question, it would be necessary to neutralise with ammonia if the substances were to be tested in an apparatus containing an ammonium salt. They had chiefly experimented with inorganic substances containing arsenic. Glycerine did not interfere, but probably it would be necessary to get rid of mucilaginous substances before applying the test.

THE SEPARATION OF BRUCINE AND STRYCHNINE—INFLUENCE OF NITROUS ACID IN OXIDATION BY NITRIC ACID.

BY WILLIAM COLEBROOK REYNOLDS, B.SC., A.R.C.S., AND ROBERT SUTCLIFFE.

When nitric acid, under suitable conditions, acts on a mixture of strychnine and brucine, the brucine is decomposed into non-basic, strongly coloured constituents, and the strychnine remains almost unacted upon, and hence the amount of each present can be determined. The method is more accurate, and occupies much less time, than older methods, such as the ferrocyanide process, and has rapidly replaced them.

The first proposal to use nitric acid for the separation of brucine from strychnine, came from Keller (Zeits. Osterr. Apoth. Ver., 1893, 542). His method consisted in adding, to the solution of 0·2—0·4 grm. of the mixed

alkaloids in 10 per cent. H_2SO_4, 1 c.c. of nitric acid of sp. gr. 1·42, allowing the reaction to proceed for from one to one and a half hours, then making the solution alkaline with ammonia and shaking out with a weighed quantity of a mixture of chloroform and ether, of which a weighed quantity was then distilled.

This process was examined by Stoeder in 1899 (Ned. Tydschr. Pharm., **11**, 1—5) who improved the process by substituting chloroform for the mixture of chloroform and ether, and caustic soda for ammonia, and adding 1·5 c.c. of a mixture of equal volumes of water and nitric acid of sp. gr. 1·42 instead of 1 c.c. of nitric acid sp. gr. 1·42.

Gordin (Arch. Pharm., 1902, **240**, 641—4) again altered the proportions. He dissolved 0·2—0·4 grm. of the mixed alkaloids in 15 c.c. of 3 per cent. sulphuric acid, to which was added 3 c.c. of a mixture of equal volumes of water and nitric acid of sp. gr. 1·42, and allowed only 10 minutes to elapse before arresting the reaction. This latter method has been adopted in the 1905 edition of the United States Pharmacopœia.

Thus there is no general agreement about the precise and all-important details of procedure, and we have, therefore, examined the various modifications that have been proposed and certain further ones that the enquiry suggested. Two reactions proceed simultaneously at first—a rapid oxidation of the brucine, and a very much slower oxidation of the strychnine—and the reaction should obviously be stopped as soon as the former is complete.

We have endeavoured to ascertain, therefore: 1. The rate of oxidation of brucine by dilute nitric acid. 2. The rate of oxidation of strychnine by the same. 3. The influence of temperature, varying the time and the concentration of the nitric acid.

We have operated upon the following materials:—Pure brucine (dehydrated), of m. pt. 178° C.; pure strychnine, of m. pt. 269° C., mixtures of the two in known proportions, as well as on the total alkaloid obtained in the assay of *nux vomica* and its galenical preparations. The strychnine has been recovered by distilling off the chloroform from a small tared flask, adding a few c.c. of alcohol when it was almost removed, and, while rotating the flask in an inclined position on the water-bath, passing a gentle stream of air into it. The alkaloid was left as a crystalline deposit over a large area of the flask, which rapidly assumed constant weight, and there was no decrepitation. The residue was finally dissolved in a little dilute acid and tested for brucine with strong nitric acid.

The following table summarises a selection of typical experiments:—

No.	Brucine taken, grm.	Strychnine taken, grm *	Proportion of dilute acid as recommended by	Nitric Acid, grms. per 100 c.c.	Time in mins.	Temp.†	Residue in grm	Remarks.
1	0·15	—	Stoeder	6·5	10	—	0·014	residue included brucine.
2	0·15	—	Stoeder	6·5	60	—	0·001	
3	0·15	—	Keller	9·0	90	—	0·002	
4	0·15	—	Keller	9·0	10	—	0·003	
5	0·15	—	Gordin	8·3	10	—	0·003	
6	0·15	—	—	5·0	10	—	0·005	residue included brucine.
7	0·15	—	—	7·0	10	—	0·003	
8	—	—	—	6·2	60	—	0·151	
9	—	0·15	—	7·0	10	—	0·150	
10	—	0·15	Gordin	8·3	10	—	0·149	
11	—	0·15	Gordin	8·3	10	—	0·150	
12	—	0·15	Gordin	8·3	10	—	0·151	
13	—	0·15	Gordin	8·3	60	—	0·146	
14	—	0·15	Keller	9·0	90	—	0·146	
15	—	0·15	Gordin	8·3	10	30°	0·146	
16	—	0·15	Keller	9·0	90	30°	0·136	
17	0·15	0·15	Keller	9·0	180	18°	0·142	
18	0·15	0·15	Gordin	8·3	180	18°	0·144	
19	0·15	0·15	Gordin	8·3	10	—	0·151	
20	0·15	0·15	Gordin	8·3	10	—	0·151	
21	0·15	0·15	Gordin	8·3	10	30°	0·146	
22	0·2	0·1	Gordin	8·3	10	—	0·100	
23	0·15	0·15	Keller	9·0	90	—	0·147	
24	0·15	0·15	—	15·0	10	—	0·151	
25	0·15	0·15	—	5·0	10	—	0·165	residue included brucine.
26	0·15	0·15	—	5·0	10	—	0·168	

Experiments 1—7 with pure brucine prove that when the concentration of nitric acid is as high as 7 per cent., the decomposition of the brucine is complete in 10 minutes, and the 90 minutes allowed by Keller is not only unnecessary, but results in the loss of a few per cent. of strychnine (partly compensated for in his original method by impurity introduced by using ammonia). If the concentration, as in experiments 1, 6, 25 and 26, is under 7 per cent., the rate of oxidation falls off rapidly and a longer time elapses before decomposition is complete.

From experiments 8—26 with strychnine and mixtures of strychnine and brucine, the rate of oxidation of the former can be approximately determined. In experiment 17 with 9·0 per cent. of nitric acid 0·008 grm. of strychnine apparently disappeared in three hours, and if we add 0·003 grm., which is the average residue obtained when using 0·15 grm. of brucine, this would mean that 0·011 grm. of strychnine had been oxidised in three hours, or 2·5 per cent. per hour at 18° C. Similarly with Gordin's 8·3 per cent. acid, experiment 18 proves that the oxidation is at the rate of 2 per cent. per hour at 18° C. Howard (Analyst, 1905, **30**, 262) with 9·0 per cent. of nitric acid found in one experiment that 9·9 per cent. disappeared in 3½ hours, or 2·76 per cent. per hour at 21° C., and in another 19·3 per cent. disappeared in 17 hours, or 1·14 per cent. per hour at 21° C.

These results prove that the loss of strychnine by oxidation with dilute nitric acid in 10 minutes is negligible at temperatures up to 25° C., even when the concentration is as high as 15 per cent., but if the time is increased to one hour or more it becomes appreciable, especially in summer time. To overcome this defect in Keller's process, Howard has proposed to carry out the treatment for 1½ hours in ice cold water; but since the reaction is complete in 10 minutes at the ordinary temperature, it is obviously more convenient to carry it out under these conditions.

Influence of temperature.—Experiments 15, 16 and 21 were carried out to ascertain the rate of increase of oxidation of strychnine with rise of temperature, and prove that it is considerable. With Keller's 9 per cent. acid it has risen from 2·5 per cent. per hour at 18° C. to 6·2 per cent. per hour at 30° C.

The assay of nux vomica preparations.—The mixed alkaloids obtained by the process below were separated by oxidation with nitric acid of varying concentration. In the cases that we have examined the strychnine has formed from 33 to 54 per cent. of the total alkaloids. As an example, 10 c.c. of a trial fluid extract gave

* In order to dissolve 0·1—0·3 grm. of strychnine in the 10—15 c.c. of dilute sulphuric acid, as in the above methods, the mixture must be heated, and strychnine sulphate crystallises out on cooling. The nitric acid was always added to the solution with the crystals suspended in it.

† The experiments were all carried out at temperatures between 14° and 20° C., except those specially mentioned.

0·343 grm. of total alkaloid. This, treated by Gordin's process, gave 0·141 grm. of strychnine, after 10 minutes which therefore formed 41·2 per cent. of the total alkaloid. Ten c.c. of the same fluid extract treated for 1½ hours by Keller's process gave 0·138 grm. of strychnine or 40·25 per cent. of the total alkaloid.

Extraction of the alkaloids.—We found the most convenient method of obtaining the mixed alkaloids was to use 10 c.c. of the fluid extract, 50 c.c. of the tincture, or 3 grms. of the extract, in the former cases removing the alcohol by evaporation, and treating the residue with just sufficient cold water to form a syrupy, cloudy fluid. This is transferred to a small separator, and the vessel rinsed out with a few drops of water, 2—3 volumes of chloroform and about 1 grm. of powdered sodium carbonate added and the mixture thoroughly agitated. (If a solution of sodium carbonate is added, or if the extractive is mixed with too much water, resinous matter is thrown out in a form that causes bad emulsions.) The chloroform is separated and the residue extracted twice with more chloroform; the chloroform is mixed and rinsed with a few c.c. of water, most of it is distilled off and shaken into dilute sulphuric acid in three successive stages; the alkaloids are again shaken into chloroform after making the solution alkaline, the chloroform is rinsed and distilled off and the mixed alkaloids weighed. If the amount of strychnine only is required, the alkaloids may be shaken from the first concentrated chloroform solution into a known volume of 3 per cent. sulphuric acid and the nitric acid at once added. For this purpose we prefer to use a total of 33 c.c. and add 3 c.c. of nitric acid of sp. gr. 1·42. The quantity of dilute acid in Keller's and Stoeder's methods (10 c.c.) is too small to effect this operation completely.

We wish to direct attention to the following points, which do not appear to have been sufficiently emphasised, but which are essential if accurate results are to be obtained:—

Part of the product of the action of nitric acid on brucine is of a very feeble acid or phenolic character, and the nature and amount of the alkali which is used to render the solution alkaline, previous to shaking it up with chloroform, has to be chosen accordingly. It is necessary to employ an excess of caustic soda or potash as was done by Stoeder and Gordin. If sodium carbonate is used, much of the decomposition products pass into the chloroform—thus in one experiment 0·3 grm. of brucine, after complete oxidation by nitric acid, yielded 0·170 grm. to chloroform, in presence of a slight excess of sodium carbonate, and in another case 0·2 grm. of brucine yielded 0·091 grm., in a third, with a large excess of sodium carbonate, 0·3 grm. yielded 0·073 grm. to chloroform.

With excess of ammonia the error is smaller, as the following results show—0·15 grm. of brucine, after oxidation yielded in one experiment 0·055 grm., in another 0·045 grm. to chloroform, using a slight excess of ammonia. When a large excess of ammonia was used, 0·2 grm. of brucine gave in one experiment 0·014 grm. and in another 0·015 grm. These residues were always coloured, and almost entirely soluble in dilute soda solution, being free from brucine.

When excess of caustic soda is employed to make the liquor alkaline, the oxidation products are almost entirely retained by the aqueous solution, the mean of six experiments with 0·15 grm. of brucine being 0·003 grm. absorbed by chloroform.

When solutions containing brucine are treated with dilute nitric acid, we have frequently observed that no reaction occurred, and the solution has sometimes remained colourless for an hour. This result we have found depended on the presence or absence of nitrous acid in the sample of nitric acid employed. We found that dilute nitric acid free from nitrous acid had no oxidising action on brucine. This we find has already been shown by Pichard (Comptes rend., 1896, 590), whose results, however, appear to have escaped other writers.

Pichard found that mixtures of brucine and potassium nitrate remained colourless when treated with dilute hydrochloric acid, whereas when potassium nitrite was used instead of the nitrate the usual red colouration was observed, and he proposed the reaction as a test for the detection of small quantities of nitrites. Nevertheless, it is very doubtful we think, if pure nitrous acid acts on brucine, for the oxidation does not proceed unless nitric acid is present also.

Solutions of nitrous acid at temperatures above 0° C., decompose according to the equation, $3HNO_2 = HNO_3 + H_2O + 2NO$. Pichard's reacting materials, therefore, contained nitric acid. We have tried the action of dilute sulphuric acid on brucine, mixed with several times its weight of sodium nitrite, in flasks kept at different temperatures. At 0° C. the solution only slowly assumes a pale orange colour, and the brucine is hardly acted upon, whilst at 20° C. the decomposition is only slow, *i.e.*, 0·15 grm. of brucine and 1·1 grm. of sodium nitrite, dissolved in 30 c.c. of 5 per cent sulphuric acid, after 30 minutes yielded 0·142 grm. of brucine, and a repetition, in which 60 c.c. of dilute sulphuric acid was used, gave the same result. On the other hand, the addition of very minute quantities of nitrites to dilute nitric acid, are sufficient to bring about the oxidation of the brucine; thus 0·5 c.c. of a 1 in 1,000 solution of sodium nitrite, was sufficient to at once start an experiment which was remaining colourless, and the brucine was completely oxidised in 10 minutes.

Experiments were made with more concentrated nitric acid, to ascertain if this would refuse to react with brucine, if it had the nitrous acid removed from it. Preliminary treatment with small quantities of urea enabled us to obtain an acid containing 20 per cent. HNO_3, that had no action on brucine, but with more concentrated acid the reaction took place more or less readily, the decomposition being merely retarded for a few seconds.

Silberrad (this J., 1906, 156) has recently drawn attention to the difficulty experienced in freeing strong solutions of nitric acid from traces of nitrous acid, and we thought that there might be minute traces present, that even urea would not act upon. This appears to be the case, for we find that by treating nitric acid with minute quantities of barium or sodium peroxide, we can obtain a solution containing 50 grms. HNO_3 per 100 c.c., which does not act on brucine after standing some hours. We could not, however, obtain acid of sp. gr. 1·42 that would not react.* The commercial pure acid of sp. gr. 1·42 has always in our experience effected the oxidation of brucine, when added to solutions containing it, the reaction commencing at the instant of contact. Other oxidising agents such as chromic acid, potassium permanganate and ammonium persulphate were not effective.

Urea reacts most effectively when the mixture is heated, the peroxide on the other hand acts best at the ordinary temperature. Volumetric estimation with potassium permanganate, as employed by Silberrad, is not a sufficiently delicate method for detecting such minute quantities as are left after urea treatment, and brucine is a more delicate test. We may say that the acid purified in this way contains traces of some substance—presumably hydrogen peroxide—that reduces permanganate.

The intense orange red colour, observed when nitric acid acts on morphine, has been generally employed as a qualitative test for the latter. It, however, forms a colourless solution in our specially purified 50 per cent. acid. Doubtless nitrous acid plays a part in many other oxidations with nitric acid.† We do not attempt to explain the phenomenon, but it recalls the behaviour of the trace of water vapour, necessary to bring about the combination of some gases, such as hydrogen and oxygen, by the electric spark.

Conclusion.—We find that both Stoeder's and Gordin's conditions lead to slightly more accurate results than Keller's original process. Of the two, Gordin's should have the preference, as it is more expeditious. In any case, the short nitric acid process is capable of accurate results, if the following points are attended to:—

1. For an amount of total alkaloid up to 0·4 grm., the reacting solution should contain at least 7 per cent. of HNO_3.

* Compare Berthelot, Comptes rend., 1898, 127, 143-160.

† *Vide* Ray, J. C. S., 1905, 171.

2. The reaction should be stopped after 10 minutes, when the brucine is entirely oxidised.

3. The temperature should not exceed 25° C.

4. Excess of caustic soda or potash should be used to liberate the strychnine, never sodium carbonate or ammonia.

5. The nitric acid should be added in the form of acid of sp. gr. 1·42, and not more dilute acid, otherwise it may be necessary to add a trace of a nitrite, to start the reaction.

Discussion.

Mr. Whiffen said it was novel to learn that the presence of nitrites or nitrous acid in nitric acid was necessary for the decomposition. He reduced the temperature at which the action took place to as low as —20° C., and found that at that temperature practically no decomposition took place. He did not consider that it was in any way due to the presence or absence of nitrous acid, that at such a low temperature decomposition was not effected. The acid was 50 per cent. (1·420) acid. Passing on to the question of time occupied, the authors mentioned that with 9 per cent. solution an hour and a half was said to be necessary. The process recommended by the New United States Pharmacopœia was about 9 per cent. acid of sp. gr. 1·420, and the time stipulated was 10 minutes at the temperature apparently of the laboratory, not reducing it to any particularly low temperature. He would remind Mr. Reynolds, that in that solution there was nearly 3 per cent. of sulphuric acid present, and that the sulphuric acid had a considerable effect. If the nitric acid they recommended were used without the sulphuric acid being present, the decomposition was much more slow, in fact, the sulphuric acid played an important part in the decomposition. The observation respecting the necessity for the use of caustic alkali such as soda, he fully endorsed. If these experiments were carried out with ammonia, they were not very reliable unless the resulting strychnine was determined by standard sulphuric acid; then there was not much harm done: otherwise if any attempt were made to weigh the resulting alkaloid it was essential that caustic alkali should be used—preferably soda. He was not quite clear whether the 9 per cent. nitric acid referred to was used without the addition of sulphuric acid or in connection with it. If sulphuric acid were present, it might account for the 1½ hours said to be necessary for the decomposition.

Mr. Carr thought that sufficient emphasis had not been laid upon the necessity of ensuring that the nitric acid used contained nitrous acid. As a matter of fact, Mr. Reynolds was led to this enquiry by coming across some nitric acid which was free enough from nitrous acid not to oxidise the brucine when the test was carried out in the ordinary way and at the ordinary temperature.

Mr. Reynolds, in reply to Mr. Whiffen, said in every case the reaction was carried out in the presence of sulphuric acid—either 3 per cent. as recommended by Gordin or 10 per cent. as recommended by Keller. The time recommended by Keller in his original process was 1½ hours, but as they stated it was altogether unnecessary, the reaction being complete at the end of 10 minutes. The conditions, as laid down in the United States Pharmacopœia, were taken from Gordin's paper.

ABSORPTION OF GALLIC ACID BY ORGANIC COLLOIDS.*

BY W. P. DREAPER, F.I.C., AND A. WILSON, B.SC.

In a previous communication (Proc. Chem. Soc., 22, 70) we have indicated the general reactions which take place when gallic acid is absorbed by certain organic colloids (see also this Journal, 1905, 233). We now give in detail the results obtained. These seem to throw further light on the nature of dyeing and tanning operations generally.

The amount of gallic acid absorbed on the formation of a tannic acid gelatin coagulum was first determined.

A solution of "collin" prepared by the method recommended by Parker and Payne (this J., 1904, 649) was taken as a typical example of an organic colloid which is not coagulated by heat alone. The copper sulphate method of estimating this acid described by one of us (Chem. News, 90—111) was used, precipitation being brought about in the presence of calcium carbonate, the tannic and gallic acids being separated by the lead method.

The addition of gallic acid to a solution of "collin" is without visible effect even after several hours' standing. Tannic acid causes an immediate precipitation, in the presence or absence of gallic acid. The tannic acid used in these experiments was the purest obtainable. It contained a slight amount of gallic acid which was allowed for. Tannic acid (25 grms. per litre) and gallic acid (12·5 grms. per litre); were after mixing in the required proportions, made up to 90 c.c. with water. Thirty c.c. of collin was then added to the mixture in each case. Collin is more sensitive than an ordinary solution of gelatin. It was, therefore, chosen for these experiments, but results of a similar order were obtained with gelatine.

After standing 10 minutes, the precipitated colloid was filtered off, and the gallic acid remaining estimated in 60 c.c. of the filtrate, the copper sulphate solution being of a strength of 15 grms. per litre. In series I., the quantities taken were:—

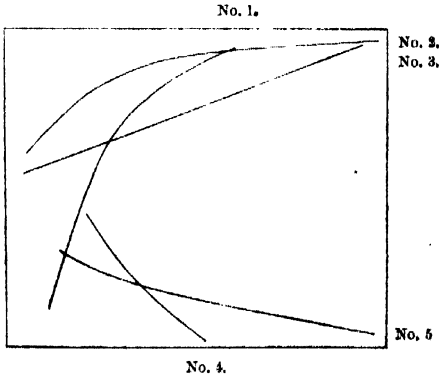
Thirty c.c. of gallic acid + 30 c.c. "Collin" + tannic acid solution, and water to make up to 120 c.c. The following table shows the amounts of gallic acid carried down by increasing quantities of tannic acid:—

No. of Expt.	Volume of tannic acid solution used.	Gallic acid carried down. as c.c. $CuSO_4$	Gallic acid carried down. percentage of amount present.
	c.c.		per cent.
1	2	3·2	7·7
2	5	4·8	11·6
3	7·5	17·2	42
4	10	21·2	53·3
5	15	30·2	71·9
6	20	33·2	83·0
7	30	39·5	96·2

(See curve No. 1.)

In the second series of experiments, the gallic acid was added after the precipitation of the tannic acid by collin; the object being to determine, if possible, the manner in which gallic acid was removed from solution. The tannic acid solution was made up to 60 c.c. by addition of water, and the collin and gallic acid solutions were then added.

After standing 10 minutes, the mixture was filtered, and the amount of gallic acid remaining in the filtrate was



Addition of reagents (N/1 solution).

* Taken as read.

estimated as before. It was observed that the addition of gallic acid entirely altered the character of the precipitated colloid, for, whilst the "tannin collin" precipitate or coagulum was so finely divided as to give the appearance of milkiness to the liquid, the addition of gallic acid to the milky liquid caused the solid to separate in flocks, leaving the supernatant solution clear.

Expt. No.	Tannic acid solution.	Amount of gallic acid absorbed.	
		as c.c $CuSO_4$	as percentage of amount present.
	c.c.		per cent.
1	2	7·2	17·3
2	5	12·8	30·6
3	7·5	21·0	50·4
4	10	24·8	60
5	15	34·2	80
6	30	40·1	97·3

(See curve No. 2.)

These figures indicate that the gallic acid is absorbed by the precipitated colloid rather than carried down by it at the time of precipitation, or at least, that the one action takes place as readily as the other, and to the same extent.

It was then thought desirable to determine the influence of a third substance, of the nature of an acid, on the absorption power that the tannin-colloid body exerted over gallic acid. With this object in view a series of estimations was carried out in presence of varying quantities of normal acetic acid.

The results observed are indicated in the following table:—

No. of Expt	Acetic acid used.	Amount of gallic acid absorbed.	
		In c.c. $CuSO_4$	percentage on amount present.
	c.c.		per cent.
1	5	13·2	32
2	10	8·8	21
3	20	7·2	17·3
4	30	5·1	12·2
5	50	0·9	2·0

(See curve No. 3.)

In another set of experiments normal hydrochloric acid took the place of acetic acid with the following results:—

Expt. No.	Hydrochloric acid used	Amount of gallic acid absorbed.	
		in c.c. $CuSO_4$	percentage of amount present.
	c.c.		per cent.
1	10	17·2	42·7
2	15	9·6	23·3
3	20	4·8	11·5
4	25	1·2	2·9

(See curve No. 4.)

It will be seen that the presence of a strong acid influences the reaction considerably, 25 c.c. of normal hydrochloric acid being sufficient to altogether prevent the absorption of gallic acid. In order to determine whether any of the acid had been absorbed by the tannin-collin precipitate, the amount of hydrochloric acid present in 30 c.c. of the filtrate was estimated by titrating with normal sodium hydroxide. The result obtained proved that none of the hydrochloric acid had been absorbed.

There is, therefore, no evidence that the stronger acid replaces the weaker one in the coagulum. When estimating the hydrochloric acid in the filtrate, it was noticed that a precipitate formed at the point of neutralisation, which dissolved upon the addition of excess of sodium hydroxide indicating that the original action is a reversible one. The experiment was repeated in the absence of gallic acid, and the same reaction was noticed. It is not clear whether the "tannin-collin" compound is slightly soluble in excess of acid or alkali, and insoluble in a neutral solution; or whether the tannin-collin compound is broken down in presence of excess of either of these reagents. The disturbing influence of a third substance of the nature of a salt was next investigated. The first salt taken was ammonium chloride, the proportions present being as before.

The following results were obtained:—

No. of Expt.	Volume of normal ammonium chloride solution	Amount of gallic acid absorbed.	
		as c.c. $CuSO_4$	percentage on amount present.
	c.c.		per cent.
1	2	22·2	53·3
2	5	22·5	53·8
3	7·5	23·0	55·0
4	10	24·8	60·0
5	20	28·8	77·3
6	30	32·3	87·0
7	50	40·0	97·0

(See curve No. 5.)

These experiments were then extended to other salts.

Normal sodium chloride was substituted for ammonium chloride, with the following result:—

Expt No.	Volume of sodium chloride solution.	Amount of gallic acid absorbed.	
		as c.c. $CuSO_4$	percentage on amount present.
	c.c		per cent.
1	2	25·2	61·1
2	5	26·8	65
3	10	33·8	82
4	20	37·4	90·7
5	30	37·9	91·7
6	50	38·6	93·2

(See curve No. 6.)

These figures show that the influence of a salt on the reaction is exactly opposite to that exerted by an acid, the amount of gallic acid carried down increasing with the addition of the salt in solution.

In order to determine the extent of the absorption power of colloids in the solid state in the absence of tannic acid some experiments were carried out with thin leaf gelatin:—

Experiment I.—30 c.c. of gallic acid and 1·8 grms. of gelatin were added to 90 c.c. of water; the mixture was allowed to stand 2½ hours, and then filtered. The result indicated an absorption of 7 per cent. of the gallic acid, in solution.

Experiment II.—The same quantities were again taken and the mixture allowed to stand 24 hours. In this case there was practically no absorption, but much of the gelatin had gone into solution.

Experiment III.—In this experiment 50 c.c. ammonium chloride (normal) were added to prevent the gelatin from dissolving. The quantities taken were:—1·8 grms. of gelatin, 40 c.c. of water, 50 c.c. of ammonium chloride solution and 30 c.c. of gallic acid solution. After standing two hours the solution was examined, and showed an absorption of 21·4 per cent. of gallic acid originally present in the solutions.

Experiment IV.—In this case alcohol was substituted for ammonium chloride solution, the quantities being: 30 c.c. of gallic acid, 30 c.c. of alcohol, 60 c.c. of water and 1·8 grms. of gelatin. After standing two hours an absorption of 5·8 per cent. was noted.

Experiment V.—1·8 grms. of gelatin, 30 c.c. of gallic acid, 3 c.c. of tannic acid water to make up 120 c.c. Allowed to stand two hours; 10·2 per cent. of gallic acid absorbed.

It will be observed that these results approximate to

those obtained when a soluble colloid (collin) was precipitated by tannic acid.

The presence of a salt distinctly increases the absorption, whilst the addition of alcohol reduces it. The presence of a small quantity of tannic acid also seems to increase the absorption, but the slightly higher value in this case may be due to the tannic acid preventing the solution of a corresponding proportion of the gelatin.

Albumin as a precipitating agent.—With a view to finding whether this absorption property of gelatin was shared with other colloids, experiments were carried out with albumin, using a standard solution of 60 grms. of purest egg albumin per litre throughout the series.

Albumin behaves like collin in that a precipitate is at once produced with tannic acid, whilst a mixture of albumin and gallic acid solutions remains quite clear after several hours' standing.

SERIES I.—A mixture of tannic and gallic acids was treated with albumin, the precipitate filtered off, and the free gallic acid estimated in 60 c.c. of the filtrate. The process was exactly the same as that adopted in the collin series, 30 c.c. of gallic acid being used and made up to 90 c.c. after adding the tannic acid; 30 c.c. of albumin solution was then added. The following results were obtained:—

No. of Expt.	Volume of tannic acid solution used.	Gallic acid carried down. as c.c. $CuSO_4$	Gallic acid carried down. percentage of amount present.
	c.c.		per cent.
1	2	29·2	70
2	5	31·2	75·7
3	10	36·4	88·3
4	20	Free tannic acid present	—

It is clear from the above table that the "tannin-albumin" compound absorbs gallic acid just as freely as the tannin-collin compound, and, therefore, there would be no advantage in using albumin as a precipitant in the valuation of tannins of which gallic acid was a constituent in the place of gelatin or "collin."

SERIES II.—In these experiments the tannic acid was omitted, the precipitation of the albumin being brought about by heat. *Experiment I.*—30 c.c. of gallic acid, 30 c.c. of albumin and 60 c.c. of water were used. The mixture was heated to 93° C., barium sulphate was added to aid separation and the whole filtered. Gallic acid absorbed = 68 per cent.

Experiment II.—The same quantities were again taken, but this time the solution was heated to 100° C. Gallic acid absorbed = 90 per cent.

These results show that the presence of tannic acid is not necessary for the absorption of gallic acid, the condition required being contact with an insoluble colloid.

The influence of salts on the absorption power of albumin is the same as was observed in the case of gelatin. The influence of ammonium chloride is shown in the following example:—A mixture of 30 c.c. of gallic acid, 10 c.c. of tannic acid, and 50 c.c. of N/10 ammonium chloride was treated with 30 c.c. albumin and filtered. Analysis of the filtrate showed that the whole of the gallic acid had been absorbed.

The effect of the precipitation of albumin by alcohol in the presence of gallic acid. The quantities taken were:—30 c.c. of gallic acid and 30 c.c. of albumin with varying amounts of alcohol: the solution was made up to 150 c.c. with water.

Three experiments were carried out in which the amounts of alcohol used were 30 c.c., 60 c.c., and 90 c.c. respectively. In each case practically the whole of the gallic acid remained in solution. The fact that no absorption takes place in the presence of alcohol is of interest.

In the fifth series the precipitation of albumin by alcohol and tannic acid was studied. The quantities taken were as in the last experiment. The tannic acid, alcohol and water were mixed together, and the albumin added last. The results obtained were:—

Expt.	Volume of Alcohol used.	Percentage of tannic acid absorbed.
	c.c.	per cent.
1	90	16
2	70	29
3	50	60
4	0	99

The amount of tannic acid precipitated decreasing with the increased addition of that reagent. The bearing of these figures on the dyeing and tannin actions is noticed later. The action of alcohol is specific; it reduces the absorption of tannic and gallic acids by the precipitated albumin.

The effect of the presence of gallic acid on the precipitation of the "tannin-albumin" compound.

To a solution containing 15 c.c. of albumin, and 40 c.c. of water, 15 c.c. of tannic acid were added.

The solution became cloudy, but no actual precipitate fell; on the further addition of 10 c.c. of gallic acid an almost complete separation of the albumin compound took place. This point would seem to be of interest in connection with the tanning of leather, indicating the probable action of gallic acid in the presence of tannic acid. It is even possible that with tannic acid of absolute purity, no precipitation would take place with such substances as albumin. An acid of such purity has never been prepared. It was, therefore, impossible to investigate this point.

It is interesting to note also that when the proportion of water present is reduced, the following results were obtained:—

1. 15 c.c. of albumen, 40 c.c. of water and 15 c.c. of tannic acid (see above).

2. 15 c.c. of albumin, 20 c.c. of water and 15 c.c. of tannic acid.

There was more precipitate than in 1, but the addition of 10 c.c. of gallic acid greatly increased it.

3. 15 c.c. of albumin, 10 c.c. of water and 15 c.c. of tannic acid.

There was more coagulation than in 2, but the addition of the gallic acid solution still increased it.

4. 15 c.c. of albumin and 15 c.c. of tannic acid.

A bulky precipitate was obtained which was not visibly increased by the addition of gallic acid.

Further consideration will be given to this matter.

The nature of the tannin albumin coagulum.—The following figures show the proportion of tannic acid absorbed by a precipitated tannic acid albumin coagulum. The amount of albumin taken was 1·2 grms. and the total volume of the solution being 120 c.c. in each case.

Expt. No.	Tannic acid used.	Tannic acid absorbed.
	grms.	grms.
1	0·375	0·375
2	0·5	0·45
3	0·75	0·49
4	1·25	0·60
5	1·75	1·0
6	2·5	1·27
7	3·5	1·45

The amount of tannic acid in Experiment I. was just sufficient to precipitate the albumen present. These figures indicate that the tannic acid is absorbed by the coagulum. There is no evidence of chemical action so far as these figures go.

In view of the above results it was considered important to test the action of different reagents (salts, acids, alcohol, &c.) on the power of absorption exerted by silk over tannic and gallic acids. At present it is only proposed to submit the figures obtained when alcohol was the reagent used.

Thirty c.c. of tannic acid were used with varying amounts of alcohol made up with water = 120 c.c. In each case 1·8 grms. of boiled-off silk were left in contact with the solution for 2½ hours, and the liquid was then examined for tannic acid.

Expt.	Alcohol used.	Tannic acid absorbed.
	c.c.	per cent.
1	0	15
2	70	4·6
3	90	1·2

It is interesting to note that with this colloid (fibroin) practically the same result was obtained as with gelatin and albumin respectively. The presence of alcohol diminishes the amount of tannic acid absorbed by the fibre.

This reaction seems parallel to the extraction of the colour from silk dyed with Night Blue by treatment with alcohol. Knecht claims that he has isolated the Night Blue amino acid compound from dyed silk, and states that the existence of this compound indicates that a chemical combination has taken place between silk and dye, and that this compound is soluble in alcohol or benzene. So far as our experiments go we find no indication that such an action takes place in the cases under review, but rather that the altered solubility of the two acids accounts for the reduced absorption by the organic colloids in presence of alcohol.

We hope to study this subject in greater detail.

Absorption of tannic and gallic acid by hide powder or leather.—Working on the lines adopted in the foregoing experiments, we found that the presence of alcohol prevents the absorption of tannic and gallic acids by hide powder.

Two examples illustrate this:—

Experiment I.—1·8 grms. of hide powder, 90 c.c. of water, and 30 c.c. of tannic acid were allowed to stand two hours, filtered and examined; 72 per cent. of the added tannic acid was absorbed.

Experiment II.—1·8 grms. of hide powder, 90 c.c. of alcohol, 30 c.c. of tannic acid were used. After standing two hours this also was filtered and examined, when it was found that only 10 per cent. of tannic acid had been absorbed.

So far as this goes, it indicates that the process of tanning is of the same nature as that of dyeing, and that both processes are similar in their effect to the absorption of these acids by gelatin or albumin.

The conclusions drawn from these experiments are as follows:—

1. That the tannin-gelatin coagulum readily absorbs gallic acid is confirmed.

2. The removal of the gallic acid is independent of the actual precipitating process of the tannin coagulum.

3. The degree of absorption of gallic acid is greatly influenced by the presence of other substances:

(*a*) Solutions of salts tend to increase the absorption factor.

(*b*) Acid solutions reduce the proportion of gallic acid absorbed.

(*c*) Alcohol in sufficient quantity altogether prevents the absorption of both tannic and gallic acids.

(4) Absorption takes place with solid gelatin, but at a reduced rate.

The effect of adding salt solutions, and alcohol, is the same as when a dissolved gelatin (collin) is used.

5. Albumin behaves like gelatin when used as a precipitant for tannins.

6. Albumin precipitated by heat absorbs gallic acid as readily as when the precipitation is brought about by tannic acid from aqueous solutions.

The presence of alcohol greatly modifies the reaction.

7. Acids and salts influence the rate of absorption as in the case of gelatin. The presence of gallic acid influences the precipitation of the tannic acid albumin coagulum.

8. Pure silk fibre (fibroin) seems to possess the properties of these other colloids in its behaviour towards tannic and gallic acids.

9. Hide powder behaves like other colloids in the above respects.

These results seem to throw light on the solution state of these substances. It is shown that coagulation may take place by stages. A tannic-acid-albumin complex, which is still in the pseudo-solution or hydrosol state, may be coagulated by the addition of gallic acid. The coagulum consists of the three reagents involved in the reaction. It is assumed that in this special case the addition of tannic acid increases the degree of aggregation of the solute, and, by degrading its solution state, brings it within the range of the action of the gallic acid, causing actual desolution with separation of a coagulum. When this substance which causes desolution is in a state of pseudo solution it may be carried down in large quantities.

One of us (Dreaper, this J., 1905, 233) recently advanced the hypothesis that the desolution effects obtained in dyeing seem to indicate that "within certain limits of concentration, and when once an equilibrium has been established, and when the action is a reversible one, the aggregates in any pseudo solution system are of equal size, this state being brought about by molecular migration." These results seem to confirm this view, which has already received the general support of Linden and Picton (Trans. Chem. Soc., 1905, 1933). With very concentrated solutions of gallic acid and albumin, where it is assumed the state of aggregation is correspondingly great, coagulation may even take place in the absence of tannic acid. The exact conditions of this reaction are being observed.

The influence of the ratio of solution/solute in these experiments indicates the close relationship existing between them even in these abnormal cases of pseudo-solution.

The influence of the presence of alcohol on the formation of a tannic acid coagulum indicates that the action is of the same order in the case of both tannic and gallic acids. Coagulation is induced under suitable conditions of solution by both acids depending on the state of aggregation of the colloid. As this increases, the action of these acids is correspondingly increased, until a point is reached when even gallic acid is able to coagulate the colloid either in the presence or absence of tannic acid. In the latter case, under conditions which would otherwise be outside the coagulating limit. The normal state of equilibrium may also be disturbed by the presence of a soluble salt or by the presence of another reacting colloid. In the presence of alcohol in which the tannic and gallic acids are more soluble if the reactions involved are due to absorption, the results obtained would be of the order indicated. In the presence of acids (hydrochloric acid) the reduced action is partly due to the gelatin and tannic acid, both being present in the soluble state as well as in the coagulum.

In any case an equilibrium is established which may or may not lead to actual coagulation. The results depend on the relative proportions of the substances present and the ratio of solution to solute.

Further work will be undertaken to determine the reactions, if any, with inorganic colloids and also the further study of this subject generally.

Newcastle Section.

Meeting held at Armstrong College on Thursday, February 15th, 1906.

PROF. HENRY LOUIS IN THE CHAIR.

SCHEIBLER'S APPARATUS FOR THE DETERMINATION OF CARBONIC ACID IN CARBONATES; AN IMPROVED CONSTRUCTION AND USE FOR ACCURATE ANALYSIS.

BY S. H. COLLINS.

The estimation of the carbonic acid in those carbonates which are readily decomposed by hydrochloric acid is one of the commonest determinations that fall to the lot of the analyst. The relative simplicity and rapidity of gasometric methods causes the analyst to prefer such

methods over others, Scheibler's method being one of the best known modes of obtaining and measuring the gas.

As has been pointed out by other writers, some forms of Scheibler's apparatus are inaccurate. For example, Mr. A. D. Hall, in the *Journal of the Chemical Society*, 1902, Trans. 81, writes, "With small proportions of calcium carbonate, 0·5 per cent. and below, Scheibler's apparatus becomes unworkable, for all the gas produced remains in the reacting acid," and A. Amos, in the "Journal of Agricultural Science," 1905, 322, writes "The volumetric method of Scheibler also cannot be used for soil containing only 0·5 per cent. of lime because all the carbon dioxide remains in solution in the decomposing acid." But I find that 0·01 per cent. of carbon dioxide is well within the limits of the apparatus I use, and indeed 0·001 per cent. could be measured, if there were any use in doing so.

The errors in Scheibler's method are due to several causes:—

(1) *Temperature.*—In gas analysis having any pretensions to accuracy, the effect of temperature is most important. In Scheibler's method, the gas given off on adding acid to a carbonate is only a fraction of the total gas dealt with, there always being a comparatively large amount of air present; the effect of temperature is in consequence multiplied. For example, if the carbon dioxide evolved be 15 c.c. and the air in the apparatus be 150 c.c., then the error due to temperature is 10 times as much in Scheibler as in other gas analysis. The measurement of temperature must, therefore, be very exact, for which purpose a water-cooling arrangement is absolutely essential.

As a compromise of all the considerations in this paper, I think that for ordinary work a decomposing flask of 150 c.c. will prove to be the best size. If in such a flask the volume occupied by substance, acid, &c., be 14 c.c., then there will be 136 c.c. of air in the flask, on which a variation of 0·4° C. will cause a variation of 0·2 c.c., equal to an error of .1 per cent. on 20 c.c. of carbon dioxide. Owing to the heat of combination of reacting substances, change of temperature of room, presence of operator, &c., I find in practice that 2 litres of water are necessary to obtain a sufficient uniformity of temperature. The less surface exposed by the water-cooler to the air of the room the better; also much can be gained by making all parts of the apparatus contribute to this constancy of temperature. At once the simplest and most efficient means of obtaining these ends is to bodily sink the apparatus under water, and the improvement I propose in construction is principally obtained by that means.

The suggestion has been made by many other workers that the size of the decomposing vessel might be diminished but this solution of the difficulty only increases other errors, which I now propose to deal with.

(2) *Solubility of the carbon dioxide in the water and acid used to decompose the carbonate.*—The amount of carbon dioxide dissolved in the acid liquors can be calculated from the known laws of gases. At 15° C. water dissolves its own volume of gas measured at the partial pressure which it is exerting on the acid or water, the volume of gas dissolved being:—

$$\text{volume of water} \times \frac{\text{volume of carbon dioxide}}{\text{volume of total gas}}$$

Let—

f = the capacity of the decomposing flask in c.c.

a = the volume of acid used in c.c.

g = the volume of gas measured in the burette in c.c.

s = the number of c.c. of gas dissolved by 1 c.c. of water.

v = the true volume of gas in c.c.

Then the amount of gas dissolved is $\frac{asg}{f+g-a}$* and

$$v = g\left(1 + \frac{as}{f+g-a}\right)$$

Further let—

B = the height of the barometer in millimetors.

t = the temperature in degrees centigrade.

T = aqueous tension in millimeters.

w = the weight of substance taken in grms.

Then—

$$\frac{g\left(1 + \frac{as}{f+g-a}\right) \times (B-T) \times 0{\cdot}1964}{760(1+\delta t) \times w} = \text{the per cent. of } CO_2 \text{ in the substance.}$$

The expressions $760(1+\delta t)$, T and s being all functions of t are given together in Table I.

TABLE I.

For calculating $\frac{g\left(1 + \frac{as}{f+g-a}\right) \times (B-T) \times 0{\cdot}1964}{760(1+\delta t) \times w}$

t	760 (1+δt)	T	s
12	793	10	1·11
13	796	11	1·07
14	799	12	1·04
15	802	13	1·00
16	805	14	0·98
17	807	14	0·96
18	810	15	0·93
19	813	16	0·91
20	816	17	0·89
21	818	18	0·87
22	821	20	0·84
23	824	21	0·81
24	827	22	0·78
25	830	24	0·75
26	832	25	0·72
27	835	27	0·70
28	838	28	0·68
29	841	30	0·66
30	844	32	0·64
31	847	33	0·62
32	849	35	0·60
33	852	37	0·58
34	855	40	0·56
35	857	42	0·54
36	860	44	0·52
37	863	47	0·50
38	866	50	0·49
39	868	52	0·48
40	871	55	0·47

Some objections might be taken to this formula.

The solubility of carbon-dioxide in hydrochloric acid might be less than that in water. The acid used, however, cannot conveniently be stronger than one part of strong acid to three of water, and cannot be much weaker than 1 to 10; the experiments have somewhat exceeded this range and give no indication of any error due to this cause, and, as will be shown later, the much more serious effect of calcium chloride, though easy to show under experimental conditions, is too small to be of any practical consequence in actual work.

It might be argued that the formula would be only true if all the gas were given off before any passed into the burette, and that the true formulæ would be

$$v = g\left(1 + \frac{as}{f-a}\right)$$

Experiments show that this modified formula is wrong, for example:—

Expt.	B	t	f	a	g	Grms of carbon dioxide found: correct formula.	Grms of carbon dioxide found: incorrect formula.	Grms of carbon dioxide taken.
L	761	16·0	85	25	25·45	0·0596	0·0654	0·0594
M	757	29·0	145	40	26·52	0·0540	0·0563	0·0543
N	740	14·4	145	35	23·90	0·0541	0·0564	0·0543

All the other experiments confirm the formula,

$$v = g\left(1 + \frac{as}{f+g-a}\right)$$

* In a few special cases the volume occupied by the solid to be tested must be subtracted from the denominator, but, as a rule, this correction is needless.

Under certain limited conditions, the above formula can be simplified. For example: if, a, is less than one-tenth of, f; g, less than one-fifth of, f, and, t, between 13 and 19°C., then the error of the formula

$$v = g(1 + \frac{a}{f})$$

is less than 1 per cent.

Within the above limitations, if, $f = 215$ c.c., and $a = 15$ c.c., then $\frac{a}{f}$ is 7 per cent., which is the correction advocated by Prof. Warrington.* With a flask of that size, in the absence of any water-cooler, an error of 10 per cent. due to change of temperature must be of frequent occurrence.

The second improvement I suggest is in the method of working out the result. As the calculations involved in the above formula are lengthy, I include Table II., and have prepared a slide rule of fair range, which I trust will render the working simple. The fraction $\frac{as}{f+g-a}$ is rarely more than one-tenth, hence an error of 10 per cent. in measuring that fraction will only make an error of 1 per cent. in the final result.

(3) The above equation can only be correct if the acid CO_2 and air in the flask have reached equilibrium, which can only be achieved by violent shaking. Scheibler recognised this fact by providing a fair length of rubber tube and a gutta tube for holding the acid. Much of the trouble recorded with this instrument is due to neglect of the necessity for violent shaking.

The improvement I suggest under this head is to substitute a tube of transparent celluloid for the gutta tube, or, if glass be essential, the device shown in Fig. 1.

(4) *The disturbing influence of various salts.*—Substances such as calcium chloride may be present in varying amounts, and such substances will reduce the solubility of the carbonic acid in the water used. A simple means of correcting for this decrease in solubility is to deduct a certain amount from the amount of acid actually used, and to calculate the result as if less acid had been used than was actually the case. The amount to be deducted will depend upon the salt, as given in Table III., which is calculated from data given in Comey's "Dictionary of Solubilities."

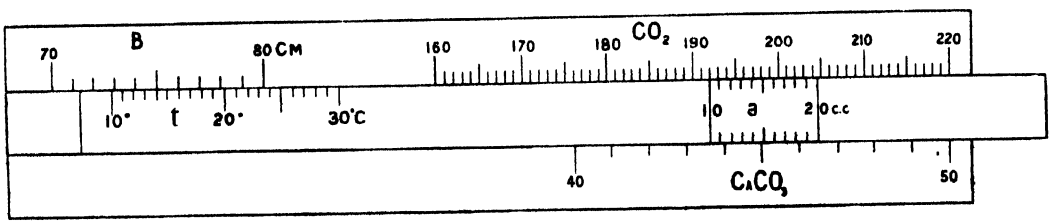
TABLE II.

Mgrms. of CO_2 corresponding to 1 c.c. of gas measured. Flask (f) 150 c.c.

	Bar = 760 mm. Gas measured (g) = 20 c.c. Acid (a) in c.c.							B (mm.) 750 770 — +	B (mm.) 740 780 — +
° C.	10	15	20	25	30	35	40		
12	1·98	2·06	2·14	2·22	2·30	2·39	2·49	0·03	0·06
14	1·96	2·03	2·10	2·18	2·26	2·34	2·44	0·03	0·05
16	1·93	2·00	2·06	2·13	2·21	2·29	2·38	0·03	0·05
18	1·91	1·97	2·03	2·09	2·16	2·24	2·33	0·03	0·05
20	1·88	1·94	2·00	2·06	2·12	2·20	2·28	0·03	0·05
22	1·86	1·91	1·96	2·02	2·08	2·15	2·23	0·03	0·05
24	1·83	1·89	1·93	1·99	2·04	2·10	2·18	0·03	0·05
26	1·81	1·86	1·90	1·95	2·00	2·06	2·13	0·03	0·05
28	1·78	1·83	1·87	1·92	1·96	2·01	2·08	0·03	0·05
30	1·76	1·81	1·84	1·89	1·92	1·97	2·03	0·03	0·05
32	1·73	1·78	1·81	1·85	1·89	1·93	1·98	0·02	0·05
34	1·71	1·75	1·78	1·82	1·85	1·89	1·94	0·02	0·05
36	1·68	1·72	1·75	1·79	1·82	1·85	1·90	0·02	0·05
38	1·66	1·69	1·72	1·76	1·79	1·82	1·86	0·02	0·05
g 0 +) 40 —)	0·01	0·02	0·03	0·04	0·05	0·06	0·08	corrections	
10 +) 30 —)	0·00	0·01	0·01	0·02	0·02	0·03	0·04		

Examples (α) $a = 20$, $t = 22$, Bar. = 750, $g = 10$
∴ 1 c.c. gas = 1·96 — 0·03 + 0·01 = 1·94 mgrms CO_2

(β) $a = 30$, $t = 32$, Bar. = 770, $a = 40$
∴ 1 c.c. gas = 1·89 + 0·02 — 0·05 = 1·86 mgrms CO_2.



Slide Rule Example.

Example (α) $t = 14°$ C., B = 750 mm., $a = 10$ c.c., then 1 c.c. gas measured = 1·92 mgrms. $CO_2 = 4·36$ mgrms. $CaCO_3$.

Example (β) $t = 20°$ C., B = 782 mm., $a = 20$ c.c., 1 c.c. of gas measured = 2·05 mgrms., $CO_2 = 4·64$ mgrms. $CaCO_3$.

* See Chem. News, 31, 253.

In order to test whether these figures worked true in practice, the following experiments were performed :—

Expt.	B	t	f	a	g	Carbon dioxide, grms. found uncorrected.	found corrected.	taken.	grms. $CaCl_2$.
O.	757	18·9	145	55	24·62	0·0629	0·0559	0·0543	10
P.	738	14·4	145	45	24·02	0·0583	0·0548	0·0543	5

The correction is therefore approximate.

The above conditions are very severe; I do not know of any actual case that could arise in practice similar to it.

The following are actual cases that have occurred :—

Crude phosphate, uncorrected, 26·96 per cent.; corrected, 26·92 per cent. carbon dioxide.

Gypsum, uncorrected, 1·78 per cent.; corrected, 1·77 per cent. carbon dioxide.

Burnt lime, uncorrected, 1·03 per cent.; corrected, 1·02 per cent. carbon dioxide.

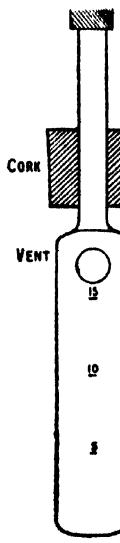
In actual practice the correction is not worth the trouble of making, it is too insignificant.

The effect of unknown amounts of calcium chloride and other salts has therefore been exaggerated by former writers, but in those rare cases, if there are any at all, where a correction is needed, Table III. may be used.

TABLE III.

For 1 grm. of	deduct c.c. acid.
Ammonium chloride	1
Potassium chloride	1
Gum	1
Sugar	1
Calcium chloride	2
Sodium chloride	2
Potassium nitrate	2
Sodium nitrate	2
Potassium sulphate	3
Sodium sulphate	3

(5) A subject, commonly referred to in connection with Scheibler's instrument, is the error due to absorption of carbon dioxide by the water in the burette. In Scheibler's original apparatus a flexible gas bag wa supplied in a separate bottle. Such an arrangement onl introduced much larger errors than it removed; th alteration in volume due to change of temperature i large, whilst the loss of gas by absorption is small. Wher the decomposing vessel is small the risk of absorption ma be important, but, for reasons given below, the instrumen shown in Fig. 2 permits no measurable loss.



GLASS TUBE FOR ACID

FIG. 1.

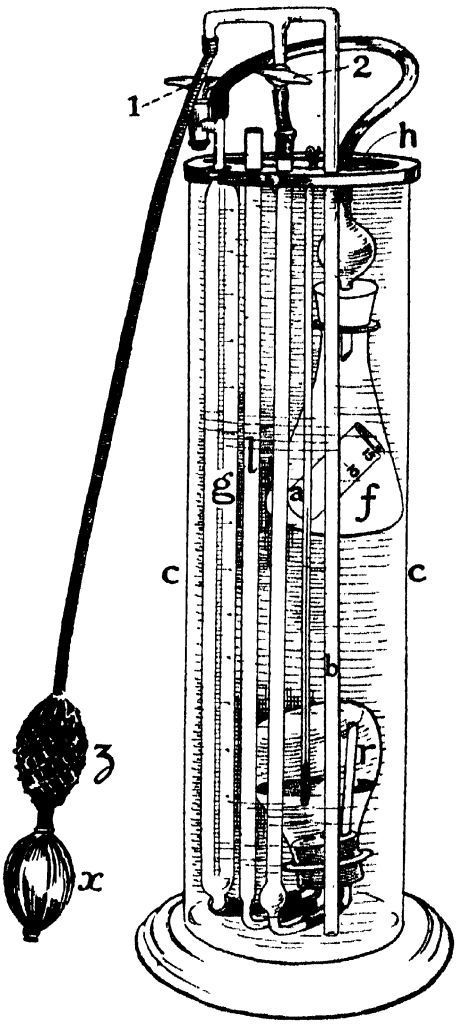


FIG 2.

Above the decomposing flask is placed a small bulb to prevent acid splashing up into the rubber tubes. This bulb, together with the rubber connecting tube, holds about 15 c.c. If 15 c.c. of gas pass into the burette, no carbon dioxide passes into the burette at all; the error by absorption is *nil*. If 30 c.c. of gas pass into the burette,

only 15 c.c. of this has come from the flask and that 15 c.c. is not pure carbon dioxide, but gas derived from a mixture of 30 c.c. of carbon dioxide and 140 c.c. of air. There is only $15 \times \frac{30}{170}$ c.c. carbon dioxide in the burette diluted to 30 c.c. with air, that is, 8·8 per cent. Gas of such concentration would need 3·4 c.c. of water to be saturated before 0·3 c.c. had been absorbed; hence an error of 1 per cent. is utterly impossible.

(6) *Alteration of volume by bending the rubber connections.*—The rubber connections should be of thick-walled, narrow bore rubber tube; thin tube is apt to "kink" and decrease the volume one to two-tenths of a c.c. So long as the rubber stopper does not exceed 3 cm. diameter no change of volume will occur from the bulging of the rubber stopper.

(7) *Occluded gas.*—Many finely-divided substances have the power of occluding gases on the surface; such occluded gas might interfere with the estimation of combined carbon dioxide. In the case of soils the amount of gas given off by decreasing the pressure or increasing the temperature is often greater than the amount of gas given off by adding acid. In the modification of Scheibler that I recommend the temperature is kept very constant, and the pressure only varies temporarily and to a small extent. Errors under this head are therefore unlikely, but I have tried several experiments to settle the question. I have placed several soils in the decomposing flask, and used water instead of acid in the celluloid tube. In no case have I observed any alteration of volume greater than 0·1 c.c.

In the experiments below I have used sand (25 grms.) and a heavy loam soil (10 grms.) with much humus, both previously extracted with hydrochloric acid, washed and air dried; to which have been added, in the case of the sand, a measured amount of a standard solution of sodium carbonate, and in the case of the soil, a weighed amount of calcium carbonate.

Expt.		B.	*t*	*f*	*a*	*g*	grms. of carbon dioxide. found	grms. of carbon dioxide. taken	per cent of carbon dioxide. found	per cent of carbon dioxide. taken
K	Sand	765	16·2	140	20	1·15	0·0024	0·0027	0·010	0·011
Q	Soil	750	15·4	150	20	1·00	0·0021	0·0025	0·021	0·025

As anticipated, no errors occur from occluded gas.

*Description of the instrument.**—The carbonate is weighed and placed in flask, *f*, the acid in tube, *a*, taps 1 and 2 opened, the flask connected up with the rubber stopper, plunged under the water in cooler, *c*, and kept there by means of the hook, *h*, engaging with a projection on the collar. Tap 2 is closed and air blown through the tube, *b*, so as to stir up the water in the glass cylinder, *c*, and obtain uniform temperature. Tap 2 is opened and the rubber bulb, *z*, gently squeezed till the water in the burette, *g*, stands at zero, tap 1 being closed with the other hand. On letting go the bulb, *z*, the level in tube 1 sinks to the bottom, when the flask, *f*, is removed from the water, the acid spilled, the flask shaken violently, returned to the water, the level adjusted by squeezing the bulb, *z*, shutting tap 2, and the volumes of gas, *g*, measured. The process of stirring, shaking and adjusting level should be continued till a constant reading has been obtained. The temperature of the water is taken by a thermometer, graduated 0° to 40° C. in fifths of a degree; the gas burette is graduated 0 to 50 c.c. in tenths of a c.c. If the temperature should vary one or two fifths of a degree during the process of the experiment, correction can easily be made, since a rise of one mark on the thermometer means that one mark on the burette must be subtracted; for 136 c.c. of air expand 0·1 c.c. for a rise of 0·2° C. With 14 c.c. of acid the amount of air left in a 150 c.c. flask would be 136 c.c.; the amount of acid used would never vary from this figure sufficiently to make any appreciable error in the correction used.

It is important to see that reservoir, *r*, is half full of water, and that the bulb, *z*, is half full of air before levelling.

* The instrument, slide rule, tables, &c., can be obtained from Messrs. Brady and Martin, Newcastle-upon-Tyne.

The tubes are held in place by an ebonite collar at the top of the cylinder and a piece of brass wire gauze ¼-inch mesh placed inside the jar (not shown).

A test occupies 10 minutes time.

Table IV. contains some additional experiments, which serve to show that the principle here worked out applies over a long range.

Table V. is useful in showing at a glance the degree of accuracy necessary in the various measurements needed. It will be seen that, so long as the decomposing flasks are picked, no exact measurement is necessary.

Where a direct reading instrument is required Table VI. may be used. By weighing 0·2 grm. of limestone, 2 grms. of burnt lime or 20 grms. of soil, and using the amount of acid indicated in Table VI., each c.c. of gas measured represents 1 per cent., 0·1 per cent., or 0·01 per cent. of carbon dioxide respectively.

This table is less accurate than Table II., but an error of 2 per cent. will be practically impossible. The difference between 10·0 per cent. and 10·2 per cent. and so on is often of little consequence, and is usually less than errors of sampling. By weighing 0·45 grm. or 4·5 grms. direct reading in per cent. of calcium carbonate can be obtained by Table VI.

My thanks are due to Mr. R. G. Hatton and Mr. H. R. Cullen for the drawings.

TABLE IV.

Additional Experiments.

Expt.	B	*t*	*f*	*a*	*g*	grm. CO_2 found.	grm. CO_2 taken.
J	765	15	140	10	1·0	0·002	0·003
F	765	13	140	57	3·7	0·012	0·010
E	765	13	140	20	6·5	0·014	0·015
G	765	13	140	76	20·9	0·076	0·074
D	765	13	140	36	31·8	0·075	0·074
H	765	13·5	140	48	47·3	0·119	0·119
I	765	15	140	48	47·9	0·118	0·119

TABLE V.

Equivalence of errors under average conditions.

B	7 mm.
t	1° C.
Fluctuation of temp.	0·4° C.
a	2 c.c.
f	15 c.c.
g	0·2 c.c.
Result	1 per cent.

TABLE VI.

Direct Reading for Technical Purposes.

Amounts, in c.c. of acid to be used, in a 150 c.c. flask, so that 1 c.c. of gas corresponds to 2 mgrms. of carbon dioxide or 4·5 mgrms. of calcium carbonate:

Bar.	mm. 730	mm. 740	mm. 750	mm. 760	mm. 770	mm. 780	mm. 790
Ther.							
12° C	19	17	15	13	11	9	7
14° C	21	19	17	15	13	11	9
16° C	23	21	19	17	15	13	11
18° C	25	23	21	19	17	15	13
20° C	27	25	23	21	19	17	15
22° C	29	27	25	23	21	19	17

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Expt.	B	t	f	a	g	Carbon dioxide, grms. found uncorrected.	found corrected.	taken.	grms. $CaCl_2$.
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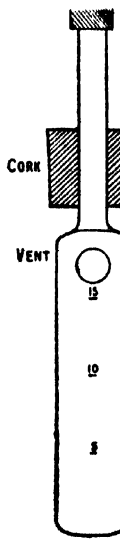
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GLASS TUBE FOR ACID

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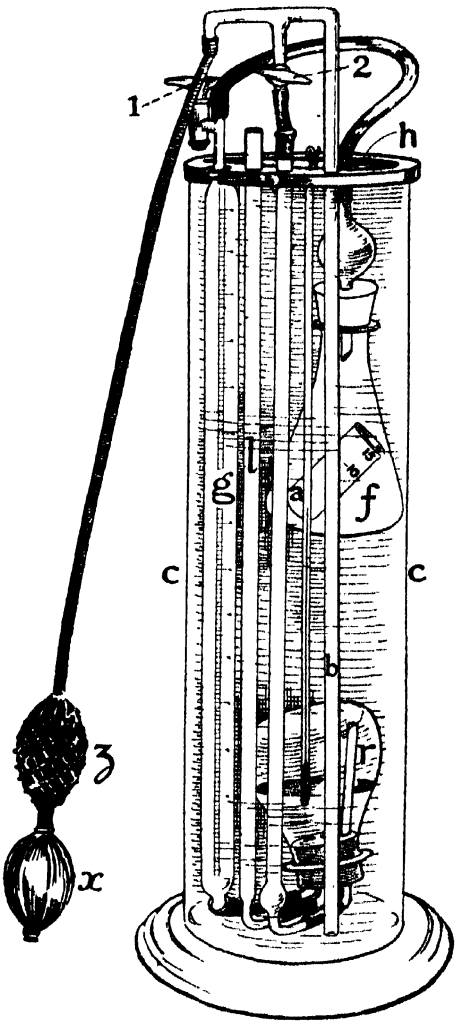


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which the air is conducted away for use by the pipe, *m*. The tubes, *a* and *b*, are filled with water or other liquid, and *b*, communicates by a branch with the reservoir, *d*, and has two valves, *e*, *f*, which prevent the water and air from passing down the pipe, *b*. The water is made to flow down the tube, *a*, in the direction of the arrow by the propeller, *h*, and draws along with it the air which is injected through the pipe, *j*, by the blower, *i*. The mixture of water and air separates after entering the reservoir, *g*; the water passes up the pipe, *b*, to be used over again, any excess passing to the tank, *d*, and the air collects in, *g*, and is compressed by the weight of the liquid columns in *a* and *b*. Should too much air collect in the reservoir, *g*, the excess can escape through the small pipe, *l*, into the pipe, *b*. In modified forms of the apparatus, rotary blowers or turbines are used to move the liquid and to inject the air, and they may be placed near the bottom of the "upward" pipe. —W. H. C.

Vacuum pans and like evaporators. A. J. Boult, London. From Milwaukee Evaporator Co., Milwaukee, U.S.A. Eng. Pat. 14,379, July 12, 1905.

SEE U.S. Pat. 794,831 of 1905; this J., 1905, 880.—T. F. B.

Evaporating, distilling, concentrating and like purposes; Method of and apparatus for treating liquids and semi-liquids for —— with continuous re-utilisation of the heat employed. E. Theisen, Munich, Germany. Eng. Pat. 19,385, Sept. 25, 1905.

SEE Fr. Pat. 356,752 of 1905; this J., 1906, 8.—T. F. B.

Filters; Impts. in ——. A. J. Boult, London. From E. Goldman and Co., Chicago. Eng. Pat. 18,833, Sept. 18, 1905.

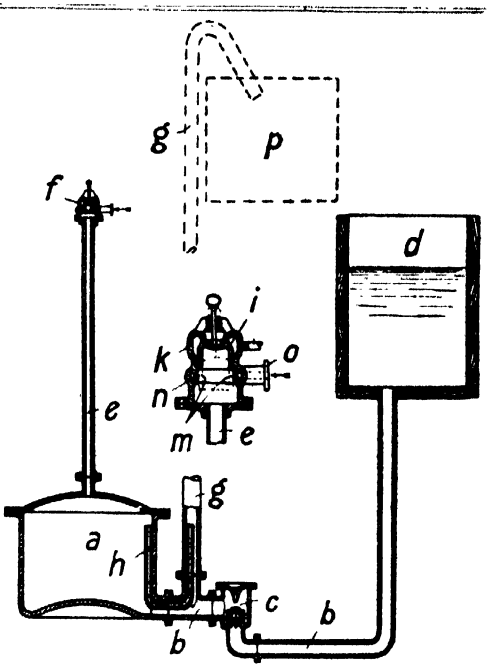
THE claim is for improvements in the filters described in Eng. Pat. 8984 of 1905 (this J., 1905, 1054), and consists in replacing the cloths on the distributor- and collector-plates by perforated metal screens.—W. H. C.

Furnaces; Impts. in the construction of regenerative ——. J. H. Brown, Nottingham. Eng. Pat. 20,318, Oct. 7, 1905.

THE control of the distribution of the waste gases to the regenerative flues, formed in the division walls of the furnace, is effected by damper tiles placed over the inlet ports to the flues and adjusted by an iron bar, introduced through doors in the furnace front. By similar means the gases coming from the regenerative flues are separated into two currents; one of which passes directly to the main flue, while the other passes first beneath the ash-pan and causes the evaporation of the water contained therein. The secondary air is distributed evenly over the air-heating flue by baffle-walls.—W. H. C.

Raising liquids by direct fluid pressure; Apparatus for ——. F. Girod, Berlin. Eng. Pat. 26,668, Dec. 21, 1905.

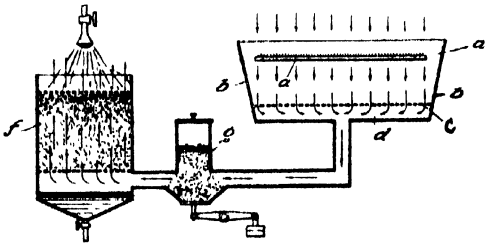
THE liquid enters the pressure chamber, *a*, from the store tank, *d*, through the tube, *b*, which is provided with a valve, *c*, driving out the air through the tube, *h*, into the delivery pipe, *g*. As soon as the level of the liquid covers the end of the tube, *h*, the escape of the air is stopped, and then the pressure exerted by the column of liquid in *g*, compresses the remainder of the air in *a*, and when a sufficient degree of compression is reached, the air inlet valve, *f*, at the top of the tube, *e*, is opened. This valve consists of a cup-shaped valve, *i*, contained in a casing, *k*, and is shown open in the figure; when closed, it occupies the position indicated by the dotted lines. The air from the compressor enters the valve by the pipe, *o*, passes into the annular passage, *n*, and, when the valve is open, through the narrow orifices, *m*, and the pipe, *e*, into the chamber, *a*, and causes the inlet valve, *c*, to close. The liquid is forced up the delivery pipe, *g*, into the overhead tank, *p*, and when *a*, is empty of liquid, the compressed air escapes also through *g*, the valve, *f*, closes, *c*, opens, and the whole process is repeated. A modification of the air inlet valve is claimed, in which the opening is effected by means of combination of a lever and diaphragm.—W. H. C.



UNITED STATES PATENTS.

Vapours of volatile solvents; Apparatus for recovering the ——. E. Bouchaud-Praceiq, Paris. U.S. Pat. 806,866, Dec. 12, 1905.

THE apparatus described is intended for recovering the vapours or volatile solvents, used for example in the manufacture of smokeless powder, artificial silk, &c. It consists of a frame, *a*, provided with openings, from



which the material to be treated passes, mounted in a vaporising chamber, *b*, which is open to the atmosphere. The chamber has a false bottom, *c*, through which the air, charged with vapours, descends into a drain, *d*, and passes to the air-purifying chamber, *f*, passing, on its way, through drying material contained in a vessel, *g*, provided with a cleaning-plug for the removal of saturated material. The chamber, *f*, contains pumice-stone saturated with fixing agents, by which the volatile vapours are removed from the air, so that on leaving the top of this chamber the air may be returned to the vaporising chamber to take up a fresh amount of vapour. The arrows show the circulation in the apparatus. The chambers are so arranged relatively to each other that the pressure of the column of fluid in the connecting passage is greater at the vaporising chamber end than at the other end, "whereby the fluid will be automatically and naturally propelled through the system by the force of gravity."

The claims also include an arrangement to prevent the loss of air, charged with vapours, over the edge of the vaporising chamber. This consists of an apron, or curtain, of flexible transparent material, which is hung, by means of elastic fastenings, from a frame, round the upper edges of the vaporising chamber, so as to extend upwards above the edge of the chamber, to prevent the escape of air laden with vapours over the edge, and, at the same time, owing to its flexibility, to allow of its being depressed easily at any point, where it is necessary to gain access to the chamber for any slight repair, &c. —W. C. H.

Furnace; Reverberatory ——. M. Cummings, Boston, Mass. U.S. Pat. 819,043, May 1, 1906.

THE bridge-wall of the furnace is made hollow and the air-space so formed communicates below with the ash-pit and, at the ends of the bridge-wall, with passages formed in the side walls of the furnace. Air passes from the ash-pit up through the hollow bridge-wall into the passages in the side walls of the furnace and from the latter, which extend above the level of the top of the bridge-wall, the air is delivered into the furnace-chamber through ports placed slightly to the rear of the bridge-wall.—W. H. C.

Furnaces; Application of heat in metallurgical and other ——. B. E. Eldred, Brooklyn, Mass., Assignor to Combustion Utilities Co., New York. U.S. Pat. 819,045, May 1, 1906.

A MIXTURE of air with products of combustion is passed through the ignited fuel on the grate of the furnace and the resulting "tardily-burning" gas is delivered into the heating-chamber above the material being heated, the combustion being completed by radiation from the furnace walls. The materials treated are passed continuously through the heating chamber.—W. H. C.

Furnaces; Means for controlling gas velocity in reverberatory — . B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York. U.S. Pat. 819,046, May 1, 1906.

THE claim is for a reverberatory furnace with a long hearth-chamber, through which the materials to be treated are moved mechanically. A number of separate fire-boxes deliver the heating gases into the hearth-chamber, through ports spaced successively along its length. The cross-sectional area of the chamber is successively increased after each inlet by raising the roof-wall, and horizontal baffle-plates or "septa" are placed above each inlet. The fire-boxes are separately fed with a mixture of air and waste gas drawn from the stack for the purpose.—W. H. C.

Separating residues from liquids; Apparatus for ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,664, May 1, 1906.

A TANK containing the liquid has two series of partition walls, extending upwards and downwards respectively, and varying in height or depth according to their distance from the inlet and outlet. Scrapers, which move transversely or parallel with the partitions, remove the residues from the top of the liquid.—R. L.

Evaporating liquids; Method of ——. A. P. Geer, New London, Conn. U.S. Pat. 819,697, May 1, 1906.

THE liquid is strongly heated just below the level of the surface and less strongly at a lower level, in order that the liquid near the surface may be evaporated, and that the portion below may be concentrated. The concentrated liquid is drawn off from below, and the volume of liquid in the apparatus is maintained constant by feeding in fresh liquid near the surface in sufficient quantity to compensate both for that withdrawn, and for the water evaporated.—W. H. C.

Gases; Process and apparatus for separating mixed ——. C. Clamond, Paris. U.S. Pat. 820,283, May 8, 1906.

SEE Fr. Pat. 346,195 of 1904; this J., 1905, 78.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 467.)

Powdered coal firing for steam boilers. G. C. McFarlane. Eng. and Mining J., 1906, **81**, 901—902.

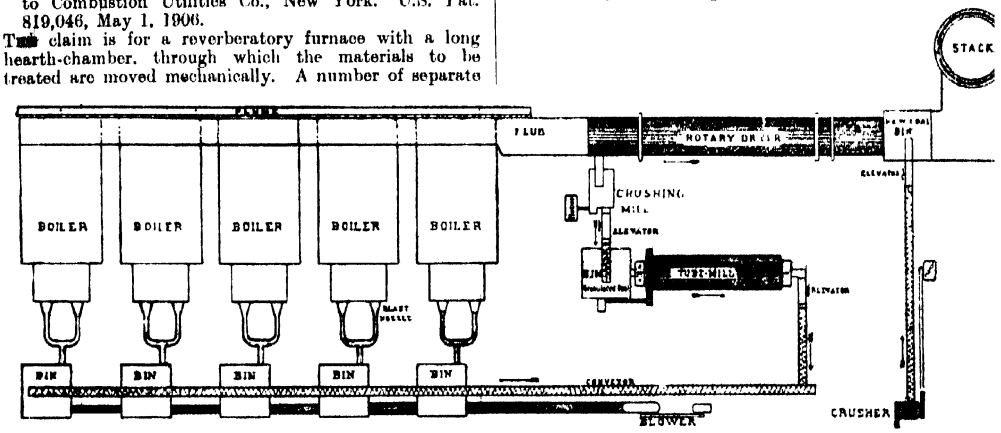


FIG. 1.

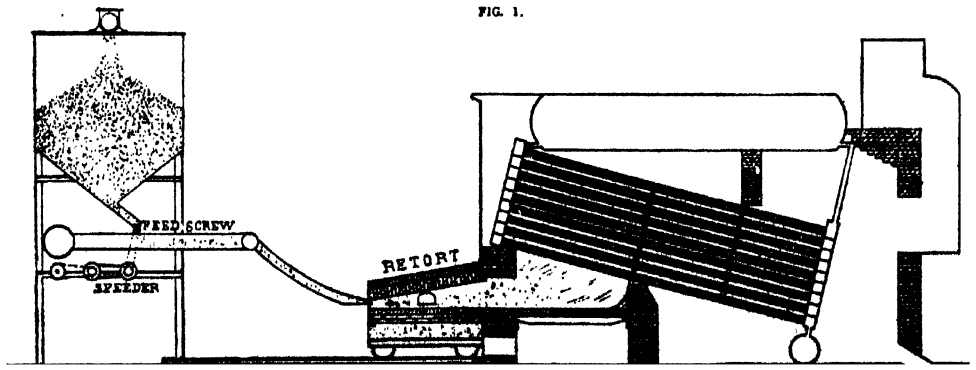


FIG. 1 shows the general arrangement of a fuel mill and boiler room where powdered coal is employed. The coal is first crushed by toothed rolls and then passes through a large rotary dryer heated by the chimney gases from the boilers, or, in the case of small plants, through a small hand-fired dryer. The dried coal is crushed to the size of granulated sugar in a suitable mill, and then further ground in a tube-mill until 95 per cent. will pass a 100-mesh sieve. The apparatus for burning the powdered coal is shown in Fig. 2. The coal-dust is fed into the blast-pipe by a 4-in. screw conveyor, and air is supplied by a Buffalo blower. The blast-pipe consists of a 10-in. rivetted sheet-iron pipe, which, at a distance of a few feet from the boiler, branches into two 7-in. pipes capped with nozzles having orifices 20 in. wide by 1½ in. deep. A fire-brick retort or combustion chamber, from 5 to 8 ft. long, is arranged in front of the boiler. About 145 cb. ft. of air are required to burn 1 lb. of coal, and the chimney gases contain from 1 to 1½ per cent. of free oxygen. It is stated that when coal is burnt in the form of dust, ½ lb. less is required per h.p. hour, than when it is burnt in the usual manner. The following comparison of the cost of hand firing and powdered coal firing is given:—

Hand firing.

Daily expense.	Dols.
65 tons of coal at 2.4 dols.	156.00
Labour	13.60
	169.60
Yearly expense, 320-day run	54,272.00

Powdered coal firing.

Daily expense.	Dols.
58 tons of coal at 2.4 dols.	139.20
Labour	8.32
	147.52
Yearly expense	47,206.40
Amortisation	2,500.00
Interest, 6 per cent. on 15,500 dols. ..	930.00
Repairs, oil, &c.	800.00
	51,436.40

—A. S

Coal-gas and air; Explosions of ——. B. Hopkinson. Roy. Soc., Proc., 1906, A. **77**, 387—413.

THE author has studied the phenomena occurring in a mixture of coal-gas and air, contained in a closed vessel and ignited at one point by an electric spark. The experiments were directed principally to settling the question of "after-burning," which has long been a matter of controversy in the theory of the gas-engine. The apparatus used consisted of a cylindrical vessel of a capacity of 6·2 cb. ft.; the gaseous mixture was ignited in the centre; the temperatures and rate of variation of temperature were ascertained by observing the variation of electrical resistance of fine platinum wires immersed in the gas at different points; and the pressures were observed simultaneously. The gaseous mixtures, which consisted of 9 vols. of air to 1 vol. of coal-gas, and 12 vols. of air to 1 vol. of coal-gas, were ignited at atmospheric pressure. From the results obtained, the author concludes that, even in the weakest mixtures, combustion, when once initiated at any point, is almost instantaneously complete. The specific heat of the products of combustion he finds to be very much greater at high temperatures than at low, the average value of γ (ratio of specific heats) being 1·25 between 1200° and 1900° C. This difference in specific heat is sufficient to account for the so-called "suppression of heat," which has been supposed to be due to the attainment of maximum pressure before the combustion of the gas was complete. No evidence of after-burning was obtained. An increase in specific heat has been observed in the case of carbon dioxide, which has been examined up to about 800° C. The author considers that in gas-engine practice, although the conditions prevailing are somewhat different from those in the apparatus employed, the working fluid may be regarded simply as a mixture of carbon dioxide, steam and inert gas, in chemical equilibrium, to which the heat of combustion, less a small percentage of loss, is added at the beginning of the stroke.—H. B.

Hydrocarbons and oxygen; Interaction of well-dried mixtures of ——. W. A. Bone and G. W. Andrew. Chem. Soc. Trans., 1906, **89**, 652—659.

Two similar tubes containing respectively, thoroughly dried, and undried, equimolecular mixtures of a hydrocarbon (acetylene, ethylene, ethane) and oxygen, were heated under similar conditions for the same length of time, comparative experiments being also made with electrolytic gas, dried and undried, in order to ensure that the degree of dryness attained was such as would practically inhibit the combustion of hydrogen. It was found that the exclusion of moisture had little, if any, influence on the rate of oxidation of the hydrocarbons.—A. S.

Hydrocarbons; Explosive combustion of ——. W. A. Bone and J. Drugman. Chem. Soc. Trans., 1906, **89**, 660—682.

THE authors have made a systematic study of the explosive combustion of a number of different gaseous hydrocarbons, including members of the saturated series, C_nH_{2n+2}, up to butane, olefines such as ethylene, propylene and the butylenes, and trimethylene and acetylene. The term "explosive combustion" is used to denote the propagation of a flame through a combustible mixture under ordinary conditions. In the case of mixtures containing sufficient oxygen to completely convert the hydrocarbon into carbon monoxide and hydrogen, there is a considerable difference between the behaviour of an unsaturated and a saturated hydrocarbon. The mixtures containing an olefine, or acetylene, or trimethylene, decompose chiefly into carbon monoxide and hydrogen, according to the empirical equation:

$$C_nH_{2n} + \frac{n}{2}O_2 = nCO + nH_2;$$

there is no separation of carbon, and very little, if any, formation of steam. With the mixtures containing a paraffin, on the other hand, there is always a considerable separation of carbon, and formation of steam, whilst the gaseous products contain, besides carbon monoxide and hydrogen, between 8 and 10 per cent. of methane, and appreciable quantities of unsaturated hydrocarbons and carbon dioxide. If the proportion of oxygen in the mixtures containing an olefine or trimethylene, be diminished, then on combustion, much water, as well as carbon is produced, the amount of water increasing as the supply of oxygen is reduced. When acetylene is burnt in the presence of a deficient supply of oxygen, however, no appreciable quantity of water is produced; part of the acetylene is burnt to carbon monoxide and hydrogen, and the remainder is decomposed into carbon and hydrogen, together with a small quantity of methane. Comparative experiments showed that mixtures of paraffin hydrocarbons and oxygen, and mixtures of corresponding olefines or acetylene with hydrogen and oxygen in proportions necessary to yield mixtures of the same ultimate composition as the paraffin mixtures, gave entirely different results on explosive combustion. As stated above, there is a considerable separation of carbon and formation of steam with the mixtures containing a paraffin, whereas with the mixtures containing an olefine or acetylene and hydrogen, no carbon separates and very little steam is formed.

The authors have succeeded in detecting the presence of aldehydes among the products of the explosive combustion of hydrocarbons, and also, in minute quantities, in the interconal gases obtained by means of a Smithell's flame-separator, in which either ethane or ethylene was being burnt, and among the products of an oxygen flame burning in an atmosphere of ethylene or of coal-gas.

The results of the present investigation are stated to show conclusively that the theory of the preferential

combustion of carbon must be discarded. There appears to be no essential difference between the mechanism of combustion below and above the ignition point, the first step in each case being the formation of an "oxygenated" molecule from the molecules of hydrocarbon and oxygen (see Chem. Soc. Trans., 1902, **81**, 536; 1903, **83**, 1074; 1904, **85**, 693, 1637; 1905, **87**, 1232; this J., 1901, 696; 1904, 601, 629; 1905, 792, 1005). Taking into consideration the results obtained in the previous paper (see preceding abstract), the authors consider that in the combustion of hydrocarbons, oxygen acts directly, rather than through the intervention of steam, as suggested by H. E. Armstrong (this J., 1905, 473). The explosive combustion of a typical olefine—propylene - may be represented as follows:—

$$CH_3.CH:CH_2 \xrightarrow{(1)} CH_3.CH:CH(OH) \xrightarrow{(2)} CH_2:CH_2 + CH_2O$$

$$CO + H_2$$

$$\xleftarrow{(3)} CH_2:CH(OH) \xrightarrow{(4)} CH(OH):CH(OH)$$

$$2CH_2O = 2CO + 2H_2$$

If the supply of oxygen be limited, the process might go as far as stage (3), and then the hydroxy compound, $CH_2:CH(OH)$, would break down into acetylene and water, or carbon, hydrogen and water. In the case of the paraffins, the decomposition may proceed according to the following scheme:—

$$CH_3.CH_2.CH_3 \rightarrow CH_3.CH_2.CH_2(OH) \rightarrow CH_3.CH_2.CH(OH)_2$$

$$CH_3.CH_2.CHO + H_2O$$

the aldehyde then being decomposed with production of carbon monoxide and a lower paraffin, which latter is, in turn, decomposed in a similar manner; or, the primary oxidation product, $C_nH_{2n+1}OH$ may decompose into steam and an olefine, the latter being then burnt in its own peculiar way. The end result would be the same in both cases.—A. S.

English Patents.

Gas for illuminating, heating or power purposes; Manufacture of —. H. S. Elworthy, St. Albans, and E. H. Williamson, London. Eng. Pat. 7713, April 11, 1905.

In the manufacture of gas rich in methane, according to the processes described in Eng. Pats. 12,461 of 1902, and 14,333 of 1904 (this J., 1903, 900; 1905, 1006), the gaseous mixture, either before or after treatment with metallic nickel, is mixed with a considerable excess of hydrogen or methane. The gas produced may be passed through retorts wherein coal is undergoing distillation, or may be mixed in any desired proportion with coal gas or other combustible gas.—H. B.

Gas producer. T. W. S. Hutchins, Blackpool. Eng. Pat. 11,657, June 3, 1905.

The producer, which is designed to be used as a suction apparatus with bituminous fuel, has a rectangular combustion chamber divided, up to a suitable height, into two chambers by means of a vertical mid-feather of refractory material. On the top of the latter rests an iron pipe, serving as vaporiser, which extends through the shell of the producer, water being admitted along with air at one end, whilst the other communicates with a valve, by means of which the mixture of air and steam may be admitted alternately to the lower regions of the two chambers. The gases thus pass up on one side of the mid-feather and descend on the other to the outlet at the base. The direction of the gases is reversed periodically by means of an automatic device, consisting of a two-chambered tilting tank, into which water flows continuously, the oscillations of the tank, as the chambers alternately fill with water, effecting the simultaneous reversal of the inlet and outlet valves.—H. B.

Gas from carbonaceous materials; Manufacture of —. G. Wilton, London. Eng. Pat. 25,275, Dec. 5, 1905.

The gas entering the hydraulic main, is caused to pass directly through a current of cooled gas-liquor kept constantly flowing through the main, for the purpose of increasing the cooling effect and the deposition of the tar.—H. B.

Gas analysis; Apparatus for use in —. C. A. Hartung. Eng. Pat. 17,708, Sept. 1, 1905. XXIII., page 561.

Filaments for electric incandescent lamps. E. L. Frenot, Paris. Eng. Pat. 8891, April 27, 1905. Under Int. Conv., May 7, 1904.

See Fr. Pat. 344,759 of 1904; this J., 1904, 1206.—T.F.B.

Incandescence lamp with filament of metallic tungsten; Electric —. W. P. Thompson, London. From Deutsche Gasglühlicht Akt.-Ges. (Auergas.), Berlin. Eng. Pat. 18,814, Sept. 18, 1905.

See Fr. Pat. 357,868 of 1905; this J., 1906, 116.—T. F. B.

United States Patents.

Fuel; Apparatus and process for the combustion of pulverulent —. A. Moore, Portland, Colo. U.S. Pat. 820,235 and 820,236, May 8, 1906.

The pulverulent fuel is supplied to the combustion-chamber through a tube, which is surrounded by an annular jacket. The annular space is divided by partitions into a number of passages through each of which a separately controlled supply of air or other fluid supporter of combustion is admitted under pressure. By varying the ratios of the pressures under which the air is supplied through the different air passages, the jet or current of pulverulent fuel may be directed towards any desired point in the combustion-chamber.—W. H. C.

Gas-producer. E. N. Trump, Syracuse, N.Y. U.S. Pat. 813,600, Feb. 27, 1906.

The producer, which is of the blast type, has a stationary base-plate, separated from the lower end of the combustion chamber by an interval sufficient to admit of the rotation, in a horizontal plane, of a radial scraper, or ash-deflector, which slowly sweeps over the surface of the base plate, expelling the ash at its circumference, and, on account of the subsidence of the fuel in the track of the scraper, causing a continual disturbance of the whole bed of fuel. In this way clinkering is prevented. The outer end of the scraper is supported by a ring which surrounds the lower end of the producer and is caused to rotate slowly by an electric motor. To ensure the uniform distribution of the fresh fuel, the feed hopper is provided at its lower end with a horizontal plate, separated from the hopper by an interval sufficient to admit of the rotation of a series of rotating arms, which sweep the fuel over the edge of the plate.—H. B.

Gas generating machine. O. V. Monroe, Assignor to General Patent Promoting Co., Portland, Oreg. U.S. Pat. 819,074, May 1, 1906.

The gas generator consists of a tank divided into three compartments. The upper compartment serves as a storage reservoir, the lower compartment as an air-chamber, and the intermediate compartment as a carburettor. The bottom of the carburettor has a central aperture over which a hood in the form of a truncated cone is secured. The air-inlet pipe passes through the opening in the upper part of the hood. A suitable valve controls the admission of air through this pipe. A gas outlet is provided on the carburettor, which is connected with the storage reservoir by a vent pipe and by a feed pipe. The reservoir end of this latter pipe is covered with a screen and protected by a dam in front of it. A vaporiser within the carburetting chamber consists of a disc with a central aperture over which a conical hood is fitted covering the air inlet. An inverted conical member within this hood holds a guide-rod in position which leads into the air inlet pipe. Channels are formed by partitions depending from the disc and baffle-plates are provided in these channels. An annular float surrounds the disc at its periphery, which is adjustably secured to the disc. The disc is covered by a roof fitted on the conical hood.

—R. L.

Gas producer. C. H. Morgan, Worcester, Mass. U.S. Pat. 819,075, May 1, 1906.

THE chamber of a gas producer has a cover and a tuyère depending from the cover, a rotating sleeve being fitted round the tuyère and moving concentrically with the axis of the chamber by means of an internal gear and pinion. The fuel is admitted through an opening in the cover, eccentric to the axis, and the top of the fuel is levelled by a scraping blade fixed tangentially to the sleeve and projecting beneath the opening in the cover. —R. L.

Hydrocarbon and combustible gas; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 819,506, May 1, 1906.

HYDROCARBONS are produced by exposing a gaseous mixture of ketones and steam to the action of heat. Thus, methane is formed by the treatment of acetone or dimethyl-ketone. A combustible gas is produced by exposing a mixture of a ketone and superheated steam to the action of incandescent carbon.—R. L.

Gas; Method of manufacturing ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,661, May 1, 1906.

THE process consists in burning oil and passing the highly heated products of combustion successively through two chambers filled with loosely-piled refractory material, thus highly heating the same, then shutting off the air and fuel, and passing, in the opposite direction, steam through both chambers and hydrocarbonaceous material through the second chamber to make gas. The gas-making steam and hydrocarbons are then shut off, and air is admitted to burn off the coke deposited from the hydrocarbons. The gas resulting therefrom is used again in heating the refractory material. Or else, the gas produced in the coking operation may be used for heating, and the gas made in burning off the coke may be added to the gas produced from the oil. —R. L.

Gas-making apparatus. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,662, May 1, 1906.

IN this gas-making apparatus a gas generating chamber, furnished with loosely-piled refractory material, is combined with a coking and combustion chamber at the gas-outlet end, the outlet pipe leading from the top of the combustion chamber. Means are provided to admit oil and air to the combustion chamber and to admit steam and oil to the generating chamber, and to close each of these inlets independently, as well as a flue and auxiliary flue on the end of the generating chamber opposite the gas outlet. Carbonaceous material can be charged into the lower portion of the combustion chamber through a door independent of the oil inlet, the combustion chamber having a transverse wall, against which the flames of the burning oil impinge. (See preceding abstract.)—R. L.

Coking and making gas; Method of ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,663, May 1, 1906.

THE method of simultaneously coking and making gas consists in charging hydrocarbonaceous material into a coking chamber, then admitting oil and air into this chamber, and burning the oil above the hydrocarbon, whilst at the same time a body of refractory material is heated and the carbonaceous material partly coked. The air supply is then shut off, but the admission of oil continued, and the vapours of the oil, together with the vapours produced from the hydrocarbons, are passed through the refractory material to make gas.—R. L.

Gas; Apparatus for generating ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,666, May 1, 1906.

A WALL extending from the top to a point near the bottom divides the gas generator centrally. An upper and a lower pile of regenerative material are placed on each side of this wall. The generator is furnished with a fluid-fuel inlet at each side above the lower pile, a gas outlet and fluid-fuel inlet below all the regenerative material, a steam inlet at each side above the upper pile, a flue for the products of combustion at each side of the top, and an air-blast conduit for conducting air to the top at each side, the flues and conduits being controlled by suitable valves.—R. L.

Furnace [Gas producer]. F. W. Burger, Assignor to Fort Wayne Foundry and Machine Co., Fort Wayne, Ind. U.S. Pat. 819,849, May 8, 1906.

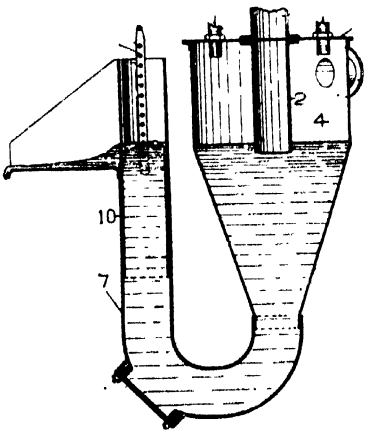
THE "fire-pot" of a gas-producing furnace is surrounded by a chamber into which moisture is introduced through a pipe, and which is connected by another pipe to the ash-pit. Air is introduced beneath the grate by a pipe or "air-duct" terminating in the ash-pit.—W. H. C.

Gas-purifying apparatus. A. M. Gow, Edgewood Park, Pa., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 815,812, March 20, 1906.

WITHIN a horizontal casing, the bottom of which is open and rests in a water tank, there extends a rotatable shaft carrying, at right angles to its axis, a number of dirt-collecting devices, which rotate with the shaft, and alternate with series of stationary, radially-fixed vanes. Each dirt-collector is built up of a number of blades, bent over along one edge. A stream of water, and the gas to be cleansed, are admitted at one end of the casing; the water is broken up into spray by the first revolving dirt-collector; the solid particles of dirt, becoming wet, are caught by the bent-over edges of the blades and impelled centrifugally to the periphery, finding their way to the water tank below; whilst the gas, on passing from the first collector, is guided by the stationary vanes in the proper direction against the second dirt-collector, and so on.—H. B.

Gas-washer. L. P. Lowe, San Francisco, Cal. U.S. Pat. 819,660, May 1, 1906.

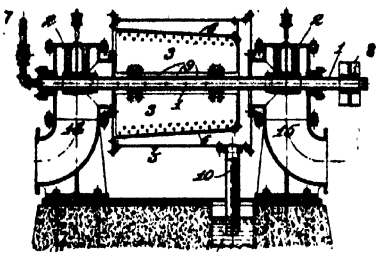
THE gas-washer proper, 4, is provided with a water-inlet pipe, and has a conical lower portion. It is connected



at the bottom to a water-outlet pipe, 7, which has the form of an inverted siphon. In the rising limb of the water-outlet pipe is a pipe, 10, which can be moved up and down, and the position of which is so adjusted that the discharge of the water can take place only at a point above the level of the bottom of the gas-supply pipe, 2. —A. S.

Gas; Machine for cleaning —— *[from tar and solid matter].* C. O. Nordensson, Scane, Sweden, Assignor to J. A. Laird, St. Louis, Mo. U.S. Pat. 820,247, May 8, 1906.

A HOLLOW shaft, 1, having radial perforations, 9, and beater-blades, 3, is mounted in the journals, 2, and can be rotated by the pulley, 8. The blades are surrounded by a conical perforated casing, 6, and by an outer casing, 5. The hollow shaft has an inlet pipe, 7, and the outer casing,



5, has a sealed drain pipe, 10. The gas enters through the pipe, 14, into the interior of the perforated casing and escapes through the pipe, 15, at the other end.—W. H. C.

Carbide; Manufacture of ——, *also of superheating compound for use therein, and of a lining for the electric furnace.* H. L. Hartenstein, Assignor to Electro Chemical and Development Co. U.S. Pats. 819,218–819,223, May 1, 1906. XIA., page 544.

FRENCH PATENTS.

Gas for lighting, heating and power purposes; Manufacture and composition of ——. H. S. Elworthy. Fr. Pat. 360,902, March 17, 1905.

SEE Eng. Pat. 7713 of 1905; preceding these.—T. F. B.

Gas from heavy oils, for operating motors; Producer for production of permanent ——. J. E. M. Briest. Fr. Pat. 360,541, Dec. 16, 1905.

THE exhaust outlets from the cylinders of an explosion motor are connected to a common exhaust pipe, in the walls of which are cast or bored a series of channels. Into the latter the oil is fed, encountering a current of air which is drawn in simultaneously, permanent gas being produced from the mixture as it passes through the hot channels on its way to the cylinders. On starting the motor, the exhaust pipe may be heated beforehand by means of a burner, or the engine may first be driven by petrol until the channels in the exhaust pipe have become hot enough.—H. B.

Carburetting apparatus for the production of [*air-*] *gas for lighting or heating.* L. Robert. Fr. Pat. 360,677, Dec. 19, 1905.

AIR is driven by a meter-drum, the rotation of which is caused by a falling weight, into a floating-bell gas holder, and passes thence through zig-zag passages in a carburetting box containing volatile hydrocarbon. In order that the production of gas may not cease during the periodical winding up of the small drum, on which is wound the cord of the falling weight, a loose pinion wheel and spring catch device is provided, enabling the meter-drum to remain stationary during the re-winding, the floating bell maintaining the supply of air in the meanwhile.—H. B.

Gases; Apparatus for the [*automatic*] *analysis of* ——. "Monopol" Betriebs-kontroll-Apparate, K. Steinbock. First Addition, dated Nov. 28, 1905, to Fr. Pat. 359,352, Nov. 2, 1905 (this J., 1906, 394). Under Int. Conv., April 12, 1905.

IMPROVEMENTS in the constructional details of the apparatus referred to in the principal patent are here described.—H. B.

Purifier for [*blast furnace*] *gases.* E. Weisse and C. Kieselbach. Fr. Pat. 360,720, Dec. 20, 1905.

WITHIN a vertical casing, upwards through which the gases flow, is arranged a number of vertical pipes, each containing a helical blade, forming a helical passage for the gases throughout the length of the pipe. The gases, on flowing upwards through each pipe, are thus given a whirling motion, the particles of dust, &c., being impelled centrifugally against the perforated walls of the pipe, where they meet with currents of water, which trickles down the interior and exterior of the pipes, and carries the impurities off to the bottom of the casing. Two tiers of pipes may be arranged within the casing, the pipes in the lower tier, through which the gases first pass, being irrigated with water, for the removal of the dust, &c., whilst the upper pipes, serving merely to retain the water-spray carried off from the lower tier, are not irrigated, but have perforated walls through which the intercepted water may pass off.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 468.)

Petroleum industry of Texas. For. Off. Ann. Series, No. 3585.

THE petroleum industry of Texas has been of growing importance during the last few years. Texas produced 30,404,203 barrels of 42 galls. each of crude petroleum in 1905—the greatest yield of oil ever credited to a single State in a year. Texas was second in 1904 with 22,241,413 barrels. All but 595,306 barrels of the output came from the Gulf coast districts in the south-eastern part of the State. The production of the Corsicana and Clay County fields, 417,255 barrels, represents the total light oil output in Texas. All of the Corsicana product and 66,160 barrels of the Clay County oil went to the refineries. Oil testing 28° B. is found at Powell and at Batson, one of the south-east Texas districts. Most of the south-east Texas oil, however, tested 20° to 24° B.

The great increase in south-east Texas production resulted from the unprecedented output at Humble, the Harris County district, where a 7000-barrel gusher, brought in on January 7, started development on a big scale. Several wells have yielded nearly 1,000,000 barrels each. During the 12 months of 1905 the Humble field produced 18,066,428 barrels of oil, excluding 75,000 barrels of inferior product, making a total gross output of 18,141,428 barrels for the year. Batson, which produced 10,904,737 barrels in 1904, dropped to 3,790,628 barrels in 1905. Sour Lake made 3,369,012 in 1905, and Spindle Top, now five years old as an oil field, produced 1,600,378 barrels.

Rail consignments of south-east Texas oil in 1905, representing consumption as fuel by railroads, power plants and other industries in Texas, amounted to 7,881,550 barrels, as against 7,067,673 barrels in 1904.

Shipments of crude oil from Port Arthur and Sabine in 1905 amounted to 6,595,706 barrels, against 10,031,459 barrels in 1904. The south-east Texas refineries increased their runs very largely, handling 7,000,000 barrels.

[T.R.]

ENGLISH PATENT.

Wood tars and resin oils; Distillation and oxidation of ——. H. Noordlinger, Floersheim on the Maine, Germany. Eng. Pat. 8590A, Sept. 15, 1905.

THE process described in Ger. Pat. 166,350 of 1903 (this J., 1906, 367) for the oxidation of beech-wood tar, is applied to the oxidation of all kinds of wood tars and resin oils to form alkali-soluble products.—T. F. B.

UNITED STATES PATENT.

Ammonia from gas; Process of recovering ——. E. J. Duff, Liverpool. U.S. Pat. 820,039, May 8, 1906.

SEE Fr. Pat. 352,180 of 1905; this J., 1905, 884.—T. F. B.

FRENCH PATENT.

Ammonia derived from the carbonisation of coal; Uniform process for the recovery of ——. W. Feld. Fr. Pat. 360,528, Dec. 15, 1905. Under Int. Conv., Dec. 15, 1904.

IN order to recover ammonia from the gases in a purer

and more concentrated form, the tar and water are successively condensed out at a temperature exceeding 40° C., whereby they are eliminated without retaining an appreciable quantity of ammonia, and the gases are then scrubbed with appropriate quantities of water, at about 20° C., or with solutions of salts, such as magnesium chloride, at 40°—60° C. Preferably the hot crude gases are first treated, at 100°—200° C., with a spray of hot tar, and are then washed with a more liquid substance, such as tar oil, to remove the last traces of tarry mist. The gases, having a temperature which may be between 40° and 150° C., are next treated with a spray of hot water containing a little milk of lime. This condenses the water mist, without retaining an appreciable quantity of ammonia, any non-volatile ammonium salts being decomposed by the lime. The gases are then scrubbed directly with the salt solution, or, if they are to be scrubbed with pure water, they are first cooled to about 20° C.

—H. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 472.)

Nitrophenols; Constitution and colour of ——. G. v. Georgievics. Ber., 1906, **39**, 1536—1538.

Aqueous solutions of picric acid, when heated, become darker. On cooling, the original colour reappears Alcoholic solutions behave similarly, although the change is not so marked. The author concludes that picric acid is capable of existing in two modifications. Two dyebaths were prepared with equal quantities of wool, picric acid, water and sulphuric acid. In one case, dyeing was done in the cold. The other dyebath was heated in the usual way. Both were then allowed to stand for a few days, until the exhaust liquors were found to be equal in strength, and the wool was then examined in a Wolff's colorimeter. The wool which had been dyed cold was of a much lighter shade than that which had been first dyed at the boil. On boiling with water for some time, it became just as dark as the other sample. A portion of the picric acid, it is said, must have been taken up in a less deeply coloured modification, which is converted into the darker form by boiling with water.—H. L.

Anüline-sulphonic acids; Acylation of ——. G. Schroeter. Ber., 1906, **39**, 1559—1570.

The authors prepared acetylnaphthionic acid, acetyl-1.5-naphthylaminesulphonic acid, benzenesulphosulphanilic acid ($C_6H_5SO_2.NH.C_6H_5.SO_3H$) and benzenesulphonaphthionic acid ($C_6H_5SO_2.NH.C_{10}H_6.SO_3H$1:4). These substances do not in general combine with diazo compounds, to form true azo bodies, but yield coloured, well crystallised diazonium salts with diazotised nitranilines, benzidine, and α-naphthylamine. Diazotised *p*-nitraniline, however, behaves exceptionally, and may be combined with benzenesulphosulphanilic and benzenesulphonaphthionic acids to form true azo compounds which dye wool in yellow and orange shades respectively. The chlorides of the above acylamino-sulphonic acids can be prepared by triturating the sodium salts with phosphorus pentachloride; they are stable, well characterised substances. By condensing benzenesulphosulphanilic acid chloride and benzenesulphonaphthionic acid chloride with cellulose, and then coupling them on the fibre with *p*-nitrophenyldiazonium acetate, the authors endeavoured to produce cellulose esters of the corresponding azo dyestuffs. Thus cotton was treated for some time under a reflux condenser with a boiling chloroform solution of benzenesulphosulphanilic acid chloride, m. pt. 177° C., containing a little pyridine. After being thoroughly washed first with chloroform, then with water, the cotton was found to contain 2·77 per cent. of sulphur. It was dyed yellow after development with diazotised *p*-nitraniline. Similarly mercerised cotton treated with a chloroform solution of benzenesulphonaphthionic acid chloride, m. pt., 171° C., and developed with diazotised *p*-nitraniline was dyed orange brown.—H. L.

Methylene Azure; Chemical nature of ——. A Bernthsen. Ber., 1906, **39**, 1804—1809.

The author confirms the recently published work of Kehrmann (see Ber. **39**, 1403; this J., 1906, 469), who showed that "Methylene Azure" is a mixture of dimethyl- and trimethyl-thionine. Methylene Azure was first obtained by Bernthsen (see Annalen, **230**, 169) by heating Methylene Blue base with alkalis. A better yield may be obtained by oxidising Methylene Blue with potassium bichromate and dilute sulphuric acid.—H. L.

1.4-*Anthraquinone.* K. Lagodzinski. Ber., 1906, **39** 1717—1718.

The author claims priority with regard to the discovery of the above compound (compare Dienel, this J., 1906, 309). He found shortly after the discovery of α-anthrol by Schmidt (this J., 1904, 182) that the latter formed red azo dyestuffs with benzene-diazonium compounds, from which 1.4-aminoanthrol was obtained by reduction in alkaline or acid solution, and which, in its turn, was converted into 1.4-anthraquinone by oxidation with ferric chloride.—D. B.

α-Naphthoflavonol. G. Woker. Ber., 1906, **39**, 1649—1653.

α-Naphthoflavanone,

$$C_{10}H_6\!<\!\begin{matrix}O\text{—}CH.C_6H_5\\ CO.CH_2\end{matrix}$$

was obtained by boiling the chalkone,

$$(HO)C_{10}H_6.CO.CH{:}CH.C_6H_5$$

in alcoholic solution with hydrochloric acid. It crystallises from alcohol in colourless needles, exhibiting a bluish-violet fluorescence and melting at 126° C. When treated with amyl nitrite and hydrochloric acid, it is converted into the isonitroso derivative, which forms yellow leaflets melting at 173°—174° C., and yields α-naphthoflavonol,

$$C_{10}H_6\!<\!\begin{matrix}O\ .\ C.C_6H_5\\ CO.C(OH)\end{matrix}$$

when boiled with a mixture of acetic and dilute sulphuric acids. The latter compound crystallises from alcohol in green leaflets, which melt at 210° C. The sodium salt is coloured intensely yellow and is only sparingly soluble in water; the acetyl derivative crystallises in lustrous laminæ, melting at 194°—195° C. The authors have effected a second synthesis of α-naphthflavone from the above flavanone by replacing a hydrogen atom in α-position by bromine, and treating the product in alcoholic solution with potassium hydroxide.—D. B.

Thio Indigo Red; a new synthetic dyestuff. E. Knecht. J. Soc. Dyers and Colourists, 1906, **22**, 156—159.

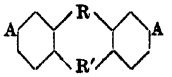
The author describes the preparation and method of using Thio Indigo Red (see this J., 1906, 367; also Fr. Pats. 359,398, 359,399 and 359,400; this J., 1906, 424, 426). This new dyestuff is more readily affected by reducing agents than indigo, but it and its leuco compound are more resistant to oxidising agents than Indigo and Indigo White. Cotton "bottomed" with Thio Indigo Red, and then treated in an Indigo vat containing a slight excess of hydrosulphite, is dyed an almost pure shade of indigo, practically all the red being "stripped." By "bottoming" first in the hydrosulphite vat with Thio Indigo Red, and then "topping" in the zinc vat with indigo, the author states that he obtained very promising effects. For instance, cotton "bottomed" with only a light shade of the new dyestuff, and then treated in an ordinary zinc indigo vat along with a piece of untreated white cotton, was dyed a blue of about (apparently) double the intensity of that shown by the plain cotton.

If cotton dyed a fairly heavy shade with Thio Indigo Red be immersed in concentrated nitric acid, the blue shade changes to a yellow shade of red, whilst the cotton is at the same time mercerised.—A. S.

Dyestuffs; Fluorescence of ——. J. Formánek. Z. Farben-Ind., 1906, **5**, 142—146; 164—169.

The author considers that, in most cases, fluorescence is shown in aqueous, alcoholic or amyl alcohol solution,

only by those dyestuffs which can be derived from the type:



where R represents oxygen, sulphur or nitrogen, and R′ carbon or nitrogen, whilst AA are auxochrome groups in the para position to the fundamental element or atomic group. If the auxochrome groups are amino groups, the hydrogen atoms of these may be replaced by alkyl or benzyl radicals without the fluorescence being destroyed. The benzene rings may be replaced by naphthalene or phenanthrene nuclei. The fluorescence is influenced by the nature of atoms or atomic groups connected directly to the benzene rings, and also by the solvent used.—A. S.

Indigo; Java ——. For. Off. Ann. Series, No. 3580.

The planting of indigo has still further diminished: in fact, many of the lands on which indigo has hitherto been cultivated have now been turned into sugar plantations. Japan and Russia, the two largest consumers of Java indigo, have not taken anything like the quantities which they did in previous years. There is still a considerable quantity used locally for the native dyeing industry, but the future is not looked forward to hopefully Exports for the past three years were:—1903, 1,297,274 lb.; 1904, 1,070,601 lb.; 1905, 540,452 lb. [T.R.]

Dyewood trade of Havre. For. Off. Ann. Ser., No. 3586.

The importations of dye woods in 1905 showed a further decrease from 1904 in logwood and yellow woods. The logwood import amounted to 33,143 tons, against 45,515 tons in 1904 and an average of 49,703 tons in the five years 1900—04. Of yellow woods only 2906 tons were imported, against 7640 tons in 1904 and an average of 8645 tons in the five years 1900—04, and of red woods 1191 tons were imported, against only 419 tons in 1904, and an average of 965 tons in the previous five years. Of the logwood 24,008 tons came from Haiti, 966 tons from San Domingo and 4,890 tons from Jamaica. The amount of quebracho wood imported was 10,044 tons, against 22,075 tons in 1904 and an average of 18,460 tons in the five years 1900—04. [T.R.]

Dyestuff and process of making same; Anthracene ——. O. Bally and M. H. Isler, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 820,379, May 8, 1906.

See Sixth Addition, of June 22, 1905, to Fr. Pat. 349,531 of 1904; this J., 1906, 14.—T. F. B.

French Patents.

Lakes from sulphide dyestuffs; Process for producing fast ——. L. Cassella und Co. Fr. Pat. 360,825, March 13, 1905. XIIIA., page 546.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 475.)

Cotton; Insects which attack ——. *in Egypt.* G. C. Dudgeon. Bull. Imp. Inst., 1906, **4**, 48—52.

The most destructive insect pest in Egypt is the boll worm, *Earias insulana*, which has reduced the yield of many plantations by as much as 75 per cent. It also feeds on varieties of *Hibiscus* and on "volunteer cotton." The elimination of the pest clearly lies in the destruction of all *Hibiscus* and "volunteer cotton" at a time when the cotton stalks have been uprooted and dried. The cotton worm does much harm, to cotton and "berseem," in many districts. Preventative measures against this worm consist in preparing the soil as long as possible before sowing, in order to starve out the worms, and the removal and destruction of all leaves on which eggs have been laid. Other insects which do much damage are the cut worm, *Agrotis ypsilon*, the asal fly, *Aphis sorghi*, and the Egyptian cotton stainer, *Oxycarenus hyalinipennis*, but the latter does not seem to attack healthy cotton plants. Locusts have also caused considerable damage during the last two years.—W. P. S.

Fibres from Madras. Bull. Imp. Inst., 1906, **4**, 23—29.

The chemical and physical properties, &c., of six samples of *Agave* and *Furcraea* fibres received from Madras were as follows:—

	No. 1. *Agave Vera Cruz* from Chickmagalur	No. 2. *Agave Vera Cruz* from Madras.	No. 3. Sisal Hemp from Madras.	No. 4 Sisal Hemp from Bangalore.	No. 5. *Agave Wightii* from Madras.	No. 6. Mauritius Hemp from Bangalore.
Moisture, per cent.	9·1	9·1	9·3	9·3	9·9	9·3
Ash, per cent.	2·5	3·4	1·5	1·2	2·6	2·1
Loss on hydrolysis (*a*), per cent	19·8	19·5	13·6	11·4	16·3	17·1
,, ,, ,, (*b*), per cent	21·4	21·6	16·9	16·0	18·7	23·9
Loss on acid purification, per cent.	5·7	4·5	2·9	2·1	2·9	6·1
Loss on mercerising, per cent.	12·2	12·7	10·8	8·4	10·9	12·0
Gain on nitration, per cent.	39·1	38·0	33·1	41·2	14·2	28·0
Cellulose, per cent.	71·4	72·5	75·7	77·6	75·2	70·3
Length of staple, feet	3—4	3·75—4·5	3·75—4·25	4·5—5	2—2·5	3·5—4·25
Comparative strength	55·3	62·7	87·5	100	57·9	81·0
Value per ton, London	£28	£22	£30	£32	£23	£24

The colour and appearance of the samples were:—No. 1, dirty white, badly cleaned; No. 2, brownish, badly cleaned; No. 3, pale straw, well cleaned; No. 4, pale straw, clean but rather coarse; No. 5, pale straw, fairly clean; No. 6, pale greenish-brown, imperfectly prepared. —W. P. S.

English Patent.

Colouring matters obtainable from indophenol [*Sulphide dyestuffs*]; *Sulphurised* ——. C. Ris, Basle, Switzerland. Eng. Pat. 17,540, Aug. 30, 1905.

See Fr. Pat. 357,587 of 1905; this J., 1906, 175.—T. F. B.

United States Patents.

Dye; Red sulphur —— *and process of making same* [*Thio-indigo red*]. P. Friedlaender, Vienna, Assignor to Kalle und Co., Akt.-Ges., Biebrich, Germany. U.S. Pat. 819,348, May 1, 1906.

See Fr. Pat. 359,398 of 1905; this J., 1906, 424.—T. F. B.

Paranitraniline Red lake for calico printing; Preparation of ——. P. P. Wicktoroff and N. W. Philippoff. Z. Farben-Ind., 1906, **5**, 182—184.

'A bright Paranitraniline Red lake is obtained by precipitating the dyestuff on a substratum of starch according to the following recipe:—1·5 kilos. of β-naphthol are dissolved in 2·9 kilos. of caustic soda of 20° B., 15 kilos. of castor oil soap, and 10 kilos. of boiling water. This solution is cooled to 6° C., and then poured into a mixture

of 19 kilos. of wheat-starch with 15 kilos. of water. The diazo solution contains 3 kilos. of *p*-nitraniline, 1·8 kilos. of nitrite, 9·2 kilos of hydrochloric acid of 20° B., 10 kilos. of water, 30 kilos. of ice, and 10 kilos. of acetic acid of 6° B. The acetic acid is added to decompose the soap, and precipitate the fatty acid. This solution is filtered and allowed to run slowly into the β-naphthol solution with good stirring. The yield of dry lake is 25·6 kilos., and the cost is stated to be low in comparison with that of competing products on the market. The printing colour consists of 6 kilos. of this lake, 1 kilo. of gum tragacanth solution 1:9, 4 kilos. of blood albumin 2:3, 2 kilos. of olive oil and turpentine mixed in equal proportions, and 600 grms. of formaldehyde-ammonia, prepared from 3 kilos. of 40 per cent. formaldehyde and 2 kilos. of 25 per cent. ammonia. A short steaming is sufficient to fix this colour, as formaldehyde is set free and rapidly coagulates the albumin. After "chloring" the shade is stated to be equal to that of Paranitraniline Red produced on the fibre, but the colour is very loose to rubbing. The authors recommend the lake prepared as above in particular for preparing a red discharge colour on an Indigo Blue ground.—H. L.

Paranitraniline; Red ——. H. Pomeranz. Z. Farben-Ind., 1906, **5**, 184—185.

The author states that the essential point in producing a bright Paranitraniline Red on cloth is that both components, in particular the sodium β-naphtholate, are in solution at the moment of combination. In actual practice, the goods are generally padded with a solution containing β-naphthol (20—25 grms. per litre), rather more than one equivalent of caustic soda, and a quantity of soap. They are then dried in the hot flue, which leaves in them a certain amount of moisture. An excess of alkali is necessary, because sodium β-naphtholate is dissociated in dilute aqueous solution, but a large excess is detrimental, according to the author, because caustic soda salts out sodium β-naphtholate, and thus tends to throw it out of solution at the moment of combination. The beneficial action of a soap is stated to be due to the solubility of β-naphthol in soap. Thus, 50 grms. of fatty acid neutralised with caustic lye and diluted to a litre, will dissolve 25 grms. of β-naphthol at 70°—80° C. On cooling, only about one-fifth to one-sixth of the β-naphthol crystallises out. The author states that a padding solution made up in this way, to which just sufficient caustic soda has been added, to prevent the β-naphthol crystallising out on cooling, yields the best results. Cloth prepared in this way is least affected by steaming. On the other hand, more than the above quantity of fatty acid is deterious to the shade. Castor oil soap is particularly suitable.—H. L.

Azo-dyestuffs; Production of —— in the fibre, and the influence of fats in the process. E. Justin-Müller. Sixth Internat. Congr. of Appl. Chem. Z. angew. Chem., 1906, **19**, 852.

The intensity of the colour depends greatly on whether the fabric, soaked in the naphthol-solution, is dried or not before combination with the diazo solution. The depth of tint depends firstly, on the penetration of the fibre by the β-naphthol derivative, and secondly, on the colloidal condition of the dyestuff. The impregnation of the fibre with soluble fats greatly favours the conversion of the dyestuff into the colloidal state.—J. T. D.

English Patents.

Dyeing and printing Aniline Black; Method of ——. W. Epstein, Frankfort a/Main, Germany (formerly of Shipley, Yorks.). Eng. Pat. 17,315, Aug. 26, 1905.

The fabric is impregnated or printed with a solution of a suitable oxidising agent, and is then exposed to the vapour of aniline or one of its homologues, alone, or diluted with a suitable gas. Cotton may be impregnated or printed with a solution of 2·2 lb. of potassium bichromate and 12 lb. of ferric sulphate in 20 galls. of water, and exposed in a chamber heated to about 130° F., to the action of aniline vapour; it is then passed through a bath made by diluting the first bath with 10 times its volume of water, rinsed, soured, rinsed again, and finally soaped and finished as usual.—T. F. B.

Dyeing fabric; Apparatus for ——. E. A. F. Zillessen, Passaic, U.S.A. Eng. Pat. 2220, Jan. 29, 1906.

See U.S. Pats. 813,478 and 813,479 of 1906; this J., 1906, 372.—T. F. B.

Waterproofing composition. J. A. Shepherd, Pollokshields, Glasgow. Eng. Pat. 17,057, Aug. 23, 1905.

A waterproofing composition for fabrics is prepared by mixing together jelly soap, 36 parts; gum tragasol, 32 parts; wax, 7 parts; and water, 37 parts. The composition is "set" in the fabric by passing the latter through a bath containing aluminium sulphate.—T. F. B.

United States Patent.

Silk; Process of charging ——. G. Gianoli, Milan, Italy. U.S. Pat. 819,751, May 8, 1906.

See Eng. Pat. 25,728 of 1904; this J., 1905, 129.—T. F. B.

French Patents.

Silk; Process for the manufacture of artificial ——. P. Germain. Fr. Pat. 360,395, Feb. 22, 1905.

A homogeneous paste is prepared by dissolving nitrocellulose, celluloid and naphthalene in acetone, and adding to the solution powdered barium sulphate. The paste is then spun into threads which are at once immersed in dilute sulphuric acid. This removes the acetone which may be recovered for further use. The excess of acid remaining in the threads is neutralised by treatment with barium hydroxide solution. Other means, such as heating, &c., may be employed for the removal of the acetone. The threads are not denitrated; and they may be redissolved when desired.—W. P. S.

Hydrosulphites [Hyposulphites]; Rendering aqueous solutions of —— stable. Soc. Anon. Plaques et Papiers Photographiques A. Lumière et ses Fils. Fr. Pat. 360,980, March 21, 1905. VII., page 537.

Discharging on coloured grounds; Method of ——. Badische Anilin und Soda Fabrik. First Addition, dated Oct. 21, 1905, to Fr. Pat. 355,117, June 9, 1905.

See Eng. Pat. 15,524 of 1905; this J., 1906, 474.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 475.)

English Patents.

Dyeing hairs; Means for and process of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 14,212, July 10, 1905.

Hairs are dyed fast shades by treatment with an alkaline solution of a sulphonic acid of *p*-phenylenediamine, *p*-toluylenediamine, *o*- or *p*-aminophenol, *p*-aminodiphenylamine, &c., with or without an oxidising agent. Fast reddish-brown shades may be produced by dyeing the hair with a solution of 4 parts of *p*-aminodiphenylaminesulphonic acid, 2 parts of calcined sodium carbonate, and 4 parts of a 25 per cent. solution of sodium hydrogen sulphite in 100 parts of water, to which is added 50 parts of 3 per cent. hydrogen peroxide solution.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 478.)

Nitrogen; Oxides of ——, *and the chamber process* [*sulphuric acid*]. G. Lunge and E. Berl, Z. angew. Chem., 1906, **19**, 807–819, 857—869, and 881—894.

The authors summarise their results as follows:—

1. Liquid nitrogen peroxide, as well as the gaseous mixtures of NO_2 and N_2O_4 which it furnishes, gives accurate analytical results, when absorbed by concentrated sulphuric acid in an appropriate apparatus, even when diluted with considerable volumes of oxygen, nitrogen, or air, the ratio of nitrogen to oxygen being exactly that required on the hypothesis of the formation from the peroxide of equimolecular quantities of a nitroso-derivative ($ONO.SO_3H$) and a nitro-derivative ($NO_2.OH$). (See Raschig, this J., 1905, 923.) 2. Sodium hydroxide also gives accurate results when it absorbs nitrogen peroxide, whether as liquid or gas, alone or diluted with an inert gas such as nitrogen, both as to the amount absorbed and the proportions of nitrate and nitrite formed. If, however, the gaseous peroxide be diluted with oxygen or air, some of the nitrite is, at the moment of formation, oxidised to nitrate; such mixtures therefore cannot be analysed by absorption in sodium hydroxide. The sensitiveness of sodium nitrite to oxidation at the moment of its production probably has an important bearing on the question of the production of nitric acid or nitrates from nitrous gases. 3. Gaseous mixtures of nitric oxide and nitric oxide are also absorbed completely by sulphuric acid, provided the molecular ratio of the former to the latter is not greater than unity; no doubt, the peroxide is first converted into nitrosylsulphuric acid and nitric acid, but the latter as formed, is instantaneously reduced by the nitric oxide to nitrosylsulphuric acid, so that an equimolecular mixture of nitric oxide and nitrogen peroxide behaves as though it were nitrogen trioxide. Any excess of nitric oxide beyond this proportion will escape unabsorbed. 4. The mixtures considered in 3 are not quantitatively absorbed by dilute solutions of sodium hydroxide; the peroxide gives nitrate and nitrite, but the nitric oxide cannot reduce the nitrate to nitrite sufficiently quickly and so escapes; thus there is a loss of nitrogen compound, and too high a ratio of nitrate to nitrite. In this respect (and no doubt in others), an equimolecular mixture of nitric oxide and nitrogen peroxide ($NO+NO_2$) is not equivalent to nitrogen trioxide (N_2O_3). 5. Not only is there no loss during the absorption of nitrogen peroxide by sulphuric acid, but the speed of absorption, even in 80 per cent. acid, is very great. Raschig's speculations based on the contrary propositions thus fall to the ground. 6. Rubber corks and connections must not be used where they will come into contact with nitrous gases. 7. When nitric oxide and excess of air are shaken with much water nitric acid is formed, no doubt through atmospheric oxidation of the first-formed nitrous acid. 8. Gaseous nitric oxide, mixed with excess of air, is oxidised directly to peroxide, *i.e.*, without passing through the intermediate stage of trioxide at all. The authors cannot discover, either in Raschig's observations or their own, the angle in the reaction-curve which, according to him, shows the completion of the rapid conversion into nitrogen trioxide and the beginning of the slow formation of nitrogen peroxide. 9. This argument for the existence of nitrogen trioxide having failed, and there being no other chemical argument in favour of its existence, and no physical one for temperatures above 50° C., there can be no justification for assuming the existence of nitrogen trioxide in any theory of the chamber process. 10. Chamber crystals are not nitrosulphonic acid, but nitrosylsulphuric acid; the nitrosyl formula must also be used for their solution in sulphuric acid. 11. Raschig's theory of the chamber process cannot be maintained: it ignores the existence of nitrosylsulphuric acid; it demands as intermediary an imaginary substance, nitrososulphonic acid, the assumption of which in no way simplifies our conceptions; it would involve the formation in the chamber of nitrous oxide, hydroxylamine and ammonia, none of which occurs; and it postulates the continual formation and reaction of nitrous acid, which also is not present. 13. Nitrosylsulphuric acid acts as carrier of oxygen. 14. Trautz' blue compound, SO_5NH_2 (called by Raschig nitrosisulphonic acid) is formed, though momentarily, in the reaction of nitrogen peroxide or nitrous acid on sulphurous acid, and in the reduction of nitrosylsulphuric acid. It is readily converted into nitrosylsulphuric acid, either by free oxygen or by nitrogen peroxide. The nitrosylsulphuric acid is then either hydrolysed into sulphuric acid and nitrous acid (which instantaneously resolves itself into nitric oxide, nitrogen peroxide, and water), or reacts, as in the Glover tower, with sulphurous acid, forming sulphuric and nitrosisulphonic acids. 15. The following are the reactions occurring in the chamber:—

1. $SO_2+NO_2+H_2O=O:N(OH)SO_3H$
2*a*. $2[ON(OH)SO_3H]+O=H_2O+2(O_2N.SO_3H)$.
$\downarrow$
$2(ONO.SO_3H)$
2*b*. $2[ON(OH)SO_3H]+NO_2=NO+H_2O+2(ONO.SO_3H)$
3*a*. $2(ONO.SO_3H)+H_2O=2SO_2(OH)_2+NO+NO_2$
3*b*. $2(ONO.SO_3H)+SO_2+2H_2O=H_2SO_4+2[ON(OH)SO_3H]$.
3*c*. $ON(OH)SO_3H=NO+H_2SO_4$
4. $2NO+O_2=N_2O_4$.

—J. T. D.

Nitric oxide; Formation of —— *at high temperatures.* W. Nernst. Z. anorg. Chem., 1906, **49**, 213—228.

The formation of nitric oxide from the air by the agency of electric sparks or the arc is known to be purely a heat phenomenon, and the author has experimentally investigated the reaction, $N_2+O_2=2NO$, at high temperatures, ascertaining the equilibrium concentration of the nitric oxide. Air was passed at known rates and in known quantities through electrically heated tubes of platinum or iridium, the temperature of which was measured by the thermo-electric junction or photometrically. It then passed on through concentrated sulphuric acid, from which the nitric oxide was afterwards liberated by mercury, and measured. The results obtained agreed well with those calculated. Equilibrium was found to be more rapidly established as the temperature increased. The following table illustrates how the equilibrium concentration (x) of nitric oxide, in volume per cent., varies with the temperature:—

Temp. °C.	x.
1227	0·10
1627	0·46
2027	1·23
2427	2·44
2827	4·39

When oxyhydrogen gas is exploded with air it has been shown by Bunsen and by Finckh (this J., 1905, 693) that nitric oxide is formed and that the amount varies with the pressure, *i.e.*, the time of reaction. The reason for this is now made clear, and by referring to the above table, the maximum amount of nitric oxide obtainable at the explosion temperature, about 2400° C., may be found.

—F. Sodn.

Nitric oxide; Decomposition velocity of ——. K. Jellinek. Z. anorg. Chem., 1906, **49**, 229—276. (Compare previous abstract.)

The reversible reaction $2NO \rightleftarrows N_2+O_2$ is found by the author to be bimolecular in either direction, between the temperatures 650° and 1750° C. Nitric oxide decomposes at a measurable rate even at 670°, the dependence of the decomposition constant k on temperature being expressed at high temperatures by the equation $\log k=AT+B$. The time required for the completion of half the decomposition of the gas at atmospheric pressure is calculated as $7{\cdot}35\times10^{3}$ minutes at 900° (absolute), and as $2{\cdot}25\times10^{-9}$ minutes at 3100° abs., about a billion times less. And,

starting with air, a still more marked variation is observed in the times necessary for the formation of one-half the possible quantity of nitric oxide. When oxyhydrogen gas is exploded with air, the actual heating time has been calculated from the above equation, assuming the temperature, and is of the order 10^{-4} seconds. In the decomposition of nitric oxide platinum proves to have a catalytic action, decreasing with rise of temperature, and iridium also acts as a catalyst.—F. Soddy.

Chromic acid; Constitution of ——. W. Manchot. Ber., 1906, **39**, 1352—1356.

When chromic acid oxidises ferrous, titanous, or uranyl salts in presence of potassium iodide, three equivalents of oxygen are liberated for each atom of iron (&c.), of which one goes to the iron (two to the uranium), while the rest liberate iodine. Chromic acid and anhydride, therefore, must have the constitutions,

$$(OH)_2Cr<^{O}_{O} \text{ and } O:Cr<^{O}_{O},$$

respectively. This accords with the old observation of Weltzien, confirmed by the author, that on heating potassium bichromate with sulphuric acid, ozone is evolved. Probably the first stage, in oxidations by chromic acid, is the attachment of the chromic acid molecule to the oxidisable substance.—J. T. D.

Barium carbonate; Dissociation of ——. A. Finkelstein. Ber., 1906, **39**, 1585—1592.

By passing air over barium carbonate heated in an electric furnace, and measuring the percentage of carbon dioxide in the issuing air, the relation between temperature and dissociation-pressure was studied.

The first step is the formation of a basic carbonate, probably $BaO,BaCO_3$, which melts at a lower temperature than the normal carbonate, and which, by coating the yet undecomposed carbonate, somewhat interferes with the progress of the reaction. The fused basic carbonate seems to dissolve both the oxide and the normal carbonate. Complete dissociation of the basic carbonate at the atmospheric pressure occurs about 1450° C. The basic carbonate is formed from its constituents with absorption of heat. The specific heat of barium carbonate appears to vary with the temperature in the same fashion as that of carbon dioxide. Incidentally, it was found that barium carbonate obstinately retains traces of moisture, which can only be completely removed by heating to 1000° C. in a stream of dry carbon dioxide.—J. T. D.

Sodium sulphates; Acid ——. J. D'Ans. Ber., 1906, **39**, 1534—1535.

If a solution containing sodium sulphate and sulphuric acid in equimolecular proportions be evaporated, needle-like crystals separate, which, after washing first with dilute sulphuric acid and alcohol, then with alcohol and ether, have the composition expressed by $Na_3H(SO_4)_2$.

To obtain the hydrate, $Na_3H(SO_4)_2.H_2O$, a solution containing 16·5 per cent. of sulphuric acid and 35 per cent. of sodium sulphate is heated to 30° C., and the two substances, in the proportions in which they exist in $Na_3H(SO_4)_2$ are gradually added, till, on cooling (and if necessary seeding with a crystal), the salt separates. It forms brilliant rhombic prisms.—J. T. D.

Fischer's salt [Potassium cobaltinitrite] and its decomposition by heat. P. C. Ray. Chem. Soc. Trans., 1906, **89**, 551—556.

Preparation.—On adding different quantities of a strong solution of potassium nitrite, acidified with acetic acid, to a fairly concentrated solution of cobalt chloride, the salt, $Co_2(NO_2)_6.6KNO_2.3H_2O$, is generally formed, but it invariably carries down with it traces of an oxide of cobalt, the figures for this metal being always too high, and those for potassium too low. In one or two cases results were obtained which appear to support Sadtler's statement (Amer. J. Science, 1870 [ii], **49**, 192) that the degree of hydration of the product depends upon the concentration of the solutions employed. Rosenheim and Koppel (Z. anorg. Chem., 1898, **17**, 35) state that by passing a current of nitrogen trioxide into a solution of potassium nitrite holding cobalt carbonate in suspension, a pure anhydrous salt is obtained. The author finds, however, by this method also, a trihydrated salt is obtained, and that it is contaminated with appreciable quantities of an oxide of cobalt.

Decomposition.—The author is unable to confirm Erdmann's statement (J. prakt. Chem., 1866, *7*, 401) that potassium cobaltinitrite evolves nitrous acid on heating. When heated without access of air, the salt begins to give off nitric oxide below 200° C., whilst at 210°—215° C., decomposition proceeds smoothly according to the equation:

$$Co_2(NO_2)_6.6KNO_2.3H_2O = Co_2O_3 + 6NO + 3KNO_3 + 3KNO_2 + 3H_2O.$$

If the salt be heated in an air-bath, the potassium nitrite is converted into nitrate, the nitric oxide acting as an oxygen-carrier.

Analysis.—A weighed quantity of the salt is heated in an air-bath for two hours at 215°—220° C., and the residue repeatedly washed by decantation with boiling water and collected on a filter. The cobalt is then determined by Rose's method, the analysis being carried out without the use of reagents. The potassium in the solution is determined as sulphate.—A. S.

Cupric oxide; Colloidal ——. C. Paal and W. Leuze. Ber., 1906, **39**, 1545—1549.

By the same process as for the corresponding silver and mercuric compounds (this J., 1902, 994) the authors have prepared blue-violet solutions of colloidal cupric hydroxide. On dialysis, traces of copper compound always pass through, for reasons not yet discovered. The solution in the dialyser gradually changes colour to dark brown, possibly through dehydration. The colloidal solution is extremely stable and yields on evaporation to dryness, a solid residue which after an indefinite lapse of time is still soluble in water, regenerating the original solution.—J. T. D.

Uranium ores; Treatment of Vanadiferous — —. M. Gin. Sixth Internat. Congr. of Appl. Chem., Rome. Z. angew. Chem., 1906, **19**, 896.

The ore is fused with potassium bisulphate, the acid vanadic sulphate converted into divanadyl sulphate, and the solution treated with a mixture of ammonia and ammonium carbonate, which forms an insoluble hypovanadate and a soluble ammonium uranium carbonate.

A second method depends on the property of ferric chloride of reacting on vanadic anhydride to form vanadium trichloride, which boils at 126° C., and can be distilled off and received in water, forming pure vanadic acid.—J. T. D.

Uranyl acetate; Action of light on ——. A. Bach. Ber., 1906, **39**, 1672—1673.

The author had shown formerly that on passing carbon dioxide through a solution of uranyl acetate, exposed to direct sunlight, reduction of the salt to a mixture of uranous and uranic hydroxides takes place. Euler showed subsequently that carbon dioxide is merely active in removing from the solution oxygen which hindered the reaction and that the reduction takes place also in sunlight alone. The author now finds that in his former experiments a chance equilibrium had existed between the reducing action of the light and the oxidising influence of the oxygen, thus confirming Euler's view. He shows that with constant illumination, uranyl acetate concentration, and diameter of the tube employed, the time required until a perceptible cloud is formed (marking the beginning of the reaction) is inversely proportional to the height of the liquid column. When the relation between the liquid surface exposed to the air and the height of the liquid has reached a certain value, reaction no longer takes place. If the illumination, diameter, and height of the liquid column are kept constant, the rate of change is inversely proportional to the concentration of the uranyl acetate. Hot saturated solutions become clouded almost at once when exposed to light. Preparations obtained by the fractional

eduction of uranyl acetate solutions in sunlight, re-oxidation of the washed precipitates exposed to the air and dissolution of these in acetic acid, show a similar behaviour owards light, and there are no grounds for assuming the resence of a photo-catalysator in uranyl acetate.
—E. F. A.

Nitrogen; Properties of liquid ——. H. Erdmann. Ber., 1906, **39**, 1207—1211.

By passing nitrogen from a cylinder through a cooling orm into a cylindrical copper vessel cooled by liquid air, he gas can be liquefied in large quantities at any pressure etween 0·7 and 2·5 atmospheres, and then, after filtration hrough an ordinary paper, forms a perfectly colourless obile liquid. Not only ice, but absolute alcohol, sinks n this liquid, so that Ramsay and Drugman's figure for ts density (0·7914) is probably nearer the truth than Dewar's (0·850). Liquid nitrogen forms an excellent ooling agent, its lower temperature rendering it more fficient than liquid air. It is a good solvent for liquids f low boiling point; is miscible in all proportions with iquid oxygen or liquid ozone; and seems well adapted s a solvent for determining the molecular weights of such ubstances. Liquid nitrogen is inert towards most ubstances, and even metals like calcium and magnesium lo not readily combine with it; but a mixture of calcium rillings and liquid nitrogen, if ignited by "thermite" gnition-mixture, continues to burn, and forms calcium itride. The author is investigating the molecular eight of liquid nitrogen, to ascertain the suitability of he gas as a material for standard thermometers.
—J. T. D.

Phosphorus; Constituent producing electrical conductivity in air which has passed over ——. R. Schenck, F. Mihr and H. Bauthien. Ber., 1906, **39**, 1506—1521.

The authors find that the phenomenon of ionisation of he air in the vicinity of white phosphorus is not directly onnected with the luminescence of the phosphorus, for nany other substances showing similar luminescence roduce no effect in discharging a charged electroscope. t is not due to ozone, but to phosphorus trioxide, for reviously prepared pure phosphorus trioxide, mixed in ninute proportion with air, produces the same effect as ir which has passed over white phosphorus. The authors ave determined the vapour pressure of the trioxide t temperatures from 22° to 91° C., the rate of its oxidation, ts molecular weight at 80° C. (at which temperature they ound the figure 218, so that no molecular dissociation had occurred), the electric conductivity (it is a good insulator), nd the dielectric constant. From none of the results ave they been able to get a clue to the cause of the onising action of the trioxide upon air.—J. T. D.

Phosphorus; Method of detecting minute quantities of white ——. R. Schenck and E. Scharff. Ber., 1906, **39**, 1522—1528. (See preceding abstract.)

The discharge of an electroscope by air which has remained n the vicinity of white phosphorus forms an exceedingly elicate test for the latter, and the authors have devised convenient and compact form of electroscope for the pplication of the test. The substance to be tested is laced in a U-tube connected with the cylindrical vessel urrounding the electroscope rod, and, after a short time, he air in the apparatus is blown by a small hand-bellows hrough into the cylinder. So small a quantity of phosphorus in the U-tube as 0·004 mgrm. increases quite ensibly the rate of discharge. The method will be of use for detecting small quantities of white phosphorus in phosphorus sulphide or red phosphorus, as also for detecting vapours of phosphorus trioxide in the air of rooms in match factories, &c.—J. T. D.

Phosphorus sulphides; Existence of ——. R. Boulouch. Comptes rend., 1906, **142**, 1045—1047.

The author doubts the existence of Giran's eutectic of the composition, P_4S (this J., 1906, 264), finding that the only eutectic point of mixtures containing more phosphorus than the sulphide, P_4S_3, occurs at —7° C., and has the composition corresponding to P_4S. These mixtures possess in a high degree the power of remaining as supercooled liquids, and unless they are seeded with the sesquisulphide, P_4S_3, they may be cooled far below their real freezing-point without solidifying. Moreover, the freezing-point curve of mixtures of the sesquisulphide (43·6 per cent. of sulphur) and phosphorus presents a sudden inflexion at 36 per cent. of sulphur (which mixture freezes exactly at the freezing-point of phosphorus), and declines much less steeply as the percentage of sulphur decreases further; and the eutectic point is at the intersection of this line with the line falling from pure phosphorus as sulphur increases, at —7°C., not at the intersection of the latter with the continuation of the first part of the line falling from the sesquisulphide as sulphur decreases, which would be about —40° C.—J. T. D.

Ammonium tri-iodate as fundamental standard substance in volumetric analysis. E. Riegler. XXIII., page 561.

Iron; the rusting of ——. G. T. Moody. X., page 539.

Nitrogen; Assimilation of elementary —— *by azotobacter and radiobacter.* J. Stoklasa. XV., page 548.

English Patents.

Arsenical sulphur ores; Treatment of —— *for the obtainment of arsenious acid and of sulphuric acid deprived of arsenic.* J. Raschen, A. E. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 16,931, Aug. 21, 1905.

The gaseous products from the burning of arsenical sulphur ores are passed into a Glover tower, down which sulphuric acid flows. The sulphuric acid, thus charged with arsenious oxide, is subjected, at a temperature of about 100° C., to the action of dry hydrochloric acid gas, preferably in a suitably packed tower. The arsenious chloride formed is withdrawn, as an oily liquid, from the sulphuric acid thus treated, and is brought into contact with an alkali, alkali carbonate, earth carbonate, or the like, in the presence of a small proportion of water, to precipitate arsenious acid, which, if necessary, may be purified by sublimation. (See also Eng. Pats. 16,929, 16,930, and 17,887 of 1905, this J., 1906, 477; and 17,886 of 1905, following abstract.)—E. S.

Sulphuric acid; Treatment of gases obtained from arsenical ——, *and other gases containing arsenious chloride, and the obtainment of arsenious acid therefrom.* J. Raschen, A. E. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 17,886, Sept. 4, 1905.

The gases evolved on the treatment of arsenical sulphuric acid with hydrochloric acid, and blowing air through (as described in Eng. Pat. 7916, of 1905; this J., 1906, 477), are passed into a minimum quantity of water containing an alkali, or alkaline earth, or carbonate thereof; or certain oxides or carbonates of the heavy metals, such as zinc oxide or carbonate, manganese-mud, or iron hydroxide. The arsenic in the gases is stated to be precipitated "in the form of arsenious acid." The process may be applied generally to the treatment of gases containing arsenious chloride. (Compare Eng. Pats. 16,929, 16,930 and 17,887 of 1905, this J., 1906, 477.)—E. S.

Ammonia; Production of —— *[from the air].* H. C. Woltereck, London. Eng. Pat. 8358, April 19, 1905.

Carbonaceous material (other than peat) is heated, preferably in upright retorts, to a temperature not exceeding 500° C., and air and steam are passed through the mass, the production of combustible gases being, as far as is possible, prevented. The heating may, at the commencement, be effected by the incipient combustion of the lower portion of the charge, and afterwards, in some cases, water in the form of spray may be introduced for the production of the steam required. It is stated that the ammonia formed, owes its origin, partly or wholly, to the nitrogen of the air admitted. The effluent gases are scrubbed, passed through an "alkali tower, or its equivalent, to liberate all ammonia," and then through sulphuric acid absorption towers. (Compare Fr. Pat. 345,399 of 1904; this J., 1904, 1215.)—E. S.

Corrosive liquids; Apparatus for spreading or distributing —— specially applicable to the manufacture of copper sulphate and the like. H. E. Dolphin, Chester. Eng. Pat. 9239, May 2, 1905.

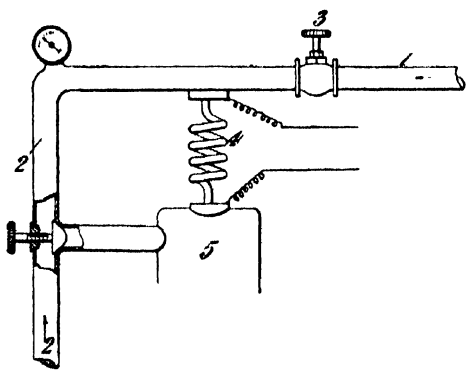
A TOWER, charged with, for instance, copper shot to be dissolved, having near its bottom an outlet pipe for flow of the solution into a receptacle, and receiving a jet of air or steam, is sprayed at the top with dilute sulphuric acid, delivered from a siphon into a shallow cup or saucer, over the edge of which the liquid splashes in an umbrella-shaped shower, with such force as to be further sprayed, on contact with the shot, over the entire surface. The saucer may be replaced by a disc or plate, or by an inclined surface attached to one side of the inside of the tower, from which the gushes of liquor from the siphon may be splashed over the charge.—E. S.

Sulphur dioxide and Glauber salts; Manufacture of pure ——. W. Garroway, Glasgow. Eng. Pat. 11,986, June 8, 1905.

SODIUM bisulphite solution, formed by acting upon sodium carbonate with sulphurous acid, and solution of nitre cake (sodium bisulphate) are separately admitted to a closed mixing vessel, supplied with a steam heating coil, from which vessel the sulphur dioxide set free is conducted through a tower and a pair of small vessels into a large vessel in which the gas is absorbed by water. (Reference is directed to Eng. Pats 2784 of 1880 and 1393 of 1888.)—E. S.

Catalytic apparatus. [*Manufacture of nitric oxide from ammonia.*] H. H. Lake, London. From Nordyke and Marmon Co., Indianapolis, U.S.A. Eng. Pat. 1204, Jan. 16, 1906

IN the figure shown, 4, is a helical coil, of small diameter relatively to its length, of a metal of the platinum group,



which is heated, at first to a temperature slightly below visible redness. Ammonia gas is admitted through the tube, 1, controlled by the cock, 3, and air enters by the tube, 2, the mixture passing through the helix and entering the receiver, 5, for the nitric oxide formed. The reaction is stated to be endothermic or exothermic, according to whether the air or the ammonia is admitted in excess, so that the temperature may be regulated without external heating after passing the initial stage of the process. The process may be conducted under pressure. The apparatus is generally applicable in catalytic processes. —E. S.

Cyanogen compounds; Process for the recovery of —— from crude gases and from bye-products in the manufacture of cyanides. W. E. Sims and H. Bowes, Manchester. Eng. Pat. 2929, Feb. 7, 1906.

IN the manufacture of cyanides from a ferrocyanide solution and sulphuric acid, the hydrocyanic acid distilled off is collected and neutralised in the usual way, and the insoluble compounds remaining in the still are removed, freed from excess of acid and soluble salts, and then mixed with caustic alkali or alkali carbonate. The alkaline mixture, with or without addition of ferrous hydroxide or carbonate, is subjected to the action of sulphuretted gases containing cyanogen compounds. By this treatment the insoluble cyanogen compounds are converted into ferrocyanide, the completion of the reaction being indicated by the disappearance of the fixed alkalinity of the mixture, which now contains ammonia compounds with ferrocyanides and ferrous sulphide. The ammonia is recovered from the product in a suitable still, and the solution of alkali ferrocyanides, after separation of insoluble matters, is purified when necessary, and distilled with sulphuric acid, as first described, to obtain hydrocyanic acid. The insoluble residues from the filtration residue, together with the insoluble distillation residue, are again used in the described cycle of operations.—E. S.

UNITED STATES PATENTS.

Nitric acid; Process of concentrating diluted ——. O. Baither, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort a/Main, Germany. U.S. Pat. 819,262, May 1, 1906.

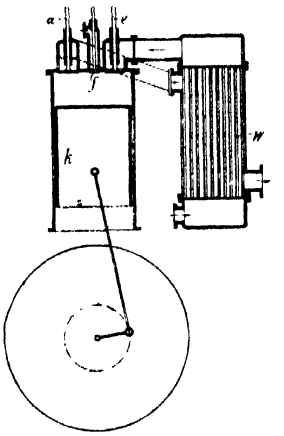
SEE Fr. Pat. 358,373 of 1905; this J., 1906, 218.—T.F.B.

Chlorine; Manufacture of ——. A. Clemm, Mannheim, Germany. U.S. Pat. 819,410, May 1, 1906.

SEE Fr. Pat. 354,109 of 1905; this J., 1905, 1067.—T.F.B.

FRENCH PATENTS.

Endothermic compounds [*e.g., oxygen compounds of nitrogen*]; *Process and apparatus for producing ——.* R. Pawlikowski. Fr. Pat. 361,119, Dec. 26, 1905.



THE invention is described with reference to effecting the combustion of nitrogen in the oxygen of the air, and to compensate for the absorption of heat that ensues, the temperature is raised in the operating cylinder by the sudden compression of the contained air, by the movement of a piston, *k*. The compression takes place at intervals, the movements of the piston inducing, in succession, aspiration through the valve, *e*, of air already heated by passage through the heat exchanger, W. When the piston arrives at or near its highest point, either a combustible is introduced through the valve, *f*, and is ignited to increase the heat, or electric sparks are passed through. As the piston makes its downward movement, work is done by the expansion of the compressed air, and on the return, the gases are forced through the valve, *a*, through the heat exchanger, whence the air carrying the nitric oxide formed, is passed to an absorber. The inner surfaces of the cylinder, not coming into contact with the piston, may be lined with a carborundum mixture, or with spongy platinum, &c., intended to act catalytically in aid of the reaction.—E. S.

Hydrosulphites [*Hyposulphites*]; *Rendering aqueous solutions of —— stable.* Soc. Anon. Plaques et Papiers Photographiques A. Lumière et ses Fils. Fr. Pat. 360,980, March 21, 1905.

AQUEOUS solutions of alkali hydrosulphites, say, of 3 per cent. strength, are rendered, comparatively, stable in air, by addition of certain proportions of tribasic sodium phosphate, acetaldehyde, trioxymethylene in presence of sodium sulphite, benzaldehyde, or hexamethylenetetramine. The presence of sodium phosphate does not interfere with the reducing properties of the hydrosulphite at ordinary temperatures; but the other substances named allow reduction to take place only near 100° C. Or, the anhydrous sodium hydrosulphite of the Badische Anilin und Soda Fabrik may be mixed with tribasic sodium phosphate, or with trioxymethylene and sodium sulphite, to form a powder, which, when dissolved in water, gives a stable solution. (Reference is made to Fr. Pat. 338,385, of 1903.)—E. S.

Sulphite liquors; Preparation of strong —— and apparatus therefor. G. Türk. Fr. Pat. 361,071, Dec. 9, 1905.

SULPHUR dioxide gas is delivered under pressure, near to the bottom of the lower, and larger, compartment of a tank, containing a dilute solution of sodium carbonate, or water in which milk of lime is diffused, through a series of nozzles so curved as to cause the gas to issue with rotary motion, in the form of very minute bubbles. The excess of the gas passes from the upper portion of the compartment, by a tube leading outside the tank, and curved downwards into the upper compartment, on the floor of which it forms a horizontal perforated extension, through which the gas issues into water, or into a solution corresponding to that in the lower compartment of the tank. An aperture, ordinarily kept plugged, is provided in the floor of the upper compartment, through which, when desired, the liquor contained therein may be discharged into the lower compartment.
—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 478.)

Silicate-melts and silicate-glasses. C. Doelter. 6th Int. Cong. appl. Chem. Z. angew. Chem., 1906, **29**, 805—807.

SILICATES may be divided into two groups entirely different from each other, but which may be connected by a series of intermediate bodies. The first group comprises silicates with a sharply defined melting-point, small viscosity, high power of crystallising, and great rapidity of crystallisation; they are but little dissociated, and do not show supersaturation or supercooling. To this group belong the calcium- and magnesium—iron—manganese silicates, as well as those of the formulæ, $CaMgSi_2O_6$, $CaFeSi_2O_6$, $Na_2CaSi_2O_6$. They do not form glasses. To the second group belong those silicates which yield glasses. They possess properties opposite to those of the first group, the most marked being the indefinite melting point, a viscous state corresponding to an interval of temperature of 100° C. and more separating the liquid from the solid state; the solidifying point is always below the melting point; and practically no heat is absorbed during solidification. To this group belong most of the sodium, potassium and aluminium silicates. The silicates of the first group are sharply differentiated from alloys, by the fact that in those circumstances where the latter would form eutectic mixtures so closely mixed as to seem definite chemical compounds, the former show exactly the opposite tendency, different silicates separating out as far apart as possible. The members of the second group do not show this peculiarity, which may be seen in many rocks.
—A. G. L.

Emery; Naxos ——. For. Off. Ann. Ser., No. 3592.

THE export of Naxos emery stone from the Government depot at Syra was again very satisfactory last year, amounting to a total of 6395 metric tons, valued at 27,170*l.*, being 42 tons in excess of the export in 1904. It was shipped as follows:—3350 tons to Rotterdam, 1010 tons to Liverpool, 1000 tons to New York, 630 tons to Havre and 405 tons to Boston. Of the total, German steamers carried 2850 tons, British 2415 tons, French 630 tons and Austro-Hungarian 500 tons. [T.R.]

UNITED STATES PATENTS.

Glass; Apparatus for the manufacture of sheets of ——. F. L. O. Wadsworth, Morgantown, W. Va., Assignor to Pressed Prism Plate Glass Co., New York. U.S. Pat. 818,209, April 17, 1906.

THE apparatus consists of a combination of a rolling mechanism and a frame which receives the glass as it passes from the rolling mechanism and by which the sheet is held vertically, means whereby a wire mesh may be supported in the frame in position to be embedded in the glass sheets, and vertical pressure-plates adapted to press the glass.—A. G. L.

Glass sheets; Apparatus for the manufacture of ——. F. L. O. Wadsworth, Morgantown, W. Va., Assignor to Pressed Prism Plate Glass Co., New York. U.S. Pat. 818,210, April 17, 1906.

THE apparatus consists of a sheet-forming roll, a table, a series of figured dies elevated above the path of the roll, and mechanism by which the dies are moved successively against the sheet as the roll passes.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 479.)

ENGLISH PATENT.

Marble and stone; Manufacture of artificial ——. T. M. Thorn, Cheshunt, Herts. Eng. Pat. 8804, April 26, 1905.

THIS invention relates to the production of artificial marble or stone, by submitting blocks or slabs of lime to the action of carbon dioxide in a closed vessel, in a special way. The vessel containing the slabs to be carbonated is exhausted by a pump, and carbon dioxide is then admitted, until the vacuum is largely reduced. As the gas is absorbed by the slabs and the pressure in the vessel consequently decreases, a further quantity of gas is admitted until the pressure rises again to its original amount, and the process is continued until the pressure remains constant, that is, until the slabs cease to absorb further quantities of gas.—W. C. H.

UNITED STATES PATENTS.

Clays containing gypsum; Treating ——. K. Sakurai, San Francisco, Cal. U.S. Pat. 818,124, April 17, 1906.

THE clay is heated to a temperature of about 200° C., so as to dehydrate the gypsum and render it "dead-burnt," without changing the clay, and is then mixed with a suitable binder, moulded whilst pasty, and dried.
—A. G. L.

Clay; Process of treating ——. E. S. Powers, Merchantville, N.J. U.S. Pat. 818,287, April 17, 1906.

CLAY and sand are mixed with a "liquid solution of silica," or similar inorganic substance; the mixture is moulded, exposed to the atmosphere and then heated, whereby a crust of crystallised silica is formed on the surface, which prevents shrinkage of the material.—A. G. L.

Bricks; Composition for the construction of ——. E. R. Stowell, Portland, Ind. U.S. Pat. 819,467, May 1, 1906.

THE composition is composed of amorphous carborundum and Portland cement.—A. G. L.

Cement-kilns ; Process of operating ——. H. L. Doherty, Madison, Wis. U.S. Pat. 818,018, April 17, 1906.

FROM 5 to 25 per cent. of the finished cement clinker is mixed with the raw materials, and again passed through the rotatory kiln.—A. G. L.

Combustion [in cement kilns] ; Process of conducting ——. H. L. Doherty, Assignor to Combustion Utilities Co., New York. U.S. Pat. 819,127, May 1, 1906.

A FLAME of producer gas opposite in direction to that of the cement raw material is produced in a rotatory kiln, and powdered coal and air is projected into this flame at a point close to the clinkering zone so as to give an intense local heating effect.—A. G. L.

X.—METALLURGY.

(*Continued from page* 482.)

Cast iron ; Volume and temperature changes during cooling of ——. T. Turner. Iron and Steel Inst., May, 1906.

A T-SHAPED bar was cast, the head of which was kept rigidly fixed by the sand of the mould and by a steel pin clamped to the iron box containing the mould. In the other end was inserted a wire nail, round the head of which the bar solidified, and the point of which was connected with a lever multiplying index, in order to record alterations in the length of the bar. A thermo-electric pyrometer, inserted at the middle of the bar, allowed of temperature-readings being made. From the shrinkage readings and the time and also from temperature-readings and time, curves were constructed. These curves group themselves into four classes :—1. Those showing no arrest in the shrinkage, illustrated by copper, aluminium, antimony, lead, tin, zinc, and zinc-aluminium alloys. 2. Those showing one retardation of shrinkage, which may amount to actual expansion ; illustrated by white iron and by high carbon steel, also by zinc-copper alloys. 3. Those showing two such arrests, illustrated by non-phosphoric grey iron ; and 4. Those showing three such arrests, illustrated by very grey phosphoric irons. In this class, the third arrest is by far the most considerable, while the second is small relatively to either of the other two.

The cooling curves show arrests, which may amount even to rises of temperature, corresponding to the arrests or expansions in the shrinkage curves.

The examination of four characteristic irons—1. Pure white cast iron ("American washed iron"), 2. non-phosphoric grey iron (No. 3 hæmatite pig), 3. Phosphoric grey iron (No. 1 Northampton), 4. Close-grained foundry iron, from a broken-up casting, gave results as follows :—

	1.	2.	3.	4.
Carbon, combined ...	2·73	0·86	0·15	0·79
graphitic ...	—	2·53	2·60	2·73
Silicon	0·01	3·47	3·98	1·41
Sulphur	tr.	0·03	0·03	0·07
Phosphorus	0·01	0·04	1·25	0·96
Manganese	tr.	0·55	0·50	0·43
First arrest.....	almost absent	1135° C.	1060° C.	1095° C.
Second „	absent	absent	900° C.	905° C.
Third „	665° C.	695° C.	730° C.	695° C.

The third expansion becomes more marked, and occurs at a higher temperature, as the silicon increases. The author considers it probable that the cause of this expansion is the separation of temper-carbon. He recommends tests on the lines of the experiments in the paper as a means of checking and controlling mixtures in the foundry. —J. T. D.

Cast iron ; Influence of the condition of the carbon on the strength of ——, *as cast, and heat-treated.* W. H. Hatfield. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

THE highest tensile tests were given by low-silicon irons in which the combined carbon was at a maximum. Grey irons gave the lowest tensile results, through the weakening action of the graphite plates. Pearlite was found to strengthen the grey irons. Annealing weakens grey irons and strengthens white irons. The strength of the heat-treated white irons is largely influenced by the condition of the free carbon, and by the amount of combined carbon present as pearlite ; when the annealing carbon is finely divided the iron is strongest. Silicon appears to affect the strength of the iron only indirectly, through its action on the carbon ; and the temperature of casting seems also to be without direct influence.—J. T. D.

Iron and mild steel ; Deformation and fracture of ——. W. Rosenhain. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

THE author confirms his view that deformation occurs only by slip and twinning, and shows that the material between adjacent "slip-bands" undergoes no distortion. He explains Osmond's observations on the behaviour of slip-bands under powerful oblique illumination, by supposing that the surfaces exposed by slip are not perfectly smooth, but rough enough to scatter light. Experiments of Osmond and Frémont, and of Stead, on isolated crystals of iron have no bearing on metallic masses composed of crystalline aggregates, where the stresses are practically uniform over the small area of a single crystal. The partial plasticity following overstrain is probably due to formation of a layer of mobile molecules on surfaces of slip ; this layer is again absorbed into the crystalline system surrounding it, when recovery takes place. The mobile molecules only retain permanently an "amorphous" condition, as Beilby's theory requires, if deformation has been extremely severe. The author applies his method of obtaining transverse sections of surfaces by the aid of electro-deposits of copper to the study of fractures. He finds that in tensile fractures the break runs through ferrite and pearlite almost alike, because of the previous weakening of the pearlite by the gradual extension ; but in shock fractures, the ferrite is fissured and the pearlite as a rule unaffected. This detailed study of fractures gives a mode of locating causes of weakness and strength in a given microstructure, and may allow of tracing the causes of fractures occurring in actual work.—J. T. D.

Iron and steel ; Hardness of constituents of ——. H. C. Boynton. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

THE author has applied Jaggar's micro-sclerometer, in which the hardness of minerals is measured by the number of revolutions required for a tetrahedral diamond point rotating at constant speed and with constant pressure, to drill to a constant depth, to determine the hardness of the constituents of iron and steel. The summarised results are as follows :—

Constituent.	Present in	Relative hardness.
Ferrite.....	Electrolytic iron	1
„	„ „ (quenched)	2·15
„	Average of all unhardened samples	1·03
„	Commercial wrought irons	1·5— 3·6
Pearlite ...	Series of 0·13 to 1·52 per cent. carbon	1·8—10·3
„ ...	„ „ 0·35 to 0·86 „ „	3·8— 4·2
Sorbite	0·48 to 0·58 per cent. carbon steel	5·2—53·6
Troostite ..	Steel, 0·58 per cent. carbon	88·2
Martensite .	„ 0·20—1·52 per cent. carbon	38·9—261·6
Austenite ..	White cast-iron, 3·24 „ „	103·4
Cementite .	„ „ „ „ „	272·8

—J. T. D.

Manganese ; Preliminary note on the influence of —— *on iron.* J. O. Arnold and F. K. Knowles. Iron and Steel Inst., May, 1906. [Advance proof.]

THE authors have succeeded in preparing a series of nearly pure iron-manganese alloys. Swedish bar iron of 99·8 per cent. purity was melted in a special "one-cross" crucible made of the following mixture :—Unburnt Stourbridge fire-clay, 45 ; unburnt Derby clay, 21 ; unburnt Stannington fire-clay, 21 ; unburnt Cornish

china clay, 10; and coke dust low in sulphur, 3 per cent. The crucible mixture must be trodden for five instead of the usual three hours. The manganese, obtained by Goldschmidt's "thermite" process, was melted separately in a special crucible made of the following mixture:—Crystalline magnesia, fused in an electric furnace, 15 lb.; unburnt Stourbridge fire-clay, 12 oz.; and water containing 12½ per cent. by volume of "fluid silicate of soda," 650 c.c. The melting crucible was fitted closely into a protective ordinary plumbago crucible. After mixing the molten metals, half a minute was allowed for transfusion, and the alloys were then cast into 2-inch square ingots weighing about 35 lb. each. It is of importance that the two metals be made fluid at almost the same moment. The total period of melting is about 5½ hours, and the manganese should be charged into its crucible about 4½ hours after the iron. If the iron is melted before the manganese is ready, it begins to oxidise; such iron, containing about 0·2 per cent. of oxygen, is so red-short that it cannot be forged. It is proposed to investigate the chemical, thermal, microscopical, mechanical, electric and magnetic characteristics of the alloys in their normal, quenched and annealed conditions. In the preliminary work it has been observed that remarkable liquation takes place in the manganese-iron alloys. This is clearly shown by the following table:—

Ingot No.	Percentage of manganese in rolled bars.		
	One end.	Middle.	Other end.
977	3·07	3·48	3·42
944	10·60	13·85	11·96
906	26·53	28·24	35·14

—A. S.

Ferromanganese; Preparation of carbon-free ——. E. G. Ll. Roberts and E. A. Wraight. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

Of the methods proposed for eliminating carbon from ferromanganese—replacement by silicon or aluminium, cementation, reaction of oxide on the carbide Mn_3C—the authors find that the last is the only hopeful one. By fusing with manganese peroxide they have reduced the carbon in a ferromanganese from 6·72 to 2·79 per cent., and see no reason why on the large scale this should not be carried further. For success, however, the basic lining must be as low in silica as possible (not above 10 per cent.), the slag must be as high in manganous oxide as is consistent with fluidity, and the temperature should be above 1600° C.—J. T. D.

Steels; Quaternary ——. L. Guillet. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

The structures met with in normal hypo-eutectoid quaternary steels are: Pearlite and ferrite, pearlite and carbide, pearlite and graphite, ferrite and graphite, martensite, martensite and carbide, martensite and graphite, sorbite and carbide, γ-iron, γ-iron and carbide, γ-iron and graphite. More complex structures sometimes occur. The only simple structures are martensite and γ-iron. Martensitic structure corresponds with: very high tensile strength and elastic limit, medium or sometimes very low elongation, great hardness and great difficulty in working or forging. γ-Iron structure corresponds with: fairly-high tensile strength, low elastic limit, good elongation and resistance to shock in most cases, ease in forging, but difficulty in machining.

The characters of steels of complex structure are as follows:—1. All graphitic steels are unserviceable—brittle, impossible to roll or hammer. 2. Steels containing carbide have the characters of the other constituent, but accentuated; in particular the brittleness is increased. 3. Pearlitic steels have characters depending chiefly on the amounts of elements other than carbon present, and not on the quantity of pearlite alone; the tensile strength and elastic limit are seldom very high, but nothing can be predicted as to brittleness or elongation.

Quenching usually transforms pearlite into martensite, save in steels containing a fairly high percentage of aluminium. It leaves martensite unchanged, or tends to form from it γ-iron. It transforms sorbite into martensite, but does not transform γ-iron, save in certain steels on the boundary line of martensitic steels. The effect of quenching carbide steels varies with the nature of the carbide; chromium carbide steels need a temperature of 1200° C. for solution, tungsten or molybdenum carbide steels 850° C.; vanadium carbide steels are not altered by quenching.

Annealing as a rule does not alter structure. Pearlite becomes finer, martensite-needles better defined, γ-iron polyhedra and carbide grains larger. But γ-iron steels bordering on martensitic steels are transformed with formation of martensite.

Cooling and hammering do not usually affect structure, save in certain nickel steels bordering on martensitic steels. In any transformations, the effects are similar to those obtaining in the case of normal steels: A γ-iron steel becoming martensitic, for example, gains in tensile strength and elastic limit, and acquires lower elongation and resistance to shock.

There is but a limited field for the commercial employment of these steels. All steels having a structure which contains either martensite or graphite should be rejected—graphite, because of the brittleness it produces, martensite because of the difficulty of working or forging. Carbide steels containing γ-iron are of no interest; when pearlitic or sorbitic they may be of use for tool steels and for bearings. γ-Iron steels which are not too readily affected by such processes as quenching, annealing and cooling, can only be obtained by using high percentages of nickel, manganese, or both, and are thus costly; moreover their elastic limit is low, and they are difficult to work, so that they are of limited availability. There remain only the pearlitic steels, and these should not contain much carbide; the most promising of these are the nickel-vanadium and nickel-tungsten steels, and possibly the chromium-vanadium steels.—J. T. D.

Wire (steel); Heat treatment of ——, *particularly of wire for ropes.* J. T. Brunton. Iron and Steel Inst., May, 1906. Reports of Carnegie Research Scholars. [Advance proof.]

Steel wires, Swedish and British, were compared, raw and annealed, as to their mechanical properties and specific gravity, after successive drawings. Besides the maximum stress, tension, and elongation, the number of bendings over pulleys requisite to break the wire, under conditions similar to those demanded of a rope in actual work, was determined.

The most useful work was done by these wires when the specific gravity was increased by drawing to between 7·885 and 7·910; at these points the Swedish steel, with 0·75 per cent. of carbon showed a maximum stress of 90—99, and the British steel, with 0·83 per cent. of carbon, a maximum stress of 101—110 tons per square inch. By this method of testing, the best condition for work in the case of any given steel can be determined. The annealing of the rod before the final annealing does not in any way produce better material, and is unnecessary. By cold drawing, the specific gravity of the steel was increased from 7·768 to 7·998, but could not be further increased. Annealing reduced both the carbon and phosphorus in the wire; the phosphorus was not found in the scale, and hence must have gone off in some volatile form—the carbon no doubt is removed as carbon monoxide.—J.T.D.

Iron; The rusting of ——. G. T. Moody. Chem. Soc. Trans., 1906, **89**, 720—730.

Dunstan, Jowett and Goulding (this J. 1903, 745; 1905, 1235) have stated that the rusting of iron depends mainly on the direct interaction of iron, water and oxygen, and that the part played by carbonic acid in the process is merely subsidiary. The author shows that if effective precautions be taken to exclude carbonic acid, no interaction takes place between oxygen and iron in the presence

of water, but as soon as air containing its normal quantity of carbon dioxide comes in contact with the iron, vigorous rusting results. In one experiment a piece of iron in contact with water, and subjected to the action of a current of air freed from carbon dioxide, remained bright and unacted upon for five weeks.

To determine the influence of carbonic acid on the absorption of atmospheric oxygen by iron, 10 grms. of clean iron wire were left in contact, on the one hand, with ordinary air and distilled water which had been exposed to the air, and, on the other, with air which had been treated with soda-lime for 24 hours, and water distilled from barium hydroxide solution. The following results were obtained :—

	Percentage of total oxygen in 100 c.c. of air absorbed by 10 grms. of iron.	
	Ordinary air and distilled water.	Air and water almost entirely freed from carbonic acid.
After 6 hours' exposure	5·7	none
,, 24 ,, ,,	20·1	none
,, 72 ,, ,,	61·3	0·9
,, 168 ,, ,,	94·3	3·8

Analyses of samples of rust from the unpainted interiors of iron flushing tanks in constant use gave results at variance with Dunstan, Jowett and Goulding's view that the formation of hydrogen peroxide is a necessary part of the process of rusting (compare Divers, this J., 1905, 1235) a considerable proportion of the iron being present in the ferrous state. In six samples of rust, from 51·12 to 68·89 per cent. of the total iron was present as ferric oxide, from 23·18 to 36·57 per cent. as ferrous oxide, and from 7·93 to 12·31 per cent. as ferrous carbonate. The first stage in the atmospheric corrosion of iron is probably the formation of ferrous carbonate, which gradually becomes basic in character through loss of carbonic acid. As showing the ease with which iron is dissolved by carbonic acid, it is stated that if distilled water which has been shaken with air be left in contact with a piece of bright iron, and tested after 40 seconds with potassium ferricyanide, a blue coloration is immediately produced. Iron dissolves to a clear liquid in a saturated solution of carbonic acid; on boiling, a green precipitate of ferrous carbonate is produced. It is stated that, in presence of air, a definite weight of carbonic acid will exert a greater corrosive influence on iron than will an equivalent quantity of hydrochloric acid or sulphuric acid.

The inhibiting effect of certain substances on the rusting of iron, cannot be due to the fact that they are capable of decomposing hydrogen peroxide as suggested by Dunstan, since some compounds, such as potassium iodide, which destroy hydrogen peroxide, do not prevent, but actually accelerate, rusting. The formation of hydrated ferric oxide, $Fe_2O_2(OH)_2$, by the action of hydrogen peroxide on iron, as observed by Dunstan, was probably due to the use of hydrogen peroxide containing some free acid. If a piece of bright iron be placed in distilled hydrogen peroxide (free from acid), diluted to 20-volume strength with distilled water, the surface of the metal becomes covered with bubbles of gas and a steady evolution of oxygen takes place, but no brown oxide of iron is formed, nor does the metal alter in weight.—A. S.

Brasses; Special ——. L. Guillet. Comptes rend., 1906, **142**, 1047—1049.

Brasses containing between 55 and 63 per cent. of copper can be forged hot; all those containing more than 60 per cent. of copper can be forged cold. Those containing more than 63 per cent. of copper contain but one solution (Shepherd's α), while those between 55 and 63 per cent. contain also a solution β; this latter is then characteristic of those brasses which can be forged hot.

When another metal is added to the copper and zinc, it alters the mechanical properties, always in such a way that a simple brass (containing only copper and zinc) can be found which resembles in mechanical properties the alloy in question. The percentage of copper or zinc in this simple brass is called by the author the "imaginary" percentage in the alloy; and for every metal there exists a "coefficient of equivalence," t, representing the percentage of zinc for which 1 per cent. of the metal will in this sense form a substitute. Thus if an alloy contain A per cent. of copper, B per cent. of zinc, and q per cent. of the third metal, and if A′ and B′ be the "imaginary" percentages of copper and zinc, then

$$B' = (B+tq).\frac{100}{A+B+tq}, \text{ and } A' = \frac{100\ A}{100+q\ (t-1)},$$

so that A′ and B′ can be calculated if t be known. It will be seen that the imaginary percentage of copper is greater or less than the real percentage according as t is less or greater than 1. The author has determined t for several metals as follows :—

Aluminium	6·0	Lead	1·0
Silicon	10·0	Iron	0·9
Tin	2·0	Cadmium	1·0
Manganese	0·5		

The resemblance of the alloy in mechanical qualities to the simple brass having the corresponding imaginary constitution holds in the case of each element only up to a certain limiting percentage—so long, in fact, as the new element enters into the solutions which would exist were it not present. As soon as its quantity is such that a new constituent appears in the metal, the mechanical qualities of the alloy at once deteriorate.—J. T. D.

Russian metal production. Eng. and Min. J., May 5, 1906.

The output of gold in Russia during 1905 was 30,365·7 kilos. valued at 20,179,232 dols., as compared with 37,700 kilos. valued at 25,075,358 dols. in 1904. The decrease of 24 per cent. is accounted for by the disturbed condition of the Empire during the past year.

The output of silver in 1905 was 3902·7 kilos. valued at 75,722 dols., as compared with 5379 kilos. worth 100,300 dols. in 1904.

The production of mercury in 1905 amounted to 317,800 kilos. equivalent to 9347 American flasks, as compared with 331,793 kilos. (9759 flasks) in 1904.

The platinum obtained in Russia during the last two years came from the following districts :—

	1904.	1905.
	kilos.	kilos.
Tcherdinsk	153·6	125·4
Perm	1107·1	1221·0
South Verkhotoorsk	3538·5	3586·9
North ,, ...	207·3	311·6
South Ekaterinburg	5·6	46·4
Total Russia	5012·1	5241·3

The 1905 output was equivalent to 168,508 troy oz., as compared with 161,131 troy oz. in the preceding year. [T.R.]

Gold Mining in Formosa. For. Off. Misc. Ser., No. 649.

The gold output of the Formosan quartz mines, for the past five years, compared with that of the gold mines, is shown in the following table :—

Year.	Quantity.		
	Quartz mining.	Placer mining.	Total.
	oz.	oz.	oz.
1901.....	18,735	15,409	34,144
1902.....	27,893	20,424	48,317
1903.....	29,605	9,239	38,844
1904.....	48,342	5,126	53,468
1905*.....	62,730	3,447	66,177

* Estimated.

The Formosa mines are three in number, namely, the Fujita Company's mine at Kyufun, the Tanaka mine at Kinkwaseki and the Kimura mine at Botanko; the area, in square miles, occupied by each of the mines is as follows:—Fujita 4, Tanaka 3 and Kimura 1. The Fujita mines are several hundred feet above sea-level. About 2,700 tons of ore are treated on an average per month, from which 2,150 oz. of alloy, 70 per cent. gold and 30 per cent. silver, are obtained. In other words, the gold varies from 1½ to 2 in 100,000, although in 1900, when it is true only 3 tons a day were dressed, the average was 5 in 100,000. The refining processes employed are amalgamation with mercury and the cyanide process. No stamps are used as the ore is of such a clayey nature as to render them unnecessary. The machinery is driven by a steam engine of 70 horse-power and a Pelton water wheel of 150 horse-power. Water is generally abundant, the Kelung district being one of the most rainy places in the world, with a rainfall of 150 inches, while coal is abundant and cheap.

The Tanaka mines are situated at Kinkwaseki to the eastward of the Fujita company's property; one lies on the seaward side of Kinkwaseki Mountain and the other on the Botanko side. These mines are connected with the mills by a double set of overhead conveyors, the longer one exceeding 7,200 feet in length. The treating process is conducted in five separate buildings, which have been erected from time to time to cope with the increased output, which at present is slightly over 2,000 oz. per month. More than three-fourths of this total is obtained from the amalgamation process, and contains 85 to 90 per cent. of gold, while the remainder, being the tailings treated with cyanide, yield 45 per cent. of gold and over 50 per cent. of silver. The slimes are not treated yet, but it is estimated that about 600 oz. could be obtained from them. The amount of ore dressed has increased considerably of late and is at present about 2,500 tons per month, the proportion of gold now being 5 in 100,000 whereas a few years ago it was as high as 2 in 10,000. Owing to the hard nature of the ore, stamps are used here, their number being 10 of 800 lb. each in one mill and 50 of 600 lb. each in another, while in addition there are two Huntington mills. The working expenses of the mine and mills are said to be about 4,500*l.* a month, and the figures regarding some of the necessary articles imported are as follows: Potassium cyanide, 2,000 to 3,000 lb. a month, costing 10½*d.* per lb. delivered at the mines; mercury costing 9*l.* a flask, about four flasks full a month are lost in treating the gold; while the monthly consumption of zinc is 825 lb.

To the south of the other two mines, in the angle formed by them, lies the Botanko mine, which, though far the smallest of the three, is said to contain the richest ore. At present the refining plant is nothing like large enough to cope with the amount of ore extracted. Of a monthly total of 1,800 tons extracted, 1,000 tons are dressed in the mill yielding 1,100 oz. of alloy, of which 90 per cent. is gold. The tailings are not treated yet but are deposited below the mill. A few months ago an exceptionally heavy fall of rain caused the retaining walls to break down and about 40,000*l.* worth of these tailings were swept away.

The new plant will consist of four crushers of 8 horse-power and eight of 2 horse-power, 12 Huntington mills, eight batteries of 5 stamps (800 lb. weight) with a proportionate amount of amalgamated copper plates, settlers, Wilfley concentrators, spitzkasten, storage tanks, leading vats (which will number 13, 5 feet in depth and 30 feet in diameter), gold solution tanks and zinc boxes. [T.R.]

Parting apparatus; New form of platinum ——. A. Jarman. XXIII., page 561.

Babbitt [anti-friction] metal; Rapid method for the analysis of ——. H. Yockey. XXIII., page 562.

English Patents.

Ores containing nickel; Treatment of ——. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 6255, March 24, 1905.

Sulphide ores containing arsenic, antimony or both are "dead" roasted in a suitable furnace, ground fine and mixed with from 25 to 50 per cent. of a sodium polysulphide and not more than 5 per cent. of carbon. The mixture is maintained at a strong red heat in a muffle, thus producing a matte which is subsequently converted by slow roasting to sulphates which are finally separated by known wet methods.—J. H. C.

Ores: Treatment of ——. H. H. Lake, London. From D. Baker and W. W. Hearne, Wayne, Pa., U.S.A. Eng. Pat. 9007, April 28, 1905.

See U.S. Pat. 788,813 of 1905; this J., 1905, 624.—T. F. B.

Kilns; Calcining ——. J. Prosser and D. Upton, Jarrow. Eng. Pat. 14,571, July 14, 1905.

The kilns arranged in continuous rows, and having a series of ore and fuel bins on each side, are built of square or rectangular form, with hopper bottoms supported clear of the ground, and provided with shoots closed by sliding doors operated by racks and pinions, whereby the calcined mineral may be discharged into cars or trucks running on straight tracks beneath the kilns.
—J. H. C.

Iron; Process of extracting —— from its ores. C. G. P. de Laval, Stockholm. Eng. Pat. 14,574, July 14, 1905.

See Fr. Pat. 356,098 of 1905; this J., 1905, 1311.—T.F.B.

Furnaces [for heating iron and steel]; Impts. in ——. A. Allen, Rotherham, Yorks. Eng. Pat. 15,024, July 21, 1905.

In reverberatory furnaces in which a portion of the waste gases is caused to return along a flue from the rear to the front end of the hearth, the opening into the return flue passes vertically upwards and has its rear wall built continuous with the plain end wall of the furnace above the entrance to the chimney flue. The object is to obtain a continuous circulation of a portion of the gases.
—W. H. C.

Roasting and desulphurising furnaces; Mechanical ——. H. Howard, Brookline, U.S.A. Eng. Pat. 21,762, Oct. 26, 1905.

See Fr. Pat. 358,977 of 1905; this J., 1906, 321.—T. F. B.

Slag; Process for disintegrating basic ——. T. Kalinowsky, Biebrich-on-Rhine, Germany. Eng. Pat. 24,655, Nov. 28, 1905. Under Int. Conv., Jan. 28, 1905.

See Fr. Pat. 360,806 of 1905; following these.—T. F. B.

Metal; Manufacture of a material for cleaning and protecting —— especially suitable for cleaning gun barrels and protecting them from rust. J. Y. Johnson, London. From Saponia-Werke Ferd. Boehm, Offenbach-on-Maine, Germany. Eng. Pat. 25,976, Dec. 13, 1905.

See Fr. Pat. 360,500 of 1905; this J., 1906, 482.—T. F. B.

United States Patents.

Smelting and refining process ——. E. C. Pollard, Seattle, Wash. U.S. Pat. 813,824, Feb. 27, 1906.

Copper ores containing sulphur are melted in presence of a suitable flux into a matte, which is subsequently bessemerised. During this process, a stream of silicious slag is made to pass over the molten matte so as to absorb the products of the blast, the still fluid slag is then brought into contact with silicious material and ferrous sulphide, whereby any copper present is reduced to subsulphide in a portion of the stream, which portion is then returned for use with a fresh portion of molten matte.—J. H. C.

Patterns; Process for applying powder to ——. F. Damhorst, A. Kemper and E. Utke, all of Berlin. U.S. Pat. 815,297, March 13, 1906.

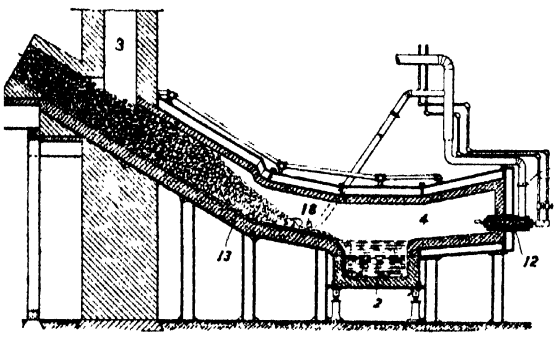
A powder, such as calcium carbide or lime, capable of generating a gas or steam in contact with water in the moulding-sand, is mixed with an anhydrous liquid, such as petroleum, and the mixture is sprayed on to the pattern

The spray adheres better than the dry powder, and gives a smoother casting.—B. N.

Ore-roaster. J. W. Boileau, Assignor to L. C. Sherwood, Detroit, Mich. U.S. Pat. 820,088, May 8, 1906.

A ROTARY tapering retort is mounted horizontally in a cylindrical casing, having a combustion chamber at one end, below the small end of the retort; the products of combustion pass through the annular space between the casing and the retort. Two rectangular gas-generators are arranged at opposite sides of the combustion chamber, one wall of each generator being constituted by a wall of the combustion chamber. The gas produced in the generators passes through pipes into a conduit extending centrally through the retort, and having openings through which the gas is discharged into the interior of the retort, for the purpose of "chemically treating" the material being roasted.—A. S.

Smelting ores; Furnace for and process of ——. E. Riveroll, Los Angeles, Cal. U.S. Pats. 820,133 and 820,134, May 8, 1906.



THE ore is fed into the upper end of the inclined shoot, 13, down which it travels by gravity until it reaches the lower and less inclined part, where its movement is arrested. At the lower end, the shoot communicates with the closed combustion chamber, 4, into which fuel and air under pressure are introduced through the burner, 12. The hot blast passes upwards through the body of ore, and the gases escape into the stack, 3; a supplementary blast of air is introduced through the pipe, 18. The fused ore flows into the well, 2, where separation of the metal and slag takes place.—A. S.

Ore roasting furnace. I. Sanfilippo, Casteltermini, Italy. U.S. Pat. 820,138, May 8, 1906.

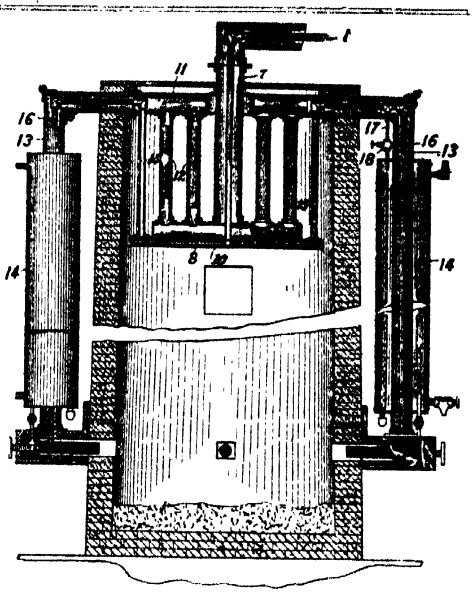
SEE Fr. Pat. 334,444 of 1903; this J., 1904, 67.—T. F. B.

Cupola. W. S. Anderson, Cincinnati, Ohio. U.S. Pat. 820,167, May 8, 1906.

THE patent relates to a cupola heated by means of liquid fuel. The fuel-supply pipe passes round the cupola and is provided with communicating "pipe-spurs" which project inwards, and are embedded in the wall of the cupola, in order to derive heat therefrom and so preheat the fuel. The fuel passes from this heating pipe to burner-nozzles which discharge into the cupola.—A. S.

Cupola. J. H. Koons, Delphos, Ohio. U.S. Pat. 820,210, May 8, 1906.

THE patent relates to a heating apparatus for a cupola. A low-pressure air-pipe, 7 (see Fig.), passes through the top of the cupola and has upper and lower branch pipes, 11, and, 8, respectively, with connecting pipes, 12. From the upper branch pipes, low-pressure pipes, 13, pass through oil-tanks, 14, to the tuyère-boxes at the lower portion of the cupola. A high-pressure air-pipe, 1, passes through the low-pressure pipe, and has branch pipes, 10, from which vertical pipes, 15, rise and connect with high-pressure pipes, 16, which also pass through the oil-tanks to the tuyère-boxes. Air-supply pipes, 17, controlled by valves, 18,



lead from the high-pressure pipes into the upper portions of the oil-tanks. The oil in the tanks is heated by means of steam-pipes, and independent supplies of oil and of heated air under high and low pressure respectively pass to the burners.—A. S.

FRENCH PATENTS.

Ores; Apparatus for the concentration of ——. P. H. L. Combres. Fr. Pat. 360,401, Aug. 12, 1905.

THE invention relates to a jigging arrangement suitable for prospectors or small mines, and consisting of a peculiarly constructed sieve working in water, contained in a partitioned trough, and so suspended as to secure both vertical and horizontal motions, whereby concentration of the heavier material is obtained, the waste being discharged at intervals as desired.—J. H. C.

Ores; Concentration of poor —— with calcareous matrix. J. de Coppet. First Addition, dated Oct. 21, 1905, to Fr. Pat. 358,089, Oct. 6, 1905 (this J., 1906, 270).

THE lime is dissolved from a mixture of lime and finely pulverised metallic oxide, suspended in water, by means of dilute acid, used in such proportion that an alkaline reaction is constantly shown by means of a small quantity of an alcoholic solution of phenolphthalein which is added at the outset.—J. H. C.

Zinc; Furnaces or apparatus suitable for the manufacture of ——. J. Armstrong. Fr. Pat. 361,023, Sept. 15, 1905.

SEE Eng. Pat. 20,543 of 1904; this J., 1905, 1113.—T.F.B.

Metals and alloys; Process and apparatus for the refining of ——. Super-refining Metallurgists, Ltd. Fr. Pat. 360,408, Oct. 23, 1905.

THE apparatus comprises a closed crucible heated by a furnace which is mounted on trunnions so that it can be tilted. The crucible communicates by means of flexible tubing with two or more vacuum chambers and a suction pump, and the furnace is connected to a blower, also by means of flexible tubing. The metal or alloy to be refined is heated *in vacuo* in the closed crucible, and is kept agitated by the oscillation of the furnace. For the purpose of making alloys the crucible may be divided into compartments by partitions extending upwards to about one-third of the height of the crucible. The components of the alloy are melted in separate compartments and are then mixed by tilting the furnace. The cover of the crucible

may have (1) a mould attached to it, which on tilting the furnace becomes filled with the molten metal, and (2) may also be provided with valved receptacles containing substances (deoxidising or desulphurising agents) which it is desired to add to the molten metal.—A. S.

Autoclaves; Employment of —— in metallurgy for the treatment of minerals and the separation of metals. L. Rivière. Fr. Pat. 360,602, Nov. 18, 1905. Under Int. Conv., May 2, 1905.

THE powdered minerals are treated in an autoclave under pressure of steam greater than that of the atmosphere, with caustic alkali, alkali carbonate or alkali sulphide. The solutions thus obtained are afterwards similarly treated with lime whereby the dissolved metallic oxides or salts are separated and the alkaline solutions are regenerated.—J. H. C.

Slags from the Thomas process [Basic slag]; Pulverisation of ——. T. Kalinowski. Fr. Pat. 360,806, Nov. 27, 1905. Under Int. Conv., Jan. 28, 1905.

THE molten slag, while at a white heat, is received in a closed receptacle, provided with a safety valve, and is showered with water, the steam thus produced under high pressure effecting the desired pulverisation.—E. S.

Minerals; Treatment of —— for the extraction of metals or metallic oxides. M. A. Eybert and C. P. Eybert. Fr. Pat. 360,520, Dec. 15, 1905.

ALKALI sulphides or polysulphides are added to the finely crushed minerals in suitable proportions together with carbon. The mixture is heated in a crucible or a reverberatory or other furnace to a temperature which may vary from 600° up to 1000° C., according to the nature of the mineral, whereby the metals are separated, whilst certain oxides are volatilised. Part of the sulphur employed may be subsequently recovered by heating the residues with carbon, sodium carbonate and chalk.
—J. H. C.

Ores; Process for agglomerating friable or pulverulent ——. J. E. Goldschmid. Fr. Pat. 360,576, Dec. 18, 1905.

THE "fines" are placed in a revolving furnace and treated with jets of flame resulting from a mixture of gas and compressed air; a temperature of at least 1000° C. is thus obtained in a strictly limited zone of the furnace, whereby the ore is effectually agglomerated.
—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 485.)

(*A.*)—ELECTRO-CHEMISTRY.

Colloidal solutions; Electrical preparation of ——. T. Svedberg. Ber., 1906, **39**, 1705—1714.

By passing the discharge from a powerful induction coil between metallic electrodes in a suitable liquid, the disintegrated metal is obtained in the form of a colloidal solution. Normal propyl and isobutyl alcohols, anhydrous acetone and paraldehyde have so far proved the most suitable liquids for the purpose. Ether-alcohol gives very unstable solutions, but their stability can be greatly increased by either adding a few drops of a slightly dissociated electrolyte with heavy positive ion, such as monochlorobenzene, or working at a low temperature (—84° C.). A list of the colours of colloidal solutions of many metals and some metalloids, thus obtained, as well as experimental details, are given in the paper.—J. T. D.

ENGLISH PATENTS.

Furnaces; Impts. in electric ——. T. Parker, London. Eng. Pat. 5721, March 18, 1905.

A CRUCIBLE of any desired shape is mounted or laid within a seating or receptacle of refractory non-conducting material, and around the inside of the receptacle is embedded a conductor, or the latter may be placed in suitable grooves, so that the exposed surface of the conductor is in contact with the crucible. The terminals of the conductor are connected to iron rings, which encircle the receptacle near its lower end. The receptacle is placed within a fire-clay base, the rings on the outside of the receptacle making contact with corresponding rings on the inside of the base, the latter rings being attached to the source of current. The base has a projecting seat for partially supporting the receptacle thus preventing the whole of the weight of the latter from falling upon the inclined contact rings. An air space is provided between the outer and inner surfaces of the receptacle and base.—B. N.

Nitrogen-oxygen compounds; Process of producing —— by means of electricity. Westdeutsche Thomasphosphatwerke, Berlin. Eng. Pat. 8721, April 25, 1905. Under Int. Conv., April 7, 1905.

SEE Fr. Pat. 353,548 of 1905; this J., 1905, 1013.—T.F.B

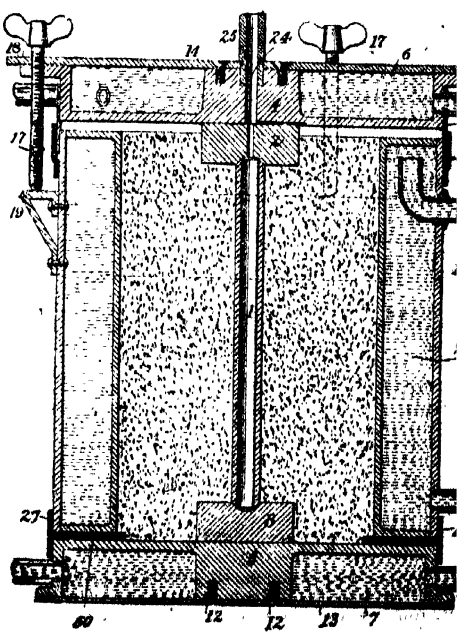
Ozonising apparatus; Impts. in [Electrical] ——. H. J. Wessels de Frise, Paris. Eng. Pat. 8836, April 26, 1905. Under Int. Conv., April 26, 1904.

THE object of this invention is to diminish or completely suppress the decomposition of ozone in the apparatus in which it is formed. The elements of a suitable shape forming one of the electrodes are alternately superposed with the elements forming the other electrode, and a central suction tube is provided at intervals with suitable openings so that the air is drawn out of the apparatus at different levels, thus avoiding the passage of the ozonised air through several electric discharges. A second form is described in which the air enters through slots between the elements of one electrode, and passes in a zig-zag manner to corresponding slots between the elements of the second electrode, the latter slots being in connection with a vacuous reservoir.—B. N.

UNITED STATES PATENTS.

Furnace; Vacuum electric ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 814,726, March 13, 1906.

A TUBE, 1, of graphite or carbon, constitutes the core of the furnace, and the material to be treated is placed



around it. At the ends of the core are arranged terminal blocks, 2 and 3, of graphite or other conducting refractory material, and these make contact with metallic terminals, 4 and 5. The core may be in the form of a rod with rounded ends fitting into corresponding depressions in 2 and 3, the surfaces being ground so as to make good contact; or, if in the form of a tube, the core may have solid rounded end portions, with suitable vent holes in the tube or in the solid end portions. The contacts, 4 and 5, are water-jacketed, and copper plates, 13, 14, are attached by the screws, 12, and also by soldering to the contacts. The upper terminal portion is supported by screws, 17, the latter passing through the extension, 18, and resting on brackets, 19, attached to the furnace body, 16. This prevents the atmospheric pressure on 14 from bending the heated core when the furnace is exhausted. A cylindrical metal tube, 15, with thin walls, slips over the furnace body, 16, and a rubber band 20, prevents entrance of air. The terminal, 4, may thus be adapted to cores of different lengths. The furnace body consists of a tube, 16, with double walls having an annular water-jacket, 21, provided with inlet, 22, and outlet, 23, and the furnace body rests on an insulating ring, 60, of asbestos or mica, a rubber band, 27, making an air-tight joint. A tube, 25, connected to the vacuum pump, is screwed into the block, 4, the bore of the tube being the same as the opening, 24. At the bottom of the block, 4, a groove or channel is cut to connect the tube, 24, with the interior of the furnace, or, in the case of a tubular core, the block, 2, may be perforated. The water-jackets, 6 and 21, may be connected in series, but the jacket, 7, is supplied from a separate source, in order to avoid electrolysis.—B. N.

Liquids; Apparatus for treating —— [electrically]. L. Dion, New York, Assignor to the Americus Electro-Hermatic Co., New York. U.S. Pat. 819,209, May 1, 1906.

A VESSEL or reservoir is constructed with an enlarged globular portion and a lower contracted portion, a group of positive and negative electrodes being arranged within the latter. The electrodes are constructed in "prismoidal form angularly bent transversely of their axes," and are arranged in vertical rows forming vertical and horizontal portions, the longitudinal section of each being rectangular, and the cross-section in the form of an equilateral triangle. One end of each electrode is connected to a base plate, means being provided for supplying a current of electricity to the electrodes. Means are also provided for supplying a liquid through the bottom of the vessel, and between the electrodes.—B. N.

"Super-heating compound" [for use in the manufacture of carbide]. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,218, May 1, 1906.

A MIXTURE is made of the following substances in a pulverised or granulated condition: calcium carbide, carbon such as bituminous coal, substances producing oxygen such as manganese dioxide and potassium chlorate, and a metallic element such as aluminium. (See U.S. Pat. 819,222, below.)—B. N.

Carbide; Manufacture of —— [electrically]. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,219, May 1, 1906.

THE material containing lime is mixed with a small quantity of carbon, and fused, the molten mass being then run into a heated mould coated with powdered carbon, the latter completing the conversion of any metallic particles into carbide.—B. N.

Carbide; Method of producing —— [electrically]. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,220, May 1, 1906.

LIME and carbon, containing elements to reduce the mass to a molten condition, are first fused, and the molten mass run off into thin sheets so as to chill it.—B. N.

Carbide; Process in the production of ——. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,221, May 1, 1906.

THE molten mass of carbide is allowed to flow directly from the furnace into a heated mould, the internal surface of which has been coated with a material impervious to water, such as tar mixed with powdered coke. The carbide is thus uniformly coated with a protective layer, and superficially impregnated with the tar whilst in a fluid and incandescent state.—B. N.

Carbide; Manufacture of —— [electrically]. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,222, May 1, 1906.

PULVERISED limestone, in the presence of carbonaceous material, such as powdered coke, is calcined, the mass being agitated during the operation in order to intimately mix the substances. The mass is then superheated to incandescence by the addition to the calcined heated mass of a super-heating mixture or flux, such as is described in U.S. Pat. 819,218 (see abstract above), in order to drive off any phosphorus in the heated mass. The latter is finally fused whilst still in a highly-heated condition.
—B. N.

Lining for electric or other furnaces and method of preparing the same. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,223, May 1, 1906.

CREAM of lime and powdered coke are mixed together, and asbestos, together with a powdered hydrocarbon, is then added. The mass is formed into non-combustible bricks, blocks or slabs, which are finally pressed and dried.
—B. N.

Furnace; Electric ——. H. L. Hartenstein, Chicago, Ill., Assignor to Electro Chemical and Development Co., Pierre, South Dakota. U.S. Pat. 819,224, May 1, 1906.

THIS invention relates to an electric furnace comprising an upper hopper or casing, carrying a smoke-stack and a pair of electrodes, and a lower member or furnace chamber located beneath the casing. The furnace chamber may be moved laterally by a truck, a pressure device elevating the chamber against the upper casing. The electrodes project into, but out of contact with, the furnace chamber, each electrode being provided with a support which passes through a slot in the hopper or casing. The support passes loosely through a "slide-guide" which is arranged to move along the slot, and a flexible cover is connected with the "slide-guide" for closing the slot in whatever position the support is adjusted. Mechanism is provided within the upper casing for tilting and adjusting the electrodes in a longitudinal, lateral or rotary direction, and also a means for adjusting the extent of projection of the electrodes into the furnace chamber in order to facilitate the removal of the latter.—B. N.

Carbon [for electrical purposes]; Apparatus for producing ——. T. P. Sharts, Readsboro, Vt., Assignor to C. J. Howe, Jamaica, Vt., W. C. Davis and J. H. Cole, Readsboro, Vt. U.S. Pat. 819,606, May 1, 1906.

THIS invention relates to an apparatus for producing charcoal carbon for electrical purposes, and comprises a combustion chamber having a lateral outlet opening directly into the atmosphere for the escape of some of the products of combustion. A burner is mounted in one wall of the furnace for blowing a jet of hydrocarbon oil, such as petroleum, and air into the chamber, and a movable wall, with a plastic sealing material for holding it in position, is fixed opposite the burner. The sealing material ensures the closing of all crevices, and permits of the collection of the carbonaceous products of the combustion in a hard homogeneous mass upon the inner face of the wall. The latter may be set back from the burner from time to time, in order to thicken the collection of carbon on the wall in successive layers.—B. N.

may have (1) a mould attached to it, which on tilting the furnace becomes filled with the molten metal, and (2) may also be provided with valved receptacles containing substances (deoxidising or desulphurising agents) which it is desired to add to the molten metal.—A. S.

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(*A.*)—ELECTRO-CHEMISTRY.

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Nitrogen-oxygen compounds; Process of producing —— by means of electricity. Westdeutsche Thomasphosphatwerke, Berlin. Eng. Pat. 8721, April 25, 1905. Under Int. Conv., April 7, 1905.

SEE Fr. Pat. 353,548 of 1905; this J., 1905, 1013.—T.F.B

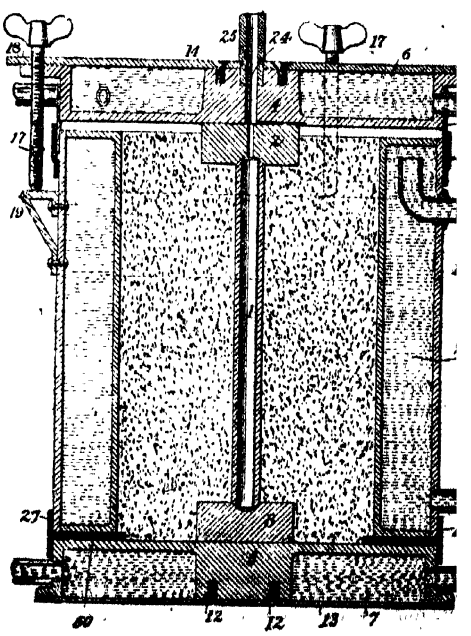
Ozonising apparatus; Impts. in [Electrical] ——. H. J. Wessels de Frise, Paris. Eng. Pat. 8836, April 26, 1905. Under Int. Conv., April 26, 1904.

THE object of this invention is to diminish or completely suppress the decomposition of ozone in the apparatus in which it is formed. The elements of a suitable shape forming one of the electrodes are alternately superposed with the elements forming the other electrode, and a central suction tube is provided at intervals with suitable openings so that the air is drawn out of the apparatus at different levels, thus avoiding the passage of the ozonised air through several electric discharges. A second form is described in which the air enters through slots between the elements of one electrode, and passes in a zig-zag manner to corresponding slots between the elements of the second electrode, the latter slots being in connection with a vacuous reservoir.—B. N.

UNITED STATES PATENTS.

Furnace; Vacuum electric ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 814,726, March 13, 1906.

A TUBE, 1, of graphite or carbon, constitutes the core of the furnace, and the material to be treated is placed



ENGLISH PATENT.

Furnaces; Electric ——. Soc. Anon. Electrometallurgique (Procédés P. Girod), Ugine, Switzerland. Eng. Pat. 25,174, Dec. 4, 1905. Under Int. Conv., Jan. 4, 1905.

SEE Fr. Pat. 350,524 of 1905; this J., 1905, 739.—T. F. B.

UNITED STATES PATENT.

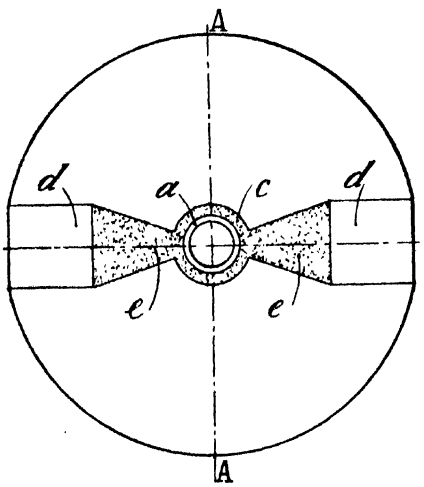
Matte; Treating molten ——. W. E. Koch, Pittsburg, Pa. U.S. Pat. 808,849, Jan. 2, 1906.

THE stream of molten matte is passed between electrodes, preferably of graphitised carbon, gases being simultaneously forced through it, whereby the iron and copper present are separated from each other and diverted by means of a "splitter."—J. H. C.

FRENCH PATENTS.

Furnace; Electric ——. P. Girod. Fourth Addition, dated Nov. 28, 1905, to Fr. Pat. 329,822, Feb. 28, 1903 (this J., 1903, 1054; 1904, 740 and 1179).

To insure uniform heating in the annular layer of resistance material surrounding the crucible, the conducting] material leading the current to it from the



terminals of the furnace has a special disposition. This is made clear in the figure, showing a plan of the furnace. The annular layer of resistance material, *c*, surrounding the crucible, *a*, is of uniform section, the connection to the electrodes, *d*, being made by similar material, *e*, arranged so that its cross-section gradually decreases from the electrodes to the annular layer. The cross-section also diminishes from the base to the top of the crucible which further assists in obtaining uniformity of heating.

The modification described is specially suitable for heating small crucibles containing metals or other electrically conducting materials.—R. S. H.

Ores and metals; Treatment of —— in the electric induction furnace. P. Gredt. Fr. Pat. 360,404, Aug. 31, 1905.

MOLTEN pig iron or other crude metal is heated in an induction furnace with slags containing oxide of iron, intimate admixture of the two being brought about by the pulsations due to the current. These pulsations are stronger the lower the periodicity of the alternating current. It is further advantageous to provide the induction furnace with side chambers in which the reactions can more readily take place.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 486.)

ENGLISH PATENT.

Oil and fatty matters from substances; Extraction of ——. E. Ridgill, Sheffield. Eng. Pat. 15,231, July 25, 1905.

THE substances to be extracted are packed in a vessel provided with a central vertical perforated pipe and a perforated coil through which steam can be blown. The solvent is passed through the material into another vessel provided with steam pipes. To recover the solvent, steam is passed into both the vessels, which are connected to concentric coils cooled by water. The steam distillate is collected in a well, where the solvent separates out.

—F. SHDN.

UNITED STATES PATENT.

Candle materials; Process for manufacture of ——. J. Glatz, Brooklyn. U.S. Pat. 819,646, May 1, 1906.

FATS or fatty acids are treated with ammonia under a pressure of 10—50 atmospheres for a period of 2—20 hours at temperatures ranging between 150° and 250° C.

—J. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 487.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Antimonial substances used for painting and other purposes; Processes for the preparation of ——, *and the products thereof.* E. Chatillon, Brioude, France. Eng. Pat. 9017, April 28, 1905.

SEE Fr. Pat. 353,565 of 1905; this J., 1905, 1023.—T.F.B.

Antimony; Process for the preparation of products of —— for painting and other purposes. E. Chatillon, Brioude, France. Eng. Pat. 9017A, April 28, 1905.

SEE Fr. Pat. 353,565 of 1905; this J., 1905, 1023.—T.F.B.

UNITED STATES PATENT.

Lake [from azo dyestuff] and process of making same; Violet colour ——. R. Kirchhoff, Gross-Lichterfelde, and L. Kerkovius, Friedenau, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 820,052, May 8, 1906.

SEE Eng. Pat. 15,170 of 1905; this J., 1906, 325.—T.F.B.

FRENCH PATENTS.

Lakes from sulphide dyestuffs; Process for producing fast ——. L. Cassella und Co. Fr. Pat. 360,825, March 13, 1905.

SULPHIDE dyestuffs may be employed, in the form of their sulphite compounds, for the production of lakes in the usual way, by precipitation with a metallic salt. For example, 40 kilos. of a 25 per cent. paste of the dyestuff is dissolved in 500 litres of a 1 per cent. solution of sodium sulphite, 100 kilos. of barium sulphate (or other vehicle) and 6 kilos. of calcined sodium carbonate are then added, and the dyestuff is precipitated by adding a solution of 20 kilos. of barium chloride.—T. F. B

Silicon monoxide [pigment]; Production of ——. H. N. Potter. Fr. Pat. 360,875, Dec. 22, 1905. Under Int. Conv., Dec. 30, 1904.

SEE Eng. Pat. 26,788 of 1905; this J., 1906, 434.—T.F.B.

(*B.*)—RESINS, VARNISHES.

Pine cultivation and turpentine production in France, Russia, Greece and the United States.

THE issue of the "Board of Trade Journal" for May 24, 1906, contains an article of the above title, prepared from reports received from H.M. representatives in the countries named. The Journal in question can be procured from Messrs. Wyman and Sons, Fetter Lane, E.C., price 1*d*.

ENGLISH PATENT.

Wood tars and resin oils; Distillation and oxidation of ——. H. Noerdlinger. Eng. Pat. 8590A, Sept. 15, 1905. III., page 529.

(*C.*)—INDIA RUBBER, &c.

Rubbers from Sierra Leone. Bull. Imp. Inst., 1906, **4**, 29—31.

THE three varieties of rubber examined had been collected in the Panguma district of the Protectorate and are known to the natives as Jenje, Gbogboi and Njawa respectively. The vine yielding Jenje rubber is closely related to *Landolphia ovariensis*, though its identity could not be definitely ascertained from the specimens received. Gbogboi rubber is derived from the tree *Funtumia elastica*, the West African rubber tree, the existence of which in Sierra Leone is a point of considerable importance. The plant yielding Njawa rubber is described as a vine, known as Sagba, but its identity is uncertain. The rubbers gave the following results on analysis, the figures expressing percentages on the dry material:—

	Jenje Rubber.	Gbogboi Rubber.	Njawa Rubber.
Caoutchouc	88·6	82·0	73·8
Resin	6·0	4·4	22·1
Albuminoid matter	2·1	2·5	3·0
Vegetable impurity	3·3	11·1	1·1
Ash	2·04	2·40	0·42
Moisture in original sample	3·2	2·1	3·6
Elasticity	good	good	poor

—W. P. S.

Carbon dioxide; Diffusion of —— through caoutchouc. Grunmach. Woch. f. Brau., 1906, **23**, 226—227.

THE author has studied the rate of diffusion of carbon dioxide through membranes of caoutchouc, ranging from 0·15 to 2·4 mm. in thickness. He found that the rate of diffusion decreased considerably in the course of several days. For instance, a plate of caoutchouc 44 sq. cm. in area and 0·6 mm. in thickness, which passed on the first day 0·021 c.c. of carbon dioxide per hour, passed only 0·003 c.c. per hour on the seventh day. With membranes of different thicknesses the rate of diffusion does not decrease in proportion to the increase of the thickness. The quality of the rubber, whether grey or red vulcanised, does not appear to have any appreciable influence. The diffusion of carbon dioxide through rubber tubes and joints, when small quantities of the gas have to be determined, is not negligible. Apparatus used for the study of the respiration of grain should have glass connections. The flasks in which the grain is stored for the subsequent determination of the carbon dioxide produced by respiration should not be closed by rubber corks, but should be sealed by fusion.—J. F. B.

UNITED STATES PATENTS.

Vulcanised material and process for making same. F. Ephraim, San Francisco. U.S. Pat. 819,529, May 1, 1906.

PLANTS containing rubber or similar gum are crushed and pulverised without separating the fibrous portions of the plants; a vulcanising substance is mixed with the powdered plant and the mixture is then vulcanised.

—J. F. B.

Whalebone or rubber substitutes; Process for producing ——. W. Polatsik, Assignor to J. L. Bloom. U.S. Pat. 820,315, May 8, 1906. XIV., page 548.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 488.)

Barbatimao bark; Notes on ——. J. Paessler. Collegium, 1906, 135—140; 142—145.

THE Barbatimao tree grows in Brazil and other parts of South America. The oldest trees attain a height of from 18 to 30 ft. with a diameter of from 8 to 12 ins. The bark is rich in tannin, yielding about 27 per cent. of tannin-substances and only 4 per cent. of soluble non-tannins. It has about the same tanning strength as valonia (28 per cent. of tannin) and a much higher one than quebracho (19 per cent. of tannin). The leaves and fruit are also rich in tannin, the former containing about 7 per cent. of tannin and 8 per cent. of non-tannins.

Calf skins tanned with this bark show a very bright colour, are soft and smooth-grained and take fat with ease. A very bright and even colour is also produced on sole leather, and the tanned material has a fine grain and is firm and pliable.—H. Bn.

Eutannin. H. Thoms. Sixth Int. Cong. appl. Chem. Z. angew. Chem., 1906, **19**, 804.

THE author has examined a preparation brought on the market, in admixture with milk sugar, under the name of "eutannin." The purified substance melts at about 234° C. with decomposition; it is readily soluble in alcohol and in hot water, sparingly soluble in ether and cold water, it crystallises in small needles, reddens litmus and is dextro-rotatory. The manufacturers claim that "eutannin," when heated with water at 100° C. in closed vessels, is resolved almost quantitatively into tannic acid. The author, however, fails to confirm this statement and finds that "eutannin," $C_{28}H_{22}O_{19}$, is merely converted into its hydrate, $C_{26}H_{24}O_{20}$, on heating with water. He also finds that "eutannin" is hydrolysed by caustic soda with the production mainly of gallic acid, together with dextrose and other bodies. Judging from the behaviour of the body, the author does not think that the dextrose is present in "eutannin" in the form of a glucoside. He suggests that the "eutannin" molecule is formed by the condensation of three gallic acid residues with one another, one of them being also condensed with the anhydride of hexahydroxyhexahydrobenzenecarboxylic acid. On treatment with water the anhydride is hydrated, and when the eutannin is hydrolysed by sodium hydroxide solution it is split up into 3 mols. of gallic acid, 1 mol. of hexahydroxyhexahydrobenzene and carbon dioxide. The hydro-aromatic product then undergoes isomerisation into dextrose. According to the author, "eutannin" is identical with the chebulic acid obtained from myrobolans.—J. F. B.

Tanning effect of various tanning materials; Comparative tests of the ——. V. Bögh. Collegium, 1906, 126—132; 134—135.

THIS work is an extension of that of Youl and Griffith, who investigated the tanning effect given by single tanning materials, whereas the author deals with mixtures as well as with single materials.

An unfiltered quebracho-wood infusion was found to have a much higher "weight-giving" property than that of one which had been filtered. The order in which various individual tanning materials may be arranged as regards weight-giving capacity is as follows, starting with the best:—Quebracho, birch bark (*Betula alba*), oak bark and finally pine bark (*Picea excelsa*).—H. Bn.

Sole leather; Adulteration of American ——. J. Gordon Parker, A. Turnbull and Committee, Manchester, Liverpool and District Tanners' Federation Year Book, 1906, 24—27.

A SERIES of analyses was made with the object of ascer-

taining the cause of deterioration in the wearing and water-resisting properties of American sole leather. The 18 samples taken represent the general run of American imported leather, and not specially selected cases. After making allowance for natural saccharine matter which is present to a small and varying extent in all tanning materials, it was found that the leathers contained from 3·21—30·10 per cent. of weighting matters, consisting of magnesium sulphate, glucose, and in one case of sodium sulphate.

The best specimen of leather contained 3·21 per cent. of crude glucose only, whilst the worst contained 21·99 per cent. of crude glucose, 2·99 per cent of magnesium sulphate, 4·42 per cent. of sodium sulphate, and 0·70 per cent. of sodium chloride.

The average total weighting matter amounted to 10·16 per cent. consisting of 2·03 per cent. of magnesium sulphate, and 7·84 per cent. of crude glucose. The amount of soluble matter washed out by cold water ranged from 18·42 per cent. to 33·20 per cent.—H. Br.

Leather; Water-resisting qualities of modern sole ——. J. Gordon Parker. Manchester, Liverpool and District Tanners' Federation Year Book, 1906, 62.

A number of samples of sole leather, of various qualities, were subjected to the pressure of a column of water 12 ins. high and 2 ins. in diameter, and the time noted when the water penetrated through the leather, damping it evenly throughout. Another test was that of hanging strips of leather of equal lengths with one end dipping into water, and noting how much of the leather above the water was made damp at the end of 12 hours. It was found in these experiments, that leather produced by the old method of oak bark tanning, wherein longer time was given than at present, was far more water-resisting than that tanned by more rapid methods.—H. Br.

Blackwattle bark trade of Natal. Board of Tr. J., May 24, 1906.

The quantity of blackwattle bark exported in 1905 was 17,513 tons, of a declared value of 102,666*l*., as against 15,819 tons of a declared value of 92,911*l* for the year 1904. At the beginning of the year 1905, the mallet bark competition practically upset the European markets. About 20,000 tons of this article, which is derived from the *eucalyptus occidentalis*, a tree growing in the virgin forests of Western Australia, were imported into Hamburg the chief centre of the European markets, for tanning material in general and wattle bark in particular. As the Natal wattle industry is dependent upon the Hamburg market to the extent of about four-fifths of the export, it is not surprising that, in consequence of the mallet bark competition, prices for Natal blackwattle bark receded. [T.R.]

Valonia; Determination of extraneous matter in ——. A. Turnbull. XXIII., page 563.

English Patents.

Hides; Process of treating ——. F. J. Oakes, New York. Eng. Pat. 24,488, Nov. 27, 1905. Under Int. Conv., Dec. 12, 1904.

See U.S. Pat. 798,293 of 1905; this J., 1905, 1023.—T. F. B.

Glue; Process for the purification of ——. W. Sadikoff, St. Petersburg. Eng. Pat. 24,984, Dec. 1, 1905.

See Fr. Pat. 356,849 of 1905; this J., 1906, 83.—T. F. B.

United States Patent.

Whalebone or rubber substitutes; Process for producing ——. W. Polatsik, Assignor to J. L. Bloom, Chicago, Ill. U.S. Pat. 820,315, May 8, 1906.

"Animal waste" (100 parts) is immersed for about 48 hours in a bath composed of 80 parts of water and 4 parts of acetate of lime, in order to remove fatty matters. It is then treated for a further 48 hours in a bath of 80 parts of water, 2 parts of strontium chloride, and 1 part of iron sulphate, and is afterwards stretched over boards, and dried whilst under compression.—A. S.

French Patent.

Keratin [horn, hair, &c.]; Treatment of ——. [*Rendering soluble.*] J. Hofmeier. Fr. Pat. 360,895, Dec. 23, 1905.

One hundred kilos. of horn scraps, hair, &c., are treated for 10 days at the ordinary temperature with 200 kilos. of 15 per cent. hydrochloric acid. The acid is then drawn off, and the residue, after washing with water, treated with 100 kilos. of 6 per cent. sodium hydroxide solution. At the end of 24 hours, an aqueous solution of 2 kilos. of potassium permanganate is added, and the mixture allowed to stand for a further 12 hours. The residue is then washed and subjected to a pressure of 400 atmospheres. An alternative method is to pass carbon dioxide into the alkali solution, decant and evaporate the solution. The product is finally clarified by means of hydrogen peroxide or permanganate, and may be used in place of casein for a variety of purposes.—W. P. S.

XV.—MANURES, Etc.

(*Continued from page* 488.)

Beetroots; Manuring of ——. A. Kausek. Z. f. Zuckerind. Böhmen, 1906, **30**, 339—351.

A great advantage is to be derived by manuring the growing beet crop in the field during the vegetative period by the suitable application of stable drainings and similar liquid sewage. The liquid should be brought to the fields in large tanks and distributed in a special manner by sprinkling evenly between the rows of beets, but not on the plants themselves. This is done by a small iron tank mounted on a pair of wheels and provided with a valve, a main pipe and three distributing pipes, each of which can be adjusted to give three different speeds of discharge. The tank holds about 100 galls., and when drawn by an ox it can cover about 5 acres of beetroots in a day's work, allowing for 50 refillings at 5 minutes each. The drainings from an average dung heap contain 0·2 per cent. of soluble nitrogen, 0·46 per cent. of potash, and 0·08 per cent. of chlorine; according to requirements, the liquid may be fortified by nitrate or by potash. Proper measures must be taken to collect all the drainage of the farm in underground pits, solid fæcal matters can be liquefied by the addition of quicklime and dilute sulphuric acid. Manuring with liquid sewage of this kind is equivalent to the application of nitrate; the beets absorb the whole of the fertilising matters rapidly, and yield an immediate return in the form of improved quality and quantity. The utilisation of these liquids is very important for European agriculture, since the available mineral supplies of nitrates are rapidly becoming exhausted.—J. F. B.

Nitrogen; Assimilation of elementary —— by azotobacter and radiobacter. J. Stoklasa. 6th Int. Cong. Appl. Chem.; Z. angew. Chem., 1906, **19**, 803.

Azotobacter chroococcum has a greater power of assimilating atmospheric nitrogen than any species yet studied. The culture media may contain either mannitol or dextrose. In the latter case, it is always necessary to add a little chalk. The author is unable to confirm Beijerinck's statements that *radiobacter* has any appreciable power of assimilating atmospheric nitrogen, and that *azotobacter* in co-operation with *radiobacter* has a greater assimilating power than in pure cultures; in fact, the fixation of nitrogen was less in the mixed cultures. *Radiobacter* is a powerful denitrating organism; it reduced 70—79 per cent. of the total nitrogen offered to it in the form of nitric acid to the state of free nitrogen, nitrous acid being an intermediate stage, and it fixed 10—18 per cent. of the total nitrogen (as nitric acid) in the form of organic bodies, chiefly nucleo-proteids. The author has studied the quantities of carbon dioxide evolved by the respiration of *azotobacter* during the assimilatory process. The

greatest intensity of respiration took place between the 4th and the 10th days. The average quantity of carbon dioxide produced by 1 grm. of *azotobacter* dry substance in 24 hours was 1·27 grms., which is a higher proportion than with any of the other species; *B. Hartlebi* gave only 0·6 grm. of carbon dioxide per grm., and *Clostridium gelatinosum* only 0·48 grm. under the same conditions. *Azotobacter*, when grown in mannitol or dextrose media, produces alcohol, lactic, acetic, butyric and formic acids, the gaseous products being carbon dioxide and hydrogen; a large portion of the latter gas is oxidised in the nascent state. The process of assimilation of elementary nitrogen by *azotobacter* appears to be related to the respiratory process, and, in all probability, to the production of hydrogen by the bacterium.—J. F. B.

German Patents.

Manure from peat and the like; Process for the manufacture of a ——. H. S. Gerdes, jun. Ger. Pat. 165,976, Jan. 17, 1902.

Humus substances, such as peat and the like, are treated with alkali according to known methods, then mixed in the moist condition with alkali silicates or phosphates, or both, and the mixture dried and ground.—A. S.

Humus substances; Process for rendering —— soluble. H. S. Gerdes, jun. Ger. Pat. 165,228, Feb. 12, 1904.

The humus substances without addition of organic nitrogenous matter, are treated in the moist condition with alkalis or alkali carbonates or with secondary alkali phosphates, especially disodium phosphate. The mass is formed into heaps, after mixing, if desired, with silicates or phosphates, or both, and the heaps are turned over several times and allowed to remain until putrefaction takes place. The material is finally dried and ground.

—A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Maple sugar industry; The ——. U.S.A. Dept. of Agric., Bull. 59; through Bull. Imp. Inst., 1906, **4**, 52—55.

The demand for maple sugar, as an article of luxury, is said to be increasing every year, but the competition of cane and beet sugar, bad seasons, attacks on the trees by the maple worm, and destruction of the forests by lumbermen, have caused a great shrinkage in the producing area. Considerable adulteration with glucose is also said to have been perpetrated by the mixers. The output in the year 1900 was 11,928,770 lbs., almost one-third less than in the year 1850. The sugar maple (*Acer saccharum*) and the black maple (*A. saccharum nigrum*) furnish the best sugar; a similar saccharine sap is yielded by three other American maples of less importance, the red, silver and Oregon species (*A. rubrum*, *A. saccharinum* and *A. macrophyllum*).—W. P. S.

Sugar-beet; The enzymes of the ——. J. Stoklasa. 6th Int. Congr. appl. Chem. Chem.-Zeit., 1906, **30**, 422.

The author has isolated from the beetroot enzymes characterised as oxydases, invertase and glycolytic enzymes. The glycolytic enzymes are to be regarded as respiration enzymes and they are secreted by the living protoplasm both in the normal and in the anaërobic respiration of the beetroot. They set up alcoholic fermentation in dextrose solutions, in presence of salicylic acid as an antiseptic; the fermentation frequently starts immediately and reaches its maximum intensity in 6—8 hours. The products of fermentation consist of considerable quantities of alcohol and carbon dioxide together with smaller quantities of lactic and acetic acids. After 24 hours an evolution of hydrogen is observed, even with free access of air. The breakdown of the carbohydrates probably takes place with the production of lactic acid, alcohol and carbon dioxide, but in presence of air, acetic acid is always produced. The formation of formic acid has also been observed; this acid is probably the source of the hydrogen, which is evolved together with carbon dioxide. The hydrogen, which is the end product of the breakdown of the carbohydrates is, to a large extent, oxidised in the nascent condition with formation of water. It is possible that this nascent hydrogen in the chlorophyll-bearing cells plays a part in the assimilation of carbon dioxide with production of formaldehyde and water. The enzymes of a glycolytic character present in the sugar-beet are enumerated as follows:—Lactolase (Buchner's lactacidase), which splits up the hexoses into lactic acid; alcoholase, which brings about alcoholic fermentation; acetolase (Buchner's glucacetase) which causes the formation of acetic acid, and formilase which produces formic acid.—J. F. B.

Dextrose and levulose; Influence of dilution and the presence of other sugars on the osazone test for ——. H. C. Sherman and R. H. Williams. J. Amer. Chem. Soc., 1906, **28**, 629—632.

It is shown that in pure dextrose solutions, when tested at constant volume with fixed amounts of phenylhydrazine hydrochloride and sodium acetate, the time required for the precipitation of the osazone varies with the quantity of dextrose present, and is nearly constant for any given dilution. Pure levulose solutions exhibit similar variations with concentration, but always yield a precipitate of osazone in about one-third the time required by the same amount of dextrose. From invert sugar solutions the osazone precipitates almost as rapidly as from levulose solutions of the same concentration. The presence of 1 per cent. of sucrose considerably shortens the time required for the precipitation of osazone from dilute (about 0·1 per cent.) dextrose solutions, but its effect is scarcely noticeable in levulose solutions. The precipitation is affected only slightly by the presence of raffinose. Maltose retards the precipitation of the osazone from dextrose solutions, and interferes less seriously in the case of levulose solutions; lactose influences the test in a similar manner to maltose, but to a greater degree. In every test, the same quantities of reagents were employed, *viz.*, 0·4 grm. of phenylhydrazine, 0·6 grm. of sodium acetate and 4 c.c. of water, the only variable factor being the amount of sugar or sugars present.

—W. P. S.

Rhodeitol. E. Votoček and J. Bulir. Z. f. Zuckerind. Böhmen, 1906, **33**, 332—339.

The methyl-pentose "rhodeose" is obtained from the glucoside convolvulin, or by the less expensive method of digesting jalap resin with warm baryta water and hydrolysing the extract by sulphuric acid. Rhodeose is reduced very slowly by sodium amalgam in acid liquids, but the reduction may be accelerated by maintaining an alkaline reaction not exceeding 0·5 per cent. of caustic soda. The product, rhodeitol, crystallises from alcohol in white plates with a silky lustre melting at 153·5° C. In aqueous solution it has a specific rotatory power of $[\alpha]_D = -1·45°$; or in a 10 per cent. borax solution, $[\alpha]_D = -4·6°$. Its solubility in 96 per cent. alcohol at 18·5° C. is 0·391 grm. per 100 c.c. When oxidised by bromine in presence of sodium carbonate or by nitric acid, rhodeitol yields rhodeoketose, no aldose sugar being formed. Rhodeitol is not oxidised by the sorbose bacterium (compare Bertrand, this J., 1905, 144); consequently, since this bacterium oxidises only those polyhydric alcohols of a certain stereochemical type, it is concluded that the configuration of rhodeose may be represented by the formula,

$$CHO.HCOH.OHCH.(CHOH)_2.CH_3$$

or its image. Rhodeose is the optical antipodes of fucose; when a mixture of the two sugars is reduced by sodium amalgam, an inactive alcohol, *r*-rhodeitol (= *r*-fucitol) is produced which melts at 168° C., and is therefore a true racemic compound.—J. F. B.

Trehalose; Determination of —— in trehala. P. Harang. J. Pharm. Chim., 1906, **23**, 471—473.

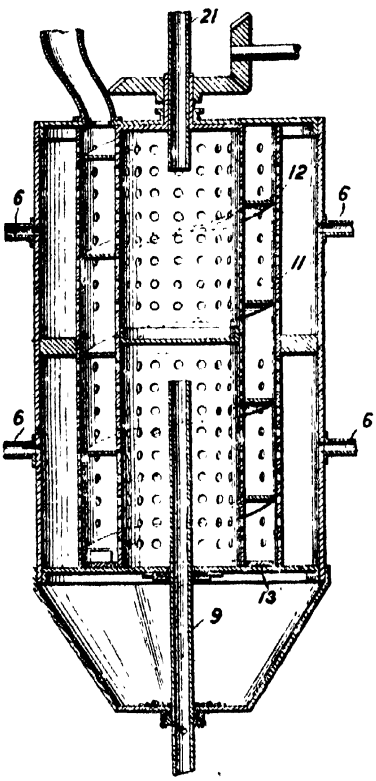
The biochemical method for the determination of trehalose by means of the ferment trehalase obtained from cultivations of *Aspergillus niger* (this J., 1906, 93) has been applied to the determination of that hexose in its original

source, trehala, the cocoons of *Larinus nidificans* (a species of beetle). Three authentic samples gave respectively 30·48, 27·16 and 23·48 per cent. of trehalose calculated on the dry material, a larger amount than that found by other investigators employing different methods. —J. O. B.

Beetroots; Manuring of ——. A. Kausek. XV., page 548.

UNITED STATES PATENT.

Sugar machine. O. B. Barth, Loveland, Col. U.S. Pat. 810,250, Jan. 16, 1906.



THE apparatus consists of a cylindrical drum placed in a vertical position, and having an inner perforated cylindrical wall at a short distance from the outer solid wall. The annular jacket thus formed around the inner perforated cylinder is divided by a horizontal partition into upper and lower compartments. At the centre of the drum there is a revolving, hollow, perforated drum, 11 (see Fig.), which carries on its outer surface a spiral wing, 12, which scrapes the inner perforated wall of the containing drum. The sugar is fed into the annular space between the two perforated walls, and is carried downwards by the spiral wing. The central perforated drum is also divided horizontally into two compartments. Steam is fed into the upper compartment of this drum through the pipe, 21, and "blue water" is fed into the lower compartment through the pipe, 9. The outermost jacket of the drum is connected in both compartments with vacuum pipes, 6. The syrup is sucked into the jacketed space under the action of the vacuum, whilst the purified sugar is discharged at the bottom through a valve plate, 13.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 491.)

Hydrogen peroxide in malt analysis; The diastatic catalysis of ——. H. van Laer. J. Inst. Brewing, 1906, **12**, 313—338.

IN order to determine the catalytic power of malt, 3 grms. of the very finely ground sample are placed in an Erlenmeyer flask fitted with a lateral tube. The flask is clamped in an inclined position with the meal in the upper part of the bottom, and 25 c.c. of a solution containing 3·4 per cent. of hydrogen peroxide are introduced in such a manner that contact with the malt is avoided. The flask is then closed, the side-tube is connected with a Hempel burette, and the zero is adjusted. The time is noted, the contents of the flask are mixed by agitation for 10 seconds, and the volume of gas liberated in five minutes is noted. This volume is taken as a measure of the catalytic power of the malt. The hydrogen peroxide solution must be free from acid, and should be freshly prepared every day, being standardised by permanganate. The fineness of grinding and the temperature have a great influence on the results; the apparatus containing the reagents should be warmed to 20° C. in a water-bath before mixing. The catalytic activity of barley differs from that of malt in the fact that the volumes of oxygen evolved in the periods after the first five minutes, decrease far more rapidly in the case of malt than in that of barley, i.e., the malt catalase is more rapidly destroyed by the hydrogen peroxide than barley-catalase. The catalytic activity of barley increases during germination and decreases during the kilning of the malt. During kilning it undergoes two sudden falls, one during the drying of the green malt, in the first 24 hours, and another during the final curing. There is a continued production of catalase during the first 24 hours of kilning, but the net result is a loss during that stage. The catalytic activity of an infusion follows the same variations as that of the grain, except in the case of raw barley and kilned malt, which only yield a small proportion of their catalase to an infusion. Catalytic activity generally runs parallel to diastatic activity; certain divergencies, however, occur, some of which are referable to the fact that diastatic activity is determined in infusions and catalytic activity in the powdered grain; thus steeliness would lower the diastatic activity of an infusion owing to imperfect extraction of the diastase present. In very old malt the catalytic activity may have disappeared whilst a certain amount of diastatic activity is retained; the two are not identical. Catalytic activities, as determined in the above manner, may be divided into: Low, 1—38; medium, 39—72; and high, above 72. If the rotatory powers of the standard wort be classified as: Low, $[\alpha]_D$ below 115°, and high, $[\alpha]_D$ above 120°, the malts can be classified according to the indications of their catalytic activities and the rotatory powers. Generally, in normal cases, a high catalytic activity corresponds with a low rotatory power of the wort and with highly attenuated beers. When the results of both determinations are reconcilable, the conclusion as to the probable attenuation of the beer is confirmed. When the results are contradictory, it is best to trust to that for the catalytic activity, except in those cases where the rotatory power is too high in comparison with the catalytic activity. A high catalytic activity and a high specific rotatory power would indicate inferior modification of the malt, since the diastase would be present in large quantities, but not readily available in an ordinary infusion. A low catalytic activity occurring with a low specific rotatory power would indicate a large percentage of ready formed sugars or great friability of the malt.—J. F. B.

Yeasts; Top-fermentation and bottom-fermentation ——. *Studies on variation and heredity.* E. C. Hansen. Cent. Bakt. (Abth. 2). 1905, **15**; Woch. f. Brau. 1906, **28**, 220—221.

THE question of the change of type from bottom-fermentation to top-fermentation yeast and *vice-versa* has frequently been raised, and various isolated cases have been recorded, but without any satisfactory explanation. The author has made experiments with

a bottom-fermentation yeast, *Saccharomyces turbidans (S. ellipsoideus II.)*, by sowing a trace of yeast in a thin layer of beer wort and storing the cultures at a temperature of 0·5° C. for three to five months. At the end of that time sowings were made from the product, with the result that both the first and all the subsequent sub-cultures were found to have a pronounced top-fermentation character. This circumstance was explained in the following experiments. It was found on analysis that the original yeast could be split up into two portions, one consisting wholly of cells of bottom-fermentation type, and the other wholly of cells of top-fermentation type. When the cells of both types were treated separately at a low temperature, as described above, the bottom-fermentation cells did not multiply at 0·5° C., whereas the top-fermentation cells showed a considerable reproduction at that temperature. In sub-cultivations of the treated cells, it was found that the type had been preserved absolutely unchanged both in the treated cells themselves and in their descendants. Thus in the original experiment, the action of the low temperature had not really brought about a change of type, but had only caused a selective multiplication of the top-fermentation cells originally present. The wine yeast *S. Johannisberg II.*, generally regarded as a bottom-fermentation yeast, gave similar results. In the same way, on analysis, the top-fermentation yeast, *S. validus (S. Pastorianus III.)*, was found to contain 3 per cent. of cells with a bottom-fermentation character. These cells were separated and treated under various conditions favourable to top-fermentation for a period extending over two years, but neither the original cells nor their descendants could be induced to show any variation in type.—J. F. B.

Yeasts; The ash contents of certain ——. G. Heinzelmann. Jahrb. Ver. Spiritus-Fab. Deutsch., **6**, 21—22; Woch. f. Brau., 1906, **23**, 228.

THE author has obtained the following results from the analysis of the two varieties of distillery yeast, race II. and race XII., cultivated in wort from the same brewing:

	Race II.	Race XII.
	per cent.	per cent.
Water	76·7	73·7
Dry substance	23·3	26·3
Ash (on the dry substance)	9·90	8·13
Nitrogenous matter, as albumin (on the dry substance)	43·34	50·28
Non-nitrogenous matter (on the dry substance)	41·59	46·76
Composition of the ash—		
Phosphoric acid	54·41	52·72
Lime	0·95	0·80
Magnesia	4·86	4·79

Analyses are also given of a "Lufthefe" (yeast propagated by aëration) and of the yeast crop obtained from a vat fermented with it. The "Lufthefe" showed a very high albumin-content, 60·20 per cent. on the dry substance, but in spite of this its fermentative power, as indicated by the volume of carbon dioxide evolved under standard conditions, was very much lower than that of the skimmed yeast-crop which contained only 50·20 per cent. of albumin.—J. F. B.

Yeast; Relations of oxygen, and of movement of the nutrient solution to the increase and fermenting power of ——. L. Nathan and W. Fuchs. Z. ges. Brauw., 1906, **29**, 226—234, 243—252, 282—289, 299—304, 312—320.

THE authors give a critical account of previous publications dealing with the influence of oxygen on the growth of, and fermentation by, yeast. From the results of their own experiments, which are very comprehensive in character, the following conclusions are drawn: (1) As was found by Buchner, an abundant supply of oxygen exerts no appreciable favourable influence on the fermentative activity of yeast, but only stimulates the budding of the cells. (2) In a nutrient solution free from oxygen, a small amount of the latter endows the yeast with fresh fermentative power, but does not cause budding. (3) Regular motion of the liquid accelerates the fermentation by producing large surfaces of contact between the wort and the yeast, and causes the growth of an increased quantity of well-nourished, active yeast. (4) The amount of oxygen absorbed by a nutritive solution is far in excess of that necessary for the fermentation. (5) By diminishing the aëration or the oxygen content of the liquid, the increase in the amount of yeast produced by agitation of the solution can be annulled. The fermentation is then effected in a shorter time and without any considerable amount of extract being given up to the yeast. (6) The carbon dioxide produced during fermentation is capable of diminishing, to a slight extent, the budding power of the yeast, but it has no influence on the fermentative activity of the cells, provided the latter are sufficiently well supplied with food. (7) If the shaking be continued beyond a certain limited time, the fermentative and budding powers cease, and the yeast dies.

The paper is accompanied by a chronological list of publications on the subject.—T. H. P.

Alcoholic fermentation without cells; Action of peroxydase on ——. A. Bach. Ber., 1906, **39**, 1664—1668.

SUGAR solutions were submitted to the simultaneous action of zymase, peroxydase and hydrogen peroxide to ascertain whether under these conditions an oxidation of the carbohydrate or any of its degredation products takes place. It was found that the hydrogen peroxide is quantitatively converted into oxygen by the catalase in the yeast; further that active peroxydase markedly retards the alcoholic fermentation, whereas peroxydase solution which has been rendered inactive by boiling, as also hydrogen peroxide in the absence of peroxydase, are without any action on the fermentation. The presence of peroxydase and hydrogen peroxide has no effect on the acidity of the fermented liquid. The retarding action of peroxydase as measured by the production of carbon dioxide during fermentation varies with different preparations, but is always very marked; in some experiments the reduction in the amount of carbon dioxide produced is of the same order as the decrease in the power of the zymase to liberate oxygen from hydrogen peroxide, but when more active peroxydase preparations are used, the yeast zymase is much more affected than the catalase. Bearing in mind that yeast is one of the few organisms which do not contain a peroxydase, the retarding action of peroxydase on the phenomenon of alcoholic fermentation without cells is of particular interest, and it would appear that the splitting up of sugar into carbon dioxide and alcohol and the presence of a peroxydase, are incompatible.—E. F. A.

Alcoholic fermentation without cells; Fate of yeast catalase in ——. A. Bach. Ber., 1906, **39**, 1669—1670.

PARALLEL experiments were carried out in which zymase, prepared by the acetone method, was allowed either to ferment a sugar solution or to undergo autolysis, and the activity of the catalase remaining in each solution was tested from time to time. It was found that the amount slowly diminished as autolysis proceeded, whilst during the sugar fermentation the process of decomposition was much more rapid. Dilution of the zymase increased the rate of destruction of the catalase in either case. No definite relationship could be established between the amount of catalase in the yeast and its fermentative activity.—E. F. A.

Catalase; Influence of peroxydase on the action of ——. A. Bach. Ber., 1906, **39**, 1670—1672.

ALTHOUGH in sugar solutions, during fermentation with zymase, the activity of yeast catalase falls off more rapidly in presence of active peroxydase than in that of the boiled enzyme, it is shown that at 30° C. vegetable (yeast) catalase is not harmed by prolonged contact with active peroxydase. In the case, however, of animal catalase from ox liver an increase in the activity was at first observed on adding active peroxydase, though after 48 hours' contact there was no difference in the activity of the catalase preparations to which fresh and boiled peroxydase solutions had been added respectively. No explanation is at present offered for the difference observed in the case of sugar solutions.—E. F. A.

Fermentation industries; The present position of the British ——. J. L. Baker. Pharm. J., 1906, 76, 439—442; 465—467; 496—498.

THE author describes the fermentation processes of the beer, spirit and cider industries of this country, discussing more particularly the question of pure yeast cultivated from a single cell in relation to these industries. The processes of isolating single cells from mixtures of yeast and of cultivating the isolated colonies in the Hansen-Kühle aseptic propagating apparatus are described in detail. This process has been successfully carried out in practical brewing by the author for a considerable time. He finds that the stock of single-cell yeast tends to become contaminated in brewery work after three to five successive runs. This difficulty is surmounted by taking regularly fresh cultures from the Hansen apparatus, propagating these cultures in a small tun of 250 galls. capacity and fortifying the slightly contaminated stock of pitching yeast with the contents of this tun. In this way the predominance of the pure culture yeast is assured. The pure yeast system has been applied chiefly for the fermentation of mild ale worts. The obstacle which has stood in the way of the general adoption of pure-culture yeast for the preparation of top-fermentation beers in this country has been the difficulty of obtaining natural conditioning by secondary fermentation. This, however, does not apply to running ales destined for quick consumption. In the author's opinion there is no sharply-defined line between primary and secondary fermentation requiring the activity of two different types of yeast; the process is more probably a continuous one. With single-cell yeast, after the violent primary fermentation ends, the residual yeast becomes for the most part quiescent. During the resting period the hydrolytic enzymes in the yeast cell undergo some modification and become active, since it has been observed that the fermentative energy, as measured by the evolution of carbon dioxide and the loss of gravity, becomes once more apparent. This recurrence of activity is more marked in some races of yeast than in others.

In the whisky industry, practically nothing has been done in the way of applying pure single-cell yeast for the fermentation of the worts, although the system is fully established in Continental distilleries. In view of the intimate dependence of the quality of the spirit on the volatile by-products of fermentation, attention to the selection of the most suitable races of yeast for the production of the more valuable amongst these by-products ought to yield profitable results. At present most pot-still distillers obtain their yeast from a neighbouring brewery.

Lastly, the author refers to the successful use on the Continent of pure cultures of fine-vintage wine yeasts for the fermentation of cider musts.—J. F. B.

Hops; Extraction of —— by solutions of various mineral salts. J. Heron. J. Inst. Brewing, 1906, 12, 300—301.

IN these experiments 10 grms. of hops were digested at the boiling temperature with 900 c.c. of solutions of the various salts containing 21 grains per gallon for one hour. The liquids were then made up to 1005 c.c. and filtered, and the extracts were examined. The following results are recorded:—

Salt.	Extract per cent.	Colour in 4 in. cell total units	Analysis of colour.		
			Red.	Yellow	Flavour.
Sodium chloride ..	18	7·2	1·2	6·0	Pleasant
Calcium chloride ..	17	5·7	1·2	4·5	,,
Sodium sulphate ..	16	6·8	1·3	5·5	Rank
Potassium sulphate	16	—	—	—	Harsh
Magnesium sulphate	16	6·2	1·2	5·0	Pleasant
Calcium sulphate..	17	6·5	1·5	5·0	,,
Sodium carbonate	19	10·9	1·9	9·0	Nauseous
Potassium carbonate	18	11·6	2·6	9·0	,,
Calcium carbonate	18	11·2	2·8	8·4	,,
Distilled water ...	20	4·7	1·1	3·6	Pleasant

—J. F. B.

Tintometer; The use of Lovibond's ——. J. L. Baker and H. F. E. Hulton. J. Inst. Brewing, 1906, 12, 302—304.

THE authors have observed that when Lovibond's tintometer is employed for the determination of the colour of worts, the results are liable to vary according to the position of the instrument and the manner in which the light falls upon it. When the readings are taken with the opal glass reflector directly facing a window (north light), the results are very much lower than when the illumination is from behind or from the side. The readings with a back or side illumination correspond well with those taken with a front illumination when the top light is cut off by covering over the space between the cell and the reflector. The above discrepancies, so noticeable in the case of malt worts, are not observed when the liquid in the cell is a mild or pale ale. The authors have observed that, in the case of malt worts with a front light, the readings are about half a degree higher when the malt extract is on the left-hand side of the standard field than when it is on the right-hand side. Caramels and black malt extracts are very difficult to match with the "52" series glasses. When a liquid cannot be matched with a single glass, it is desirable that one of the compound glasses should be as near as possible to the intensity required.—J. F. B.

Beer; Nitrogenous substances in ——. O. Miskovsky. Z. ges. Brauw., 1906, 29, 309—312.

THE author describes the methods he adopts to determine the various nitrogen compounds in beer and gives the following results obtained:—

	1 litre of beer contains.	100 grms. of dry matter of beer contain.
	grms.	grms.
Total nitrogen	0·308	0·833
Albuminoid nitrogen (according to Rümpler)	0·188	0·509
Albuminoid nitrogen (according to Stutzer)	0·112	0·303
Ammonia-nitrogen	0·010	0·027
Nitrogen coagulated by magnesia	0·045	0·122
Amide-nitrogen	0·015	0·041
Amino-acid nitrogen (according to Stanĕk)	0·036	0·097
Xanthine-nitrogen	0·013	0·035
Choline-nitrogen	0·009	0·024
Betaine-nitrogen	0·004	0·011
Arginine-nitrogen	0·002	0·005
Histidine-nitrogen	0·001	0·003
Lysine-nitrogen	—	—
Albumins (according to Rümpler)	1·175	3·185
,, ,, ,, Stutzer)	0·700	1·894
Choline	0·078	0·211
Betaine	0·033	0·089
Arginine, about	0·005	0·015
Histidine, about	0·002	0·006
Lysine	—	—

—T. H. P.

Beers; Darkening of pale ——. *C.* Bleisch and K. Runck. Z. ges. Brauw., 1906, 29, 277—282.

ONE of the fundamental factors to which the darkening of pale beers is due is the presence of a large amount of calcium carbonate in the brewing water. Calcium sulphate, on the other hand, favours the formation of a pleasant greenish-yellow colour in the beer. Alkali carbonates also cause darkening, but these compounds seldom occur in brewing waters. The darkening of pale beers may hence be obviated by the use of gypsum, by thoroughly boiling the brewing and sparge liquors, and also by employing a thin mash. Badly coloured and, especially, old hops should be avoided. The darkening is strongly aided by aërating the wort and maintaining it at a high temperature, particularly in presence of calcium carbonate. Long standing of the wort and pumping, especially with centrifugal or capsule pumps, also increase the colour owing to the aëration they effect. The employment of deep coppers is also detrimental. Iron coppers

have, in general, no influence on the colour of the beer, nor, in all probability, have copper ones, and no difference in this respect can be observed between fire and steam heating.—T. H. P.

Brandy fermented by beer-yeast and cask-lees; Improvement of the flavour of ——. G. Heinzelmann. Jahrb. ver. Spirit. Fabr. Deutsch., 6, 22; Woch. f. Brau., 1906, 23, 227.

THE brandy obtained had an alcoholic strength of 47 per cent., a turbid appearance and a sharp, irritating flavour, and was not suitable for drinking purposes. Filtration through charcoal or distillation from alkali did not bring about the desired improvement in quality. On the other hand, when the brandy was treated with oxidising agents, such as hydrogen peroxide and subsequently distilled with alkali, the flavour was much improved.—J. F. B.

Cloudy beer; Bacteriological investigation of ——. M. Ogawa. Eisec Saikingaku Jiho, 1904, 1, No. 2; Z. ges. Brauw., 1906, 29, 308.

THE author has examined 27 bottles of beer of six different kinds on the appearance of turbidity. Along with yeast, he found generally very common bacteria, such as the potato bacillus, hay bacillus, brown potato bacillus, &c. In only 7·4 per cent. of the beers investigated was a thread fungus found as the cause of the turbidity.—T. H. P

Distillery washes; Analysis of fermented ——. H. Hanow. Z. Spiritusind., 1906, 29, 180—181.

THE analysis of a fermented wash should include a microscopic examination, and determinations of the attenuation, acidity, presence or absence of diastase, alcoholic contents and the presence of fermentable carbohydrates (see also this J., 1904, 263). The author tabulates the results of the analysis of 18 samples of fermented washes (potato) and discusses their bearing as regards the detection of the causes of defects. If the density of the filtered wash exceeds 1° Balling, the attenuation may be regarded as poor. The process of examination consists in removing the alcohol by evaporation, neutralising any excessive acidity, adding diastase if the original wash was defective in this respect, and fermenting under favourable conditions with pure yeast. Poor attenuations due to bad fermentations will be accompanied by high acidities (above 0·8°); the excessive acidity may also cause a destruction of the diastase. Diastase may be absent even from well attenuated washes, but it is generally present in such cases. Under the conditions described above, even well attenuated washes will yield a further quantity of about 0·3 per cent. of alcohol. If a larger quantity be obtained, the original attenuation will have been poor and the fault will be traced either to bad fermentation, indicated by high acidity, or to insufficiency of diastase in the original wash. If a further yield of alcohol cannot be obtained, and if the original attenuation was poor, the cause may be attributed to the presence of unfermentable matters in the potatoes or to the formation of such substances by over-steaming.

Vinasses should not contain more than 0·1 per cent. of alcohol; their acidity ranges from 0·5° to 0·9°, and their solid extract from 5·0 to 5·6 per cent. A high acidity indicates souring of the vinasses after cooling, owing to bacterial action. Sour or imperfectly fermented or distilled vinasses cause diseases in cattle. It is recommended that vinasses for fodder should be boiled under pressure after distillation.—J. F. B.

Sugar-beet; The enzymes of the ——. J. Stoklasa. XVI., page 549.

Carbon dioxide; Diffusion of —— through caoutchouc. Grunmach. XIIIC., page 547.

ENGLISH PATENT.

Lactic acid; Method for manufacturing —— for technical purposes. E. A. Mislin, Prague, and L. Lewin, Vienna. Eng. Pat. 10,436, May 18, 1905.

SEE Fr. Pat. 355,520 of 1905; this J., 1905, 1248.—T. F. B.

FRENCH PATENT.

Amylaceous materials; Treatment and fermentation of —— by mucedinae and other ferments. E. Deleurance. Fr. Pat. 361,030, August 10, 1905.

THE grain is sterilised and steeped by heating with water and a little acid for an hour at the boiling temperature, agitation being effected by the injection of filtered air. The mixture is then boiled under a pressure of 3—4 atmospheres in a convertor for a short time until the starch is rendered soluble. The mash is then pumped through a sterilised refrigerator, and when it is sufficiently cool, it passes into the saccharifying vessel where it is treated in the usual aseptic manner with the mucedinae ferment. The saccharifying vessel is capable of holding several charges from the convertor which are admitted in succession. This vessel only requires sterilising when it is first started; it is never emptied completely, the residue from one charge serving to inoculate the next. The development of the yeast is effected in a similar manner in another vessel under aseptic conditions, and when violent fermentation has begun, the mash is discharged into wooden tuns where fermentation is completed under ordinary conditions.
—J. F. B.

GERMAN PATENT.

Grains, e.g., of maize, which have not been subjected to a preliminary treatment; Process for the rapid steaming of —— for use in the spirit and pressed yeast industries. H. A. Hübner. Ger. Pat. 166,628, May 19, 1904.

THE grains are charged as rapidly as possible into a steamer containing boiling water, and provided with two steam-pipes; the steamer is then hermetically closed, and a strong current of steam is introduced through the lower steam-pipe in order to raise the pressure directly to 2—3 atmospheres, after which the steaming is completed by gradually further raising the pressure to four atmospheres. According to another claim, steam under pressure is introduced at first, and then, after some time, the upper steam-pipe is closed, and the steam which has collected in the upper part of the steamer is allowed to escape, the lower steam-pipe being kept open throughout the process.
—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 493).

(A.)—FOODS.

Gliadin; Optical rotation and density of alcoholic solutions of ——. W. E. Mathewson. J. Amer. Chem. Soc., 1906, 28, 624—628.

THE results given show that the specific rotation of gliadin in 70 per cent. to 75 per cent. alcohol is practically independent of the gliadin concentration, but with 70 per cent. to 80 per cent. alcohol it decreases with the increase of the alcohol concentration. Increase of temperature between the limits 20°—45° C. produces a slight increase in the specific rotation; a sample of gliadin had a specific lævo-rotation at 20° C. of 91·3° which at 45° C. rose to 93·6°. The change in specific gravity of gliadin solutions for such differences as would be met with in flour analysis is not large, and determinations of gliadin in flour from the density of the alcoholic extract, as recommended by Fleurent (this J., 1901, 941), cannot be made with any approach to accuracy.—W. P. S.

ENGLISH PATENTS.

Gluten in the dry state; Process and apparatus for the production of ——. L. A. Morel, Meaux, France. Eng. Pat. 13,948, July 6, 1905. Under Int. Conv., July 6, 1904.

SEE Fr. Pat. 344,631 of 1904; this J., 1904, 1232.—T. F. B.

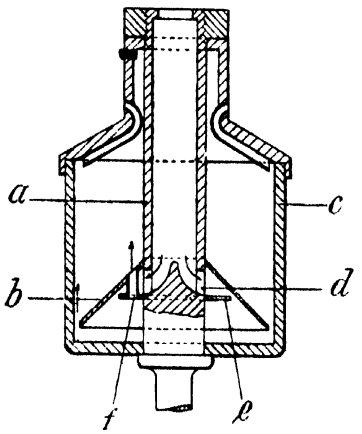
Flour or grain; Treatment of —— and apparatus therefor. H. H. Lake, London. From Nordyke and Marmon Co., Indianapolis, Ind., U.S.A. Eng. Pat. 23,391, Nov. 14, 1905.

See Fr. Pat. 359,771 of 1905; this J., 1906, 492.—T.F.B.

Alimentary, medicinal or like substances; Production of protective or preservative coatings or casings for ——. E. Donard and H. Labbé, Paris. Eng. Pat. 1474, Jan. 19, 1906. Under Int. Conv., Jan. 25, 1905.

See addition of Jan. 25, 1905, to Fr. Pat. 320,027 of 1902; this J., 1905, 853.—T.F.B.

[Milk] Separators; Centrifugal liquid ——. G. de Laval, and E. E. F. Fagerström, Stockholm, Sweden. Eng. Pat. 5859, March 10, 1906.



The claim is for the introduction of a horizontal plate, *e*, disposed below the conical division plate, *b*, but not extending as far as the latter, for the purpose of preventing the milk which is fed down the central pipe, *a*, and flows out of the openings, *d*, under the cone *b*, into the drum *c*, from mixing with the cream which tends to collect under the plate, *e*. Tubes, *f*, passing through both the plates, *e*, and *b*, are provided to allow the cream to pass from beneath the plate *e*, to the upper part of the drum *c*, where it flows away through the cream outlet.—W. H. C.

French Patents.

Vegetables; Preservation of ——. L. Fontaine. Fr. Pat. 360,806, March 15, 1905.

The vegetables, such as peas, beans, &c., are immersed for from five to ten minutes in boiling water containing from ½ to 3 thousandths of their weight of sodium aluminate. The latter forms a stable green lake with the chlorophyll contained in the vegetables.—W. P. S.

Milk, cream, and analogous substances; Process of treating ——. A. T. Pfeiff. Fr. Pat. 360,654, Dec. 19, 1905.

The fat of milk, it is stated, consists partly of large, soft globules and partly of smaller, waxy globules, the latter tending to reduce the quality of the butter obtained from the milk or cream. In order to soften the waxy globules and remove dissolved gases from the milk or cream, with a view to obtaining an improved quality of butter, the liquid is alternately heated to near its boiling point and then cooled, while kept in continuous movement, in a current of purified air. The liquid is preferably treated in thin layers, to expedite the heating and cooling, and thus obviate deterioration in the flavour owing to prolonged treatment.—H. B.

Milk; Process for the preservation of ——, for a short time. P. Bretsau. Fr. Pat. 360,679, Dec. 19, 1905.

The fresh milk is placed in suitable receptacles and a slow current of an inert gas, such as carbon dioxide, passed through it. The supply of gas is then cut off, and the milk subjected to as low a pressure as possible. After repeating these operations a second time, the milk is heated to a temperature of about 40° C., under reduced pressure. Carbon dioxide is then again admitted, the receptacles are hermetically closed and cooled. Milk preserved in this manner will, it is claimed, remain fresh for about 15 days.—W. P. S.

Milk powder and milk products. G. A. Kammermann. Fr. Pat. 360,764, Dec. 21, 1905.

Milk, either alone or mixed with cocoa, sugar, coffee, &c., is evaporated at a temperature below 100° C. The condensed product obtained is then further dried on hot rollers heated to a temperature below 100° C., the rollers being so worked that when they have made a half revolution, the film of dry milk is removed by a scraper.—W.P.S.

Wheat; Process for cleaning ——. W. R. Reid. Fr. Pat. 360,659, Dec. 19, 1905.

The grains are intimately mixed with finely powdered slaked lime or other substance before being subjected to the action of a winnowing machine, the object being to destroy sticky substances which cause dirt, &c., to adhere tenaciously to the grains. About 1 part by volume of lime to 400 parts of grain is a suitable quantity to employ. —W. P. S.

Eggs and egg-containing substances; Process of drying ——. J. R. Hatmaker. Fr. Pat. 361,117, Dec. 26, 1905. Under Int. Conv., Jan. 2, 1905.

See Eng. Pat. 28 of 1905; this J., 1905, 1319.—T.F.B.

Albuminoid rich in nitrogen and phosphorus; Extraction of an ——, from the marc of grapes. G. E. Jacquemin. Fr. Pat. 361,125, Dec. 28, 1905.

The waste substance, such as the marc, stones, &c., of grapes, is ground, dried, freed from oil, and then macerated with soft water for some days. The liquid portion is decanted, heated to a temperature of 50° C., and allowed to settle. The precipitate formed is collected and dried under reduced pressure. The residue left after the maceration is pressed, mixed with its own weight of sand and 2 per cent. of its weight of sodium carbonate, and then treated with boiling water acidulated with hydrochloric acid. Sufficient acid must be used to make the solution feebly acid in reaction. The solution is concentrated, treated with lime water and sodium acetate until practically neutral, and the precipitate which forms collected, dissolved in water and purified by recrystallisation. The precipitate is finally dissolved in water and added to the filtrate from the first precipitate. The resulting turbid liquid is dialysed and the residue mixed with the first precipitate.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Air which extinguishes flame; Analysis of a sample of ——. B. Blount. Analyst, 1906, 31, 144—145.

The air in a large cold storage was found to be incapable of supporting combustion as it contained only 17·5 per cent. of oxygen by volume. At one part of the room was the shaft of a disused well up which passed a strong current of air, evidently coming from some neighbouring tunnels where compressed air was in use. The escaping air from these tunnels passed through ground containing pyrites, which removed some oxygen, before finding a vent up the well-shaft. Ordinary air when kept in contact with the mud obtained from the bottom of the shaft was completely deprived of its oxygen.—W. P. S.

ENGLISH PATENT.

Smoke issuing from smoke funnels, chimneys and the like; Improved process for laying ——. P. Kestner, Lille, France. Eng. Pat. 9549, May 5, 1905.

WATER or steam according to the temperature, is injected into the smoke gases which are then passed through a mixing fan. As the smoke cools, the steam condenses on the solid particles of soot, &c., and causes them to become heavier, so that they are said to be deposited almost immediately after leaving the funnel.—W. H. C.

UNITED STATES PATENTS.

Air for respiration purposes; Apparatus for re-oxygenating exhaled ——. M. Bamberger, F. Böck and F. Wanz, Vienna. U.S. Pat. 819,704, May 1, 1906.

SEE Eng. Pat. 9185 of 1905; this J., 1905, 1027.—T. F. B.

Sewage or the like; Screen for ——. F. Brunotte, Hamburg, Germany. U.S. Pat. 819,720, May 8, 1906.

SEE Eng. Pat. 11,231 of 1905; this J., 1905, 1250.—T. F. B.

FRENCH PATENT.

Water; Process and apparatus for introducing reagents for the purification of ——. J. Overhoff. Fr. Pat. 360,397, Feb. 22, 1905.

THE water to be purified flows from a reservoir, placed some height above the other parts of the apparatus, through a pipe into the lower part of a vessel containing milk of lime. This vessel is closed and has the shape of an inverted cone. The water is thus saturated with calcium hydroxide, and arrives at the top or wider part of the vessel as a clear solution, which is conducted downwards through a pipe to the bottom of a cylindrical vessel, where it receives the addition of dilute sodium carbonate solution. The latter is contained in a separate narrow cylinder, from which it is forced into the main cylinder by the pressure of water derived from the reservoir. When required, the milk of lime may be renewed in the conical vessel by cutting off the water supply and opening a tap at the bottom of the vessel. Part of the contents flow out, reducing the pressure in the vessel. The tap is then closed and a fresh supply of milk of lime drawn in at the top of the vessel through a tapped pipe from a lime tank. Similar means are provided for re-filling the sodium carbonate cylinder. The supply of sodium carbonate solution is regulated by a tap on the pipe conveying it to the main cylinder. The treated and settled water passes from the top of the main cylinder into a collecting tank.—W. P. S.

(*C.*)—DISINFECTANTS.

Disinfecting action; Relations between chemical constitution and ——. H. Bechhold and P. Ehrlich. Z. physiol. Chem., 1906, **47**, 173—199. Chem. Centr., 1906, **1**, 1444—1445.

THE experiments were confined to phenol and its derivatives and allied substances, and the disinfecting action was studied chiefly on diphtheria bacilli, but also on other pathogenic bacteria (B. coli, pyocyanaeus, typhi, Streptococci and Staphylococci). It was found that the introduction of halogens (chlorine and bromine) into the phenol molecule, increases the disinfecting effect of the latter; 1 mol. of monobromophenol has the same effect on diphtheria bacilli as 500 mols. of phenol. The disinfecting power is also increased by the introduction of alkyl groups into phenol or its halogen derivatives, and also by the union of two phenol residues, either directly or by a connecting group such as CH_2, CHOH, $CHOCH_3$, $CHOC_2H_5$. The union of two phenol residues by a CO or SO_2 group, or the introduction of a COOH group into the phenol molecule has an injurious effect on the disinfecting power. The following new disinfectants are described:—Tetrabromo-*o*-cresol prevents the development of diphtheria bacilli at a dilution of 1:200,000, and kills the organisms in less than two minutes when used as a 1 per cent. solution. It has little toxic effect at the dilutions mentioned. Tetrachloro- and tetrabromo-*o*-diphenol also destroy diphtheria bacilli in less than two minutes in 1 per cent. solution, and prevent their development at a dilution of 1:640,000. Hexabromodihydroxydiphenylcarbinol is practically non-poisonous; in 1 per cent. solution it destroys diphtheria bacilli in from two to more than 10 minutes, and prevents development of the bacilli at a dilution of 1:200,000. It has little effect on water bacteria.—A. S.

Disinfectants; Influence of organic matter on the efficacy of certain ——. M. W. Blyth. Analyst, 1906, **31**, 150—155.

THE experiments here recorded have particular regard to the influence which even small quantities of organic matter have on the comparative germicidal values of disinfectants of the phenol class. The disinfectants dealt with are phenol, cresols, "Izal," "Cyllin," resorcinol and pyrogallol. From the results given, it is seen that the higher phenols suffer a great loss of efficacy when mixed with fat, albumin or fæces and urine, but that the influence is much less in the case of phenol itself. The germicidal value of a disinfectant, acting on a "naked" organism gives little, if any, indication of its value in the presence of organic matter. In some experiments with worms of equal weight, it was found that the time taken to kill them by means of 5 per cent. solutions was:—Phenol, half a minute; cresols (ortho, meta and para), three-quarters of a minute; resorcinol, 3 minutes; pyrogallol, 5 minutes; "Izal" and "Cyllin" over 10 minutes. The poisonous nature of phenol, resorcinol and pyrogallol seems to be decreased as hydroxyl groups are introduced, and is directly proportional to the germicidal value. Taking phenol, cresols, "Izal" and "Cyllin," the germicidal value appears to be in inverse proportion to the poisonous nature; but phenol and cresols, which lose but little germicidal value when mixed with milk, are highly toxic, whilst "Izal" and "Cyllin" which lose about 80 per cent. of their germicidal value when mixed with milk, are but little toxic. The supposition that a poisonous albumin-phenol is formed, the act of union killing the organism, is supported by the fact that, although resorcinol gives a copious precipitate with albumin, it suffers but little loss of germicidal value. It appears impossible in the phenol class to combine a low toxic value with a high germicidal value in the presence of much organic matter.—W. P. S.

FRENCH PATENT.

Disinfection, &c.; Process and apparatus for ——, *and for the production of formaldehyde [from burnt sugar].* E. Rouquier. Fr. Pat. 360,476, Feb. 24, 1905.

SUGAR or other carbohydrate is heated in a metallic dish above which is placed a dome-shaped cover containing several horizontal sheets of wide-meshed copper gauze, fitted one above the other to a central rod. The gases produced by the combustion of the sugar pass through the metallic sheets, which have a catalytic action, and are then allowed to enter the room, &c., to be disinfected, or are passed through water to form an antiseptic solution. Formaldehyde may be separated from the latter. Several forms of apparatus constructed on the above principle are described.—W. P. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page 494.*)

Paper and pulp mill effluents. J. H. Vogel. Papier-Zeit., 1906, **31**, 1278—1280, 1314—1316 and 1355.

THE author expresses the opinion that the effluents from paper mills may as a rule be quite suitably discharged into a river of moderate size, provided the suspended matters be previously removed. The organic matters dissolved in these effluents are derived from the washing of rags or straw and similar pulps; they are considerably diluted by the purer waters from the paper machine and

are favourably influenced from a hygienic point of view by the residues of bleaching materials they contain. The effluents are not highly putrescible, but the discharge of any considerable quantity of fibrous matter into the streams is injurious to fishes and vegetation. The effluents from sulphite wood-pulp mills, on the other hand, are very objectionable, and no satisfactory process exists for their purification. These liquors contain, in addition to the sulphur derivatives, considerable quantities of sugars which afford nutriment for the growth of a fungus, *Sphærotilus natans*, in the streams. Hofer has shown that it is the fermentable hexose sugars, principally, which give rise to this growth. Numerous attempts have been made to treat the liquors by the same process as is employed for the bacterial purification of sewage, but the sulphur compounds have such an inhibitive action on the bacteria that no purification is effected in the beds. The author thinks, however, that if the liquors were first treated for the precipitation of sulphites, and were then subjected to putrefaction in a septic tank with the addition of sewage, something might be effected by this process. Some mills dilute their liquors and run the effluent continuously day and night into the stream; but Hofer considers that less harm is done by discharging the whole of the liquors at once, intermittently, provided the stream is a large one, since the fungus growths are thereby nourished for a shorter time. The so-called continuous settling arrangements do not remove the suspended matters so efficiently as sedimentation in tanks; in these, after 12—15 hours, the liquors only contain 10—12 mgrms. of suspended matter per litre. In soda-pulp mills, only the more dilute washings, containing 10 per cent. of the total wastes, have to be discharged. In small streams these liquors give rise to the accumulation of algæ. They should, however, be quite amenable to treatment on the bacterial system after a preliminary putrefaction in a septic tank, which would also serve for the removal of the fibrous matters by sedimentation.—J. F. B.

United States Patent.

Strawboard; Process of making ——. P. Prins, Minneapolis, Minn. U.S. Pat. 819,595, May 1, 1906.

Straw is chopped into short lengths and placed in a closed boiler with quicklime in the proportion of 0·06 lb. per lb. of straw. Steam under a pressure of about five atmospheres is then introduced and the mixture of straw and lime is kept in agitation for about 3½ hours. The pulp is then ground up into a homogeneous mass and is beaten, filtered and made into sheets in the usual way.—J. F. B.

French Patents.

Sulphite liquors; Preparation of strong —— and apparatus therefor. G. Türk. Fr. Pat. 361,071, Dec. 9, 1905. VII., page 537.

Paper pulp; Process and apparatus for preparing ——. P. Couper. Fr. Pat. 361,005, Dec. 29, 1905. Under Int. Conv., Feb. 10, 1905.

See Eng. Pat. 2774 of 1905; this J., 1905, 1251.—T. F. B.

Silk; Process for the manufacture of artificial ——. P. Germain. Fr. Pat. 360,395, Feb. 22, 1905. V., page 532.

Celluloid; Non-inflammable ——. H. Lagneau, E J. Nebel and M. E. Vignes. Fr. Pat. 360,912, March 18, 1905.

Four parts of a supersaturated solution of magnesium sulphate are treated with 2·5 parts of amyl acetate, containing 1 part of camphor, and 1 part of nitrocellulose is added. The nitrocellulose dissolves and the solution floats on the top of the aqueous layer. The whole is then thoroughly incorporated together and the celluloid is produced in sheets under the action of heated rolls. A large number of other salts, capable of resisting heat and extremely soluble in water, can be employed instead of the magnesium sulphate. The celluloid obtained is stated to be transparent and non-inflammable.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 496.)

Cocaine hydrochloride; Decomposition of —— on keeping. P. Breteau. J. Pharm. Chim., 1906, **23**, 474—476.

A specimen of cocaine hydrochloride 15 years old was found to have decomposed into methyl benzoate, free benzoic acid, and ecgonine hydrochloride. This decomposition is attributed to the presence of a trace of water in the lamellar form of crystals characterising the salt in the earlier years of its commercial production. The granular crystalline hydrochloride of the present day is perfectly anhydrous; but it should be carefully preserved from contact with any trace of moisture to obviate decomposition.—J. O. B.

Aconite root; Variability in potency of ——. Chevalier and Bardet. Bull. gén. de Therap. (Paris), 1905, **150**, 713. Pharm. J., 1906, **76**, 471.

The amount of total alkaloids in aconite root is generally from 0·2 to 0·5 per cent., but Chevalier found in a sample from North America, 0·378 per cent. of crystalline aconitine and 0·583 per cent. of an amorphous base having the m. pt. 204·5° C. and the optical rotation of japaconitine. An extract made from this root by the method of the Codex would contain 50 mgrms. of alkaloids in 1 grm. instead of the usual 25 mgrms. The morphological characters of the root agreed in every particular with those given in the official (Codex) description. Bardet states that aconite root from the Zinal Valley is much more toxic than that from the Vosges.—A. S.

Lichen substances. W. Zopf. Annalen, 1906, **346**, 82—127.

The author gives descriptions of the principal constituents of the following varieties of lichens. *Rhizoplaca chrysoleuca* (Sm.) Zopf.; *Rhizoplaca opaca* (Ach.) Zopf.; *Lecanora sulphurea* (Hoffm.) Ach.; *Biatora Lightfootii* (Sm.) *f. commutata* (Ach.); *Biatora granulosa* (Ehrh.) Mass.; *Blastenia Jungermanniae* (Vahl); *Cladina rangiferina* (L.) Wainio; *Cladina destricta* (Nyl.); *Cladina silvatica* (L.) Hoffm.; *Cladina silvatica* (L.) Hoffm. var. *spumosa* Flörke; *Haematomma leiphaemum* (Ach.); *Haematomma porphyrium* (Pers.); *Haematomma coccineum* (Dicks); *Parmelia Mougeotii* Schaerer; *Lepraria candelaris* Schaer. A note on rhizocarpinic acid is given, and a full description of diploschistesic acid.—F. Shdn.

Terpenes and essential oils, 78th communication. Pinene series. O. Wallach. Annalen, 1906, **346**, 220—247.

Pinocarveol, $C_{10}H_{15}OH$, is obtained by treating pinylamine with sodium nitrite and excess of acetic acid. It is a colourless liquid, boiling at 100°—102° C. at 12 mm.; sp. gr. 0·980 at 18° C.; $n_D^{18°} = 1·4988$; M, 45·52. This value of M (the molecular refraction) agrees with that calculated for an alcohol with one ethylene linkiny. On oxidation with chromic acid, pinocarveol yields a certain amount of pinocarvone, $C_{10}H_{14}O$, which is not the ketone corresponding to nitrosopinene. When purified through the semicarbazide (m. pt. 204° C.), pinocarvone boils at 95° C. at 12 mm., and has the sp. gr. 0·984 at 20° C.; $n_D^{20°} = 1·5050$; and M, 45·21. Both pinocarveol and pinocarvone give pinic acid on oxidation with permanganate. In the transformation of pinylamine into pinocarveol, the double bond moves from the ring to the side-chain. There is every reason to believe that an optically active pinocarveol is present in the essential oil of *Eucalyptus globulus* (this J., 1905, 1029). The ketone corresponding to nitrosopinene is carvopinone, $C_{10}H_{14}O$, which is obtained in small quantities by treating nitrosopinene with oxalic acid. Carvopinone boils at 94°—96° C. at 12 mm. and from it small glistening prisms of a semicarbazone are obtained, which do not melt below 300° C. Reduction with sodium and alcohol

ives pinocamphone $C_{10}H_{16}O$. When treated with ydroxylamine, carvopinone gives a substance strongly esembling nitrosopinene. If nitrosopinene be reduced rith zinc and glacial acetic acid, pinylamine and a aturated ketone, pinocamphone are produced. Pino-amphone boils at 87° C. at 12 mm. and gives a semi-arbazone, m. pt. 208° C., and dibrompinocamphone, $_{10}H_{14}Br_2O$, m. pt. 116°—119° C. It is very stable owards acids. Chromic acid oxidation produces *a*-pinonic cid, and an isomeride of camphoric acid, m. pt. 186°—87° C. The constants of pinylamine have been again etermined; sp. gr., 0·9400 at 20° C., 0·9440 at 15° C.; $^{20°}_{D} = 1·5036$; $n^{15°}_{D} = 1·5062$; M, 47·53, 47·54. The alue of M corresponds to one ethylene bond. Oxidation f pinylamine by permanganate in the cold produces arvopinone and an acid $C_9H_{14}O_3$. If pinene is treated rith nitrous acid and reduced with zinc and acetic acid, minoterebenthene, $C_{10}H_{17}N$, is produced. The base from -pinene has the sp. gr., 0·9325 at 19° C.; $n^{19°}_{D} = 1·4960$; $_D = -1°37'$. The base from *l*-pinene has the sp. gr. 0·9320 t 20° C.; $n^{20°}_{D} = 1·4957$; and $\alpha_D = -1°55'$. On oxida-ion with chromic acid, cuminic aldehyde and cuminic cid are produced. It appears that the amino-group is ttached to the side chain in aminoterebenthene and that he base is the derivative of a methene-terpene, probably iopinene.—F. Shdn.

Terpenes and essential oils, 79th communication. Cyclo-hexanone series. O. Wallach. Annalen, 1906, **346**, 249—265.

This paper includes the following. Comparative beha-viour of 1.2-, 1.3-, and 1.4-cyclomethylhexanones. Con-stitution of the isoximes of 1.3-cyclomethylhexanone. soximes from trimethylcyclohexanone. Isomerism mongst the bases derivable from 1.3-methylcyclohexanone. —F. Shdn.

Terpenes and essential oils, 80th communication. Iso-carvoxime, carvoline and isomerism of oximes. O. Wallach. Annalen, 1906, **346**, 266—285.

This paper deals with isocarvoxime and its bromine ddition products, also its reduction to carvoline. If the mino group in carvoline be replaced by chlorine and the esulting compound oxidised, *p*-acetyl-chloro-toluene is roduced.—F. Shdn.

Eucalyptus staigeriana, F. v. M., and its essential oil; The lemon-scented ironbark ——. R. T. Baker and H. G. Smith. Pharm. J., 1906, **76**, 571—572.

Eucalyptus staigeriana is a small tree found in Queens-and, the leaves of which yield, on distillation, 2·5 per ent. of a mobile oil having a light lemon-yellow colour, nd a very aromatic odour, quite different from that f ordinary eucalyptus oil. The oil has the sp. gr. 0·8708 t 16° C., optical rotation $[\alpha]_D = -43·1°$; refractive ndex at 16° C., 1·4871; it is not soluble in six volumes f 80 per cent. alcohol by weight, and a slight turbidity emains even with eight volumes. The principal con-tituents are as follows: *l*-limonene, 60·00; geraniol, 2·72; geranyl acetate, 8·32; and citral, 16·00 per cent. he oil is interesting as being the first eucalyptus oil n which *l*-limonene has been found.—A. S.

Backhousia citriodora; Oil of ——. J. C. Umney and C. T. Bennett. Chem. and Drug., 1906, **68**, 738.

The oil of *Backhousia citriodora* now being placed on the narket in quantity, has the following characters: Sp. gr., ·895—0·898; refractive index, 1·4889; aldehydes principally citral), 94—95 per cent., as determined by bsorption with sodium bisulphite. The oil is either ptically inactive or slightly lævo-rotatory; it is soluble n 2½—3 volumes of 70 per cent. alcohol, and distils lmost entirely between 215° and 230° C. The characters of the first and last fractions obtained on distillation are as follows:—

	First 10 per cent.	Last 5 per cent.	Residue (5 per cent.)
Specific gravity ..	0·886	0·895	—
Refractive index .	1·4798	1·4907	1·5132

The oil should not be confounded with that obtained from *Eucalyptus citriodora*, which latter consists almost entirely of citronellal. (See also this J., 1905, 689, 749.) —A. S.

Rosemary oil. E. J. Parry and C. T. Bennett. Chem. and Drug., 1906, **68**, 671.

The authors have examined oils distilled from authentic specimens of rosemary herbs from Spain and France, and the results show that contrary to the opinion gener-ally held, genuine oils may be lævo-rotatory, or if dextro-rotatory, may yield lævo-rotatory fractions on distillation. In France the oil is usually distilled from plants collected after the flowering period (February and March) and dried for about eight days in the sun, but in Spain distil-lation is carried on throughout the year and with both fresh and dried herbs. The fresh herb yields from 0·4 to 0·75 per cent. of oil, whilst the dried herb yields about 1 per cent. of oil of finer quality. The results obtained with three typical samples of oil are shown in the follow-ing table:—

	1 (Spanish).	2 (French).	3 (French).
Source of oil	leaves alone	stalks (nearly 60%) + leaves	leaves alone
Specific gravity	0·917	0·897	0·914
Optical rotation	+5° 30′	—8° 30′	—3°
Esters, as bornyl acetate	3·2%	3·0%	3·6%
Total borneol	19·7%	10·9%	18·5%
Optical rotation of first 10% on distillation at 100 mm.	—1	—12° 30′	—10°

The oils were fractionally distilled at 100 mm. pressure, and eight fractions, each 10 per cent. of the original quantity, collected. With sample No. 1, the first three fractions were lævo-rotatory and the others dextro-rotatory, whilst with Nos. 2 and 3 all the fractions were lævo-rotatory. The lævo-rotatory constituent (*l*-pinene) is present in larger quantity when the stalks are used with the leaves for the preparation of the oil; the leaves alone yield an oil with a finer odour and containing more borneol than when both leaves and stalks are employed. —A. S.

Borneol and bornyl acetate from pinene hydrochloride. J. Houben. Ber., 1906, **39**, 1700—1702.

The author claims priority over Hesse in the formation of borneol from pinene hydrochloride by the action of free oxygen on pinene-magnesium hydrochloride (this J., 1906, 390). Bornyl acetate can be obtained by treating pinene-magnesium hydrochloride, after oxidation, with acetic anhydride.—F. Shdn.

Nerol and its preparation from linalool. O. Zeitschel. Ber., 1906, **39**, 1780—1792.

The work of the author and previous observers on the action of acetic anhydride or other acid reagents on linalool shows that linalool suffers isomeric change into nerol as well as into geraniol and terpineol. Geraniol and nerol are most probably space isomerides, the follow-ing being their respective formulæ:—

$$CH_3.C.CH_2.CH_2.CH:C(CH_3)_2$$
$$CH_2(OH).\ddot{C}.H$$

Geraniol.

$$CH_3.C.CH_2.CH_2.CH:C(CH_3)_2$$
$$H.\ddot{C}.CH_2.OH$$

Nerol.

These formulæ are confirmed by the fact that terpin hydrate is more rapidly formed from nerol than from geraniol. It follows, also, that citral *b* is the aldehyde of nerol, and citral *a* the aldehyde of geraniol. Linalool (Barbier's licarhodol) was heated to 140° C. with acetic anhydride. The product on saponification yielded geraniol and nerol. The same products were obtained by using, instead of acetic anhydride, formic acid or acetic acid with sulphuric acid, or dilute mineral acids. Citral was reduced with sodium amalgam in alcohol, the solution being kept slightly acid, nerol and geraniol being thus formed. If nerol is oxidised with chromic acid some citral is obtained. Geraniol, linalool and nerol are all more or less converted into terpin hydrate on prolonged shaking, the relative velocity being 1(geraniol):5(linalool): 9(nerol).—F. Shdn.

Nerol; Identity of artificial and natural ——. H. v. Soden and W. Treff. Ber., 1906, **39**. 1792—1793. (See this J., 1906, 334.)

Nerol was prepared by the action of acetic anhydride and sodium acetate on linalool. This was purified from geraniol by the method used to obtain pure nerol from oil of petitgrain (*loc cit.*). The properties and derivatives of the artificial nerol agreed in every respect with those found for the nerol isolated from petitgrain oil.
—F Shdn.

Diphenyl or alkylphenyl camphomethane and methylene. A. Haller and E. Bauer. Comptes rend., 1906, **142**, 971—976

Diphenylcamphomethylene $C_8H_{14}\begin{matrix}C{:}C(C_6H_5)_2\\ CO\end{matrix}$ was prepared by heating camphor with sodium amide in ether and then adding benzophenone. On fractionating, a yellow liquid passes over at 250° C. at 15 mm., which solidifies on cooling. After crystallising from ether and petroleum spirit, fine octahedra are obtained, melting at 113·5° C. and with $[\alpha]_D = +287°$. This substance can be also prepared from diphenylcamphocarbinol. The carbinol is formed by the interaction of the organo-magnesium compound of monobromcamphor and benzophenone in ether. After standing, fine white crystals are deposited, melting at 122·5° C. and with $[\alpha]_D = +62°\ 49'$. The ethereal mother-liquor yields diphenylcamphomethylene on fractionation. If the carbinol be dehydrated by heating with formic or pyruvic acids, the chief product is an isomeric alcohol $C_{23}H_{26}O_2$, melting at 200° C. This substance forms a potassium salt soluble in water but insoluble in alkalis. A small quantity of the methylene compound is produced by the dehydration. Sodium amalgam reduces the methylene compound to diphenyl-camphomethane melting at 106°—107° C.—F. Shdn.

Esterification of alcohols and phenols. I. J. Houben. Ber., 1906, **39**, 1736—1753.

The alcohol or phenol, dissolved in ether, is treated with an organo-magnesium compound, when a replacement of the hydrogen of the hydroxyl takes place:— $R.OH + R^1MgI = R.OMgI + R^1H$. On treating the magnesium compound with acetic anhydride, or even acetyl chloride, the acetic ester is formed:—

$$R.OMgX + (CH_3CO)_2O = R.O.COCH_3 + CH_3.COOMgX.$$

Good results were not always obtained when iodine or bromine magnesium compounds were employed. But the chlorine magnesium compounds generally gave satisfactory results. The acetates of isobutyl alcohol, isoamyl alcohol, geraniol, linalool, terpineol and thymol were prepared; also the propionates of linalool and terpineol. Terpinyl acetate (b. pt. 115°—118° C. at 13 mm.) is a liquid as mobile as water, with an odour resembling that of lilies. Linalyl propionate is a colourless liquid boiling at 108°—111° C. at 12 mm., and 115°—119° at 16 mm. Terpinyl propionate boils at 119°—121° C. at 11·5 mm. *Cis*-terpin can be made by this method to yield terpin diacetate, boiling at 140°—141° C. at 10 mm. On distillation at ordinary pressure, terpin diacetate yields terpinyl acetate, and unsaturated hydrocarbons containing some dipentene. Polyvalent, solid and difficultly soluble alcohols can be esterified by this method—cellulose and starch for example.—F. Shdn.

Phenylation with copper as catalysor. I. Goldberg. Ber., 1906, **39**, 1691—1692.

Phenylanthranilic acid $C_6H_4(COOH)(NH.C_6H_5)$ can be readily prepared by the interaction of anthranilic acid, bromobenzene and potassium carbonate in the presence of a small amount of copper. Benzanilide, $C_6H_5CO.NH.C_6H_5$, and salicylanilide,

$$C_6H_4(OH)CO.NH.C_6H_5,$$

can also be formed by the same reaction.—F. Shdn.

Displacement of the acetyl by the methyl group by means of diazomethane. J. Herzig and J. Tichatschek. Ber., 1906, **39**, 1557—1559.

Diazomethane has no action on acetanilide or phenacetin. On the other hand *p*- and *m*-acetoxybenzoic acid are converted into *p*- and *m*-methoxybenzoic acid respectively (see J. Herzig and J. Tichatschek, Ber., 1906, 268). Thus it appears likely that in diazomethane we have a reagent to distinguish between the acetylamino and acetoxy group. The reaction is, however, not generally applicable to ortho-substituted hydroxyl bodies. Salicylic acid itself, when treated with diazomethane, yields principally gaultheria oil. Similarly, acetosalicylic acid (aspirin) yields salicylic acid acetyl ether methyl ester. Salol, on the other hand, yields salol methyl ether quantitatively, whilst acetylsalol remains unchanged.
—H. L.

Ketones; New method of formation of ——. H. Haehn. Ber., 1906, **39**, 1702—1704.

By heating monocarboxylic acids of the fatty series to a high temperature with calcium carbide, ketones are produced, water and carbon dioxide being separated.

$$2R.COOH = R.CO.R + CO_2 + H_2O.$$

The water reacts with the calcium carbide to form acetylene and calcium oxide or hydroxide. To carry out the reaction, a combustion tube is filled with calcium carbide in pieces of the size of a pea, and is heated in a combustion furnace. The acid is allowed to flow slowly into one end of the tube and the ketone is collected in a receiver connected to the other end. If the crude ketone have an acid reaction, either the distillation is being carried on too rapidly, or the carbide has not been heated to a sufficiently high temperature. Formic acid yielded by this process, water and carbon monoxide. Acetic acid yielded a mixture of acetone and a primary alcohol (probably methyl alcohol) having a constant boiling point of 62° C. From 50 grms. of propionic acid, 28 grms. of crude diethylketone were obtained (theoretical yield, 28 grms.). The yield of dipropylketone from butyric acid was 30 per cent. of the theoretical. Benzoic acid yielded benzophenone, the yield being improved by working in a vacuum of about 20 mm.—A. S.

Antimony tartrate and its ethyl ester. J. Bougault. J. Pharm. Chim., 1906, **23**, 465—469.

Further experiments show that even when antimony oxide is allowed to react with excess of aqueous tartaric acid in the cold, and the compound formed is precipitated with acetone, the product still has the composition, $C_4H_3O_6Sb$, as previously recorded (this J., 1906, 325). When thus prepared and dried in the air, it retains 1 mol. of acetone, which, however, is given up at 100° C. This anhydride, $C_6H_3O_6Sb$, is therefore the constant product of the reaction, and the acid, $C_4H_5O_7$, of P. Guntz, is non-existent. By treating the anhydride, in the cold, with a solution of tartaric acid in 95 per cent. alcohol, esterification gradually takes place and the ester formed, being less soluble, is gradually deposited, the crystallisation not commencing for eight or ten days, and continuing for several months. These crystals, in the form of very fine needles, often aggregated to spherules, dried at 100° C., have the formula, $C_4H_2O_6Sb.C_2H_5$. This ester is insoluble in all ordinary neutral solvents. It is slowly dissociated on contact with water. It is dissolved by neutral potassium tartrate solution, potassium ethyl tartrate and tartar emetic being formed, probably by the dissociation of the ester.—J. O. B.

Monazite sand; Best method of treating ——, *to obtain thorium and cerium.* Garelli. Sixth Internat. Congr. of Appl. Chem., Rome. Z. angew. Chem., 1906, 19, 895.

The sand is fused with sodium peroxide, or with a mixture of sodium and potassium chlorates. The fused mass is treated with sulphuric acid, and the solution thus obtained heated with ammonia, which precipitates ceric and thorium compounds. These are treated with oxalic acid, and separated by salicylic acid or sodium thiosulphate. This method requires less oxalic acid than the ordinary methods. The author proposes to use crude ceric salts, as energetic oxidisers, for bleaching wool, and also in purifying acetylene.—J. T. D.

Colloidal gold solutions; Formation of —— *with essential oils.* L. Vanino and F. Hartl. Ber., 1906, 39, 1696—1700.

Colloidal solutions of gold can be formed by the addition of gold chloride solution to water containing small quantities of the following substances:—Turpentine oil, pinene, rosemary oil (used formerly in the production of "potable gold"), potassium carbonate with formaldehyde, pinene, turpentine oil, or alcohol. The formation of the colloidal solution is accelerated by adding to the gold chloride solution a few drops of a gold solution already in the colloidal state.—F. Shdn.

Actinium; New product from ——. O. Hahn. Ber., 1906, 39, 1605—1607.

From thorium, itself inactive, is obtained radiothorium, which emits α-rays, and this is followed in turn by thorium X, the characteristic emanation, and the "active efflorescence." Actinium shows close analogy to thorium, save in the first step; and the author has now produced from actinium "radioactinium," by adding thiosulphate to a strongly acid actinium solution, when the precipitated sulphur carries down with it a substance which emits α-rays, though but little β-rays or emanation. The intensity of the α-radiation increases to a maximum in about three weeks, then falls to half value in 20 days. The β-radiation and the emanation follow a similar course.—J. T. D.

Essential oils; Sicilian and Calabrian ——. Schimmel's Report, April, 1906.

The statistics show that last year's export, as compared with that of the previous year, has suffered a falling off amounting to 137,859 kilos., value 1,048,830 lire, or about 14 per cent. This reduction in the export is not, however, in any way due to a decline in the demand from abroad, but must be attributed to the fact that with the comparatively feeble crops of the winter season 1904—1905, smaller quantities of oil were available for the export than in the preceding year. It has probably never happened before that the market has passed over from one season into another with stocks of all kinds of essences completely cleared out, as was the case in the autumn of 1905. [T.R.]

Cinnamon oil. Schimmel's Report, April, 1906.

The price of fine Ceylon cinnamon-chips is practically unchanged. The figures of the export in 1905 again show a considerable increase, the total being 2,235,395 lb. (of which the United Kingdom took 358,146 lb.), as against: 2,135,220 lb. in 1904; 2,160,352 lb. in 1903; and 1,763,679 lb. in 1902.

Citronella oil. Schimmel's Report, April, 1906.

The shipments in 1905 from Colombo and Galle were 1,282,471 lb., of which the United Kingdom took 398,700 lb.: the shipments in 1904 were 1,133,068 lb.; in 1903, 1,027,486 lb.; and in 1902, 1,294,750 lb.

On the other hand, the January shipments, of a total of only 19,618 lb., show a great falling off, as compared with a monthly average export of about 100,000 lb.; this appears to explain the lack of available goods and the high price of the same. In Ceylon, the distilling came to an end in December, and as all the labourers are employed on the rice-fields in January, the work on the citronella grass-fields ceased for the time being. Stocks are already cleared out, and oil for early delivery is all contracted for, so that only later deliveries come under consideration. It is therefore possible that the position may become more acute, and that the adjustment between supply and demand will only take place when stocks have again accumulated in the principal consuming countries.

Under these circumstances it is for the present out of the question that prices will go back, much less than the values formerly considered normal will again be reached. [T.R.]

Alkaloids; Precipitation and determination of —— *with potassium bismuth iodide.* D. Jonescu. XXIII., page 563.

English Patents.

Carbon tetrachloride and sulphur chloride; Manufacture of ——. E. Haworth and H. Baker, Runcorn, Lancs. Eng. Pat. 9404, May 4, 1905.

In the manufacture of carbon tetrachloride and sulphur chloride by passing chlorine gas, even containing considerable quantities of air, through carbon bisulphide, the residual gases are passed through liquid sulphur dichloride containing antimony chloride, or through a mixture of these two substances with sulphur monochloride. Chlorine mixed with air or other inert impurity can be passed into a mixture of sulphur monochloride and antimony chloride till more or less sulphur dichloride is formed. This is treated with carbon bisulphide and the mixture fractionally distilled to obtain carbon tetrachloride and sulphur monochloride.—F. Shdn.

Dialkylmalonic acids; Manufacture of diamides of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat., 19,352, Sept. 25, 1905.

See Fr. Pat. 358,085 of 1905; this J., 1906, 197.—T. F. B.

United States Patents.

Carbon chlorides; Process of making ——. F. J. Machalske, Brooklyn. Assignors to F. Darlington, Great Barrington, Mass. U.S. Pat. 808,100, Dec. 26, 1905.

Oxychlorides of carbon (chloro-carbonic acid or perchloromethyl formate) are produced by heating a suitable mixture of quicklime, calcium chloride and carbon in an electric furnace in absence of air. The best proportions are those corresponding to the equation, $2CaO+2CaCl_2+10C=4CaC_2+2COCl_2$. The carbon oxychloride produced is passed through a series of towers containing a substance such as coke, bone charcoal or pumice, which, by the action of surface-contact, decomposes the oxychloride into carbon tetrachloride and carbon dioxide, thus: $2COCl_2=CCl_4+CO_2$. The tetrachloride is condensed in a worm cooled by water, whilst the carbon dioxide is drawn off and compressed.—J. F. B.

Alkamine esters of p-aminobenzoic acid. A. Einhorn, Munich, Germany. Assignor to Farbw. vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. U.S. Pat. 812,554, Feb. 13, 1906.

p-Nitrobenzoylchloroethanol, obtained by the action of *p*-nitrobenzoyl chloride on ethylene-chlorhydrin, is heated for several hours at 100°—120° C. with diethylamine. Ten parts of the *p*-nitrobenzoyl-diethylaminoethanol so obtained are digested at a moderate temperature with 13 parts of tin and 25 parts of concentrated hydrochloric acid. The product, *p*-aminobenzoyl-diethylaminoethanol, is one of the class of alkamine esters of *p*-aminobenzoic acid now claimed. These esters, in the form of their hydrochlorides, are employed as local anæsthetics which are stated to have no irritating action.—J. F. B.

Carbon acids and ketones; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 817,690, April 10, 1906.

Carbon dioxide is mixed with a hydrocarbon such as methane, and the mixture is heated to a temperature near-

that at which dissociation of carbon dioxide takes place. At this temperature the hydrocarbon is oxidised by the oxygen of the carbon dioxide with the production, in the case of methane, of a mixture of acetic acid and acetone. The relative proportions of the products depend on the proportions of the reacting gases and on the temperature employed. The use of an excess of methane and a very high temperature favour the production of acetone. The reaction between the mixed gases takes place in a closed cylinder in which the desired temperature is maintained by the presence of diaphragms of platinum gauze heated by electricity. The products of the reaction are drawn away and condensed as fast as they are formed. The temperature must not exceed the dissociation temperature of the products.—J. F. B.

Formates; Process of making ——. J. Weise, F. Rieche and A. Barth, Assignors to R. Koepp und Co., Oestrich on Rhine, Germany. U.S. Pats. 820,159, 820,373 and 820,374, May 8, 1906.

See Fr. Pat. 342,168 of 1904; this J., 1904, 911.—T. F. B.

French Patents.

Malonyl-p-phenetidine; Process of making dialkylated derivatives of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 360,864, March 15, 1905.

See Eng. Pat. 4564 of 1905; this J., 1905, 1188.—T. F. B.

Theobromine barium; Process of making an easily soluble double salt of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 360,904, March 17, 1905.

See Eng. Pat. 4959 of 1905; this J., 1905, 1188.—T. F. B.

Dimethyl- and trimethylxanthine; Process of making double salts of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 360,909, March 18, 1905.

See Eng. Pat. 4958 of 1905; this J., 1905, 1254.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 485.)

English Patent.

Development of photographic plates, films and the like. W. F. C. Kelly, Fulham. Eng. Pat. 3164, Feb. 15, 1905.

The invention relates to the use of a single tablet containing all the materials necessary for developing photographic plates: the following example is given for a tablet suitable for developing a quarter-plate:—Metol, 2 grains; quinol, 4 grains; potassium metasulphite, 0·5 to 1 grain; borax, 10 to 20 grains, and sufficient colloid and glycerin or glucose to mould the tablet.—T. F. B.

French Patents.

Illuminating compositions for photography in artificial light. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils. Fr. Pat. 360,588, March 2, 1905.

Compositions for producing artificial illumination for photographic purposes are obtained by mixing magnesium, with or without aluminium, with the chromate of a metal which has two degrees of oxidation, *e.g.*, iron, aluminium, copper, manganese. The following mixtures may be used:—Magnesium, 2—3 parts; manganese chromate, 1 part; magnesium, 2 parts; copper chromate, 1 part. Such mixtures are stated to produce a highly actinic flame on ignition, and to evolve very little smoke.—T. F. B.

Reproduction of models, pictures, writing, &c.; Process for the multiple ——. Neue Photographische Ges. Fr. Pat. 360,826, March 13, 1905.

The design, &c., which it is desired to reproduce is drawn upon paper with a substance which resists, wholly or partially, the action of the liquid or gas which is to be used for making the copies. Such liquids and gases are, for example, ammonia, halogens, oxides of nitrogen, acetic acid, alcohol, &c. As an example of the process, the design is drawn on paper with dextrin, a layer of asphaltum varnish is applied, and the paper is washed with water, which removes part of the dextrin, leaving a "negative pattern." The paper which is to receive the reproduction is then prepared with a substance which is coloured or changed in colour by the reacting liquid; using ammonia for this purpose, the paper may be prepared with turmeric, a manganese salt or a mercury salt. If the pattern be made by simply drawing the design with asphaltum varnish, and the receiving paper be coated with alkaline phenolphthalein, and acetic acid used for the treatment, a red design on a white ground is produced. Numerous other examples of the process are given in the specification.—T. F. B.

Photographic pictures; Process for decomposing —— into grained images. Klimsch et Cie. Fr. Pat. 360,697, Dec. 20, 1905.

It is claimed that photographic positives, produced by printing from a negative on to a bichromated gelatin or albumin surface, are converted into grained positives by evaporating on the surface of the positive a solution of resin, oil, fat, &c. It is stated that the resin is separated into minute globules or points, exactly corresponding in size and arrangement to the details of the positive.

—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 498.)

Nitroglycerin; Freezing and melting of ——. Kast Sixth Internat. Congr. of Appl. Chem. Z. angew Chem., 1906, **19**, 850.

Nitroglycerin has two melting-points, 2°·8 and 13°·5 C. The less stable modification melts at the lower temperature. Both forms are monotropic.—J. T. D.

Nitroglycerin; Production of —— of low freezing-point. Will. Z. angew. Chem., 1906, **19**, 899—900.

When glycerin is heated for 7—8 hours to 290°—295° C., and any water produced is removed, it is converted to the extent of 25—45 per cent. into diglycerin, a small amount (4—6 per cent.) of tri- or polyglycerins being also produced. By fractional distillation under reduced pressure, the diglycerin can be isolated as a colourless, very viscous, sweet-tasting liquid, boiling at 245°—250° C. under 8 mm. pressure. It can be nitrated exactly like glycerin, and gives a nitro-product almost identical in explosive properties with trinitroglycerin, save that it is somewhat less sensitive to shock. If about 25 per cent. of this substance be mixed with nitroglycerin, (or if a mixture of glycerin with 25 per cent. of diglycerin be nitrated), an explosive is obtained with all the properties of nitroglycerin, but remaining fluid at – 15° or – 20° C.

—J. T. D.

Explosives; Addition of charcoal to ——. L. Mommi. Sixth Internat. Congr. of Appl. Chem. Z. angew. Chem., 1906, **19**, 850.

The usual explosives give carbon dioxide and water vapour. If charcoal be added, the gases formed are carbon monoxide, hydrogen, and nitrogen. The temperature is considerably lowered by this, and the corrosion of the gun materially lessened.—J. T. D.

Smokeless powder; Residue from explosion of ——, *and its influence on the rusting of guns.* G. van Pittius. Sixth Internat. Congr. of Appl. Chem. Z. angew. Chem., 1906, **19**, 848—850.

None of the substances contained in the residue from either nitroglycerin powder or nitrocellulose powder is in itself injurious to the gun; but they may become so in presence of moisture. The gun should, therefore, be washed out

as soon as possible after use, and where that is not possible, a greasy cleaning-rod should be put through it to keep moisture from the hygroscopic residue.—J. T. D.

Phosphorus; Method of detecting minute quantities of white ——. R. Schenck and E. Scharff. VII., page 535.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 500.)

APPARATUS, ETC.

Parting apparatus; New form of platinum ——. A. Jarman. Inst. of Min. and Metall., May 17, 1906.

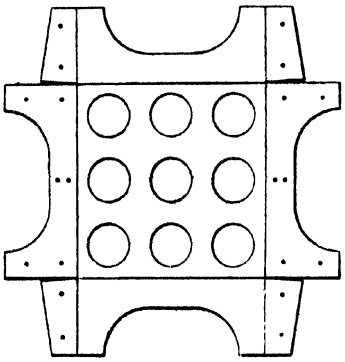


FIG. 1.

THE new form, designed by Liversidge, is much less expensive in platinum and simpler in construction than the usual form described in Percy's "Metallurgy of Silver and Gold." The mode of construction is obvious from the plan (Fig. 1) and the photograph (Fig. 2). Fig. 1 shows the apparatus in plan of ⅜rds scale, each hole being ⅜ in. in diameter. It is made of platinum 0·006 in. thick, and the joints may either be gold-soldered or riveted as indicated on the plan. A glass beaker is used as the boiler, and the legs of the stand are 2 mm. longer than the thimbles, which are thus suspended, by their turned-out lips, with 2 mm. of acid between them and the bottom of the beaker, so that free circulation of the acid can occur. The cost is about £9 13s. 6d. for a 9-cup tray with thimbles.

The pin apparatus, shown in Fig. 3, is in most respects preferable to a tray and thimble apparatus; the acid

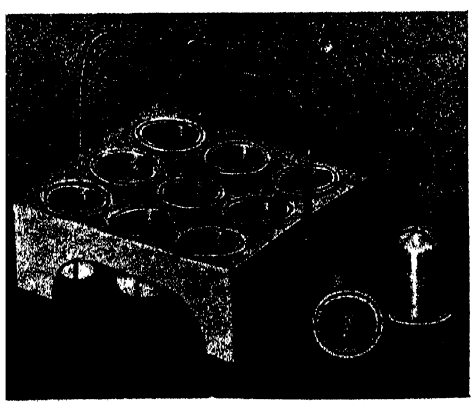


FIG. 2.



FIG. 3.

has freer access to the cornets, and the progress of the operation can be watched. The apparatus shown, which is made of gold, has the disadvantage that the cornets have to be removed on to a tile for annealing, as they might stick to the frame if it were heated with them; but that could be obviated by making the frame of platinum.—J. T. D.

ENGLISH PATENT.

Gas-analysis; Apparatus for use in ——. C. A. Hartung, Berlin. Eng. Pat. 17,708, Sept. 1, 1905, Under Int. Conv., Sept. 2, 1904.

IN this improved apparatus for gas-analysis, the gas is drawn from a pipe branched from, and returning to, the main current. The gas is drawn off by a hydraulic pump and then forced through a vessel containing absorbents, and the reduction in volume read off or recorded. The absorption vessel is then opened automatically to the atmosphere. The required volume of gas is pumped by a uniformly rising and falling liquid column. This rising and falling is maintained by a constant flow of water and an intermittent siphon. The cylinder of the gas-pump is connected with a hydraulic valve so that constant volumes of gas are pumped into the absorption vessel. The size and position of the siphon can be adjusted. By means of a three-way cock the apparatus can be connected simultaneously to a burette or to a registering device.—F. SHDN.

INORGANIC—QUANTITATIVE.

Ammonium tri-iodate as fundamental standard substance in volumetric analysis. E. Riegler. Sixth Internat. Congr. of Appl. Chem. Z. angew. Chem., 1906, **19**, 845—846.

AMMONIUM tri-iodate is a well-crystallised, anhydrous, non-hygroscopic substance, stable both as solid and in solution, and of well ascertained composition. It is prepared by dissolving 100 grms. of pure iodic acid in 200 c.c. of hot water, filtering if not perfectly clear, adding either 10 grms. of pure ammonium chloride or 3 grms. of ammonia (NH_3) in the form of strong ammonia solution, and allowing to stand for 24 hours. The separated tri-iodate is pure, but may be re-crystallised if desired, by dissolving in four times its weight of boiling water and allowing to cool. Its use in standardising sodium thiosulphate solution, or for other purposes where a definite quantity of free iodine is required, is obvious from the equation, $(NH_4)H_2(IO_3)_3+15KI+16HCl=15KCl+NH_4Cl+9H_2O+9I_2$. One molecule sets free nine molecules of iodine, so that 3·025 grms. per litre forms a decinormal solution. To standardise thiosulphate solution, about 1 grm. of potassium iodide is dissolved in 40 c.c. of water, and 1 c.c. of concentrated hydrochloric acid and 10 c.c. of the tri-iodate solution are added; the thiosulphate is then run in and the titration

finished with starch as usual. The solution can also be used directly, without acid, according to the equation:—

$$3\{(NH_4)H_2(IO_3)_3\} + 6Na_2S_2O_3 = 3Na_2S_4O_6 + 5NaIO_3 + NaI + 3NH_4IO_3 + 3H_2O;$$

in this case 27·234 grms. per litre forms a decinormal solution.

The same solution is, it will be seen, alkalimetrically equivalent to a decinormal solution of iodic acid, and can be used to standardise alkali hydroxide solutions; the best indicators are luteol (0·2 grm. in 100 c.c. of alcohol), Congo Red (0·1 grm. in 90 c.c. of water and 10 c.c. of alcohol), Alizarin Red (0·1 grm. in 100 c.c. of water). Alkalimetric titrations can also be done by adding a known volume of the alkali solution to a known volume, more than equivalent, of the tri-iodate, and ascertaining the amount of the latter not neutralised which remains, by titration with thiosulphate solution.

Ammonium tri-iodate decomposes hydrazine sulphate according to the equation:—

$$2\{(NH_4)H_2(IO_3)_3\} + 9N_2H_4H_2SO_4 = (NH_4)_2SO_4 + 8H_2SO_4 + 6HI + 18H_2O + 9N_2;$$

and measurement of the nitrogen evolved affords a method of ascertaining the strength of a tri-iodate solution. —J. T. D.

Iron; Detection and determination of minute quantities of ——. A. Mouneyrat. Comptes rend., 1906, **142**, 1049—1051.

To 50 c.c. of the extremely dilute solution of iron salt, 3 c.c. of ammonia solution free from iron (62 grms. of NH_3 per litre) are added and hydrogen sulphide is passed through for 10—12 minutes. A dark-green solution is formed, apparently containing the iron in a colloidal condition; and the amount of iron present can be determined colorimetrically by comparison with solutions of known strength. Mineral acids and many inorganic salts destroy the green colour; but many organic substances—glycerol, cane-sugar, dextrose, mannitol, lactic acid, tartaric acid, or citric acid, and especially albumin—increase the stability of the colloidal state and the sensitiveness of the reaction. Iron can be detected by this method in a solution containing 1/800,000.—J. T. D.

Gold; Determination of small quantities of ——, *colorimetrically.* R. N. Maxson. Z. anorg. Chem., 1906, **49**, 172—177.

The intensity of the colour of red colloidal gold solution is proportional to its concentration, and small quantities of the metal may be estimated colorimetrically in this manner. The solution of gold, as chloride, is evaporated on the water-bath if necessary to get rid of acid, and an aqueous solution of acetylene, obtained by dissolving the washed gas in water, added. After development of the red colour, the solution is shaken and then compared with a standard. The colour meter recommended consists of vertical tubes in a dark box illuminated from below by means of a mirror. The bulk of solution must be kept small if very little gold is present, or the colour may not appear. Traces of electrolytes cause coagulation of the gold, but this may be prevented by adding a few drops of ether. The standards remain unchanged for weeks, if free from electrolytes, and the method is a rapid one.—F. Sodn.

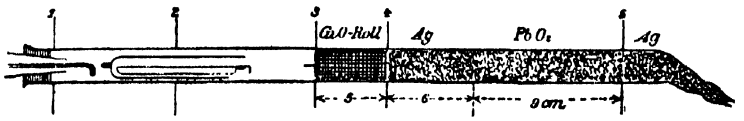
Babbitt [anti-friction] metal; Rapid method for the analysis of ——. H. Yockey. J. Amer. Chem. Soc., 1906, **28**, 646—648.

About 1 grm. of the filings or borings are evaporated with 20 c.c. of nitric acid (1:2) to dryness on the water-bath, and the residue then heated for one hour at a temperature of 120° C. for one hour. The residue is moistened with nitric acid, boiled with water for five minutes and the oxides of antimony and tin collected on a filter. After washing with hot water, the filter and its contents are dried, ignited, and weighed, the weight giving the antimony and tin oxides present. The filtrate is diluted to 250 c.c., of which 50 c.c. are treated with 10 c.c. of ammonia (1:1) and 6 c.c. of glacial acetic acid, boiled and the lead titrated with standardised ammonium molybdate solution, using tannin solution as indicator. The remaining 200 c.c. of the filtrate are neutralised with sodium carbonate until a precipitate forms, 1 or 2 c.c. of ammonia are added, and if a blue coloration appears, denoting the presence of copper, the solution is titrated with a standardised potassium cyanide solution until the blue colour disappears. The lead carbonate and hydroxide present do not interfere with the titration. In a second weighed portion of the sample the antimony is determined, the method described by Walters and Apfelder (this J., 1903, 927) being employed for this purpose.—W. P. S.

INORGANIC—QUANTITATIVE.

Copper oxide layer, 5 cm. long, in ultimate organic analysis; Use of ——. J. Marek. J. prakt. Chem., 1906, **73**, 359—373.

The principle of this method of combustion is the use of a roll of copper gauze 5 cm. long and 2 mm. smaller in diameter than the combustion tube. This gauze is so tightly packed round with asbestos in the tube that all the gases are compelled to pass through the copper oxide and not merely over it. The copper oxide being kept out



of contact with the glass greatly increases the life of the tube. Complete combustion is obtained with a moderate current of oxygen (30—35 c.c. per min.). The portion of the tube containing the copper oxide is wrapped round with asbestos and a tube of sheet iron slipped over. The combustion tube is of Jena glass, 20 mm. diameter, drawn off at one end and bent slightly downwards. The narrow end is completely filled with silver shavings, a device which obviates warming the tube at the end of the combustion; 3—4 cm. behind the silver is the copper oxide gauze. If nitrogen, halogens and sulphur are absent, a tube 30 cm. long will suffice. If these elements are present, a layer 8—10 cm. long of lead peroxide is placed in the tube between plugs of silver shavings. 1, 2, 3, 4 and 5 are perforated plates which serve as supports. The portion of the tube containing the peroxide can be made to pass through an air-bath heated to 180°—200° C., the temperature being kept constant before, during and after the combustion. The portion of the tube where the substance is burned, lies in a trough of iron wire gauze. The copper oxide is heated by a Teclu or Bunsen burner 3 cm. in width, no furnace being necessary. Uniform heating is obtained by means of iron plates covered with asbestos. The substance is placed in a porcelain boat inside a tube of hard glass. The oxygen is passed into the tube through the vertical arm of a T-tube. A thick iron wire passes through the horizontal arm, and by its use the boat can be moved or uncovered to burn off any residue of carbon. Accurate and concordant results were obtained for sugar, benzoic acid, antipyrine, quinine sulphate, &c., the actual combustion lasting from 10—40 mins. For highly volatile liquids, such as ether, the following arrangement was used: The vessel A has a capacity of about 80 c.c. B is a thick iron wire ending in a plate, *d*; *f* is a roll of thick iron wire gauze 1 cm. long. The tube T, which is introduced into the stopper of the combustion tube, is packed with silver shavings. The sealed bulb containing the substance is placed inside and oxygen passed through c and A to T. The tap C is then turned to the position shown in the figure and the bulb

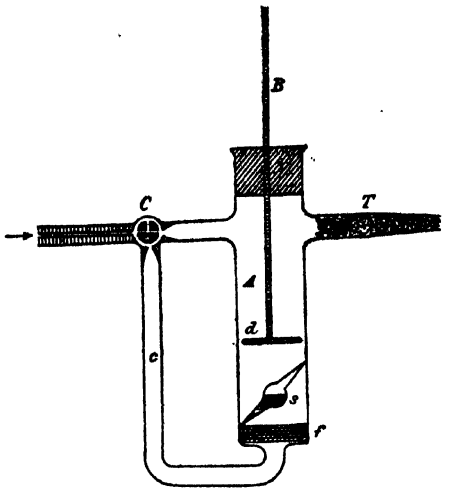


Fig. 2.

broken. After half to one hour the tap is turned to the left through a right angle and oxygen led through for another half hour, followed by air. To remove all traces of the substance the vessel is slightly warmed.—F. Shdn.

Hydrogen, carbon and sulphur in organic compounds; Electrical method for the simultaneous determination of ——. H. N. Morse and C. W. Gray. Amer. Chem. J., 1906, **35**, 451—458.

This paper is a continuation of work by Morse and Taylor (this J., 1905, 753), making the method of electrical heating applicable to a determination of sulphur along with carbon and hydrogen. The modifications necessary for this are as follows:—A platinum boat containing a weighed amount of dry lead peroxide is introduced near the end where the gases enter the absorption apparatus. A "graphited" porcelain tube containing asbestos mixed with lead peroxide is placed between the combustion tube and the absorption apparatus; this completes the absorption of any oxides of nitrogen and is kept heated electrically at 175° C. The lead peroxide in the boat is partially converted into lead nitrate and lead sulphate. After the combustion is finished, the boat and its contents are placed in a hard glass tube and ignited in a current of nitrogen, which decomposes the lead peroxide and nitrate, yielding lead oxide. The weight of sulphate present can be calculated after weighing the lead oxide obtained by heating a weighed quantity of lead peroxide.—C. E. F.

Valonia; Determination of extraneous matter in ——. A. Turnbull. Manchester, Liverpool and District Tanners Federation Year Book, 1906, 107—108.

The following is a quick method of estimating the "dirt," mainly consisting of limestone and sand contaminated with iron, which is often present in valonia beard, and which is dissolved by acid tan-liquors with disastrous results to the leather, especially when much iron is present.

A quantity of valonia is added to a calcium chloride solution (sp. gr. about 1·4) in a pear-shaped separating funnel, fitted with a wide-bore stopcock. After careful shaking, the mixture is allowed to settle; the dirt sinks and is run into a basin and washed, ignited and weighed. The ash is treated overnight with N/1 hydrochloric acid, filtered and titrated back with N/1 sodium carbonate. The amount of hydrochloric acid neutralised by mineral dirt is calculated to calcium carbonate. The solution is made up to a definite volume with distilled water and iron estimated in an aliquot part.—H. Bn.

Alkaloids; Precipitation and determination of —— with potassium bismuth iodide. D. Jonescu. D. pharm. Ges. Ber., 1906, 130; Chem.-Zeit., 1906, **30**, Rep., 156

Thoms has shown that potassium bismuth iodide can be used for the determination as well as the precipitation of alkaloids. Two grms. of quinine were dissolved in 50 c.c. of 10 per cent. sulphuric acid, and precipitated with potassium bismuth iodide. The precipitate was filtered off with suction and well washed with 5 per cent. sulphuric acid. The moist precipitate and filter were transferred to a wide-mouthed stoppered cylinder, 200 c.c. in capacity, and mixed with 20 grms. of sodium carbonate crystals which had been triturated with 40 c.c. of 10 per cent. sodium hydroxide. The alkaline liquid was shaken with 50 c.c. of ether, 25 c.c. of which were drawn off and evaporated in a tared vessel. From 1 grm. of quinine 0·9405 grm. was recovered in this way. The same process can be used for caffeine, but the alkaline liquid must be shaken out with chloroform. From 1 grm. of substance 0·9546 grm. was recovered. Antipyrine was determined in the same way as caffeine, but the precipitate required an hour's shaking with 20 grms. of sodium carbonate and 60 c.c. of 10 per cent. sodium hydroxide; 1 grm. of antipyrine left behind 0·9273 grm. of residue.—F. Shdn.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 501.)

Light; Hydrolytic action of ——. G. Ciamician. Sixt Internat. Congr. of Appl. Chem. Z. angew. Chem 1906, **19**, 850.

In aqueous solution, under the influence of light, aceton is converted into methane and acetic acid, methyl-ethyl ketone into ethane and acetic acid. Menthone gives th decilic acid which Wallach obtained from menthonoxim and at the same time an aldehyde isomeric if not identic with citronellal. Should the reverse reactions be pro ducible by light, the matter will have considerable interes for vegetable physiology.—J. T. D.

Hydrate formation; Relation between —— and temperatu coefficient of conductivity in aqueous solutions. H. Jones. Amer. Chem. J., 1906, **35**, 445—450.

The electrical conductivity of a solution increases with ris of temperature. The increase is due to a diminution i viscosity and to the decrease in the number of wate molecules which are attached to the ions. A review c work already published by the author and his co-worker on the hydrates which are present in aqueous solution leads to these conclusions. The temperature coefficient of conductivity of aqueous solutions are greater the strong is the hydrate-forming power of the electrolyte, and th coefficients are of approximately the same order of magni tude for substances with the same hydrating power. Th calcium bromide or chloride have greater temperatu coefficients than potassium bromide or chloride.

The temperature coefficient of conductivity for an given substance increases with the dilution, and th increase is greatest for those substances with large hydra ing power.—C. E. F.

Water; Anti-catalytic actions of ——. G. Bredig and V Fraenkel. Ber., 1906, **39**, 1756—1760.

It has been previously pointed out (Z. Elektrochem, 190 **11**, 525) that the decomposition of diazoacetic ester b water: $N_2{:}HC.CO_2C_2H_5 + H_2O = HO.H_2C.CO_2C_2H_5 + N$ affords a ready means of measuring the catalyti effect of hydrogen ions, the reaction being greatly accel rated by the presence of small quantities of free acid. Th authors, in studying the catalysis in alcoholic solution have found that the presence of traces of water in th alcohol has a strong retarding influence on the decomp sition. The velocity of the reaction: $N_2{:}HC.CO_2C_2H_5 + C_2H_5OH = C_2H_5.O.H_2C.CO_2C_2H_5 + N_2$, under the catalyt influence of 0·00909-molar picric acid at 25° C. was dete mined (1) in absolute alcohol (prepared by Winkler method; this J., 1905, 1253), and (2) in absolute alcoh to which 0·18 per cent. by weight of water was adde

It was found that the addition of the water lowered the velocity constant of the reaction by about 22 per cent.

Traces of water exert a similar retarding effect on the decomposition of oxalic acid into water, carbon monoxide, and carbon dioxide, by the action of concentrated sulphuric acid. For example, the time required for the decomposition of a definite quantity of oxalic acid by sulphuric acid containing about 100 per cent. of H_2SO_4 is prolonged from 50 minutes to three hours by the addition of 0·05 per cent. of water.—A. S.

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ANNUAL REPORT OF THE IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE YEAR 1904—05. CALCUTTA Government Central Press. 1906. Price as.12, or 1s. 2d.

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THE NATIONAL PHYSICAL LABORATORY. Parrott and Ashfield, Printers, The Causeway, Teddington. 1906.

REPORT for the Year 1905, of large 8vo size, and containing 57 pages of matter. The following is the List of Official Papers published during 1905 by the Laboratory, or communicated by members of the staff to scientific societies or institutions, or to the technical journals:—

"An Analysis of the Results from the Falmouth Magnetographs on 'Quiet' Days during the twelve years 1891 to 1902."—Phil. Trans. A, Vol. 204, 1905, pp. 373—406. By C. Chree, D.Sc., F.R.S.

"Alternating Stress Testing Machine."—Engineering, Feb. 17, 1905. By T. E. Stanton, D.Sc.

"On a New Type of Electric Furnace, with a Redetermination of the Melting point of Platinum."—Proc., Roy.Soc., Series A, Vol. 76, pp. 235—250. By J. A. Harker, D.Sc.

"On the Specific Heat of Iron at High Temperatures."—Proc. Phys. Soc., June, 1905; Phil. Mag., Oct., 1905. By J. A. Harker, D.Sc.

"The Types of Structure and the Critical Ranges on heating and cooling of High-speed Tool Steels under varying thermal treatment."—By H. C. H. Carpenter, M.A., Ph.D. Awarded the Andrew Carnegie Gold Medal at the May Meeting of the Iron and Steel Institute, 1905.

"On the Properties of a Series of Iron-Carbon-Nickel-Manganese Alloys."—Seventh Report to the Alloys Research Committee of the Institution of Mechanical Engineers. By H. C. H. Carpenter, M.A., Ph.D., P. Longmuir, and R. A. Hadfield.

"Photometric Tests of Street Lamps in Teddington."—"Electrician," April 28, 1905; "Journal of Gas Lighting," May 2, 1905. By C. C. Paterson.

"On the Construction of some Mercury Standards of Resistance, with a Determination of the Temperature Coefficient of Resistance of Mercury."—Phil. Trans. A, Vol. 204, 1905, pp. 57—120; "Collected Researches of the National Physical Laboratory," Vol. I., 1905. By F. E. Smith, A.R.C.Sc.

"On the Construction of a Cadmium Cell."—British Association Report, 1905. By F. E. Smith, A.R.C.Sc.

"Temperature Experiments on the Field Coils of Electrical Machines."—Engineering Standards Committee Report, Feb., 1905. By E. H. Rayner, M.A.

"On the effect of Temperature on Insulating Materials."—Engineering Standards Committee Report, May, 1905. By E. H. Rayner, M.A.

"Report on Temperature Experiments carried out at the National Physical Laboratory."—"Journal of Instn. of Elect. Engineers," Vol. 34, 1905, pp. 613—659. By E. H. Rayner, M.A., A.M.I.E.E.

"Report on Errors in Workmanship."—Published by the Engineering Standards Committee. By S. W. Attwell.

"On the Testing of Cast Iron and other Materials by the Ewing Permeability Bridge."—Communicated to the Institution of Electrical Engineers. "Page's Weekly," Dec. 29, 1905, p. 1421. By Albert Campbell, B.A.

DIE ELEKTROLYSE GESCHMOLZENER SALZE. Dritter Theil, Elektromotorische Kraft. Von RICHARD LORENZ, Ph.D. Professor für Elektrochemie und physikalische Chemie am eidg. Polytechnikum in Zürich. Wilhelm Knapp's Verlag. Halle a. S., 1906. Price M.10.

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THE CHEMISTRY OF HAT MANUFACTURING. Lectures delivered before the Hat Manufacturers' Association by WATSON SMITH (1887—1888). Formerly Lecturer in Chemical Technology in the Owens College, Manchester, and of the Victoria University. Revised and edited by ALBERT SHONK. Scott, Greenwood and Son, 19, Ludgate Hill, London, E.C., 1906. Price 7s. 6d. India and British Colonies, 8s., other countries, 8s. 6d. net. D. van Nostrand Co., 23, Murray Street.

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JOURNAL OF THE

Society of Chemical Industry.

No. 12.—Vol. XXV. **SUPPLEMENT.** **JUNE 30, 1906.**

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Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

List of Members Elected.

June 22nd, 1906.

Bennett, A. E. J., 14, Franklin Street, Woburn, Mass., U.S.A., Leather Manufacturer.

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Carveth, Dr. H. R., Niagara Electro-chemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

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Hinckley, E. H., Saylesville, R.I., U.S.A., Foreman.

Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.

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When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

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Wrampelmeier, T. J., l/o San Francisco; 2126, Emerson Street, Berkeley, Cal., U.S.A.

Change of Address Required.

McEwen, Atholl F., l/o Johannesburg, Transvaal.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 12,502. Kestner. Process and apparatus for the concentration of liquids. [Fr. Appl., May 29, 1905.]* May 29.
,, 12,523. Dennis. Process for treating material by heat.* May 29.
,, 12,616. Pritchard, and The United Alkali Co., Ltd. Apparatus for use in bringing liquids and solids in contact. May 30.
,, 12,700. Shears. Apparatus for homogenising liquids and semi-liquids.* May 31.
,, 12,757. MacDonald. *See under* XII.
,, 12,945. Roessler, and The Air Light Co., Ltd. *See under* II.
,, 13,021. Borbeck. Crucible furnaces.* June 5.
,, 13,241. Downs. Solvent extracting apparatus. June 8.
,, 13,406. Hough. Furnaces. June 11.
,, 13,669. Matthews. Smoke cleaner.* June 14.
,, 13,751. Gewecke. Regenerative furnaces. June 15.
[C.S.] 5072 (1905). Ljungström. Centrifugal separators for liquids. June 20.
,, 8440A (1905). Adams and Cannon. Kilns. June 7.

[C.S.] 10,874 (1905). Aktiebolaget Separator. Centrifugal separating apparatus. June 7.
" 11,776 (1905). Clark. Apparatus for promoting the absorption of soluble substances by liquids, applicable for use in purifying illuminating and other gases. June 7.
" 12,216 (1905). Zylberlast. Apparatus for cooling liquids. June 13.
" 12,371A (1905). Fitts and Akins. Apparatus for washing and separating granular or pulverulent material. June 20.
" 14,700 (1905). Gasquet. Apparatus for washing and cleaning casks, vats, carboys, &c. June 20.
" 17,933 (1905). Soddy. Method of producing vacua. June 20.
" 18,130 (1905). Jürgens. Vacuum evaporating apparatus. June 7.
" 20,866 (1905). Trent. Centrifugal filters. June 13.
" 20,941 (1905). Constans. Machines for lixiviation processes. June 7.
" 24,737 (1905). Faller. Boiling apparatus for liquids containing or depositing solid substances. June 13.
" 25,454 (1905). Schmidt. Smoke consuming furnaces. June 20.
" 25,552 (1905). Grove. Apparatus for evaporating liquids. June 13.
" 2991 (1906). Boult (Goldman and Co.). Filters. June 20.
" 2992 (1906). Boult (Goldman and Co.). Filters. June 20.
" 5349 (1906). Soddy. Production of vacua. June 20.
" 8183 (1906). Simmance. Tubular apparatus for effecting the transference of heat between fluids. June 13.

II.—FUEL, GAS, AND LIGHT.

[A.] 12,461. Thoms. Carburetting apparatus.* May 29.
" 12,465. Hartenstein. Manufacture of carbide.* May 29.
" 12,467. Wilkie and Hutchins. Producer gas generators. May 29.
" 12,572. Von Mehren. Agglomeration of coal without pitch or tar. May 30.
" 12,945. Roessler, and The Air Light Co., Ltd. Compressing plant specially suited for gas. June 2.
" 13,181. Thorpe and Dougan. Incandescence gas mantles. June 7.
" 13,598. Newton. Gas producers. June 13.
" 13,615. McEwen and Astbury. Revivification of oxide of iron used in purifying coal and other gases. June 14.
" 13,681. Wheatley (Frowein und Wiescher). Incandescence mantles. June 14.
" 13,682. Wheatley (Frowein und Wiescher). Incandescence mantles. June 14.
" 13,701. Saurer. Carburetting apparatus.* June 14.
" 13,703. Bickerton, Robson, and National Gas Engine Co., Ltd. Gas producing plant of the suction type. June 14.
" 13,764. Büchel. Method of manufacturing briquettes. June 15.
" 13,775. Paxman. Suction gas producing plants. June 15.
" 13,787. Wilten. Gas washers.* June 15.
" 13,861. Sabatier. Preparation of pure methane or of a gaseous mixture rich in methane. [Fr. Appl., June 17, 1905.]* June 16.
[C.S.] 11,725 (1905). Goskar and Burn. Suction gas producer plants. June 7.
[C.S.] 11,776 (1905). Clark. *See under* I.
" 11,859 (1905). Marriott and Darch. Agglutinants for artificial fuel and the like. June 7.
" 12,563 (1905). Wilson. Gas producers. June 7.
" 15,065 (1905). Arundel and Higginson. Apparatus for supplying a uniform mixture of gas and air, especially for use with yarn or thread gassing machines. June 13.
" 21,369 (1905). Harding. Production of a combustible gaseous mixture. June 13.
" 24,418 (1905). Jaubert. Purification of acetylene gas. June 20.
" 1331 (1906). Goehtz. Gas producers. June 13.
" 1841 (1906). Schatz. *See under* XXIII.
" 2440 (1906). Hugershoff. Carburetting apparatus. June 20.
" 2907 (1906). Wilton. Purification of gases produced in the destructive distillation of coal, &c. June 20.
" 12,210 (1906). Potter. Cleansing of gases. June 20.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 13,229. Rouxeville. Process for treating hydrocarbons.* June 8.
" 12,840. Martini. Method of and automatic electrode for oxidising cold crude petroleum or any of its distillates from cyclic series C_nH_{2n} to the higher paraffin hydrocarbons ranging from hexane to octodecylthiophane and sp. grs. 0·688 to 0·923, for explosion in internal combustion engines. June 16.
[C.S.] 16,182 (1905) Soc. Anon. des Combustibles Industriels. Oxidation and distillation of tar, naphtha and like hydrocarbons. June 13.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 12,418. Imray (Meister, Lucius und Brüning). Manufacture of ω-chloracetanilides. May 28.
" 12,421. Soc. Chem. Ind. in Basle. Manufacture of nitroalphylacidylamidonaphtholsulphonic acids, nitroalphylamidoacidylamidonaphtholsulphonic acids, amidoalphylacidylamidonaphtholsulphonic acids, or amidoalphylamidoacidylamidonaphtholsulphonic acids, and of azo dyestuffs therefrom. [Fr. Appl., May 29, 1905.]* May 28.
" 12,518. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series.* May 29.
" 13,054, 13,055 and 13,056. Dreyfus, and The Clayton Aniline Co., Ltd. *See under* XX.
" 13,057. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series and of colouring matters therefrom.* June 5.
" 13,772. Abel (Act.-Ges. f. Anilinfabr.), Manufacture of a new *p*-aminodiphenylaminesulphonic acid. June 15.
[C.S.] 17,382 (1905). Imray (Meister, Lucius und Brüning). Manufacture of green acid mordant dyestuffs. June 20.
" 22,021 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of colouring matters of the triphenylmethane series. June 7.
" 6189 (1906). Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of azo colouring matter. June 7.
" 7288 (1906). Dreyfus, and Clayton Aniline Co. Manufacture of sulphuric acids of the aromatic series. June 20.

[C.S.] 10,079 (1906). Meister, Lucius und Brüning. Manufacture of products soluble in water, fats and oils, from the salts which higher fatty acids and acids of the oleic series form with organic colour bases. June 7.

„ 10,323 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of salts of 1.2-diazonaphtholsulphonic acids. June 20.

„ 10,505 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. June 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 12,433. De Montlord. Flax treating apparatus. [U.S. Appl., May 29, 1905.]* May 28.

„ 12,517. Johnson (Badische Anilin und Soda Fabrik). Removal of colouring matter from dyed or coloured material.* May 29.

„ 12,573. Ellis. Winch drums for use in dyeing cloth goods. May 30.

„ 12,596. Gaebele. Manufacture of vegetable hair from the fibres of the cocoanut.* May 30.

„ 12,718. Minck, and Bremer Baumwollwerke. Obtaining fibres from cotton seed hulls and other similar waste products.* May 31.

„ 12,842. Friedrich. Method of washing and drying artificial threads.* June 1.

„ 13,334. Soc. Anon. de Blanchiment Teinture. Fabric printing machines. [Fr. Appl., March 31, 1906].* June 9.

„ 13,420. Serret. Manufacture of artificial waterproof silk. June 11.

„ 13,695. Ellis (Chem. Fabr. von Heyden). Manufacture of ketone sulphoxylates and ketone hydrosulphites.* June 14.

„ 13,752. Puchert and Puchert. Wool-fibre cleaning apparatus.* June 15.

„ 13,788. Ellis (Chem. Fabr. von Heyden). Manufacture of formaldehyde hydrosulphites and sulphoxylates.* June 15.

[C.S.] 11,294 (1905). Hasselmann. *See under* IX.

„ 15,065 (1905). Arundel and Higginson. *See under* II.

„ 14,193 (1905). Brown and Young. Impregnating or coating materials with a liquid or semi-liquid substance. June 13.

„ 16,583 (1905). Peessarer. Preparation of threads, films and laminæ from viscose. June 20.

„ 18,168 (1905). Hulme. Apparatus for printing calicoes and other woven fabrics. June 20.

„ 20,220 (1905). Hanitzsch. *See under* XIX.

„ 1296 (1906). Bottomley. Manufacture of boracic acid wool. June 7.

„ 3833 (1906). Haines and Whit-Gould. Washing apparatus. June 13.

„ 8313 (1906). Frankenberg. Manufacture of waterproof materials. June 20.

„ 10,094 (1906). Müller. Manufacture of lustrous bands, threads, strips and the like of viscose. June 7.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 12,401. Hausser. Production of oxides of nitrogen by means of explosion engines. [Ger. Appl., May 31, 1905.]* May 28.

„ 12,538. Gaillard. Apparatus for concentrating sulphuric acid.* May 29.

„ 12,618. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of chromic acid. May 30.

[A.] 12,834. Jaubert. Oxygen generators. [Fr. Appl., June 5, 1905.]* June 1.

„ 13,012. Masson. Recovery of antimony and arsenic from ores, concentrates, tailings and slimes.* June 5.

„ 13,480. Elworthy. Manufacture of hydrogen and of mixtures containing the same. [Fr. Appl., June 17, 1905.]* June 12.

„ 13,579. Serpek. Production of compounds of aluminium and nitrogen.* June 13.

„ 13,615. McEwen and Astbury. *See under* II.

„ 13,828. Wolffenstein. Manufacture of hydrogen peroxide.* June 16.

[C.S.] 6611 (1905). Tee. Manufacture of white salt from rock salt. June 13.

„ 21,280 (1905). Ellis (Merck). Manufacture of a new lithium salt. June 13.

„ 22,080 (1905). Cellarius. Manufacture of sulphuric acid. June 30.

„ 23,841 (1905). Gaillard. Concentration of sulphuric acid. June 7.

„ 9793 (1906). Davis. Manufacture of alkaline prussiates. June 13.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 12,431. Fourcault. Apparatus for drawing glass. [Appl. in Denmark, June 8, 1905.]* May 28.

„ 12,603. Fourcault. Apparatus for drawing glass. [Appl. in Denmark, June 8, 1905.]* May 30.

„ 12,815. Fourcault. Apparatus for drawing glass. [Appl. in Denmark, June 8, 1905.]* June 1.

„ 13,296. Beckett and Eaton. Glazing and enamelling clayware. June 9.

„ 13,472. Meakin, Ltd., and Jackson. Kilns for firing or drying ceramic and similar wares. June 12.

[C.S.] 22,335 (1905). Bundy. Production of marbled effects on glass, porcelain, &c. June 7.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 12,353. Bougleux. Manufacture of cement.* May 28.

„ 12,621. Schumacher. Method of increasing the binding power of silicates of lime. May 30.

„ 13,007. Bale. Materials for laying and absorbing dust. June 5.

„ 13,232. South, Payne and Payne. Cement.* June 8.

„ 13,267. Atkinson. Production of cement. June 8.

„ 13,355. Suski. Binding agent. June 9.

„ 13,855. Reade. Compounds for treating wood for preventing and arresting dry rot. June 16.

[C.S.] 11,294 (1905). Hasselmann. Impregnation of wood and textile or fibrous substances to prevent putrefaction, rot and fungus. June 7.

„ 11,696 (1905). Carr and Unwin. Manufacture of firebricks. June 13.

„ 15,582 (1905). Hoffmeister, Hundt, Eifler and Winther. Artificial stone and the like. June 13.

„ 23,695 (1905). Melville. Floor and wall covering material. June 20.

„ 1458 (1906). Surmann. Manufacture of briquettes, blocks, artificial stone and the like. June 13.

„ 3477 (1906). Böseken. Production of artificial marble. June 13.

X.—METALLURGY.

[A.] 12,395. Wallin. *See under* XI.

„ 12,599. Gouber. Soldering aluminium and its alloys and solder therefor. May 30.

„ 13,012. Masson. *See under* VII.

[A.] 13,127. Cowper-Coles. *See under* XI.
„ 13,186. Birmingham. Alloys.* June 7.
„ 13,189. Soc. Electrométall. Française. Manufacture of decarburised cast iron. [Fr. Appl., Aug. 5, 1905.]* June 7.
„ 13,400. Jenkins. Soldering paste.* June 11.
„ 13,499. Mills. Manufacture of steel. June 12.
„ 13,541. Aspinall. Furnaces for smelting metals. June 13.
„ 13,655. Cowper-Coles. Process for coating and alloying one metal with another. June 14.
„ 13,845. Newton Bros., and Newton. Magnetic separation. June 16.
C.S.] 13,811 (1905). Davies and Clark. Welding iron and steel with each other or with other metals and fluxes therefor. June 13.
„ 15,809 (1905). Taylor and Mudford. Treatment of steel. June 7.
„ 17,250 (1905). Windhausen. Concentrating or separating ores and metals. June 13.
„ 17,370A (1905). Leggo. Rabble shafts and arms for furnaces for roasting, desulphurising, dehydrating or drying ores and other substances. June 7.
„ 26,076 (1905). Babé and Louvrier. Metallurgical furnaces. June 20.
„ 494 (1906). Delporte. Refining iron in a Siemens-Martin furnace. June 13.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 10,802A. Cowper-Coles. Electrolytic deposition of metals. June 12.
„ 12,395. Wallin. Method of obtaining metals from ores or for heating substances in electric furnaces, and electric furnaces for use therewith.* May 28.
„ 13,023. De Hemptinne. Process for oxidising liquids with aid of electric discharges. June 5.
„ 13,127. Cowper-Coles. Electrolytic refining of copper. June 6.
„ 13,699. Cowper-Coles. Electro-deposition of iron. June 14.
C.S.] 10,120 (1905). Schiele. Electroplating of metals. June 20.
„ 12,253 (1905). Kelley. Electric accumulator plates. June 20.
„ 16,570 (1905). Hartung. Storage batteries. June 7.
„ 19,035 (1905). British Thomson-Houston Co. (General Electric Co.). Insulating material. June 20.
„ 26,876 (1905). Boult (Stebbins). Secondary batteries. June 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 11,950A. Zonca. Devices for separating oil from its emulsions.* June 1.
„ 12,404. Buatois. Liquid detergent for toilet purposes.* May 28.
„ 12,757. MacDonald. Means for mixing liquids, especially "ley" with cotton oil. June 1.
„ 12,894. Esuman-Gwira. Machine for extracting oil from nuts. June 2.
„ 13,233. Premier Oil Extracting Mills, Ltd., and Caley. Apparatus for extracting oil from seeds, &c., by means of solvents. June 8.
C.S.] 25,425 (1905). Burley and Burley. Manufacture of soap. June 13.
„ 3132 (1906). Pryor (Chem. Fabr. von Heyden A.-G.). Manufacture of iodine fats. June 7.
„ 4481 (1906). Lanza and Gamna. Extraction of olein and stearine from fatty acids. June 13.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 13,301. Adam. Carbon recovery plant for the manufacture of lamp black and the like. June 9.

(*B.*)—RESINS, VARNISHES.

[A.] 12,885. Groppler. Method of obtaining copal. June 2.
[C.S.] 20,888 (1905). Godfrey, and Linoleum Manufacturing Co. Manufacture of linoleum. June 20.
„ 2344 (1906). Holtkott. Rolling or pressing inlaid linoleum. June 7.
„ 2436 (1906). Marks (Holtkott). Manipulation of granular linoleum mass and the like. June 7.
„ 3788 (1906). Baringer. Process for rendering copal, manila, sandarach, &c., insoluble in oil. June 20.

(*C.*)—INDIA-RUBBER.

[A.] 12,525. Boult (Köneman). Recovery of rubber from rubber waste.* May 29.
„ 12,526. Boult (Köneman). Recovery of rubber from rubber waste.* May 29.
„ 12,527. Boult (Köneman). Treatment of rubber and rubber waste.* May 29.
„ 13,290. Spencer and Romock. Treatment of india-rubber. June 8.
„ 13,493. Hopkinson and Midgley. Vulcanisation of rubber goods.* June 12.
„ 13,513. Carr. Substitute for india-rubber or gutta-percha. June 13.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 13,621. Carter. Tan pits or apparatus for tanning leather. June 14.
[C.S.] 17,536 (1905). Forster. Machinery for use in the manufacture of leather. June 20.
„ 4570 (1906). Sadikoff. Manufacture of glue. June 7.

XV.—MANURES, ETC.

[C.S.] 6429 (1906). Chisolm. Fertilisers. June 7.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 12,950. Wagner. Process of manufacturing anhydrous grape-sugar from corn and analogous farinaceous materials.* June 2.
„ 13,217. Barbet. *See under* XVII.
[C.S.] 11,838 (1905). Wetter (Weinrich). Process for purifying massecuite, syrups, or impure sugar solutions. June 7.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 12,838. Bergo and Kainscop. Process of manufacturing beer. [Fr. Appl., June 6, 1905].* June 1.
„ 12,898. International Malt Machine Co. Malting apparatus.* June 2.
„ 13,217. Barbet. Process of sulphurising saccharine juices in fermentation and desulphurising such juices. [Fr. Appl., Oct. 27, 1905.]* June 7.
„ 13,441. Connell, Haldane and Thomson. Treatment and utilisation of "pot ale" or "spent wash." June 12.
„ 13,563. Nilsson and Jonson. Improving the quality of wine and the like. [Swed. Appl., June 16, 1905.]* June 13.

[A.] 13,629. Bearman. Brewing beer and stout. June 14.

„ 13,838. Lean (Mühlenbauanst. u. Maschinenfabr. vorm. Gebr. Seck). Process for obtaining a high return of extract from malt.* June 16.

[C.S.] 20,086 (1905). Chew, and West and Co. Apparatus for cooling and carbonating beer and the like. June 20.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 12,398. Janitzky, Hamilton and Cummings. Preservation of animal substances.* May 28.

„ 12,424. Von Tury. Production of an egg substitute.* May 28.

„ 12,783. Hatmaker. Drying milk and proteid containing liquids. June 1.

„ 12,916. Müller. Manufacture of artificial butter.* June 2.

„ 13,169. Héritte. Method of preserving organic substances. June 7.

„ 13,178. Frings. Process and apparatus for manufacturing vinegar. [Ger. Appl., June 7, 1905.]* June 7.

„ 13,744. Wenström. Method and apparatus for producing aerated beverages.* June 15.

[C.S.] 14,073 (1905). Lehmann. Preservation of food. June 7.

„ 15,667 (1905). Weil. Manufacture of baking powder. June 7.

„ 21,086 (1905). Trettau. Process and apparatus for improving grain. June 13.

(*B.*)—Sanitation; Water Purification.

[A.] 12,910. Tice. Septic tanks.* June 2.

„ 13,264. Travis. Purification of sewage or other liquids. June 8.

[C.S.] 9578 (1905). Adams. Bacterial sewage purification plant. June 13.

„ 16,177 (1905). Clark (Amer. Water Purifying Co,). Distilling water by the multiple effect system and apparatus therefor. June 7.

„ 5908 (1906). Kremer, and Ges. f. Abwässerklärung. Separation of solid matters from sewage. June 20.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 12,849. Dickson and James. Manufacture of celluloid. June 1.

„ 12,920. Cochran. Production of cellulose.* June 2.

[A.] 12,936. Mestrallet. Manufacture of non-inflammable celluloid. June 2.

[C.S.] 20,220 (1905). Hanitzsch. Devices for spraying fluid on the surface of paper, fabrics, or the like. June 20.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 12,630. Ellis (Chem. Fabr. von Heyden A.-G.) Manufacture of isobornyl esters.* May 31.

„ 13,054. Dreyfus, and The Clayton Aniline Co., Ltd. Manufacture of aromatic sulphinic acids. June 5.

„ 13,055. Dreyfus, and The Clayton Aniline Co., Ltd. Separation of sulphinic acids from solutions, and obtaining them in the form of stable compounds. June 5.

„ 13,056. Dreyfus, and The Clayton Aniline Co., Ltd. Manufacture of sulphonic chlorides, bromides, and amides. June 5.

„ 13,188. De Laire. Manufacture of products by condensing phenol alcohols with other organic compounds.* June 7.

„ 13,401. Newton (Bayer und Co.). Production of new pharmaceutical compounds. June 11.

[C.S.] 21,280 (1905). Ellis (Merck). *See under* VII.

„ 22,094 (1905). Lidholm. Manufacture of compounds of acetylene and chlorine. June 13.

„ 25,571 (1905). Newton (Bayer und Co.). Manufacture of new pharmaceutical preparations. June 7.

„ 10,999 (1906). Chem. Fabr. von Heyden A.-G. Manufacture of isobornyl esters. June 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 13,561. Burnett. Manufacture of iso- or orthochromatic plates. June 13.

[C.S.] 17,007 (1905). Manly. Photographic printing. June 7.

„ 24,875 (1905). Krebs. Flash lights for photographic purposes. June 13.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 12,716. Reschke. Manufacture of safety explosives.* May 31.

[C.S.] 16,514 (1905). Macnab, and Ammonal Explosives, Ltd. Explosives. June 7.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 1841 (1906). Schatz. Automatic apparatus for analysing gas. June 13.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Manchester, on Wednesday, July 11th next and following days. A programme and request form accompanied the May 31st issue of the Journal, and the member's ticket accompanied the June 15th number.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see Journal for April 30th, p. 341) will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Eustace Carey has been nominated to the office of President under Rule 8; Dr. E. G. Love, Mr. A. Gordon Salamon, and Mr. Chas. Wightman have been nominated Vice-Presidents under Rule 8; and Dr. E. Divers, F.R.S., has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Dr. F. J. Smale, Mr. Thos. Tyrer, Sir Thos. Wardle, and Mr. R. C. Woodcock have been nominated, under Rule 18, to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

ALTERATION OF BY-LAWS.

With a view to facilitate the voting of members residing abroad, notice is hereby given, in accordance with Rule 38 of the By-laws, that the Council will propose to the forthcoming Annual General Meeting the amendment of the Society's By-laws as follows:—

1. Rule 18. (*a*) That the words "At least two months before the date of each Annual General Meeting," in the first and second lines thereof, be replaced by the words, "In the second issue of the Society's Journal for the month of April in each year."

(*b*) That the words "date of that meeting," in the fourth line thereof, be replaced by the words "Annual Meeting next ensuing."

(*c*) That the words "At least one month before the date of;" in the sixth line from the end thereof, be replaced by the words "not later than the last day of May prior to."

(*d*) That the words "to the election to take place at which it refers" in the fifth line from the end thereof, be replaced by the words "at which the election to which the nomination refers is to take place."

2. Rule 19.—That the words "at least five days before the commencement of the said meeting," in the two last lines thereof, be replaced by the words, "in the second issue of the Society's Journal for the month of May."

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1905.

(Made up to the 12th May, 1906.)

REVENUE.

	£ s. d.	£ s. d.
Annual Subscriptions:—		
2 Subscriptions for 1905 received in 1903	2 10 0	
124 Subscriptions for 1905 received in 1904 (*less* 8*s.* short paid)	154 12 0	
3843 Subscriptions for 1905 received in 1905 (*less* 6*s.* short paid)	4803 9 0	
59 Subscriptions for 1905 received in 1906	73 15 0	
4028		5034 6 0
Entrance Fees (406 at 1*l.* 1*s.*)	426 6 0	
Life Composition Fee (1 at 20*l.*)	20 0 0	
"Collective" Index and "Decennial" Index Subscriptions		6 10 0
Investments—Interest from—	£ s. d.	
Gas Light and Coke Company's 3 per cent. Consolidated Stock	600 0 0 — 17 2 0	
Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock	1509 0 0 — 57 6 10	
Great Northern Railway 3 per cent. Debenture Stock	800 0 0 — 22 16 0	
Great Western Railway 5 per cent. Guaranteed Preference Stock	1250 0 0 — 59 7 6	
Metropolitan 3 per cent. Consolidated Stock	4476 9 2 — 127 11 8	
Midland Railway 2½ per cent. Perpetual Preference Stock	1696 0 0 — 40 5 8	
North British Railway 3 per cent Consolidated Lien Stock	1084 13 4 — 30 18 4	
New South Wales 3 per cent. 1935 Stock	485 4 8 — 13 16 6	
New Zealand 3 per cent. 1945 Stock	1000 0 0 — 28 10 0	
Nottingham Joint Station 3 per cent. Stock	200 0 0 — 5 14 0	
South Eastern Railway 4½ per cent. Preference Stock	673 0 0 — 28 15 5	
Southwark and Vauxhall Water Company's 3 per cent. Debenture Stock	1000 0 0 — 28 10 0	
Deposit account at Bank	.. — 24 8 2	
	£14774 7 2	484 17 1
Journal—		
Advertisements	237 1 7	
Sales	491 7 10	728 9 5
		£6254 2 6

EXPENDITURE.

	£ s. d.	£ s. d.
Journal Expenses:—		
Publishing	2224 11 0	
Editorial:—	£ s. d.	
Editor's Salary	600 0 0	
Editor's Expenses	62 1 6	
Abstractors	563 17 7	
Sub-Editor's Salary	150 0 0	
Indexing Journal	150 19 6	
Foreign Journals	13 15 0	
Sundry Journals	12 9 0	
	1553 2 7	
Insurance of Stock	6 0 0	
French Patents and Specifications	59 0 4	
U.S.A. Patents and Specifications	3 0 0	
	62 0 4	
		3845 13 11
Sectional Expenses	658 0 4	
Annual Meeting Expenses	202 1 0	
		860 1 4
Secretary's Salary	300 0 0	
Assistant	150 0 0	
		450 0 0
Printing Sundries	114 12 9	
Stationery	50 9 4	
Library (Binding Books)	5 17 9	
Clerical Assistance	17 3 6	
Honorarium to Treasurer's Assistant	52 10 0	
		240 13 4
Office Expenses (including Rent, Lighting, &c.)	209 1 7	
Auditors' Fee	10 10 0	
Sundry Charges	13 10 3	
Bank Charges	5 4 11	
		238 6 9
Treasurer's Petty Cash and Postage	22 0 6	
Secretary's Petty Cash and Postage	82 7 11	
		104 8 5
Decennial Index (1896—1905) and Insurance of Manuscript		91 1 0
Investment:—		
Great Western Railway 5 per cent. Preference Stock, 65*l.*	1005 8 6	
Balance of Revenue over Expenditure		423 17 9
		£6254 2 6

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY FOR THE YEAR 1905.

Dr. Cr.

	£ s. d.	£ s. d.
To Cash on Deposit (1st January, 1905)	1000 0 0	
Balance at Bank (1st January, 1905)..	158 13 7	
	1158 13 7	
Less Cash due to Secretary (1st January, 1905)	3 10 3	
		1155 3 4
Annual Subscriptions :—		
70 Subscriptions for the year 1904..	87 10 0	
3843 Subscriptions for the year 1905 (*less* 6*s.* short paid)	4803 9 0	
202 Subscriptions for the year 1906 (*less* 4*s.* short paid)	252 6 0	
2 Subscriptions for the year 1907..	2 10 0	
Excess Payments and Sundry Balances on Account of Years 1904, 1906 and 1907	5 8 0	
		5151 3 0
4117		
Entrance Fees (406 at 1*l.* 1*s.*)		426 6 0
Life Composition Fees (1 at 20*l.*)		20 0 0
"Collective Index" Subscriptions....	5 10 0	
"Decennial Index" Subscriptions....	1 0 0	
		6 10 0
Interest from Investments :—	£ s. d.	
Gas Light and Coke Company's 3 per cent. Consolidated Stock ..	600 0 0 — 17 2 0	
Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock ..	1509 0 0 — 57 6 10	
Great Northern Railway 3 per cent. Debenture Stock	800 0 0 — 22 16 0	
Great Western Railway 5 per cent. Guaranteed Preference Stock	(600 0 0) (650 0 0) — 59 7 6	
Metropolitan 3 per cent. Consolidated Stock ..	4476 9 2 — 127 11 8	
Midland Railway 2½ per cent. Perpetual Preference Stock	1696 0 0 — 40 5 8	
North British Railway 3 per cent. Consolidated Lien Stock	1084 13 4 — 30 18 4	
New South Wales 3 per cent. 1935 Stock	485 4 8 — 13 16 6	
New Zealand 3 per cent. 1945 Stock	1000 0 0 — 28 10 0	
Nottingham Joint Station 3 per cent. Debenture Stock	200 0 0 — 5 14 0	
South Eastern Railway 4½ per cent. Preference Stock	673 0 0 — 28 15 5	
Southwark and Vauxhall Water Company's 3 per cent. Debenture Stock	1000 0 0 — 28 10 0	
Deposit Account at Bank ..	— 24 3 2	
	£14774 7 2	484 17 1
Journal :—		
Sales		527 0 6
		£7770 19 11

	£ s. d.	£ s. d.
By Journal Expenses :—		
Publishing	2108 16 4	
Insurance of Stock	6 0 0	
Editorial :— £ s. d.		
Editor's Salary .. 600 0 0		
Editor's Expenses.. 58 1 11		
Sub-Editor's Salary 150 0 0		
Abstractors 518 0 1		
Indexing Journal . 150 19 0		
Foreign Journals . 13 15 0		
Sundry Journals .. 12 9 0		
	1503 5 0	
French and U.S.A. Patent Specifications	60 10 6	
		3678 11 10
Sectional Expenses :—		
Birmingham and Midland Section	26 7 3	
Canadian Section	35 0 0	
Liverpool Section	43 7 0	
London Section	78 16 2	
Manchester Section	39 17 4	
Newcastle-on-Tyne Section	44 15 5	
New England (U.S.A.) Section .	80 0 0	
New York (U.S.A.) Section	194 4 2	
Nottingham Section	29 5 9	
Scottish Section	36 1 11	
Sydney, New South Wales, Section	1 7 3	
Yorkshire Section	48 18 1	
		658 0 4
Expenses connected with Annual Meeting		202 1 0
Secretary's Salary (see also Sub-Editor)	300 0 0	
Assistant	150 0 0	
		450 0 0
Printing Sundries	104 8 6	
Stationery	45 9 10	
Clerical Assistance	17 3 6	
Honorarium to Treasurer's Assistant	52 10 0	
		219 11 10
Office Expenses :—		
Rent, &c.	153 15 0	
Gas and Electric Light	13 19 6	
Cleaning, Attendance, &c.	18 6 5	
Furniture, Repairs, &c.	9 14 2	
Sundries	17 9 3	
Fire Insurance	0 15 6	
Sundry Requisites	12 11 0	
		226 10 10
Auditors' Fee	10 10 0	
Bank Charges	5 4 11	
		15 14 11
Investment :—		
650*l.* Great Western Railway 5 per cent. Preference Stock		1005 8 6
"Decennial" Index (1896—1905) paid on account	80 0 0	
"Decennial" Index, Insurance of Manuscript	5 1 0	
		91 1 0
Treasurer's Petty Cash and Postage	22 0 6	
Secretary's Petty Cash and Postage	82 7 11	
		104 8 5
Cash on Deposit (31st December, 1905)	750 0 0	
Balance at Bank (31st December, 1905)	361 1 6	
Cash in Secretary's hands	8 9 9	
		1119 11 3
		£7770 19 11

We have compared the above statement with the vouchers, counterfoils of the receipts issued and other records, and are of opinion it correctly exhibits the cash transactions of the Society for the year 1905. The amounts of the Metropolitan 3 per cent. Consolidated, 3 per cent. New Zealand and 3 per cent. New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected and the Bank Balances have been certified to us by the Bankers.

23, St. Swithin's Lane, London, E.C.
2nd May, 1906.

(Signed) MIALL, WILKINS, RANDALL & Co.,
Chartered Accountants.

Birmingham and Nottingham Sections.

Meeting held at Burton-on-Trent on Thursday, April 26th 1906.

J. M. C. PATON IN THE CHAIR.

YEAST AS A BY-PRODUCT.

BY FRANK E. LOTT AND C. G. MATTHEWS.

(*Abstract.*)

Only in recent years has brewery yeast been regarded as available for purposes other than "pitching" or continuing yeast either in breweries, or distilleries at home and abroad. Now, however, there are not a few industrial uses to which this valuable substance—yeast—is put.

A large and increasing quantity of pressed yeast is now being used for the preparation of patent foodstuffs.

Nearly twenty years ago Mr. Cornelius O'Sullivan pointed out the nutritive value of yeast extract. In 1895 Wahl and Henius, of Chicago, patented a process for making "Bouillon Stock" from yeast, which has been a commercial success in America. In 1897 Goodfellow took out an English patent a few months before Mr. C. O'Sullivan himself patented what he had produced many years before, and both these articles have been before the public and consumed in quantity.

Another similar preparation called Vejos was largely advertised as superior to the majority of meat extracts.

In Germany a similar preparation named Sitogen was produced, and probably not a few others of the same type. More recently the "Marmite" Company prepared, and

Mixed with gypsum or lime, yeast has also been used in the preparation of fertilisers, some of which have been patented. Among these may be mentioned "Plasmite,"

	Farm manure.	Guano.	Protorex.	Triterfex.	M. and L. yeast preparation.	Yeast.
Moisture	75	16	34	26	16·2	50
Organic matter	17	52	23	24	32·5	46
Containing $N=NH_3$	1·0	17·0	4·0	3·0	4·7	4·5
Ash { phosphates	1	26	3	3	4·6	3·9
Ash { other salts	7 } 8	6 } 32	40 } 43	47 } 50	46·7 } 51·3	0·1 } 4
	100	100	100	100	100·0	100

are now manufacturing from yeast the food extract sold under that name.

A comparison of the compositions of some of the patented preparations is shown in the following table:—

"Protorex," and "Trifertex." The authors have also prepared a yeast manure "M. and L. Yeast Preparation," and the general composition of such fertilisers is illustrated in the above table.

Meat Extracts and Yeast Preparations.

	Soup from beef and bones.	Liebig's extract.	Bovril.	Kemmerich's extract.	Vejos.	Sitogen.	Marmite.
Water	94·1	17·7	29·1	16·6	24·1	29·0	28·8
Nitrogenous substances	1·6	34·9	27·7	35·4	35·9	43·8	36·4
Carbohydrates, fats, &c	3·7	24·7	25·7	25·9	22·3	5·9	9·4
Mineral matter (phosphates, &c.)	0·6	22·7	17·5	22·1	17·7	21·3	25·4
	100·0	100·0	100·0	100·0	100·0	100·0	100·0
The above Calculated to Water-free Substance.							
Nitrogenous substances	27·1	42·4	39·1	42·4	47·3	61·7	51·1
Carbohydrates, fats, &c.	62·7	30·0	36·2	31·1	29·3	6·3	13·2
Mineral matter (phosphates, &c.)	10·2	27·6	24·7	26·5	23·4	30·0	35·7
	100·0	100·0	100·0	100·0	100·0	100·0	100·0

An interesting comparison may be instituted between the composition of yeast and that of fungi, taking the mushroom *Agaricus campestris* as a type of the latter in an edible form.

In the following table the composition is returned in terms of dry substance:—

Mushroom and yeast.

	Mushroom *Agar. compestris*	Yeast Nägeli and Löwe analysis.
Nitrogenous matter	46·1	47·0
Extractive matter, carbohydrates (including cellulose) fat	48·7	46·0
Mineral matter	5·2	7·0
	100·0	100·0

Pressed yeast has also been employed for the preparation of cattle foods by admixture with (*a*) dried grains, (*b*) dried grains and spent hops, (*c*) malt culms, ground cereals, &c. The composition of two such articles, compared with that of other well-known cattle foods, is shown in the next table:—

London Section.

Meeting held at Burlington House on Monday, May 21st, 1906.

MR. A. G. SALAMON IN THE CHAIR.

THE ELECTRO-CHEMICAL PROBLEM OF THE FIXATION OF NITROGEN.

PROF. PHILIPPE A. GUYE.

English science has contributed largely to the solution of the electro-chemical problem of nitrogen. Without going back as far as Cavendish's memorable experiments on the transformation of nitrogen into nitrous vapours, we will restrict ourselves to modern researches; it will be enough for me to mention the name of Sir William Crookes, whose experiments of 1893 and whose suggestive address as President of the British Association in 1898 are still present in your minds. Furthermore, there are the experiments of Lord Rayleigh (1897) on the com-

Ordinary and patent cattle foods (in round figures).

	Linseed cake.	Hay.	Dried grains.	Myer's patent food.	Sustene.
Moisture	11	15	10	10	14
Fat and oil	10	2	6	1	6
Starch and digestible carbohydrates	35	39	40	41	17
Woody fibre	9	16	20	13	27
Nitrogenous matters	28	13	20	29	28
Mineral matter	7	13	4	6	8
	100	100	100	100	100

bustion of nitrogen. And lastly, this problem has been recently treated in a particularly competent way before scientific circles by Prof. Silvanus Thompson and before the general public opinion of your country by my friend, Sir William Ramsay.

I have followed very closely the development of the large Swiss electro-chemical enterprises which utilise hydro-electric power. Moreover, for some years past, in connection with the "Société d'Etudes Electrochimiques à Genève," I too have been co-operating in researches on the fixation of nitrogen on a semi-industrial scale. Under these circumstances, I hope to be able to secure your attention to special points which have stimulated the study of this interesting problem in the electro-chemical circles of our country.

Before entering on my subject, I have to ask your indulgence in frequently bringing before you numerical tables and data. It is, however, the only way of emphasising the fundamental points of this important question.

I.—Importance of the Problem.

The part played by nitrogenous bodies in economical problems has been so frequently discussed during recent years, that it is unnecessary for me to describe it at length. Certain figures, taken from recent statistics, will suffice as a *résumé* of the most important economical data which dominate its whole study.

The two principal sources of nitrogenous matter of which use is made by civilised nations are nitrate of soda from Chili, and ammonium sulphate.

In 1905, the entire consumption of Chili nitrate was 1,567,000 tons; while that of 1896 was 1,060,000 tons. Of these 1,567,000 tons, we can reckon about 300,000 tons as having been utilised in chemical industry (80,000 to 100,000 tons in the United States and the rest in Europe).

The two principal chemical uses in Europe are: (1) the manufacture of nitrites; and (2) the manufacture of pure nitric acid for explosives, colours, &c.

The use of nitrate of soda as manure is represented by the balance, approximately 1,267,000 tons for 1905; this consumption is rapidly increasing, especially since a commencement has been made in the direction of applying nitrogenous manures to the culture of corn in the United States. Recent calculations by M. Vergara, which have taken into consideration the increase in the consumption of the last few years, indicate the year 1923 as the date when the Chili beds will be exhausted.

This date will be still nearer if we accept the statement made by Sir William Crookes, who estimates that the quantity of nitrate necessary to meet the yearly increasing needs of the "wheat eaters" will be more than 12,000,000 tons after 30 years or so.

Although not quite so considerable, the consumption of ammonium sulphate is by no means less important; it is impossible, however, to obtain statistics for this product as definite as for nitrate, on which duty is paid at the Chili ports of embarkation and on arrival at European and American ports; nevertheless, those most competent to form an opinion, compute that the entire production of ammonium sulphate in 1905 reached at least 500,000 tons (others, however, reckon it as high as 600,000 tons). This quantity is distributed approximately in the following proportions:—

220,000 to 250,000 in Great Britain.
100,000 to 120,000 in Germany.(1)
70,000 to 80,000 in other European countries.
50,000 to 60,000 in America.(2)

The larger part is utilised for agriculture, chemical industry using only 10 to 15 per cent. of the total amount produced. The European consumption would not exceed 350,000 tons.(3)

A large fraction of this product, namely that manufactured in Great Britain, is exported outside Europe, particularly to the East.

This sulphate of ammonia is derived exclusively from gas and coke works. Three years ago it was estimated that the recuperation of ammonia was only practised in about half of the entire number of coke ovens. Since then, there has been a tendency for it to become more general. It will be enough to add that only 10 to 15 per cent. at most of the nitrogen contained in the coal is obtained in the form of ammonia.

At the present rate the production of sulphate of ammonia is, however, insufficient to meet the increasing needs for nitrogen which we may expect in the future.

As regards the commercial value of the nitrogen contained in Chili saltpetre and ammonium sulphate, compared with that of the nitrogen in nitric acid, it may be expressed in the following figures which are based on the market of Great Britain for 1905:—

Product.	Value.	Value of 1 kilo. N.
Chili nitrate, containing 16·5 per cent. N	10*s.* 4½*d.* per cwt.	1*s.* 3*d.* = fr. 1.55
Sulphate of ammonia, containing 21·2 per cent N.	£12 10*s.* per ton	1*s.* 2½*d.* = fr. 1.45
Nitric acid, containing 22·2 per cent. N.	£2 per 100 kilos.*	1*s.* 7½*d.* = fr. 2.25

* Corresponding to 50 fr. per 100 kilos of acid of 100 per cent. HNO_3, a price realised in a great number of factories. This price is a little lower in Germany.

The nitrogen contained in nitric acid has a higher value than that contained in sulphate of ammonia. This can easily be understood, seeing that the expenses incurred in industrial operations for transforming the nitrate into nitric acid must be covered. As to the difference between the nitrogen of the nitrate and that of ammonia, it may be explained by the fact that for the same weight of nitrogen, manures containing nitrate give for most agricultural purposes, and especially for cereals, slightly superior results to those obtained with ammonium sulphate manures. A few years ago a superiority of 10 to 20 per cent. was attributed to the nitrogen of the nitrate over that of the ammonia salt. The difference in price is now slightly less.

Having sketched the general position, it still remains for us to examine how far electro-chemical industry will contribute to equalise the insufficiency of nitrogenous bodies which is to be expected in the near future.

The electro-chemical processes which have been proposed for fixing atmospheric nitrogen are at the present moment very numerous. Most of them have as yet only been studied very summarily; several Reviews have published detailed *resumés* on this subject, of which the following may be more especially alluded to:—Electrochemische Zeitschrift, 1905; Revue générale de chimie pure et appliquée (1906); Moniteur de Quesneville, 1906. We will confine our attention to methods which have received industrial application, in order to be able to throw light on the principal economical factors on which final success depends. The number of these methods at the present day is two: the first produces calcium cyanamide ("Kalkstickstoff" or "chaux azotée"), the other nitric acid and nitrates.

II.—Calcium Cyanamide.

General considerations.—In the course of their researches on the cyanides, Drs. Frank and Caro observed that barium carbide, BaC_2, heated to a high temperature, combines nearly quantitatively with nitrogen to form barium cyanide.(4)

$$BaC_2 + N_2 = Ba(CN)_2.$$

When they tried to apply this reaction to calcium carbide, they were surprised to find that the quantity of cyanide formed was much less than the theoretical amount. Further study revealed the fact that the reaction is different from that which occurs in the case of barium carbide and that in the case of calcium carbide, it is represented by the equation:—

$$CaC_2 + N_2 = CaCN_2 + C.$$

The carbide gives off half of its carbon and changes, not into cyanide, but into calcium cyanamide. This body can be considered as a derivative of ammonia (cyanamide):—

NH_3	$NH_2—CN$	$Ca=N—CN$
ammonia	cyanamide	calcium cyanamide.

When cyanamide is heated with water under pressure, ammonia is set free according to the reaction:—

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3.$$

When distributed on the ground the same reaction goes on more or less slowly, and it is therefore easily understood that cyanamide has given very interesting results when used directly as a fertiliser.

Theoretically, the mixture of calcium cyanamide and carbon produced by the reaction given above should contain about 30 per cent. of nitrogen. As a matter of fact the content of nitrogen in the raw calcium cyanamide is less than this amount, either on account of impurities in the calcium carbide or of the changes which it undergoes during the process of transformation. According to the communications of Dr. Frank, the content of nitrogen varies from 14 to 20 per cent. The product of recent manufacture is stated to contain about 20 per cent.(5) From this it will be seen that this amount approaches that of sulphate of ammonia.

The economical future of calcium cyanamide is clearly dependent on its cost price. According to the manner of manufacture this cost price itself depends—

1. On the cost price of calcium carbide;
2. On the cost price of nitrogen;
3. On the cost of transforming the carbide into cyanamide.

Let us examine these three points separately.(6)

Calcium carbide.—In 1902, Vogel estimated the cost price of carbide per ton, without packing, as being about 250 frs. (£10). This price has since then remarkably diminished. This statement can be justified in the following manner:—

Cost price of calcium carbide (without packing):

	frs.
1000 kilos. lime, at 15 frs. per ton	15
700 kilos. coke (retort-coke), at 25 frs. per ton	17.50
20 kilos. electrodes, at 35 frs. per 100 kilos.	7
	39.50
Electric power (1 kilowatt-year) at 50 frs. gives 2.1 tons	23.80
Small expenses:—wages (8 frs.); mechanical power for accessory work(7) (transport, grinding) (30 frs.)	38
General expenses	22
Cost price at the factory	123.30
	or £4 18*s.* 8*d.*

To this sum of 123.30 frs. must be added the depreciation of the plant and interest on capital, both extremely changeable elements; certain factories have had serious technical difficulties when commencing to work, while in others, the price of the hydro-electric installations much exceeded what had been foreseen. It is difficult to give *a priori* a general estimate. On the other hand, it is clear that capital actually invested in these undertakings (if we take into account the reductions of the original nominal capital of the companies) is at the present moment (in the larger works) about 200,000 frs. per 1000 kilowatts, which corresponds approximately to 100 frs. per ton-year on the finished product, of which 25 frs. represents working expenses.

Taking into account a depreciation of 8 per cent. on the plant (75 frs.) and an interest of 5 per cent. on the total capital invested (100 frs.) we have to add to the above sum of ..... frs. 123.30

For depreciation	frs. 6	
For interest on the capital	frs. 5	
		— frs. 11
The net price is therefore	frs.	134.30
		or £5 6*s.* 5½*d.*

This price of 134.30 frs. per ton carbide seems to me to be at the present day the minimum realised cost price, especially if we take into consideration the many industrial risks which are practically unavoidable. According to information which I have received, the estimate has only been realised in Europe in a single works exceptionally well placed in every respect. Only works in Norway can perhaps realise slightly better conditions. It is exceeded to a very large extent on the other hand in the majority of works.

Giving full consideration to the average conditions in Europe, it will be wise to consider the cost price as about from 140—150 frs. in the best situated works, rising to 180 or 185 frs. (185 frs. = £7 6*s.* 7½*d.*) in those placed in less favourable circumstances or whose annual production is not so great.(8)

Cost price of nitrogen.—It is still difficult to give an exact valuation of the cost price of atmospheric nitrogen obtained by the liquefaction and distillation of air. The calculations published on this subject are all based on installations of considerable size and greatly exceeding those which one might expect for a long time to come in the industrial manufacture of calcium cyanamide. In these large installations the cost price would be only a few tenths of a penny per cubic metre or kilogramme of nitrogen. For the relatively restricted production which we are discussing now, it would be wise to estimate the nitrogen at at least 10 centimes, or 1*d.*, per kilo.(9)

Cost price of calcium cyanamide.—No precise information has yet been published on this subject. It is possible, however, to make a first estimate which ought not to be far from facts, based on the following considerations:—

The raw material being calcium carbide, the first thing to take into account is the extreme limits of the price of this product, *viz.*, 140 frs. per ton for large scale factories and 185 frs. per ton for the average European factories. We need not discuss works at which the price would exceed 185 frs.

The cost price of a ton of calcium cyanamide containing 20 per cent. N = carbide at:—

	140 Frs. £5 11*s.* 0*d.*	185 Frs. £7 6*s.* 7½*d.*
1 ton carbide, containing 80 per cent. CaC_2 (*)	140	185
200 kilos. nitrogen	20	20
Manufacture, pulverisation of carbide, charge and discharge of retorts, heating retorts	20	20
Necessary repairs of mills, retorts, liquefying machines	25	25
General expenses	10	10
Packing	20	20
Transport (†)	20	20
Depreciation and interest on capital invested	15	15
Cost price per ton	270 £10 14*s.* 0*d.*	315 £12 11*s.* 2½*d.*
The price of 1 kilo. nitrogen amounts to	frs. 1·35 1*s.* 2*d.*	1·57 1*s.* 3½*d.*

(*) By the addition of certain salts, such as calcium chloride only 800 kilos. carbide would be consumed; but the value of these salts would have to be added, from which we can calculate the average cost of 1 ton.

(†) The transport expenses are calculated for factories working on a small scale. For factories working on a large scale, we would have to take into account that the area supplied would be much larger and the expenses of carriage would be proportionately higher.

At first sight, the price of a kilogramme of nitrogen amounts approximately to the same as that of ammoniacal nitrogen or that of nitrate nitrogen.

But in order to make an exact comparison we must also take into account the coefficient of the agricultural utilisation.

According to the different experiments the value is not yet determined with great accuracy; it seems to depend on the nature of the body and on the manner of utilising the calcium cyanamide as manure. The figures given are between 0·64 and 0·95, Chili nitrate being taken as unity. Adopting, for instance, the average 0·85, it will be seen that the kilogramme of nitrogen, with carbide at 185 frs. per ton, is already more expensive than the nitrogen of ammonium sulphate; in this case, the manufacture of calcium cyanamide appears to be industrially possible only with carbide at 140 frs. per ton. At this price it is evident that the carbide works have every interest in using for this purpose only the excess they are unable to sell for the production of acetylene, carbide intended for lighting purposes giving them a

higher profit; at the present time, this product is taken on the average at 200 frs. per ton (without packing). It realises even higher prices in France and Italy.

III.—Electro-chemical Nitric Acid.

General considerations.—The second way of fixing atmospheric nitrogen has, as its starting point, an observation of Priestley, confirmed and amplified by Cavendish (1784), who found that nitrogen and oxygen combine slowly under the action of electric discharges to form oxides of nitrogen, which then change, by more or less complex chemical processes, into nitric acid, nitrous acid, or nitrates and nitrites. The fundamental reaction is therefore, according to the happy expression of Sir William Crookes, a real "combustion" of nitrogen in oxygen. But we may add, in order to be precise, that this combustion is "slow and lazy," since it goes on only as long as the electrical energy continues to act and since it also stops as soon as the content of nitrogen oxides in the gas has attained a certain limiting value.

For about 10 years attempts have been made to devise a process of manufacture of nitric acid on this basis. I do not intend to describe in detail the various methods which have been suggested, but will summarise the general conclusions which may be drawn from these researches. I should state, however, that the first attempt of this kind, made in Switzerland, was due to Aloys Naville in 1893, who proposed to me shortly afterward to study this problem in collaboration with him and Prof. C. Eug. Guye.

The principal results of this collaboration have been condensed in patents taken out in 1895 and 1896, in which we formulated for the first time a principle which appears to us fundamental; it is *that the yield is notably increased when the electrodes are placed in a narrow part of the chamber, in which the reaction takes place, in order to submit the whole of the gas to the action of the electric energy and to draw off as rapidly as possible the gases which have been subjected to this action.*

The results of this work were taken up in 1896 by the "Société d'Etudes Electrochimiques," in Geneva, and tests have been carried out continually since that time on a moderately large scale. Other experiments in the same direction have been made by the Atmospheric Products Co., at Niagara Falls (Bradley-Lovejoy method), the "Groupe d'Initiative," in Freiburg, Switzerland (method of Kowalski), and the Hydro-elektrisk Kvælstofaktieselskab, in Norway (method of Eyde and Birkeland).

Recently we have heard about projected plants which will be worked by Pauling in Austria, and by the "Badische Anilin und Soda Fabrik" in Germany.

Independently of these developments, which have a more or less industrial character, very interesting laboratory researches have been made by Crookes (1897), Lord Rayleigh (1897), McDougal and Howles (1900), Muthmann and Hofer (1903), von Lepel (1903), Nernst (1904), and Scheuer (1905).

At the beginning of these researches contradictory results were often announced. It appeared as though the effects produced would be different, according to whether the arc is produced by alternating or direct current, or whether the arc is elongated or shortened. Some have recommended currents of small intensity, others currents of large intensity. The presence of water vapour in the air has sometimes been claimed to prove favourable, sometimes unfavourable. Even the form of the electrodes appeared to play a more or less important rôle. To sum up, the combustion of nitrogen at the temperature of the electric arc appeared to be subject to very peculiar, capricious, and mysterious laws, and seemed to depend on new and strange factors.

All the factors mentioned above are now known to be secondary and accessory. The detailed study of the problem has proved that the phenomenon is strictly governed by the fundamental laws of chemical dynamics.

This method of looking at the problem has not only the advantage of simplicity, but it also furnishes valuable indications of the possibilities which may be realised, and so far there exists good agreement between theory and experimental results. The following discussion is based upon this point of view:—

Chemical Phenomena Due to an Arc in Air.

The chemical phenomena which occur when an electric arc passes through atmospheric air, may be suitably discussed under three different headings: First, the initial reaction; second, the influence of temperature; third, the reverse reaction.

Initial reaction.—At the high temperature of the electric arc in air, the molecules of nitrogen and oxygen dissociate into their atoms, which is followed by the combination of these atoms to form nitric oxide. The reactions are, therefore,

$$N_2 = 2N \text{ and } O_2 = 2O$$

then

$$2N + 2O = 2NO$$

Like most chemical reactions, this reaction is incomplete. That means that for a given temperature and for given initial conditions of pressure, composition, &c., the reaction stops when the content of nitric oxide reaches a certain value.

The underlying reason of the stoppage of the reaction is its reversibility. The stoppage will take place when the above reaction—the combination of the N and O atoms to nitric oxide—and the reverse reaction—the dissociation of the nitric oxide into N and O atoms—hold each other in equilibrium; *i.e.*, when in the same time the same number of NO molecules are formed by one reaction as are dissociated by the opposite reaction. The reversibility is expressed by the equation—

$$\tfrac{1}{2}N_2 + \tfrac{1}{2}O_2 \rightleftarrows NO$$

It is difficult to measure the content of the nitric oxide gas in the state of equilibrium, since in the presence of an excess of oxygen (which is always the case in these experiments) the nitric oxide changes rapidly into peroxide at temperatures below 500° or 600° C.

$$NO + O = NO_2{}^{(10)}$$

The results of analysis are, therefore, generally given in the form of NO_2. But this does not modify the preceding conclusions.

Effect of temperature.—The reaction proceeds the further the higher the temperature, other things being equal. The following figures were found by Nernst and controlled by calculation on the basis of the law of mass action:—

Absolute Temp.	Per cent. by volume of NO, observed.	Per cent. by volume of NO, calculated.
° C.	per cent.	per cent.
1811	0·37	0·37
2033	0·64	0·67
2195	0·97	0·98
3200	5·0	4·4

The time in which the limit of NO gas is formed, *i.e.*, the time in which the condition of equilibrium is reached at a certain temperature, is the shorter the higher the temperature. We give some figures of the same author indicating the time during which the reaction is half completed; *i.e.*, the time in which half the above limiting values are reached. It is 100·0″ at 1540° and 3·5″ at 1737°.

It follows that a double advantage is derived for the combustion of nitrogen from the use of as high a temperature as possible. First, the content of nitric oxide is increased, and, second, the transformation occurs more rapidly.

It is true that these advantages are partly compensated by the fact that considerably more heat energy will be required at an elevated temperature, since the electric arc has to furnish the calories, raising to the desired temperature not only the nitrogen and oxygen which combine, but also the excess of the two gases which do not combine. A careful calculation shows, however, that the larger expenditure of energy required at the higher temperature represents an expense which is more than counterbalanced by the better efficiency obtained thereby. The use of a high temperature is therefore an advantage.

Prof. F. Haber[11] gives the following figures:

1 kilowatt-year (of 365 days of 24 hours each) can theoretically yield the following maximum amounts of nitric acid by combustion of atmospheric nitrogen:

1850 kilos. HNO_3 at 4200° C.
819 kilos. HNO_3 at 3200° C.

A decrease of the temperature by 1000° C. results, therefore, in this case in a reduction of the efficiency by more than 50 per cent.

Reverse reaction.—The formation of nitric oxide at the high temperature is followed by the dissociation of the oxide into nitrogen and oxygen during the period of cooling.

This is a necessary consequence of the laws of chemical dynamics applied to reversible reactions. If, for instance, the fundamental reaction

$$\tfrac{1}{2}N_2 + \tfrac{1}{2}O_2 \rightleftarrows NO$$

is carried out at a temperature of 3200°, whereby the limit of formation of nitric oxide in volume is 5 per cent. (Nernst's figure), and if the gas mixture is then cooled very slowly to 2200° and equilibrium is again established at this temperature, the volume of the NO will be reduced to 1 per cent. During the slow reduction of the temperature by 1000°, therefore, 80 per cent. of the NO which was produced before at 3200° is lost. This is the phenomenon of the reverse reaction.

We have already seen that by raising the temperature equilibrium establishes itself with greater speed at higher than at lower temperatures. In the same way, when the temperature is diminished, the reverse reaction proceeds more rapidly at higher temperatures than at lower temperatures. This is also a consequence of the general phenomenon of reversibility.

It follows that the most dangerous temperatures—those in which the reverse reaction during cooling will undo what has been performed before—are higher temperatures, near the temperature of the primary reaction. From this results the necessity of cooling the gas mixture as suddenly as possible from the temperature of the arc, in order to bring it in the shortest possible time to temperatures at which the velocity of the reverse reaction is practically zero. In the case of combustion of nitrogen this condition is realised more easily, for the reason that below 600° NO combines gradually with the excess of oxygen to form nitrous vapours which escape the reverse reaction.

In practice, the tendency has been to obtain this result first by rapidly sweeping the gases out of the region of action of the arc, while more recently use has been made of electrical or mechanical devices by which the arcs were successively lighted and interrupted several thousand times per second, or the arc has been forced to play in different regions of the space. In all these cases the gas mixture which has been brought instantaneously by the arc to a very high temperature is also cooled instantaneously in the mass of surrounding cold air, and the effects of the reverse reaction are, if not suppressed, at least considerably diminished.

To sum up, the fundamental considerations which govern the combustion of atmospheric nitrogen are the following: First, it is necessary to work at a high temperature in order to increase the efficiency and the velocity of the reaction; second, to cool the gas instantaneously in order to avoid the reverse reaction.

It is at once evident that it is rather difficult to realise simultaneously these two conditions in practice. According to whether the experimenters have satisfied more or less one or the other condition, the results have apparently been contradictory. This explains the very peculiar results to which we referred above.

The gases obtained in this way contain some 1 or 2 per cent. by volume of nitric oxide when they pass out of the arc chamber, and must then be treated in order to transform the nitric oxide gas into nitric acid or into nitrates and nitrites. These operations are more of chemical than of electro-chemical interest, and it will be sufficient to indicate their principle, although the practical operation involves certain difficulties. It is, indeed, necessary to handle a considerable dead weight of inert or indifferent gases. By cooling the nitric oxide gas, NO is transformed into N_2O_3 and N_2O_4 as soon as the temperature falls below 500° or 600°. Proper reactions with water, or with alkaline solutions (caustic soda, lime water, &c.), give either dilute nitric acid or nitrates or a mixture of nitrates and nitrites.

We may finally call attention to a characteristic feature common to all the methods which have been studied.

Whatever may be the method which is adopted, whether with direct current or with alternating current, or with rapid electric oscillations in air in motion, or whether the electric discharges are displaced in space, the arc, in order to be lighted, requires a higher voltage than that which is sufficient to maintain it in a state of stability after it has once been established. It is, therefore, necessary to install between the source of electrical energy and the arc chamber either a considerable resistance with direct current or one or several induction coils with alternating currents or oscillatory discharges. From a practical point of view, this means that in the arc only a fraction of the nominal capacity of the dynamo can be utilised. With alternating currents, for example, there will always be a considerable phase difference, measured by a power factor which has often a rather unfavourable value. Estimates of installations must take this point into account, since it amounts to an increase in the cost of dynamos, and, therefore, in the cost of electrical energy.

The extended and expensive researches of recent years have, therefore, very greatly simplified the understanding of this problem which formerly was so mysterious. It may be interesting to state what has been accomplished in practice.

In respect of the cost, the sources of information are much less numerous than in those which concern calcium carbide and, consequently, cyanamide. The problem of the fixation of nitrogen as nitric acid presents many different features. Nevertheless, several important publications relative to experiments carried out in Norway, on a very considerable scale, furnish very interesting information as regards fixing the cost price of electro-chemical nitric nitrogen.

This cost price appears to depend in the first place upon factors easy enough to determine. In reality it is simply a question of provoking a partial oxidation of the atmospheric nitrogen by submitting the air to the action of electric energy and then combining the oxides of nitrogen thus formed with water and oxygen in order to obtain them in the form of nitric acid; by neutralisation with lime we could get, if wanted, calcium nitrate; in Norway, they use an excess of lime and produce a basic calcium nitrate containing about 75 per cent. $(NO_3)_2Ca$ (12 to 14 per cent. N), with about 2 per cent. CaO in excess.

It is rare to find a chemical process so simple; the only expenses to be considered are, on the one hand, electric power and, on the other hand, current manufacturing expenses. Finally—an occurrence practically unique in the industrial world—the cost of the raw material is zero, if it is simply a question of preparing nitric acid, and is almost negligible when nitrate of calcium is produced.

Let us examine these different elements one by one.

Electric energy.—The most favourable results as yet published indicate a production of 900 kilos. HNO_3 per kilowatt-year, measured at the arcs (Eyde and Birkland). (All the yields are calculated as nitric acid of 100 per cent. HNO_3.) Prof. Haber has calculated a theoretical yield of 1800 kilos. per kilowatt-year. According to Prof. Witt the quantity of nitric acid obtained at Notoden during last summer amounted to between 500 and 600 kilos. per kilowatt-year. In one of their patents the Badische Anilin und Soda Fabrik mentions that they obtained 650 kilos.

At the "Société d'Etudes Electrochimiques" at Geneva, with extremely simple and cheap apparatus, we have obtained a yield of about 400 kilos. of nitric acid.

It seems then that we may take a production of 500 kilos. HNO_3 per kilowatt-year as being a fair average. This production may be greater or less according to the degree of simplicity of the apparatus employed. Without doubt, the yield will be certainly increased in the future; in reality we are only in the introductory stages of this industry.

Recovery of the oxides of nitrogen.—The process of recovery which has been, up to the present, adopted by different experimenters is based on the absorption of these oxides by water. Prof. Witt states that approximately 95 per cent. of the nitrogen oxides thus formed at Notoden are recovered.

In reality the recovery is not so simple as it might appear at first sight; for the chemical mechanism of the fixation of nitrogen oxides by the elements of water is extremely complex.

At Notoden, the products of three furnaces, each 700 h.p. (500 kilowatts), are conducted into a system of two parallel series of five granite towers, each of which has a capacity of 40 cb. m.; in each of the series the last tower is filled with milk of lime in order to retain the poorer gases. The capacity of the system is thus 400 cb. m.; its power of absorption amounts to 3·3 kilos. of HNO_3 per cubic metre in 24 hours. This corresponds approximately to the capacity of production in lead chambers (2 to 4 kilos. per 3 m. of chamber, acid of density 1·5 to 1·6), which is equal to from 2 to 4 kilos. per cubic metre.

As the result of the researches made by the "Société d'Etudes Electrochimiques," it is more advantageous to employ sulphuric acid as absorber; the power of absorption of this latter being in reality much greater than that of water. On the other hand, the methods of absorption by water are capable of considerable improvement.

The "Société" is now engaged in studying certain newly patented processes by which either dilute nitric acid of 50 per cent. HNO_3 is directly produced, or fuming nitric acid containing 96 per cent. HNO_3.

The plant built in Norway, which represent nearly 0·3 cb. m. capacity per kilowatt, seem to be somewhat expensive, especially if we take in consideration all the accessories they demand (tubulated cooling system, extensive canalisations for both gases and liquids, ventilators, pumps, &c.). No actual figures have as yet been published as to the cost of that plant; but their principal dimensions being given, it is not difficult to estimate approximately the cost; it must reach to between 300 to 400 frs. for each kilowatt used in the furnaces. The sum necessary to keep all this material in repair ought to be a considerable fraction of the current expenses.

By the recuperation by means of sulphuric acid, I estimate the capital invested at 200 frs. per kilowatt.

Having established these points, we find that the cost price of a ton of nitric acid is represented by the following figures:—

	frs.
Electric energy at 50 frs. per kilowatt-year for a production of 500 kilos. per year	100
Repairs	40
Wages and general expenses	10
Depreciation and interest on capital at 5 per cent.	55(12)
In francs	205
In £ Sterling	£8 3*s.* 5*d.*

To this price of 205 frs. we must add the expenses of packing and transport; these will be entirely different according to the form in which the product is delivered. This fact allows us to distinguish the two following principal alternatives:—

1. When the nitric acid is transformed into calcium nitrate; in this case there are approximately the following additional expenses:—

	frs.
Lime, 0·45 ton at 15 frs. the ton and handling thereof	15
Packing (air-tight drums)	28
Transport (the same figure as for cyanamide)	20
	63
Expenses of production	205
Price per ton HNO_3 delivered as nitrate of calcium	268
	£10 14*s.* 5*d.*
Cost price of nitrogen per kilogramme in the same form	1.25 or 1*s.*

2. When the nitric acid is delivered direct as acid (in particular as concentrated nitric acid). In this case it would be enough to add to the above-mentioned sum of ..... frs. 205
The expenses of packing and transport .. frs. 50

Price per ton HNO_3 delivered as nitric acid.. frs. 255 or £12 2*s.*
Price per kilogramme nitrogen ..... frs. 1.15 or 11½*d.*

We have already mentioned that the actual value of nitrogen per kilogramme is the following:—

1.55 frs. in Chili nitrate = 1*s.* 3*d.*
2.25 frs. in chemical nitric acid = 1*s.* 7½*d.*

On comparing these figures we may conclude that electro-chemical nitric acid can compete successfully with the last two products. Besides that, the price of electro-chemical nitric nitrogen per kilogramme is practically the same as that of the nitrogen contained in calcium cyanamide prepared from the excess in the manufacture of carbide (1.35 frs.), if we do not take into consideration an agricultural coefficient of the cyanamide.

IV.—Future Prospects.

If we attempt to compare the characteristic features of the two principal methods of electro-chemical fixation of nitrogen, which occupy at the present moment the attention of manufacturers and economists alike, we observe in the first place that the yield per unit of electric energy is superior in the cyanamide process.

Yield in nitrogen per kilowatt-year.—With one kilowatt-year electric power, we obtain 2 tons carbide = 400 kilos. fixed nitrogen.(13) With the same power we obtain 0·5 tons HNO_3 = 111 kilos. fixed nitrogen.

Nevertheless, the cost price per kilogramme of fixed nitrogen is no higher in the electro-chemical nitric acid process (without taking into account an agricultural coefficient for cyanamide):—

Cost price per kilogramme fixed nitrogen.—By the cyanamide process, carbide at 140 frs. a ton = 1.35 frs.; carbide at 185 frs. a ton = 1.58 frs. By the electro-chemical nitric acid process, as basic nitrate of calcium = 1.21 frs.; as nitric acid = 1.15 frs.

Profit per kilowatt installed.

(The capital invested for one kilowatt installed is almost the same for the two processes, that is 200 to 300 frs., or £8 to £12).

With cyanamide.—Nitrogen sold at the price of that of ammonium sulphate: $400 \times (1.45 - 1.35) = 40$ frs. = £1 12*s.*

With nitric acid.—(A) Nitrogen sold at the price of that of Chili nitrate: $111 \times (1.55 - 1.20) = 38.85$ frs. = £1 11*s.* 1½*d.*

(B) Nitrogen sold at the price of that of nitric acid: $111 \times (2.25 - 1.20) = 116.55$ frs. = £4 12*s.* 5½*d.*(14)

The lower price of nitrogen in nitric acid is due to the fact that the yield, although smaller in the last-named process, is greatly compensated for by the extreme simplicity of the operations and also inasmuch as it is unnecessary to take the price of raw materials into account.

If we consider the matter, it is really impossible to imagine more simple operations than the oxidation of atmospheric nitrogen and the subsequent absorption of the oxides of nitrogen formed.

Nitric nitrogen offers in itself several important economical advantages which it is interesting to examine briefly.

To begin with: as regards agricultural needs it is evident that calcium nitrate, closely related as it is to sodium nitrate, has before it almost unlimited prospects which are daily increasing. It is already well known that all nitrates of alkalis or of lime are as good manures as the nitrate of soda.

In the second place, electro-chemical nitric nitrogen has before it an extremely brilliant opening, through its sale in the form of nitric acid, which represents in Europe alone a market of about 200,000 tons. It looks as if it were an economical error in this new industry to supply,

in the first place, nitrate of calcium, as is done in Norway, instead of nitric acid. The nitric acid leaves a greater margin for profit as has already been shown. Our principal efforts ought, therefore, to be concentrated on the manufacture and sale of this acid, which would make it possible for the factories to pay off rapidly the capital invested on the initial plants, at the same time perfecting the technique of the processes. It is all the more to the interest of this industry to follow this branch, since the uses of nitric acid are continually increasing and others are to be expected as soon as its price has sunk lower.

To continue, as regards the future of the two industries, we think that the development ought not to be considered as that of two rivals in the usual sense of the word.

The principal aim in the development of the nitric industry should be that of the production of nitric acid, at the same time with a view to increasing the yield. It will have consequently before it a very large future, in the manufacture of nitrate.

On the other hand, the cyanamide industry is destined, at first, to be linked with the carbide industry; considering the actual cost price of calcium carbide, it will scarcely be possible to develop this industry anywhere but in the neighbourhood of carbide works, possessing favourable economical conditions: and even then it would only employ the excess of carbide not absorbed for lighting purposes. We have already observed that the sale of carbide for lighting is much more remunerative. If all the circumstances are not especially favourable, the building of large carbide factories, destined exclusively for the manufacture of cyanamide, seems to be more or less hazardous; especially if we take into consideration the diminution in price of nitric nitrogen, which can be considered practically certain to take place in the more or less near future. Other considerations, which will be examined a little later, give further weight to this argument. Although limited in this way, I consider that the field for activity still remains very large.

Finally, I should like to add that it is all the more in the interest of these two growing industries not to consider themselves as rivals, for they can benefit by working hand-in-hand with a view to a better utilisation of the atmospheric elements—nitrogen and oxygen—as I have already suggested in my lecture before the *Société Helvétique des Sciences Naturelles*. In the cyanamide industry, the atmospheric oxygen is actually lost; whereas it might be employed with advantage in the manufacture of electro-chemical nitric acid, in which the addition of this gas to the atmosphere constitutes a favourable factor in increasing the yield per unit of electric energy.

Captivating as the prospects are which are open to these two young industries, it may be well to glance at several exterior factors liable to promote or retard their development.

We have just indicated the importance of liquid air in this respect; it is certain that every progress realised in this branch ought to be considered as a factor favourable to the rapid extension of the processes of electro-chemical fixation of nitrogen.

A question not less important concerns the production of electric energy, which is indispensable to the extension of these processes. It is certain that the first nitrogen works will make use of this energy at a low price, furnished as it will be by large hydro-electric stations; however, we must not deceive ourselves and certainly not forget that this source of energy is more limited than is generally realised. The hydraulic forces still available, and at the same time favourably situated, reach in Europe a power of several hundred thousand kilowatts—at most one million. Although it is true that they constitute a reserve sufficient to fix a quantity of nitrogen corresponding to a very large part of the present European consumption of nitrates and ammoniacal salts, still they would not be sufficient to meet the larger consumption which we may consider as a certainty in the near future.

Our attention is therefore attracted to the problem of the economical production of energy by means of motors, employing in some form or other (vapours, poor gases, &c.) coal power. The progress made in this branch during the last 20 years has been so considerable that we may contemplate its future with confidence.

In this respect, the important industrial researches of Dr. L. Mond, seem to me to have indicated the fundamental principles by means of which electric energy will certainly be furnished in the future to the electro-chemical industry in countries which do not possess hydraulic power. These methods, based on the recuperation of nitrogen, are doubly interesting in connection with the subject which is occupying our attention. It is, therefore, indispensable that we should pause here for a few moments, less in order to fix the details with which you are already acquainted, than to emphasise the immense future which awaits these processes: and here let me express my thanks to Dr. Mond and to Mr. Emile Mond, Managing Director of the Power Gas Corporation, to whom I am indebted for several of the following particulars.

Dr. Mond's system consists in producing gas from gas-producers under conditions which permit the recovery in the form of ammonia of the greater part of the nitrogen contained in the fuel and in utilising afterwards this gas in gas engines, which, in their turn, drive dynamos.[15]

In the case of especially powerful producers, moist air is passed through the incandescent coal (up to 2½ tons of water per ton of coal). This operation ought to be conducted at not too high a temperature. After the gases have been scrubbed in appropriate apparatus, from 60 to 70 per cent. of the nitrogen contained in the coal is extracted as ammonia; this represents on the average 40 kilos. of ammonium sulphate per ton of coal.

The system is applicable even to combustibles of very inferior quality.[16] The calorific power of the fuel being approximately 6786 cal., the heating power of the gas would be 77 per cent. of that of the coal.

From the economical point of view, these most remarkable results may be interpreted by one or other of the following possibilities:—

(*a*) Either the combustible gas is reckoned at the ordinary price of general production; in which case the cost price of sulphate of ammonia amounts to £4 per ton (Journal of Gas Lighting, 1903).

(*b*) Or we may deduct the profit arising from the sale of ammonium sulphate from the cost price of the motive power generated by gas engines; a fact which is distinctly in favour of the gas engine.

If we apply the preceding data to the average conditions in Europe for the production of electric energy in power stations producing several thousand h.p. by gas engines, and if we reckon at £14 per electric h.p. the cost of the outfit, the price per electric h.p.-year would amount to about £3 with fuel at 10*s.* a ton.

The industrial Mond-gas plants which have been built in England realise conditions very similar to those which we have just indicated. The price per h.p. (electric) is, I understand, approximately £2 15*s.* a year, with fuel at 7*s.* a ton.

If we apply this last figure to the cost price of electro-chemical nitric acid, as we have already estimated it, the latter would amount to 325 frs. (£13) a ton; in which the fixed nitrogen would be 1.58 frs. = 1*s.* 2*d.* the kilo. This is about the price of the Chili saltpetre nitrogen; it leaves, on the other hand, a very interesting margin for the production of nitric acid.

If we take into consideration the enormous advantages which the chemical industry will gain in manufacturing these products in the neighbourhood of centres of consumption, we shall be able to appreciate without difficulty the very great interest attaching to the development of these methods.

Their importance is still further enhanced by the possibility of producing ammoniacal salts in enormous quantities if we remember that the world's consumption of coal is now not far from one million million tons a year.[17]

It is scarcely necessary to add that this production of ammonia will furnish the electro-chemical nitric acid industry with facilities for producing ammonium nitrate at a low price. This latter, among all the nitrogenous bodies destined for agriculture, is the one which is best adapted to long distance transport, thanks to its high percentage of nitrogen. At the same time it is the nitrogenous fertiliser *par excellence*.

The following table shows the percentage of nitrogen contained in the various nitrogenous bodies under consideration :—

	Nitrogen per cent.
Sodium nitrate	16·5
Ammonium sulphate	21·2
Guano	10—15
Calcium cyanamide	14—20
Calcium nitrate	17·1
Basic calcium nitrate (Norway)	13—14
Nitric acid HNO_3	22·2
Nitric acid of 95 per cent.	21·1
Ammonium nitrate	35·0

Such are, gentlemen, the different prospects of the near future, presented by the problem of the fixation of nitrogen. To what degree and how soon will they be realised ? That is a question difficult to answer. Although the value of the numerous figures which I have given is rather comparative than absolute, it remains an indisputable fact that at the present day this branch is really and effectively open to industrial methods, which will shortly assure the civilised world of a supply of nitrogen which it will no longer be able to extract from the exhausted reserves in Chili.

The principal part of the nitrogen will be derived from the atmosphere : electro-chemistry now being in a condition to fix this precious element. On the other hand, we can foresee that coal also, which has already proved of such importance in our economical development, will not lag behind in this conquest, to which, furthermore, contributions will certainly be made by rational methods of liquefying air and so separating its elements. Final success is, in a word, dependent on the expansion and development of the most modern discoveries of science and of applied chemistry. It is on this final success that the future of the civilised world depends, and I think, gentlemen, that these considerations are sufficiently important to attract and hold the attention of your Society.

I should like to add my cordial thanks to the Society for having given me the opportunity of bringing before them a problem which has occupied my attention for the last 10 years.

(1) M. Frank (Ztschft. für angew. Chem., 1905, p. 836) recently indicated that agricultural needs in Germany absorb 200,000 tons yearly. Prof. Witt gives only 90,000 tons in his report on the Paris Exhibition of 1900.

(2) 40,000 tons according to a recent publication (Electrochemical and Metall. Industry, 1906, p. 121).

(3) These estimates comprise only the consumption of ammonium sulphate. In order to obtain the total consumption of ammonium we must add to these figures the ammoniacal liquors used in the soda factories, which employ the Solvay process. According to Mr. Ernest Solvay (Congress of Berlin, 1905), the entire production in 1902 of soda by the ammonia process reached 1,610,000 tons. This figure ought to be still fairly exact, as shown by a communication for which I am obliged to Mr. Armand Solvay. On the other hand, Mr Schreib states that the minimum loss of ammonia is 0·75 kilos. per 100 kilos. of soda, from which we can deduce an average loss of 1 kilo. In this case the ammonia consumed by the Solvay Soda Works would be 16,100 tons, which corresponds to about 77,000 tons of ammonium sulphate.

(4) This process was patented by Readman and Parker, and is in operation at the works of the Scottish Cyanide Company, at Leven, Fifeshire.

(5) This high percentage of nitrogen is obtained only with calcium carbide of good quality.

(6) In giving the following figures, I have endeavoured to make an estimate which shall not err on the optimistic side. I have preferred to place a somewhat high price on the power and on the raw materials, and to make the conditions as far as possible comparative. If any of my figures require correction in a more favourable sense, I shall be the first to express satisfaction.

(7) In this case the price is restricted to factories working on a large scale ; it reaches a much higher figure for smaller installations.

(8) The chief improvements introduced since 1902 into the manufacture of calcium carbide may be summarised as follows :—
The quantity of raw materials employed (lime and coke) has somewhat diminished ; per ton of carbide, 1100 kilos. of lime and 750 kilos. of coke were then deemed sufficient ; the most important reduction relates to the electrodes. By more rational construction of the furnaces, a saving of 10 to 20 kilos. has been effected in lime and carbon, at least in making fused carbide ; some works have succeeded in making a saving of even more than 20 kilos. On the other hand, the manufacture of electrodes has been centralised more and more in special works, and they are now sold to carbide manufacturers at a price on delivery of 35 to 40 frs., instead of the 50 or 60 usual some years ago.
In the early days of the manufacture of fused carbide (*carbure coulé*) (the manufacture of cakes is being given up), only 3·5 kilos. of 80 per cent. carbide was produced by 24 electric kilowatt-hours. However, by careful supervision, by improvements in furnaces, and especially by the use of greater electric power (500, 1000 and 2000 kilowatts), the yield has been increased to 6 kilos. per 24 kilowatt-hours, or 2·1 tons per kilowatt-year ; it is said that some works obtain even more.
The cost of electric energy must be taken at a very low figure, for the manufacture of carbide has stopped except in works very favourably situated in this respect. Several works in central Europe reckon that their electric power costs not more than 50 per kilowatt-year.

(9) It is necessary to note that a carbide factory of 5000 kilowatts power, able to turn out 10,000 tons carbide a year, and disposing of, for instance, 20 per cent. of its production to transform it into calcium cyanamide, namely, 2000 tons, would consume only 400 tons of nitrogen—in other words, a little more than a ton a day However, in accordance with the calculations published the nitrogen could not be obtained at a price of a few centimes the kilo. unless the daily production reached 40 to 50 tons.

(10) Some authors have assumed that nitrogen peroxide is directly formed But this assumption is untenable in view of the experiments of Richardson, who found that the gas NO_2 dissociates completely into NO and $\frac{1}{2}O_2$ at a temperature between 500° and 600° C , which is much below the temperature of the electric arc.

(11) F. Haber, Thermodynamik technischer Gasreaktionen (München, 1905), page 251.

(12) This is calculated on a capital of 200 frs. per kilowatt. instead of from 300—400 frs., to make allowance for the improvements resulting from the rational recovery by means of sulphuric acid.

(13) Or 280 kilos. if the percentage of nitrogen is only 14 per cent.

(14) This figure is certainly too high : if the production of electro-chemical nitric acid is realised on a large scale, the price of this product will become lower.

(15) The consumption of gas is 66 cb. ft. per B.H.P. hour, *i.e.*, about 71 cb. ft. per electric h.p. hour.

(16) Thus with coal of 62·69 per cent. C and 10·42 per cent. ash, it was possible to convert into gas 57·38 per cent. of C, whereas 5·31 per cent. remained in the ash. The gas so obtained contained (in volume) :—CO, 11 per cent. ; H_2, 29 per cent. ; CH_4, 2 per cent. ; CO_2, 16 per cent. ; N_2, 42 per cent. One ton of the fuel produced 30·59 cb. m. of this gas, saturated with water at 15° C. ; its calorific power was 1317·8 cal. per cb. m.

(17) The recovery of the nitrogen, applied to only one-tenth of this consumption, within the limits of the Mond's process, would give about one million tons nitrogen per annum, *i.e.*, four times about the actual consumption of nitrogenous bodies.

Discussion.

The Chairman read a telegram from Dr. Frank, of Charlottenburg, regretting his inability to be present. He was glad to add, however, that his colleague, Dr. Caro, had specially come to attend the meeting. He also read letters from Lord Rayleigh, P.R.S., and Dr. Ludwig Mond, F.R.S., expressing regret at their inability to be present.

He felt sure that the discussion would be free from bias towards any particular process or patent. They were there to discuss, in its broadest possible aspects, a question of enormous importance, namely, whether or not it was practicable from an industrial point of view to supply nitric acid in a form which could be obtained from the atmosphere, instead of being dependent on Chilian nitrate as they were to-day. Amongst other points raised, the question of the transport of nitric acid appeared to demand consideration, and he would like to hear the views of technologists as to whether or no there were difficulties attending the transport upon such a scale and over great distances of nitric acid of such strength as 1·5 sp. gr. He did not suggest it could not be done. There were questions in connection with transhipment, &c., which should be discussed. With regard to the cyanamide, the author had treated that as a by-product, resulting from the surplus production of carbide, and he had taken the price of the latter without packing at something over £5 a ton. Those might be the conditions obtaining to-day, but many of them would have read of propositions to which practical effect, he understood, was about to be

ven to produce carbide at a very much lower price, id if that proved to be correct, he would suggest that the atement that cyanamide would come out at about the me price as nitrate of soda would require serious modifi- tion. He should also like to hear what such authorities Dr. Voelcker and Dr. Dyer had to say with respect the stability of cyanamide possessed of a definite anurial value at the place where it was used: such ability had, he understood, been questioned. The prices on which the author had based his nitric acid compari- ns appeared to be taken upon the present price of trate of soda, and one would like to know whether, in ew of the suggested competition, in respect of 200,000 ns per annum to commence with, those interested in trate would be content to remain passive, or whether ere was a possibility of a reduction in price, and to hat extent it could go. What was the margin of reduc- on possible in that connection? Even if this process ly effected a serious reduction in nitrate, it must react vourably to the whole community. They would like learn more about the wear and tear of the furnaces hich had been described, and how long they had been at ork on a sufficient scale to make a fair estimate in this rection possible.

After Dr. DIVERS, as President of the Society, had pressed a welcome to the distinguished visitors,

Sir WILLIAM RAMSAY said he wished to make a slight rrection; it was not Cavendish who first discovered e union of nitrogen and oxygen by the spark, but riestley, as Cavendish himself acknowledged. It was ue that neither of those experimenters knew what they ere doing. They were dealing with "phlogisticated" id "dephlogisticated air"; still, the credit was due Priestley for the original discovery, though great progress as made by Cavendish, in his remarkable researches. The hairman suggested that, supposing this new scheme came to force, and calcium carbide could be made at a very w figure in Norway, whether that would not throw so uch on the market that it could not all be taken up for ghting purposes, and that a great deal would be available r the production of cyanamide, or that possibly it would so. But there was a counter consideration.

Calcium carbide gave a very cheap light, and from e country-house point of view, illumination by its use as by far the simplest method if one excluded the oil mp. Now, if the price of calcium carbide were reduced, e consumption would go up enormously, because what ilitated against its use at present was its high price. alcium carbide at its present price when interpreted into gures would represent coal gas at about 8*s.* or 10*s.* r thousand, and that was rather a deterrent for the oprietors of small country houses. He believed, how- er, that if calcium carbide were made cheaper, a great crease in consumption would take place, and that again ould militate against its use in any large proportion r manufacturing calcium cyanamide.

Dr. N. CARO said the Chairman had correctly pointed it that the question whether the processes for the xation of atmospheric nitrogen became valuable, would epend upon whether these processes were economical. e believed it to be of importance, therefore, to correct me of the statements of the author, on the ground of actical experience. He would not criticise the figures ven for the process of obtaining nitric acid from atmo- heric nitrogen, as he had had no practical experience of e process, but he would point out that in these figures, e not inconsiderable cost of concentrating the dilute id seemed to have been omitted. On the other hand, could furnish some information as to the cost of manu- cture of the product, obtained from calcium carbide id nitrogen, called "Kalkstickstoff" (crude calcium anamide). The cost of manufacture of carbide given rresponded in general to that obtaining in practice, z., a yield of 2·1 tons of carbide per kilowatt-year, a cost of 140 francs per ton, with electric energy at 150 ancs per kilowatt-year. This cost was not, however, e actual first cost of the carbide, but represented also a rtain profit for the carbide manufacturer, so that it would be possible to count on carbide at this price, even if it were bought from a carbide factory, and not specially manufactured in the calcium cyanamide works. The statement of the lecturer that one ton of carbide was required to obtain one ton of crude calcium cyanamide was not correct, only 800 kilos. of 80 per cent. carbide being necessary, *i.e.*, one ton of carbide would yield 1·25 tons of crude calcium cyanamide containing 20 per cent. of nitrogen. The statement that the nitrogen used in the process cost 10 centimes per kilo. also needed correction. The nitrogen was isolated from the air either by chemically fixing the oxygen, or by mechanical means, *e.g.*, by Linde's process. The cost of the latter process varied according as electric power or coal was used. Linde himself stated that oxygen obtained by his process, even when a tolerably dear fuel was used (25 francs per ton), cost about 6—7 centimes per cb. m. Since for each cb. m. of oxygen about 4 cb. m. of nitrogen would be obtained, the price of 10 centimes per kilo. for nitrogen, given by the lecturer, was much too high. The other estimated general expenses were also much too high. These varied according to local conditions, but practical working had shown that the cost per kilo. of nitrogen combined in calcium cyanamide was considerably less than the 1·35 francs given by the author; indeed, the manufacture of crude calcium cyanamide would still be remunerative if the price of nitrate-nitrogen fell to 1 franc. per kilo. For nitrate, on the other hand, the position of affairs was very different; the very accurate, exhaustive investigations of Sempers and Michels (Z. Berg.-Hütten-u. Salinewesen, 1904, 359) had shown that the price of Chili saltpetre could not fall below 20 francs per 100 kilos., free at London, that is, the Chili saltpetre industry is capable of existence only with a price of 1.35 francs per kilo. of nitrogen. This fact would furnish an answer to Sir W. Ramsay, who inquired as to the prospects of the calcium cyanamide manufacture if the price of Chili saltpetre fell below its present value (1.55 francs per kilo. of nitrogen). Calcium cyanamide was a substance which could not only be used directly in agriculture, for which purpose it was eminently suitable, as it contained a high percentage (20 per cent.) of nitrogen, which was not reduced on keeping, and gave in practice results at least equal to those obtained with sodium nitrate and ammonium sulphate, but which could also serve as raw material for the preparation of numerous other nitrogenous compounds, in which the price of 1 kilo. of nitrogen was much higher than in calcium cyanamide. The crude calcium cyanamide, consisting of a mixture of calcium cyanamide and carbon, was suitable for the hardening of iron. The separated carbon was of a graphitic character, and the calcium cyanamide belonged to that class of carbon-nitrogen compounds capable of yielding carbon (in the form of graphite) to iron. A mixture of crude calcium cyanamide and a flux has been prepared under the name "Ferrodur," and has proved excellent for hardening iron. Pure cyanamide and its polymerisation product, dicyandiamide, obtained from calcium cyanamide, form the raw materials for the preparation of a large number of important substances. From cyanamide, urea and guanidine are prepared. Dicyandiamide may be used as an addition to explosives; it does not reduce the shattering effect of the explosive, as large quantities of gas are evolved in its decomposition, but it diminishes the temperature of the products of explosion. According to the most recent investigations of Professor Scalliazzoni, dicyandiamide should also be the most active product for agricultural purposes, as calcium cyanamide, when applied as a manure, is first converted into dicyandiamide. If that observation were confirmed, dicyandiamide would represent a fertiliser *non plus ultra*, since, owing to its containing 66 per cent. of nitrogen, the expenses of freight and transport would be reduced to a minimum. A further application of cyanamide rested on the fact that its alkali salts served as good condensing agents in the preparation of indigo from phenylglycin. Calcium cyanamide was also largely used for the technical manufacture of cyanides. In the fused state calcium cyanamide reacted with carbon, with the formation of cyanide, and this process was now used on the large scale for the manufacture of potassium cyanide. By the action of steam

on calcium cyanamide the whole of the nitrogen was converted into ammonia. Since ammonia was converted into nitric acid under the influence of catalytic agents, and the oxygen necessary for the reaction was available after the separation of the nitrogen from the air in the manufacture of calcium cyanamide, this latter compound might also be looked upon as an intermediate product in the manufacture of nitric acid from atmospheric nitrogen by a method which would probably be more economical than the direct combustion of nitrogen in oxygen. In the preparation of calcium cyanamide, and of ammonia and nitric acid therefrom, the power-consuming reaction was that concerned in the manufacture of carbide. Theoretically 1400—1500 kilos. of nitrogen could be fixed in the form of calcium cyanamide per kilowatt year; actually, 2·5—2·6 tons of calcium cyanamide were produced, that is, 500—520 kilos. of nitrogen fixed. According to the figures of Haber and Muthmann and Hofer, only 380 kilos. of nitrogen per kilowatt-year could be fixed by the direct combustion of nitrogen in oxygen, and actually only 140 kilos. of nitrogen were so fixed in practice. The calcium cyanamide process had thus attained, in practical working, a yield of nitrogen fixed, considerably higher than that theoretically possible by the direct process. In conclusion, the speaker claimed that the process devised by Prof. Frank and himself for the fixation of atmospheric nitrogen by carbides, together with its numerous extensions, represented a method of utilising, in the future, atmospheric nitrogen both for agricultural purposes and for chemical industry.

Dr. J. A. Voelcker said that the subject from its agricultural bearings was most interesting. All the attempts which had been made to supply nitrogen for the farmer's use resolved themselves in a question, as to the Chairman had said, of economy in production, and when all was said and done, and although great hopes had been raised by Sir William Crookes, people were apt to be led on a little too far in their conclusions. He did not think that even if nitrogen could be supplied free from the atmosphere a solution would be found for the many difficulties attending farming at the present time. Still, it would certainly form an advance, and an important advance, though its ultimate success had to be considered purely from the economical point of view. The present subject resolved itself into a consideration of whether either of the two materials mentioned in the paper they had listened to could be produced at a cost less than that of other materials which the farmer was in the habit of using at the present time. Naturally, too, there came the question of the practical utility of the two materials for agricultural use, and having had some experience with one of them, he might be allowed to briefly mention what this had been. So far, experiments with calcium cyanamide had not borne out the expectations held forth. There were difficulties undoubtedly with respect to its keeping. He had had to do with calcium cyanamide which had been produced in Germany, and after keeping it and testing it in the second year, he found that it had lost a considerable amount of its ammonia. Moreover, experiments in the field with cyanamide in comparison with sulphate of ammonia had led, at the best, to what must be called uncertain results. Both at Rothamstead and at Woburn cyanamide had been tried, and although it was not considered desirable, before making further trials, to publish the actual figures obtained, he must say that the results were not favourable to the cyanamide. He had not as yet had the opportunity of trying nitrate of lime, but so far as he might be allowed to draw a comparison between this and cyanamide, his own inclination would be very much in favour of the calcium nitrate, and still more, of the basic calcium nitrate as made in the improved way which Dr. Messel had suggested. It seemed to him on general grounds that the nitrate of lime was the more natural form in which the material could be utilised by the plant and be handled by the farmer, and there was, to his mind, no reason why it should not act as well as nitrate of soda, the value of which was universally recognised. Further, the presence of lime, especially for land in which lime was wanting, would prove an additional benefit. He rather looked in that direction, than in that of cyanamide, for any really practical application of this new discovery, but it all resolved itself, as he had said, into a question of the price at which the calcium nitrate could be produced. He could not form any idea as to how far the figures set out represented the real state of affairs, and he should have liked more definite information on these points, for it was there that the difficulty would be found. If the estimates for production, repairs, general expenses, and the other items of packing and transport were really correct, well and good: but if they were not, the farmer would undoubtedly still keep on using nitrate of soda as before.

Dr. Bernard Dyer said the matter, in this stage, was essentially a problem of chemical engineering. It was no longer a question of chemistry. They knew all about the application of nitrogen when they had it, and what they wanted to know now was, what the prospects were of getting it economically in either of these ways. He thought the calcium nitrate was more likely to be useful to the farmer, but they required to know whether these early developments were going to be practically developed, and they would need a good deal of experience before that could be decided.

Mr. Bingham said the author had correctly stated that the whole question of the cost of the manufacture of nitrate of lime was based on the cost of the carbide, and he thought these figures of the manufacture of carbide were entirely illusory. It was quite true Dr. Caro had considerably improved the aspect of the subject, but from his statements it appeared that he employed a very poor carbide, 68 per cent., which at present could not possibly be sold for use in acetylene lighting. So that the suggestion made by Sir William Ramsay that the surplus production could be used for making nitrate of lime, to a great extent fell to the ground. He must point out that there was only one carbide factory in Norway and Sweden which could obtain lime at 15 frs. per ton. At most places it cost nearly double that figure, chiefly owing to the fact that to get good acetylene carbide the raw material had to be imported from foreign countries. The point he wished to make was this: the author had very correctly stated that there were some carbide factories which could make 6 kilos. of carbide per kilowatt-day, but there was an enormous difference between this amount and 2·1 tons per year. If you divided the latter figure by 6 kilos., that meant a working year of 350 days. He did not know of a single carbide factory able to work 350 days consecutively night and day, and in his opinion, it was very risky to count upon such a basis. There might be factories in existence, he believed there was one, which did succeed in working 350 days. There were waterfalls, like one which was now being harnessed in Norway, giving about 100,000 horse power, and if they could harness two or three thousand they could, as a rule, reckon on getting power all the year round, especially if the plant were duplicated. But if that were done, the figure of 6 frs. for depreciation was absolutely out of the question. Even without duplicating the plant, assuming all went well, the figure of 6 frs. for depreciation was, in his opinion, much too low. Still it was fair if you took a poor carbide of 80 per cent.; and if it was possible, which he believed it was, to use a carbide which was not suitable for lighting purposes, containing a high percentage of phosphorus, you might produce carbide at £6 a ton, and he believed that was the figure originally calculated by Dr. Frank; at any rate, it was the figure contained in some papers sent from him. At the same time, no doubt, the fact that the extra cost of carbide was to a great extent neutralised, as Dr. Caro had pointed out, by the much higher yield of nitrate of lime obtained from a ton of carbide than was shown in the figures, therefore it really seemed possible that the end figures might actually be obtained in practice.

Mr. R. J. Friswell said a very important remark fell from the author when he called attention to the fact, that if power were raised by Mond gas as it stood at present, they would have the cost per kilo. of nitrogen

fixation coming out at about 15 pence. That was the price which he calculated in his table as being the price per kilo. of nitrogen from Chilian nitrate at about £10 6*s.* 8*d.* a ton. Of course, it was a moot point whether that price was one capable of much reduction. When he was engaged in the manufacture of nitric acid, he devoted some attention to that point, and found that with the prices at which the nitrate was now being introduced into Europe, there were large numbers of beds of Chilian nitrate which were said to be not worth working. It was really only a few of the deposits which paid to work at present prices. So that unless that price was artificial, there did not seem any very great margin for reduction. Owing to the enormous troubles which appeared to accompany the production of electricity in mountainous countries by means of water power, they were driven to look to its production by means of producer-gas. There was still a great deal to be done in reducing the price of power generated in that way. Professor Guye correctly stated that at present it costs about 50*s.* per horse power per year, but there was no doubt that when improved methods of scrubbing producer-gas were introduced, so as to get better results in gas engines, that price could be considerably reduced. If that were so, then they would have an opportunity of reducing the cost of the oxidised nitrogen. But after all, that was a comparatively small matter compared with another point. All the author's calculations were based on the production of 500 kilos. per kilowatt-year of nitric acid. If, theoretically, it was possible to produce 800 kilos. per kilowatt-year, that meant that at present they were only producing five-eighths of the possible amount. Evidently there was great room for improvement in the yield of the nitric acid. Taking that in conjunction with a higher power from engines driven by producer gas, it appeared to him that the possibility of the production of nitric acid by such means was extremely hopeful.

Mr. W. F. Reid said he would like to look at the matter from the general point of view, namely, the great advances which had been made in industrial chemistry through either of these processes. They had now in their hands such means of fixing the nitrogen of the air that it was only a question of cost, and in this they were getting so close to the natural sources of nitrogen, that it became a question of fractions of a penny only. This question of the fixation of nitrogen had always been a fascinating one for chemists. The very first practical fixation was by a French chemist in 1777. Instructions were issued in that year for the management of the "nitrières" for the production of saltpetre in France, when the supply was cut off through our British Navy. They then formed these nitre plantations, and used their sewage to make saltpetre for the preparation of gunpowder. That was a practical utilisation of their sewage which was the beginning of the fixation of nitrogen, and also of the bacterial treatment of sewage on a large scale. He did not think Dr. Caro, although he had given one or two of the applications of calcium cyanamide, had fully done justice to the developments which were possible with that extremely interesting product. He heard Dr. Frank's paper at Rome, and he mentioned guanidine, and some other substances which could be produced in a very simple way from the calcium cyanamide. Also with regard to the production of nitric acid, the oxygen which was a waste product in distilling liquid air could be used for producing nitric acid cheaply. This process of Dr. Frank could produce nitrate of lime, ammonia, or calcium cyanamide. These were all products which could be used industrially on a large scale, besides other substances which were useful as raw products for fine chemicals. All were interested in the cheap production of nitric acid from a national point of view, for, not having the means of producing it in our own country at present, we were entirely dependent on foreigners for the supply of the chief material for our national defence, and it was only by the introduction of such processes as this in our midst, on the industrial scale, that we should be rendered independent in our national defence should be we attacked.

Mr. Oscar Guttmann said, with regard to the electric production of nitric acid from the air, the author had made the cheapest possible calculations. The electric power at 50 frs. per kilowatt-year was perhaps possible in Switzerland or Norway, but if those who produced electric power there would calculate very carefully, they would find that after some years when their repairs increased and dilapidations were coming on, when the atmospheric and other occurrences would multiply, which Mr. Bingham had mentioned, 50 frs. per kilowatt-year was an impossibility. Another item which was quite impossible in his opinion, having himself managed works in Switzerland, was 10 frs. for wages and general expenses per ton of nitric acid. The mere handling of a ton of nitric acid cost more than 10 frs.; he did not consider even the question of packing, because he took it they must find some means of utilising the nitric acid on the spot.

Then there was the cost of 205 frs. per thousand kilos. of mono hydrate, but in what form was that obtained? Not at all as 1·500 acid. There was no means at present known of producing nitric acid by electricity in a concentration of 1·500 sp. gr. All that was possible with every treatment known to the industry of the engineer was acid between 50 and 60 per cent. Then there was the cost of £10·2 for a ton of mono hydrate, in a form in which it could not be sold at £2 per hundred kilos. as stated, which was the price in England, or at a cost of £14 per ton, as it was in similar places as those where the electric nitric acid was supposed to be made; but it was in a form in which it was worth a great deal less than £14; in a form in which it could not be sold at all in most cases, because there were no means of consuming 50 per cent. acid to such an extent. Thus, in all these calculations which were brought forward by all these lecturers and writers, every one had made the same great mistake. Turning to the question of cyanamide, he fully believed that Dr. Frank and his assistants were approaching the subject in a scientific manner, and that in spite of all the enormous initial difficulties, they were getting wonderfully well on the way to producing something of extraordinary value. He had no wish to say that in these initial stages in which they were—for they had only erected one works of a large character, comparatively recently—they had succeeded in producing their product in the cheapest possible manner. He believed that, like everybody else, they would after years of experience, succeed in making improvements which would enable them to supply what was required. No doubt the calcium carbide industry, which had already achieved such good results, would continue to improve. The cyanamide process was capable of great development in many ways, applicable to so many industries that there was no question that it was one of the most important inorganic compounds which had been brought to their notice for some time. It was only fair to give Dr. Frank and his collaborators time to show what they could do. He could not go into the question of cost because the figures were only known to Dr. Frank and his colleagues, but speaking from what he saw on the subject, it was not yet such as might induce agriculturalist to take the product in place of some form of nitrate of soda. This brought him to the last point. All the figures were given as in England, but, on the other hand they were compared with the cost price as in Switzerland or Norway, which was quite right. Still, nitrate of soda cost the same, probably a little more, in Norway than in England, and therefore you could compare it, although you could not compare nitric acid. Nitrate of soda as a matter of fact had not always been 10*s.* 4*d.* a hundred weight; he had known it a great deal less, in fact, not long ago it was only 8*s.*, and it had dropped within a few days nearly 1*s.*, so that the whole calculation would be thrown out. Be that as it may, he should be confronted with the objection that with the increased consumption of nitrate of soda for agricultural purposes, it was likely to go higher, and the deposits of nitrate of soda being as Prof. Guye said, on the point of exhaustion, they would find it going higher still. But those who said that forgot that in Chili an enormous quantity of nitrate of soda was thrown away every day. They were really working in the manner best characterised by the German mining expression "Raubbau," robbing the ground—

they only took out the best parts of the deposits, and those that could not be worked were thrown back into the trenches. Was it not more likely, with these millions of tons of inferior caliche lying about, that one day a chemist would find means of extracting them profitably? Was it not within practical bounds to ship that waste caliche to other countries and burn it in a mixture with some organic combustible lying about in millions of tons, like peat, thereby utilising both in a manner best calculated to give the best results? Could they not in this way obtain by-products as valuable as were obtained by coking coal, or might not Dr. Mond make use of that and produce a gas which would surpass even his own? Much as electricity had done, much as they had reduced the cost of electrical bleach and other products, he did not think yet that electricity was capable of playing that rôle in the production of manure, which some thought or that chemical products like calcium cyanamide could supersede in a hurry those natural resources like those in Chili, which were certainly well worth a study.

Mr. H. DE MOSENTHAL said he would only refer to two points, one of which had been mentioned by Mr. Guttmann, namely, that the acid produced was only 50 per cent., which would have either to be concentrated, or treated in some way. The other point was in answer to a question the Chairman asked. Strong nitric acid was transported in Germany by rail in tanks.

Prof. H. E. ARMSTRONG said, no doubt these two processes were of great interest, and marked an important step forward in the possibility of dealing with atmospheric nitrogen and making various new compounds, but he could not help thinking a great deal of care needed to be exercised before coming to any definite conclusion with regard to the use of this new material for manurial purposes. Dr. Voelcker had already called attention to the fact that the results obtained in this country had not been altogether satisfactory, and even supposing they had been during a year or two, they would have to await the result during a series of years. They had to learn whether a soil would bear the continued alkaline treatment which it would be subjected to if this were used. They knew already it would not bear continued treatment with sulphate of ammonia; they knew that sodium nitrate was a very superior manurial material on account of its inertness in many respects, and that it was very favourably contrasted with ammonia salts, and this material might suffer from a like objection. But one could not help feeling that the problem was a much bigger one than that. Not only might a great deal be done in the direction Mr. Reid had said, and if they could be as thrifty as the French were, and go back to the old treatment, and save a great deal of the nitrogen now thrown away, it would be of great importance; but there had also been discovered, within recent years, methods of fixing nitrogen in the soil by the agency of bacteria. No doubt that subject was in its earliest stages of investigation, but there was no reason to suppose that in the future they might not discover in the humble bacterium a means of carrying on the necessary manufacture within the soil itself locally all over the world. That was the solution, he took it, to which the agriculturalist looked forward, and that would seem to be the natural solution from that point of view. When the supply of Chili saltpetre was exhausted as a means of making nitric acid, this process would have an enormous value, but he could not help thinking that this discussion had a more or less academic value. In this country it had an altruistic as well as an economic side. He thought they ought not to allow coal to be used for purposes of this kind; the supply was so short that it ought only to be manufactured in countries where water power was available, and the discussion ought to be adjourned to Canadian and South African districts. In this country he did not himself think they should allow even Mond gas to be used for such a purpose.

Prof. Guye wrote as follows in reply:—

"J'ai été très vivement intéressé par les diverses observations présentées à la suite de l'exposé qui je viens de faire du problème electro-chimique de l'azote. Ne pouvant, sans abuser de votre temps, revenir sur les diverses observations, je me permets de renvoyer à la publication detaillée de mon manuscrit qui comprendra quelques notes justificatives à l'appui des chiffres que j'ai donnée. Je tiens seulement à faire remarquer que le prix de revient du carbure de calcium tel que je l'ai établi correspond très semblement à celui des bonnes fabriques de l'Europe Centrale, avec des variantes dans l'importance relative des divers facteurs, mais sans changement appreciable dans le resultat final. En ce qui concerne les gisements du Chili, los renseignements qui m'ont été fournies confirment l'opinion qui a été émise ce soir d'après laquelle les frais d'extraction sont aujourd'hui plus élevés qu'autre fois et ne permettent pas d'entrevoir la possibilité d'une baisse appreciable dans le prix de vente de ce produit.

"En terminant, je tiens encore à insister sur le caractère comparatif des calculs que j'ai présentés, les resultats absolus pouvant suivant les circonstances être plus ou moins largement modifiés. Mon but a été surtout de poser une question, et non de la résoudre."

(Translation.)

"I have been much interested by the various observations made at the close of the account of the electro-chemical problem of nitrogen which I have just given. As I cannot venture to occupy any more of your time, I will only refer to the details which will appear in print, and which will justify the figures which I have given. I will only remark that the cost price of calcium carbide which I have mentioned is practically that of well-placed and successful works in Central Europe, which vary among themselves as to the relative importance of certain factors, but yet which show close agreement in their final estimate. As to the Chili deposits, data with which I have been furnished, confirm the views which have been stated to-night, namely, that the cost of extraction is now higher than formerly, and that no drop in the price of Chili nitrate is likely to occur.

In conclusion, I must again insist on the purely comparative nature of the figures I have given; for circumstances must necessarily modify all absolute figures. My object has been rather to state questions for discussion than to answer them.

New York Section.

Meeting held at Chemists' Club, on Friday, April 20th, 1906.

DR. RUSSELL W. MOORE IN THE CHAIR.

NOTES ON THE OXIDATION OF LINSEED OIL.

BY A. H. SABIN.

It has long been known that linseed oil dries by combining with oxygen, and that in so doing it gains in weight. At least one competent authority says that in drying it gives off water and carbon dioxide; but, as this latter assertion seems incompatible with the gain in weight which all observers have recorded, the following experiment has been made to test the truth of the assertion.

Six weighed glass flasks, of about 600 c.c. capacity each, were fitted with rubber stoppers, through each of which passed two glass tubes, one reaching near the bottom of the flask and the other about an inch below the stopper. These tubes were bent, above the flasks, at right angles, so that they could be joined with bits of rubber tubing, so that a current of pure air could be drawn through the whole. To remove moisture and carbon dioxide, the air was first passed through jars filled with calcium chloride and lumps of caustic potash; and on leaving the apparatus it was again passed through a calcium chloride tube and

caustic potash. One of the flasks was then filled with pure raw linseed oil, from which it was poured into the second flask, and so on until each flask had been wetted with the same oil. The flasks were drained, weighed, and then set up in series and connected as indicated; then a slow current of air was drawn through the apparatus by a filter-pump. It was anticipated that in about ten days the oil film would be dry, and then the flasks would be again weighed, also the drying tube, and the carbonic acid estimated. Considerable care was taken to make the joints tight, although, as the whole apparatus was open to the air at one end, leakage was not expected.

The oil did not, however, uniformly wet the inside of the flasks, but the film at first formed broke up and gathered into drops, and a little pool of oil formed at the bottom of the flask. The flasks were new and clean. After a day or two the oil in the first flask began to bleach and in due course dried, as was shown by the formation of a film of linoxyn, and then dried still further, as indicated by the shrivelling and wrinkling of this film; and all this time, which was about ten days, the oil in the other flasks was not acted on. Then the oil in the second flask began to bleach, and dried; then the oil in the third flask; and, after more than two months, the oil in the sixth flask was finished. Evidently something was done to the air in passing through a flask containing a few hundred mgrms. of oil which prevented it from oxidising any more oil. This seems remarkable, and worthy of record. Possibly it was the removal of ozone; if this should be shown to be true it would account for the fact that oil dries more rapidly out of doors than within, and this is true whether it is in the sun or not. These flasks were not in direct sunlight, but were in a well-lighted room, and directly under a sky-light.

When the calcium chloride and the potash were examined, it was found that they had gained in weight far more than was possible to account for except by leakage; but this is not remarkable, as everyone knows who has tried to make joints tight for a long time; so the original purpose was defeated.

When the flasks were re-weighed it was found that in no two of them was there uniform percentage increase of weight of oil; and the extremes, which were in adjacent flasks, differed so much that one had gained two and a half times as much as the other, the figures being 10·1 and 25·5 per cent. Yet it was the same oil that was put in all these flasks; and the amount which remained in the several flasks was about the same, being about 300 mgrms.

After this, the stoppers were removed from the flasks, which were then hung up, mouth downwards, for several months, and occasionally weighed; no important changes developed. They were then cleaned and re-weighed, and the original weights were thus verified.

An attempt was made to repeat this experiment with greater care, but after a time leakage developed and the experiment was abandoned; but as far as it went it agreed with the one described.

In connection with this it may be well to refer to the work of G. Keppeler, in his studies on the Hargreaves sulphate process, as reported in "Chemische Industrie" for 1905, No. 5, page 173, where he says: "Oxygen, under the influence of certain treatment or of some substances, loses its property of readily effecting oxidation, and heating the oxygen reduces its oxidising power."

It will be remembered that ozone is destroyed by heat or by contact with rubber, or other oxidisable matter.

Dr. P. C. McIlhiney said with regard to the atmospheric oxidation of linseed oil, he had himself found that the same sample of linseed oil would at different times, and under conditions that were apparently the same, absorb very different percentages of oxygen, or at least that the increase of weight on drying was very different.

Obituary.

SIR CHARLES TENNANT, BART.

Sir Charles Tennant of the Glen, Peebleshire, was the grandson of Charles Tennant, the "Wabster Charlie" of Robert Burns. Charles Tennant gave up weaving for bleaching, and removed ultimately to Glasgow. There in 1787, the father-in-law of James Watt, inventor of the steam-engine, had begun to bleach linen by the aid of "Eau de Javelle" obtained from Paris. Charles Tennant with his partner Knox, improved on this by producing a more portable form of bleaching agent—*viz.*, "chloride of lime" or "bleaching powder." With this invention commenced the history of the St. Rollox firm, which became one of the largest in the world. John Tennant succeeded his father, Charles Tennant. Sir Charles, the second son of John Tennant, was born in 1823. Following his school education, he received a business training as an apprentice in Liverpool, and then returned to Glasgow, where he at once made his mark, winning success and fortune by the exercise of business qualities of the highest order. In 1878, he took over the management of the St. Rollox works, of which there were branches at Hepburn-on-Tyne and Manchester, and salt works at Haverton Hill, Durham.

The Steel Company of Scotland was originally formed in 1872, with Sir Charles Tennant as chairman, for the manufacture of malleable iron, and also steel (by the Siemens-Martin process), from the purple ore forming the residue of the pyrites supplied by the Tharsis Company, after burning in the kilns and extraction of copper and sulphur. Though the malleable iron scheme failed, the Steel Company did not, and mild steel was produced for ship-building and engineering purposes. Sir Charles, whose energy had overcome all difficulties in this direction, held the chairmanship of this Steel Company till 1894, and became thereafter honorary president. He was the first chairman of the Tharsis Copper Company, and was a prominent figure among the alkali manufacturers of the United Kingdom who purchased the copper pyrites mines in the south of Spain, which had failed in the hands of the French companies. The enormous concern, which was the outcome of this purchase, was worked up under his able direction. His own firm, Chas. Tennant, Sons, and Company, of St. Rollox, was the principal one of the 40 engaged in the production of Leblanc soda, which entered into combination as the United Alkali Co., Limited, in November, 1890, Sir Charles being elected the honorary president. Among the other posts which he occupied at one time or other, were the vice-chairmanship of the North British Railway, the chairmanship of Nobel's Explosives Company, and the chairmanship of the Union Bank of Scotland. Sir Charles Tennant was an original member of the Society of Chemical Industry.

He received a baronetcy in 1885. He sat in the House of Commons from 1879 to 1886.

Sir Charles died rather suddenly on June 4, at his residence, Broadoaks, Byfleet, at the age of 82 years.

ERRATA.

This J., 1906, 523, col. 1, l. 23 from top, for "he established" *read* "he introduced." Col. 2, l. 2 from top, for "about this time" *read* "In the earlier years between 1880 and 1890."

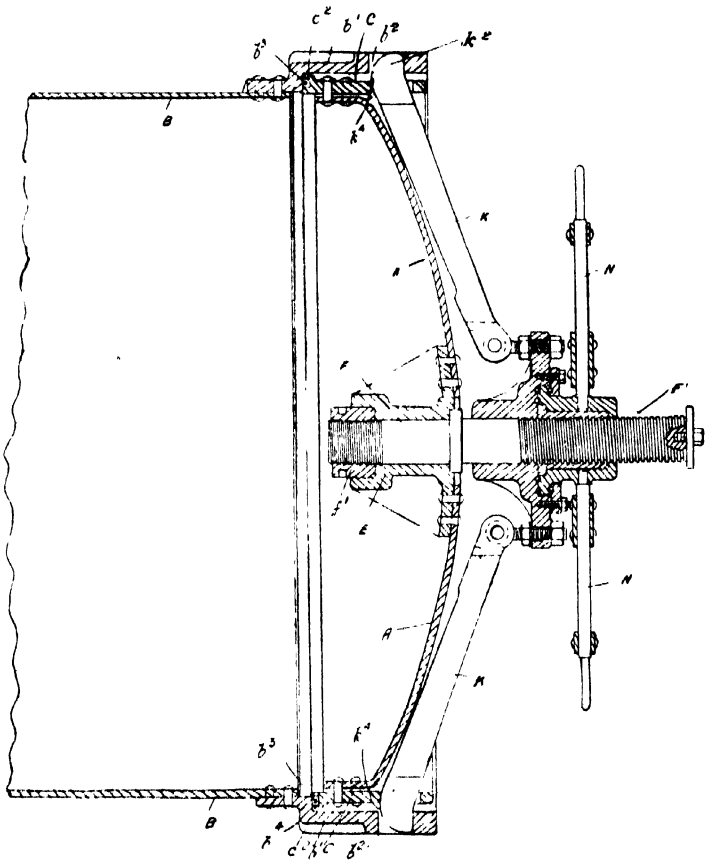
Journal and Patent Literature.

I.—PLANT, APPARATUS & MACHINERY.

(*Continued from page* 525.)

ENGLISH PATENTS.

Hermetically sealed doors of cylinders and chambers used for creosoting, vacuum pans, and brick-hardening chambers for high pressure and the like purposes; Impts. in ——. A. B. C. Danks, Netherton, Staffs. Eng. Pat. 7752, April 12, 1905.



THE claim is for improvements in the method of making the joint between the door, A, and the chamber, B, in apparatus in which the door is closed and secured by "screw applied radiating arms." K, engaging with slots or staples, b^2, in the end of the chamber. The dished wrought iron door, A, has a heavy cast marginal ring, C, which fits into a rebate, b^4, formed in the ring, b^1, riveted to the end of the chamber. The face of the door ring has a recess, C^2, filled with soft metal which is forced on to a chisel-edged projection, b^3, formed on the face of the rebated surface of the chamber ring, b^1, by the radial arms, K. The latter are actuated by a screw, F^1, and a capstan-wheel, N, working on ball-bearings on the shaft, F, situated axially with regard to the chamber, and carried in a socket, E, mounted so as to pass through the end of the door, A. The ends, k^2, of the radial arms are curved or of a cam shape, and act directly on the outer side, k^4, of the heavy rim riveted to the dished door, A.—W. H. C.

Furnaces; Impts. in ——. J. D. F. Andrews, London. Eng. Pat. 9952, May 11, 1905.

THE fuel is introduced into a "fuel-chamber" which has no grate and is heated by the combustion taking place in an adjacent "combustion-chamber." The gases given off in the "fuel-chamber," and the residual coke are passed through an opening or port into the "combustion-chamber" where they are burnt by air admitted either entirely through the grate of the latter or partially through the grate and partially through the "fuel-chamber."—W. H. C.

Furnaces, muffles and kilns; Impts. in the construction of ——. W. P. Gibbons, Lower Gornal, R. Masters, Dudley, and G. A. Baeddicker, Harborne. Eng. Pat. 13,614, July 3, 1905.

THE furnace or muffle is built above a gas-producer, and the secondary air is pre-heated by passing through the hollow arch of the gas-producer, and through passages in the side walls of the latter. The gases and air are mixed and burnt in an arched combustion chamber situated over the producer and below the furnace or muffle, and the products of combustion are conducted through flues constructed in the floor and side-walls of the latter to two flues above the furnace arch. From these flues the gases may pass either directly to the chimney or stack, or to the interior of the muffle and then to the chimney.—W. H. C.

Chemical action between materials; Processes for obtaining a violent ——, *and apparatus therefor.* C. G. P. de Laval, Stockholm. Eng. Pat. 14,572, July 14, 1905. Under Int. Conv., July 19, 1904.

See Fr. Pat. 356,096 of 1905; this J., 1905, 1311.—T.F.B.

Separation of solid particles from each other; Impts. in the ——. A. P. S. Macquisten, Glasgow. Eng. Pat. 15,119, July 22, 1905.

The invention relates to improvements in the method of separating solid particles from each other, described in Eng. Pat. 25,204 of 1904 (this J., 1906, 112), and consists in the addition of a small proportion of oil or soap to the liquid or pulp. The proportion suggested is 1 part of oil to 5000 or 10,000 parts of liquid or pulp. The particles to be separated are immersed in the liquid, and are brought gently up to or through the surface. The physical condition of the particles, or the surface tension of the liquid is altered, or both effects are obtained. Further, small amounts of acid and of a salt or salts may be added.—W. H. C.

Separating machines; Impts. in ——. W. S. Ayres, Hazleton, Pa., U.S.A. Eng. Pat. 19,913, Oct. 3, 1905.

The claim is for a separating floor, which consists of an endless band on which the materials (coal, ores, minerals, &c.) to be separated are fed from a shoot with an adjustable spout. The band is inclined transversely to the direction of movement of the minerals being treated, and may also be inclined in the direction of the flow. The direction of movement of the materials is controlled by guide-bars arranged across the endless belt, which in a modification of the apparatus may be made up of a number of narrow endless bands placed parallel.—W. H. C.

Drying furnaces for coal and similar materials with several shelves or hearths superposed one above the other. P. Ostertag, Winterthur, Switzerland. Eng. Pat. 20,752, Oct. 13, 1905.

See Fr. Pat. 358,035 of 1905; this J., 1906, 170.—T. F. B.

Agitating and mixing apparatus. L. C. Trent, Van Trent, Cal., U.S.A. Eng. Pat. 20,865, Oct. 14, 1905.

See U.S. Pat. 806,214 of 1905; this J., 1906, 8.—T. F. B.

Screw presses for drying and similar operations; Continuous ——. J. G. Lorrain, London. From American Process Co., New York, U.S.A. Eng. Pat. 26,724, Dec. 21, 1905.

The apparatus consists of a horizontal casing in the shape of the frustum of a cone, into the larger end of which, the material to be pressed is fed from a hopper by a "star-wheel." It is moved along and compressed by the blades of a screw, mounted on a hollow perforated shaft, which extends axially through the casing. Steam can be introduced into the front end of this shaft to moisten the contents of the press, and the expressed liquid escapes through the perforations in the rear end of the hollow shaft, which has a partition in the middle, and through a small perforated cone, which tapers in the reverse direction and is clamped round the shaft just before the outlet end of the casing. The compressed material is delivered through the annular space between the two cones, and is cut off by knives held by the clamps which fasten the smaller cone. The shaft is carried on suitable bearings at each end of the casing; it is rotated by a worm-gear at the inlet end, and has a small central steam pipe leading to the rear end, to blow out the draining portion and the small cone if they become blocked.
—W. H. C.

United States Patents.

Separating metals and other substances from liquids; Apparatus for ——. L. Dion, Assignor to the Americus Electro-Hermatic Co., New York. U.S. Pat. 820,483, May 15, 1906.

A number of horizontal cylindrical filter cages are arranged in vertical rows and covered with filtering material, over which, in each case, works a rotary brush, with bristles extending inward and actuated by means of cams and rods.—C. S.

Filter; Rotary ——. F. A. Evans, Redwood Falls, Minn. U.S. Pat. 820,560, May 15, 1906.

The filtering chamber, which is annular, is fitted with a scraper mounted obliquely, and adjustable both longitudinally and angularly, working over the open parts of the filter, for removing the solid materials from which the liquid has been drained.—C. S.

Drying kiln. J. F. Hanrahan, Buffalo, N.Y. U.S. Pat. 820,865, May 15, 1906.

The drying chamber is provided with an air inlet, extending the whole way along the bottom, and fitted with a damper; also with an air outlet extending all the way along the top, and fitted with a regulator. The heat is supplied by means of a series of pipes, supported by cross-bars, at a sufficient height above the bottom of the chamber to permit the air entering at the bottom to pass to the opposite side of the kiln, before coming entirely under the influence of the heat radiated from the pipes.
—C. S.

Furnace for heating comminuted material. H. K. Kriebel, Philadelphia, Pa. U.S. Pat. 820,931, May 15, 1906.

A number of communicating hearths are mounted one above another, so as to overlap and form a tortuous flue. The furnace is almost entirely surrounded by an air chamber, communicating with a series of horizontal pipes partially embedded in the hearths. Underneath the bottom hearth means are provided for heating the same, to initially start the furnace, and also charging doors with air ports are placed opposite the several hearths.
—C. S.

Furnace for burning comminuted material. H. K. Kriebel, Philadelphia, Pa. U.S. Pat. 820,932, May 15, 1906. (See preceding abstract.)

In place of the air chamber and pipes, the furnace is provided with a boiler and water-jacket, together with lateral communicating means for procuring a circulation of water across the furnace.—C. S.

Liquid purifier. C. Tuckfield, East Molesey. U.S. Pat. 821,207, May 22, 1906.

See Eng. Pat. 16,689 of 1904; this J., 1905, 982.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 529.)

English Patents.

Coke; Manufacture of ——, *and apparatus therefor.* J. J. Shedlock, Little Bentley, Essex. Eng. Pat. 9588, May 6, 1905.

Small coal or slack of a non-coking character is intimately mixed with about 10 per cent. of liquid hydrocarbons, such as gas-tar, and the mixture is heated so as to render the tar more fluid, and to cause it to enter the pores of the coal. The mixture is then placed in coking chambers heated externally, hot air and steam being also introduced internally, whereby a hard coke is obtained. The volatile matter produced at the same time may be condensed.
—A. G. L.

Distillery refuse known as "pot ale" or spent wash; Treatment of —— *for the production of fuel.* J. T. Connell, F. F. Haldane, and J. Thomson. Eng. Pat. 13,914, July 6, 1905. XVII., page 604.

Retorts for the carbonisation of coal; Vertical ——. H. W. Woodall, Wimborne, and A. M. D. Duckham, Upper Parkstone, Dorset. Eng. Pat. 11,956, June 7, 1905.

Vertical retorts are provided externally with longitudinal ribs projecting so far as to abut against the retort setting, or against the corresponding ribs of adjacent retorts in the same setting.—H. B.

Gas retort settings and regenerator furnaces for the same. E. Körting, Berlin. Eng. Pat. 12,176, June 10, 1905.

The setting, which is adapted for use with horizontal retorts of 3 m. or more in length, is divided into two retort-heating compartments by a partition at right angles to the axis of the retorts. A transverse wall depends into the generator (which is situated beneath the retorts) to a point somewhat below the surface of the fuel, and thus divides the upper regions of the generator and fuel bed into two portions. The gas from the front portion passes up into the front retort-heating compartment, whilst the gas from the rear portion passes up into the rear compartment, mingling in each case with secondary air supplies which have been preheated in the lower portions of the setting. By this means the uniform heating of lengthy retorts is assured.—H. B.

Retorts for the carbonisation of coal; Vertical ——, H. W. Woodall, Wimborne, and A. M. D. Duckham, Upper Parkstone, Dorset. Eng. Pat. 12,289, June 13, 1905.

To prevent the cracking of the top section of a vertical retort which is fed by a mechanical feeding device (such as that described in Eng. Pat. 16,497 of 1903; this J., 1904, 744), the cast iron cover of the retort is provided with an upright flange, forming a tank in which water is circulated, thus keeping the feeding device cool. The cover has a depending flange, the lower edge of which rests upon sand contained in an annular trough surrounding the top of the retort. The sand deadens the vibration and forms a gas-tight joint between the cover and the trough.—H. B.

Coal gas; Method of and means for producing or enriching ——. R. Hooton and J. Noble, Ashton-under-Lyne. Eng. Pat. 10,733, May 23, 1905.

Cotton-seed shells or husks, either compressed or not, are introduced along with coal, coal slack, or coal breeze into gas retorts, and carbonised in the usual manner. —H. B.

Gas apparatus; Suction ——. S. Griffin, Bath. Eng. Pat. 14,264, July 11, 1905.

For the automatic supply of fuel to a suction gas-producer in accordance with the varying demand of the connected gas-engine, a mechanical stoker is so connected to any suitable part of the engine or producer as to be actuated intermittently by the pressure of the exhaust gases, or the suction in the producer. For example, a rotatable feeding drum or worm, situated at the base of the fuel hopper, is caused to rotate gradually by means of a ratchet-wheel and pawl arrangement, which is operated by a spring-controlled piston moving in a cylinder which communicates with the exhaust pipe of the gas engine. At each discharge of the exhaust gases, the pressure drives the piston up the cylinder, causing a proportionate slight rotation of the feeding drum or worm, and a corresponding delivery of fuel into the producer.—H. B.

Gases for gas turbines; Treatment of ——. L. Wilson, Greenock. Eng. Pat. 1977, Jan. 26, 1906.

Gas, or oil, and air are compressed separately and admitted through pipes, provided with non-return valves, into a water-jacketed combustion chamber wherein the mixture is ignited electrically, the hot gaseous products rushing at high velocity through a series of water-cooled exit pipes, and impinging upon the blade devices of a turbine. The combustion chamber may also contain water-tubes, the object of the water-cooling devices being to cool the gases to a safe working temperature. The various water-jackets and tubes communicate with a steam drum, the steam produced being utilised. The electric ignition of the gases is timed by means of an adjustable contact-maker attached to the tapering shank of one of the non-return valves of the inlet pipes.—H. B.

Internal combustion motors; Method of producing a working medium for ——. P. Winand, Cologne. Eng. Pat. 3006, Feb. 7, 1906. Under Int. Conv., Feb. 8, 1905.

For the production of a working fluid for internal combustion motors operating with exclusion of air (*e.g.*, in submarine vessels), the combustion of volatile hydrocarbon is effected with nitrogen peroxide or some other substance richer in oxygen than air. In order to dilute the explosive mixture to a suitable degree, a portion of the gaseous products of combustion is cooled, and added to the succeeding charge.—H. B.

Incandescing bodies [Mantles] for incandescent lighting; Manufacture of ——. E. Hirsch, Berlin. Eng. Pat. 9864, May 10, 1905.

Mantles, which have been manufactured and burned off in the usual way, are dipped into a 5 per cent. solution of zirconium nitrate, dried, and then collodionised as usual. Mantles so treated, if crushed whilst in a stiffened condition, do not fall to pieces on burning off the collodion. —H. B.

United States Patents.

[*Calcium carbide*]. *Calcium oxide; Process of reducing* — —. T. L. Willson, Assignor to Union Carbide Co. U.S. Pat. 820,031, May 8, 1906. XIA., page 594.

Gas; Process of producing ——. B. E. Eldred, New York, Assignor to Combustion Utilities Co., New York. U.S. Pat., 820,485, May 15, 1906.

Claim is made for a process of passing the waste gases from a blast furnace through a deep bed of hot fuel, which may be treated alternately with a current of air. The product from the blast furnace gases is purified by cooling and washing, before delivery to a gas engine.—C. A. M.

Gases; Method of treating and utilising ——. F. W. Schniewind, Everett, Mass., Assignor to The United Coke and Gas Co., Charleston, W. Va., U.S.A. U.S. Pat. 820,525, May 15, 1906.

The richer gases that are produced first in carbonising carbonaceous fuels in retorts, are drawn off separately, and used for illuminating or other purposes. The poorer gases subsequently produced are collected in separate receptacles, and treated so as to separate their more condensable illuminants, by condensing and washing them to remove tarry and other impurities, or extracting these illuminants with oil from which they are afterwards separated by distillation. The residual gases from which the more condensable illuminants have been removed, may be used for heating the retorts in which the gases are generated.—C. A. M.

[*Oil*] *Gas; Apparatus for making* ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 821,594, May 22, 1906.

The apparatus described consists of a suitably-lined casing, divided into two compartments by a vertical wall, which extends from the bottom to near the top of the casing; the two compartments communicate with each other over the top of this wall, and are packed with regenerative material. An oil-supply pipe discharges direct into the chamber common to both compartments above the wall, and there are steam and air inlets to the bottom of each compartment. There is an outlet for the products of combustion from the bottom of each compartment, and means for controlling independently the inlets and outlets, and a conduit to carry off the manufactured gas from the bottom of each compartment. The conduits communicate with a common washer, and means are provided for controlling the passage of the gas through either conduit.—W. C. H.

Gas; Process of making ——. F. Dannert, Assignor to J. A. Hutmacher, Berlin. U.S. Pat. 821,928, May 29, 1906.

See Eng. Pat. 19,995 of 1905; this J., 1906, 114.—T. F. B.

Gas; Apparatus for purifying ——. A. Elsenhans, Rüttenscheid, Germany. U.S. Pat. 820,772, May 15, 1906.

See Fr. Pat. 360,361 of 1905; this J., 1906, 466.—T. F. B.

FRENCH PATENTS.

Generator for gas, vapours, or liquids from closed vessels. R. Desouches. First Addition, dated March 21, 1905, to Fr. Pat. 343,390, May 24, 1904 (this J., 1904, 1021).

THIS addition to the principal patent relates to a form of the apparatus, which consists of a series of primary generators, communicating with one another and with the carburetter; a convenient number of these generators is arranged inside a common envelope, through which passes a heating agent, preferably fluid, so that the liquefaction, distillation, or dissociation of the products to be converted into gases or fluids is effected by the heat of the gases escaping from the motor, which pass through the envelope. The generators or reservoirs may be of rectangular or elongated ovoid form, and may be closed by screw stoppers, arranged inside the common envelope, to allow of filling them from the outside. There is also an auxiliary generator, with a separate heating arrangement, as, for instance, a burner, to produce a quick distillation to start the motor; this may be used alone, or in conjunction with the main generating apparatus. The claims also include the use of lattice work or metallic web to increase the transmission of heat and the rapidity of distillation or gasification.—W. C. H.

Generator for gas, vapours, fluids, or liquids — . R. Desouches. Fr. Pat. 360,982, March 21, 1905.

A SERIES of generating chambers, each supplied with a manhole and cover, and all communicating by means of valved tubes, is placed within a common envelope. The space between this envelope and the generators can be heated to any required degree by the circulation of waste gases, or by other convenient means. At the beginning of the series is an auxiliary generator containing the substances to be treated, which can be heated externally in any convenient manner and to any required degree, so as to distil, vaporise or dissociate the said substances; the products are "aspirated" through the apparatus at any desired rate.—J. H. C.

Producer for the treatment of all kinds of combustibles. V. Sépulchre. Fr. Pat. 361,127, March 25, 1905.

THE producer is constructed like a blast-furnace, with tuyères at the lower portions, so as to develop such an intense heat that the non-combustible matters of the fuel become fused, and are allowed to flow out in the form of slag or matte. If the fuel is rich in pyrites, a matte containing sulphide of iron is obtained. An appropriate flux may be added. The fuel is charged into the producer through a double cup-and-cone device, and falls first into a cylindrical casing, open at the bottom, which depends a certain distance into the combustion chamber; whilst in this casing, the fuel undergoes a preliminary distillation, the volatile products being either led down to the incandescent zone of the fuel, or treated separately for the utilisation of by-products. The fuel in the casing gradually subsides into the main combustion chamber, as the fuel in the latter is consumed. The casing is suspended from the cover of the producer, and its height can be varied, a water-seal preventing ingress of the producer gases at the top.—H. B.

Gas-generator with automatic outlet for ashes. A. von Kerpely. Fr. Pat. 360,965, Dec. 27, 1905.

THE bottom of the generator consists of a sort of rotating basin which delivers the ashes against and over an inclined plate fixed at one point on its circumference.—J. H. C.

Gases of a gaseous mixture; Process for separating the —. F. Capron. Fr. Pat. 362,155, Jan. 4, 1906. Under Int. Conv., Jan. 22, 1905.

THE gaseous mixture is led through a chamber containing porous partitions or enclosures, whereby a partial separation of the gases in accordance with the laws of diffusion is effected. The process is repeated with the fractions obtained, until the desired degree of purity is arrived at. —H. B.

Sulphur and cyanides from spent oxide, &c.; Proce and apparatus for the extraction of —. J. J. Bécigneul. Second Addition, dated Nov. 25, 190 to Fr. Pat. 345,071, July 23, 1904. (See this J., 190 1216; 1905, 1067.)

IN addition to the solvents for sulphur mentioned in t principal patent and first addition, any of the hydr carbons obtained by the distillation of tar oil may used; and for the removal of tarry matters from t sulphur solutions, any porous substance containi carbon may be employed.—H. B.

Incandescent filaments [Vacuum arc lamp]; Process Manufacture of —. A. Frankfurther and H. Kul mann. First Addition, dated Nov. 13, 1905, to F Pat. 356,999, Aug. 17, 1905 (this J., 1906, 12).

INCANDESCENCE filaments made of pure graphite, described in the principal patent, are here used in t construction of vacuum arc-lamps operating with eith direct or alternating currents. In both kinds of lam the electromagnetic arrangements are designed to wit draw the graphite electrodes from each other to a pr determined, invariable distance, since no combustion the carbons occurs and no automatic regulation of t distance between the carbons is necessary.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 530.)

Coal tars. E. Börnstein. Ber., 1906, **39**, 1238—124

IN a previous communication (this J., 1903, 83) referen was made to the presence of catechol in tar liquo obtained by decomposing German coals at the lowe possible temperature. In the course of the same inves gation tars were obtained differing considerably fro ordinary gas-tar and resembling the Jameson coke-ov tars described by Watson Smith (this J., 1883, 49 One specimen, however, obtained from Westphali coal of the Altendorf pit behaved differently. Wh distilled at 500° C., this coal furnished a tar, which w free from paraffin and naphthalene, and had a sp. gr. 1·03. The fraction distilling above 350° C. gave oil, which on cooling, deposited fine, greenish-yello crystals, consisting of a mixture of methylanthracen $C_{15}H_{12}$, and "crackene," $C_{24}H_{18}$. A similar fraction w obtained from tars produced by decomposing Westphali coal from two adjacent pits, Baaker Mulde and Hambur and it would therefore appear that these types of co which yield a high percentage of coke, furnish ta poor in hydrogen, containing no solid paraffins, b yielding solid aromatic hydrocarbons of high boili point.—D. B.

Petroleum industry of Roumania. For. Off. Ann. Serie 1906, No. 3618. [T. R.]

THE petroleum industry of Roumania is steadily develo ing. The total production of crude oil in 1905 was abo 601,700 tons, or double the production of four years ag The total export was 214,348 tons as against 160,442 to in 1904, and 126,227 tons in 1903. France took 55 per cen of the export of 1905, comprising 11,790 tons of crud 79,766 tons of refined oil, and 27,369 tons of benzin Germany took 17 per cent., the United Kingdom 10 p cent. (entirely refined petroleum), and Austria-Hunga 9 per cent. of the total. The late disturbances in t Baku petroleum fields did not appreciably benefit t Roumanian industry.

ENGLISH PATENTS.

Coke ovens; Regenerative —. E. Coppée, Brussel Eng. Pat. 14,485, July 13, 1905.

SEE Fr. Pat. 359,888 of 1905; this J., 1906, 468.—T.F.

Ammoniacal liquor obtained by washing illuminating and heating gases; Treatment of certain products of ——. J. Radcliffe, Elland, Yorks. Eng. Pat. 10,075, May 13, 1905.

The "spent liquor" remaining from the recovery of ammonia from gas-liquor, &c., is neutralised, or rendered slightly acid, preferably by hydrochloric or sulphurous acid, and is fed at a fixed rate into a receptacle which also receives in like manner solution of a copper salt, regulated so as to precipitate as copper thiocyanate the thiocyanate compounds present, the process being made continuous. The copper salt may be in the cuprous or the cupric state, but in the latter case, sulphurous acid must be present, or be added, in sufficient proportion to effect its reduction. The foul gases remaining after absorption of the ammonia distilled from the gas-liquor, may be burnt, and the sulphur dioxide formed, be absorbed in any usual way, and utilised in neutralising the spent liquor. The copper thiocyanate precipitated may be withdrawn as sludge from time to time, separated by filter-pressing, and then treated with alkalis to recover cuprous oxide, and obtain marketable compounds of cyanogen. Should the "spent liquor" thus freed from thiocyanate contain any copper (added in excess), this may be precipitated by lime or an alkali, or removed by passing the effluent through a channel containing iron, before it is discharged in an innocuous state. It is stated that "spent liquor," after undergoing the described treatment, has a beneficial effect when added in the bacterial treatment of sewage.—E. S.

Petroleum and mineral oils; Refining ——. T. Macalpine, J. F. Simmance, and J. Abady, London. Eng. Pat. 11,893, June 6, 1905.

The oil is neutralised by agitating it with about 5 per cent. by weight of a solution in water of sodium carbonate (1 lb. of sodium carbonate to 10 of water), for half an hour, and the oil is then distilled and agitated with about 5 per cent. of sulphuric acid of sp. gr. about 1·72 for about half an hour at 40° C., to throw down the tarry substances. After settling for four to five hours, and running off from the sediment, the oil is transferred to a still fitted with an inverted condenser, and is treated with about 5 per cent. of finely-ground manganese dioxide or other suitable oxidising agent, together with 10 per cent. of sulphuric acid of sp. gr. not exceeding 1·2. The mixture is quickly heated to about 110° C., and maintained thereat until the remaining impurities are oxidised; after settling and separation from the sediment, the oil is refined and distilled in the usual way.—C. S.

United States Patent.

Distilling coals and other hydrocarbonaceous substances; Apparatus for ——. H. Wurtz, Newark, N.J., Assignor to American Chemical Eduction Co. U.S. Pat. 821,323, May 22, 1906.

In the apparatus described the coals or other hydrocarbonaceous substances to be distilled are placed upon spaced and "staggered" trays, arranged in a casing in a compartment, which casing can be moved into the compartment during distillation, and moved out of it for the discharge of the coke and for recharging with fresh coal. Heat is supplied from one or more fire-chambers, which are separated from the compartment by a partition or partitions. The heat passes through flues to the compartment, and takes a zig-zag course over the substance to be heated, and under and around the ends of the trays, the other end of the compartment being connected with an exhaust pipe; openings leading to the heat-flues are also arranged in the walls of the compartment. By means of the exhaust, heated products of combustion are drawn from the fire-chambers, through the flues and openings, over and around the trays, together with the products of distillation; means are provided for controlling the inflow of the products of combustion to the compartment, within which is a valve chamber or chambers with valves for controlling the temperature in the compartment. The products of combustion and distillation are also drawn by the exhaust out of the compartment. Fuel magazines, with water-sealed tops, are arranged above the fire chambers.—W. C. H.

German Patent.

Saturator for the manufacture of ammonium sulphate. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 165,308, March 25, 1903.

A small saturation-chamber is constructed in the upper part of the bell immersed in the liquid contained in the main saturation-vessel. In the bottom of the small saturation chamber is an opening, and communication with the interior of the bell can be opened or closed at will by means of an indented plate or inverted pan, which is arranged over the opening, and can be raised or lowered. Fresh acid is introduced, when required, into the small saturation-chamber, and then, by raising the indented plate, flows into the main saturation-vessel. According to one claim the indented plate is fixed to the lower portion of the ammonia gas-supply pipe, which slides telescopically in the upper part of the pipe.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 531.)

Benzidine and aniline; Combination of [*diazotised*] ——. *Diphenylbidiazoaminobenzene and diphenyldisazoaminobenzene.* L. Vignon. Bull. Soc. Chim., 1906, **35**, 313—315.

The combination of aniline with a tetrazobenzidine salt on the one hand, and of benzidine with a diazobenzene salt on the other, gives rise to the same compound, a yellowish-red substance, of m. pt. 180° C., which is decomposed by acids into aniline and *p.p'*-dihydroxydiphenyl; from this fact and from its elementary analysis, it is established as diphenylbidiazoaminobenzene, $C_6H_5NH.N_2.C_6H_4.C_6H_4.N_2.NHC_6H_5$. The isomeric diphenyldisazoaminobenzene, $NH_2.C_6H_4.N_2.C_6H_4.C_6H_4.N_2.C_6H_4.NH_2$, was obtained by heating 5 grms. of the diazo compound with 50 grms. of aniline and 2·5 grms. of aniline hydrochloride for 48 hours at 50°—60° C. It is a yellowish-red compound, of m. pt. 158°—159° C.

—T. F. B.

Alizarin; Action of ammonia on ——. R. Scholl and M. Parthey. Ber., 1906, **39**, 1201—1206.

The compound obtained by Perger by the action of ammonia on alizarin is shown to be 1-hydroxy-2-aminoanthraquinoneimide. It is formed by heating alizarin with ammonia for five hours at 140° C. Its composition is represented by the formula $C_{14}H_6ONH(OH)(NH_2)$. It is insoluble in ammonia, dissolves in alkalis and acids, and yields an acetyl derivative, thus exhibiting the properties of an aminophenol. When boiled with water, alkalis, or acids, ammonia is given off; by substituting oxygen for the imino group, 1-hydroxy-2-aminoanthraquinone is obtained; whilst by treating with ethyl nitrite, 1-hydroxyanthraquinone is formed. It is further shown, that the alizarinimide obtained by Liebermann and Troschke by heating alizarin with ammonia is identical with 1-hydroxy-2-aminoanthraquinoneimide.—D. B.

English Patents.

Logwood dyestuffs and extract for dyeing purposes; Production of ——. Lepetit, Dollfus and Ganser, Milan, Italy. Eng. Pat. 9604, May 6, 1905. Under Int. Conv., June 4, 1904.

See Fr. Pat. 351,018 of 1905; this J., 1905, 800.—T. F. B.

Dyestuffs; Manufacture of concentrated liquid dyestuffs or easily liquifiable pastes from sulphurised [*sulphide*] ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 9883, May 10, 1905.

Sulphide dyestuffs, isolated from their salts, and

preferably in the form of moist press-cakes, are converted into fluid form by addition of certain quantities of crystallised sodium sulphide; the quantity varies according to the nature of the dyestuff, and when it is increased beyond certain limits, the dyestuffs no longer remain fluid, but become solidified again. 1347 parts of a press-cake, containing about 60 per cent. of dry substance (obtained by melting trinitroaminodiphenylamine with alkali polysulphide, blowing air through the solution of the fused mass, and pressing the product) are stirred with 950 to 1000 parts of crystallised sodium sulphide; the mass becomes fluid, having a viscosity number of 118—120 (water = 82). Such solutions are convenient for transport, being concentrated, and for immediate use in the dye-house. It is advisable not to use too highly oxidised dyestuffs for the process, in order to increase the fluidity of the product, and to reduce the amount of sulphide necessary.—T. F. B.

Dyestuff of the anthraquinone series [Anthracene dyestuff]; Manufacture of a new ——, and of intermediate products for use therein. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,359, Oct. 9, 1905.

See Fr. Pat. 358,271 of 1905; this J., 1906, 260.—T. F. B.

Aminophenols; Manufacture of ——. F. Sachs, Berlin. Eng. Pat. 22,412, Nov. 2, 1905.

See Fr. Pat. 359,064 of 1905; this J., 1906, 369.—T. F. B.

Dyestuffs; Manufacture of blue sulphurised [Sulphide] ——. H. W. Lake, London. From Chem. Fabrik Griesheim-Electron, Frankfort-on-the-Maine, Germany. Eng. Pat. 6198, March 14, 1906.

By oxidising *p*-aminophenol and mono-alkyl derivatives of *o*-chloraniline, new stable indophenols are obtained, which yield diphenylamine derivatives by reduction. The latter are converted into sulphide dyestuffs when heated with alkali polysulphides. They differ from the dyestuffs described in Eng. Pat. 7919 of 1901 (see Fr. Pat. 309,898; this J., 1902, 42), in that they do not contain chlorine in the molecule, dye cotton redder shades, and are faster when washed.—D. B.

United States Patents.

Dye; Green-blue sulphur —— [Sulphide dyestuff] and process of making same. P. Julius and E. Münch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 820,501, May 15, 1906.

See Fr. Pat. 357,600 of 1905; this J., 1906, 175.—T. F. B.

Indigo colouring matter; Process of making ——. H. S. A. Holt, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany U.S. Pat. 820,869, May 15, 1906.

See Eng. Pat. 12,854 of 1905; this J., 1905, 885.—T. F. B.

Indigo colouring matters; Reduction of ——. R. Wimmer, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 820,900, May 15, 1906.

See Fr. Pat. 348,360 of 1904; this J., 1905, 495.—T. F. B.

Dye and process of making same; Rhodamine — — [Pyrone dyestuff]. H. A. Bernthsen, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 821,452, May 22, 1906.

See Fr. Pat. 347,546 of 1904; this J., 1905, 329.—T. F. B.

Dye and process of making same; Blue sulphur —— [Sulphide dyestuff]. C. Ris, Basle, Switzerland. U.S. Pat. 821,378, May 22, 1906.

See Fr. Pat. 357,587 of 1905; this J., 1906, 175.—T. F. B.

French Patents.

Inks; Colouring matter for ——, and its manufacture. P. Fireman. First Addition, dated Dec. 12, 1905, to Fr. Pat. 357,912, Sept. 21, 1905.

See U.S. Pat. 802,928 of 1905; this J., 1905, 1180.—T.F.B.

Tanning and colouring materials; Automatic extractor for ——. L. F. Jury. First Addition, dated Dec. 19, 1905, to Fr. Pat. 358,783, Oct. 7, 1905. XIV., page 598.

German Patents.

Hydroxyanthraquinone methyl ethers; Process of preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 166,748, Jan. 17, 1904. Addition to Ger. Pat. 156,762, Sept. 8, 1903 (see this J., 1905, 669).

β-Hydroxyanthraquinone methyl ether is obtained by heating anthraquinone-β-monosulphonic acid with methyl alcohol and alkali hydroxide. The product is said to be of value for the preparation of dyestuffs.—T. F. B.

m-Diarylsulphodiamides; Process for nitrating ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 166,600, Dec. 9, 1904.

m-Diarylsulphodiamides are nitrated by warming with dilute, aqueous nitric acid, with or without addition of a solvent. The nitro groups enter the *p*-positions to the arylsulphamino groups, providing both these are free. The initial material is obtained by the action of 2 mols. of arylsulphochloride on 1 mol. of the *m*-diamine in presence of sodium carbonate. (Compare Eng. Pat. 27,497 of 1904; this J., 1905, 1297.)—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 532.)

Indigo vat; The fermentation ——. H. Wendelstadt and A. Binz. Ber., 1906, **39**, 1627—1631

Indigo can be reduced with zinc dust or other chemical reagents in the smallest utensils, but in the fermentation process of reduction a quantity of at least 12 litres of liquid is necessary to ensure success. The authors find that in small quantities of liquid, with a large air surface, the micro-organisms obtain oxygen from the air instead of reducing the indigo. When air is excluded satisfactory reduction is obtained even in test tubes. This effect of atmospheric oxygen is not due to a re-oxidation of the indigo white, since it is often found advantageous in practice to obtain a "head," which shelters the liquid below it from the air. The indigo maker has already been in the habit of protecting his vats from the air, nominally with the object of restricting the loss of heat. The authors have isolated from the indigo plant a number of bacilli and a red and a white yeast. Only with the white yeast could sterilised indigo extracts be fermented, and it is suggested that the rational employment of pure cultures may be of advantage in this industry.—E. F. A.

Tin; Absorption of ——, by the wool-fibre in tapestry carpet yarn printing. D. Paterson. J. Soc. Dyers and Col., 1906, **22**, 188—189.

It is known that when stannous chloride is employed as a mordant in worsted yarn printing, the wool-fibre becomes harsh and tendered, and contracts to such an extent as to interfere very considerably with the regularity and symmetry of the design. Oxalic acid possesses the property of preventing this corrosive action, and from a series of experiments on the absorption of tin by the fibre during the steaming process, it is shown that this acid in no way affects the absorptive power of the fibre for tin.—D. B.

Tin; Detection of ——, *in woollen goods.* D. Paterson. XXIII., page 610.

ENGLISH PATENTS.

Threads; Apparatus for the manufacture of artificial ——. E. W. Friedrich, Blaton, Belgium. Eng. Pat. 17,381, Aug. 28, 1905. Under Int. Conv., Sept. 7, 1904.

SEE Fr. Pat. 357,172 of 1905; this J., 1906, 70.—T. F. B.

Electrolytic apparatus [for bleaching liquor]. G. G. Hepburn and Mather and Platt, Ltd. Eng. Pat. 12,221, June 13, 1905. XI*A*., page 593.

Vegetable fibres; Dyeing khaki on ——. A. E. Sunderland and Bradford Dyers' Association, Ltd., Bradford. Eng. Pat. 19,205, Sept. 22, 1905.

USE is made of the solubility of metallic oxides in alkaline solutions in the presence of certain organic compounds, such as glycerin, glucose or the like. By adding these substances to solutions of salts of iron, chromium, copper, manganese or nickel, and then caustic alkali, the precipitated hydroxide is redissolved on a further addition of alkali. By impregnating vegetable fibres with these solutions, and slowly drying, the metallic oxide is fixed upon the fibre, and the excess of alkali can be removed by washing.—D. B.

Dyeing bobbins and the like; Machines for ——. C. and R. Wansleben, Crefeld, Germany. Eng. Pat. 3194, Feb. 9, 1906. Under Int. Conv., March 1, 1905.

THE goods to be dyed are secured to an endless band provided with hollow members to receive the spindles. This band is caused to travel through a dye-bath having at the bottom a suction-chamber with perforated top, and then over a second chamber located at the delivery end of the bath, whereby the dye-liquor can be drawn through the goods travelling through the bath, and air sucked through, and superfluous liquor out of the goods immediately after leaving the dye-bath.—D. B.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, sewage, waste or spent dyes, and the like, the evaporator being also applicable as a smoke washer. A. B. Lennox and P. Dawson. Eng. Pat. 9572, May 6, 1905. XVIII*B*., page 605.

Serum or blood albumin for commercial purposes; Treatment of ——, [*Decolorising*]. The Calico Printers' Association, Manchester and W. Warr, Stalybridge, Lancs. Eng. Pat. 10,227, May 16, 1905.

To 1 gall., of serum or a solution of 1 lb. of blood albumin, is added 0·5 oz. of sodium hydrosulphite (hyposulphite) dissolved in a small quantity of water. After stirring the mixture, about 3 oz. of 40 per cent. acetic acid are added, and the whole allowed to stand for at least 24 hours to bleach the albumin. For transport the excess of acid may be neutralised, and the solution evaporated to dryness at a temperature below 100° F.—W. P. S.

Textile fibres; Printing sulphide colours on ——. L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 1300, Jan. 17, 1906. Under Int. Conv., July 15, 1905.

IN order to prevent the corrosion of metal rollers, the sulphide colours are printed together with a mixture of sodium hydrosulphite (hyposulphite) and glycerin. —D. B.

Fabrics; Apparatus for steaming, ageing and drying ——. Mather and Platt, Ltd., and D. P. Smith, Manchester. Eng. Pat. 15,951, Aug. 4, 1905.

INSTEAD of attaching forked hooks to the endless chains at intervals apart as prescribed in Eng. Pat. 20,117 of 1902, it is now directed to provide each link with a projection or finger, which is capable of holding the loose rollers between any contiguous pair when the chains are straight, and release them when bent.—D. B.

Textile piece goods; Apparatus for drying and carbonising ——. Tomlinson-Haas, Ltd., Manchester. From F. Haas, Lennep, Germany. Eng. Pat. 17,836, Sept. 4, 1905.

THE apparatus claimed comprises a series of drying chambers and intermediate heating compartments following one upon the other alternately, so arranged that the cloth passes over suitable guide rollers in a horizontal direction, and the heated air in a direction contrary to the passage of the fabric, and from one side of the chamber to the other in a line with the weft threads of the material. Although the air passes through both sets of compartments, the fabric traverses the drying chambers only, which arrangement permits a better treatment of the goods by enabling a proper regulation of the temperature. In the carbonising chamber into which the material is led after drying, the fabric is arranged in vertical windings. This chamber is excluded from the air circulating through the drying and heating compartments, and is provided with suitable pipes.—D. B.

UNITED STATES PATENTS.

Mercerising; Apparatus for ——. W. Mather, J. Hübner, and W. J. Pope, Manchester. U.S. Pat. 821,812, May 29, 1906.

SEE Eng. Pat. 2993 of 1905; this J., 1905, 1225.—T.F.B.

Dyeing; Apparatus for ——. H. L'Huillier, Paris. U.S. Pat. 820,654, May 15, 1906.

SEE Fr. Pat 350,981 of 1905; this J., 1905, 988.—T.F.B.

Discharging paste and process of making same. K. Reinking, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 820,889, May 15, 1906.

SEE Addition of Sept. 17, 1904, to Fr. Pat. 297,370 of 1900; this J., 1905, 130.—T. F. B.

Waterproof fabric. L. A. Bond, Assignor to Rubbertex Cloth and Paper Co., Logansport, Ind., U.S. Pat. 820,694, May 15, 1906.

SEE Fr. Pat. 358,619 of 1905; this J., 1906, 313.—T.F.B.

FRENCH PATENT.

Discharging by means of hydrosulphites; Process of ——. Badische Anilin und Soda Fabrik. Fourth Addition, dated Dec. 22, 1905, to Fr. Pat. 297,370, Feb. 19, 1900. Under Int. Conv., Nov. 18, 1905.

SEE Eng. Pat. 26,381 of 1905; this J., 1906, 474.—T.F.B.

GERMAN PATENT.

Lithopone; Use of —— *for obtaining a pure, permanent, white discharge.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 166,717, July 1, 1904.

THE claim is for the use of lithopone (a mixture of zinc sulphide and barium sulphate) as an addition to hydrosulphite (hyposulphite) discharges mixtures for the purpose of obtaining a pure and permanent white discharge on dyed woollen and half-woollen fabrics. Lithopone is stated to be more active than the zinc-white hitherto employed for the purpose of preventing the re-oxidation of the leuco compounds produced by the discharge of triphenylmethane dyestuffs. Also, printed fabrics on which discharges have been produced by lithopone can be subsequently treated in acid baths without injury. —A. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page 537.*)

Calcium sulphate ; Solubility of —— in solutions of ammonium sulphate. J. M. Bell and W. C. Taber. J. of Physical Chem., 1906, **10**, 119—122. Chem. Centr., 1906, **1**, 1689.

SULLIVAN (this J., 1905, 618) has recently shown that the solubility of calcium sulphate in ammonium sulphate solution at 25° C. first decreases, and subsequently increases again as the concentration of the ammonium sulphate becomes greater. No formation of a double salt was observed. In order to ascertain whether the double salt, $CaSO_4.(NH_4)_2SO_4.H_2O$, described by previous investigators is stable only at temperatures above 25° C., the authors determined the solubility of calcium sulphate in ammonium sulphate solutions at 50° C. At this temperature the solubility curve consists of three distinct parts. The solid phases corresponding to the two extreme portions of the curve consist of the pure salts, calcium sulphate and ammonium sulphate, whilst that corresponding to the middle portion is a double salt. The composition of the double salt was ascertained by Bancroft's method (J. of Physical Chem., **6**, 178), which is as follows:—If to a saturated solution, varying quantities of the two components be added, the composition of the solutions remains constant only if the two components are added in the same proportions in which they are present in the solid phase. In this way the composition of the double salt was found to be: $CaSO_4.(NH_4)_2SO_4.2H_2O$.—A. S.

Tin ; Sulphides, selenides, and tellurides of ——. H. Pélabon. Comptes rend., 1906, **142**, 1147—1149.

As sulphur is added gradually to tin, the solidifying point rises rapidly up to 5 per cent. of sulphur, then more gradually up to the composition corresponding to SnS (880° C.). Beyond that, the solidifying point falls, but the investigation cannot be carried farther than about 25 per cent. of sulphur, as sulphur is then lost rapidly by volatilisation when the mixture is heated.

Mixtures of selenium with tin, and of tellurium with tin, show precisely similar phenomena. When the proportion of metalloid exceeds that in the compound, SnR, the solidifying point steadily falls in the case of selenium, and in that of tellurium falls to a eutectic minimum (388° C.) at about 85 per cent. of tellurium, and then rises regularly to the melting point of tellurium. The existence of higher selenides or tellurides than SnR is not marked on the curves of solidifying point.—J. T. D.

Nitrogen ; Apparatus employed for the utilisation of atmospheric ——. A. Neuburger. Z. angew. Chem., 1906, **19**, 977—985.

Nitrate of soda combination. Eng. and Mining J., June 2, 1906. [T. R.]

AT a meeting of the producers and promoters at Iquique, Chili, on March 31, some concessions were made on both sides. It was then agreed that should 96 per cent. of the producers concur by April 3, in forming a new combination on an estimated producing capacity of 3,800,000 tons per year for all of the 147 manufacturing plants, a new agreement would be entered into. At the meeting of April 3 it was found that 99½ per cent. were ready to concur.

The prospect of having 3,800,000 tons of nitrate thrown on the market during the next twelve months, while there is no prospect that more than 2,000,000 tons will be consumed during the same period, together with the fear that the Chilian Government would legislate against those not entering the combination, was more than the manufacturers were willing to risk.

The term of the new combination is for three years, dating from April 1, 1906, on a basis of a possible producing capacity of all the "oficinas" of 3,800,000 tons yearly, each "oficina" to submit to a *pro rata* reduction in its producing capacity to conform to the consumption of the previous year. The production for the next 12 months will probably be cut down to 2,000,000 tons.

Sulphur Industry ; Sicilian ——. For. Off. Ann. Series, 1906, No. 3595. [T. R.]

THE shipments of sulphur from Sicily last year amounted to 470,341 tons as compared with 508,980 tons in 1904. The total stock existing in Sicily on Dec. 31, 1905, was 462,845 tons.

The Sicilian sulphur industry is passing through a crisis. The producers have become convinced that the American production is seriously threatening them, and most of them agree that an obligatory State-imposed association becomes absolutely necessary for the salvation of the industry. This association would limit the output and guarantee a fair price.

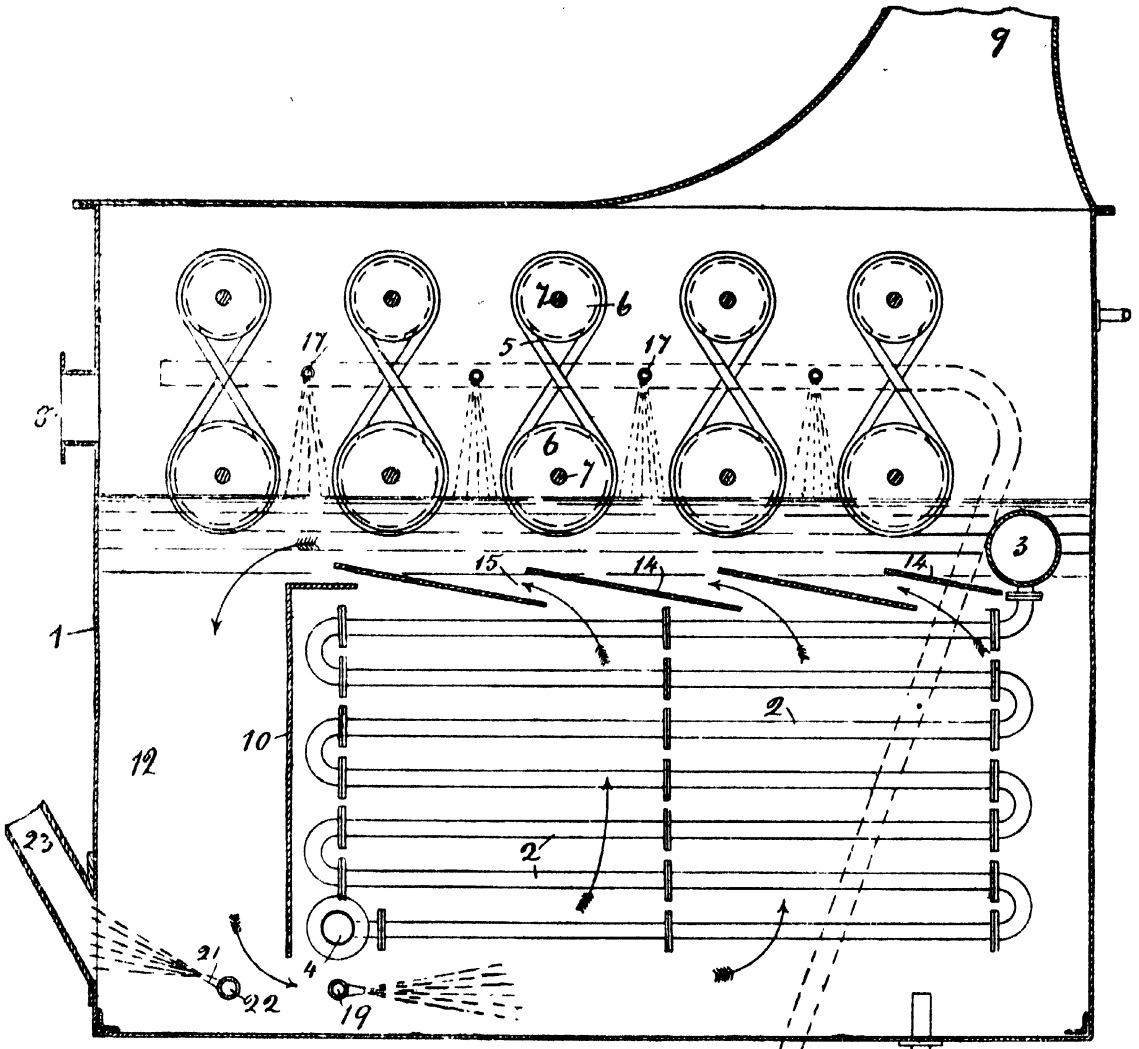
ENGLISH PATENTS.

Salt ; Manufacture of common ——. G. R. Ray, Manistee, Mich., U.S.A. Eng. Pat. 5428, March 6, 1906.

THE invention relates to apparatus for supplying anti-incrustation solutions to the ordinary vacuum apparatus for the manufacture of common salt from brine. A relatively small reservoir, containing the solution to be applied in preventing incrustation on the brine-circulating tubes of the vacuum apparatus, is divided into two compartments, in order to supply solution, of different strength if desired, to two pans working in a double effect. Into each compartment, the inlet end of a pipe dips below the surface of the solution, and is then extended horizontally, its outlet end being connected to the brine-supply pipe, so that the two liquids may mingle before entering the pan, above the top of the brine-circulating tubes, and preferably at a point between the top of the tubes and the surface of the brine. The partial vacuum in the pan draws in the solution, which may be caused to flow in at a rate modified by adjusting valves, and by elevating or depressing the reservoir above or below the level of the outlet into the brine pan. There is a pipe for the passage of water into the reservoir, in which, preferably, the anti-incrustation solution is made.—E. S.

Solutions [Brine] ; Means and appliances for concentrating ——, and obtaining and conveying salts. J. Hargreaves, Widnes, Lancs. Eng. Pat. 10,560, May 20, 1905.

THE tank, 1, is divided into compartments by the partition, 10, so as to form a space, 12, for collection of the precipitated salt. The submerged tubes, 2, are heated by exhaust steam from an engine, for example, passed from the inlet tube, 3, to the outlet tube, 4. The sloping covering plates, 14, directing the current of heated brine through the channels, 15, protect the tubing from becoming clogged with salt. Film-exposing surfaces, consisting of cords, 5, passing over pulleys, 6, secured on rotating shafts, 7, dip into the liquid, and carry it upwards for exposure to currents of air drawn over the surface of the brine through the inlet, 8, and outlet, 9. Brine is continuously fed by the pump, 18, having a steam-jacket, 20, through a pipe extending above the liquid, and provided with nozzles, 17, through which the brine issues as spray upon the saline crust as it forms: the salt as it falls upon the surface is swept by the currents in the liquid, shown by the arrows, into the compartment, 12, whence it is driven



up the outlet pipe, 23, by jets, 21, in the pipe, 22, which, as well as the pipe, 19, are supplied with brine from a second pump.—E. S.

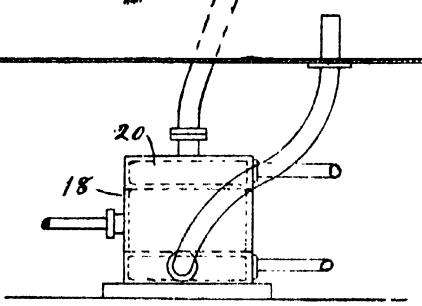
Ammoniacal liquor obtained by washing illuminating and heating gases; Treatment of certain products of ——. J. Radcliffe. Eng. Pat. 10,075, May 13, 1905. III., page 584.

Nickel ores or oxidised nickel mattes; Treating ——. R. W. E. Mac-Ivor and M. Fradd, London. Eng. Pat. 10,869, May 24, 1905.

THE mixture of metal oxides, resulting from the roasting of mattes or regulus, is digested under pressure with a strong solution of magnesium chloride, nickel chloride being formed in the solution.—A. G. L.

Hydrogen peroxide; Preparation and purification of ——. C. Poulenc, Paris. Eng. Pat. 1771, Jan. 23, 1906.

SEE Fr. Pat. 359,523 of 1905; this J., 1906, 374.—T. F. B.



Sulphur from sulphuretted hydrogen or gaseous mixtures containing it; Process for obtaining ——. Chem. Fabr. Rhenania, und F. Projahn, of Stolberg 2. Aachen, Germany. Eng. Pat. 3122, Feb. 8, 1906.

IN order to obtain a larger yield of sulphur from gaseous mixtures containing sulphuretted hydrogen, than that obtained by the use of the contact substances hitherto employed in a Claus-kiln, in which the gases pass in a downward direction, the inventors propose the use of

bauxite, or other natural material of similar composition containing alumina or its hydrate, with artificial or natural metal oxides or their hydrates.—W. C. H.

United States Patent.

Cyanogen compounds; Production of ——. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 821,457, May 22, 1906.

See Fr. Pat. 347,373 of 1904; this J., 1905, 333.—T.F.B.

French Patents.

Sulphur and cyanides from spent oxide, &c.; Process and apparatus for the extraction of ——. J. J. M. Bécigneul. Second Addition, dated Nov. 25, 1905, to Fr. Pat. 345,071, July 23, 1904. II., page 583.

Gas-fired furnace for calcining alumina and similar products. R. Brosse. Fr. Pat. 361,268, Dec 30, 1905.

The furnace comprises a series of calcining chambers, each of which has three superposed hearths. A track extends alongside the whole length of the furnace, on which track, wagons containing the alumina to be calcined, travel. The alumina falls from the wagons into vertical conduits at the side of the hearths of each calcining chamber, and is spread on the hearths by means of mechanical rakes. Gas from a producer at one end of the furnace, is delivered to two independent supply pipes extending the whole length of the furnace, from which the gas passes to burners furnished with mixing chambers, and projecting into the calcining chambers. The air is preheated by being drawn through the chambers where the calcination has been completed, and then passes to a conduit below the furnace, whence it is delivered to the burners as required.—A. S.

German Patents.

Muffle furnace for the production of sulphate and hydrochloric acid. K. Oehler, Anilin und Anilinfarbenfabrik. Ger. Pat. 165,099, May 10, 1904.

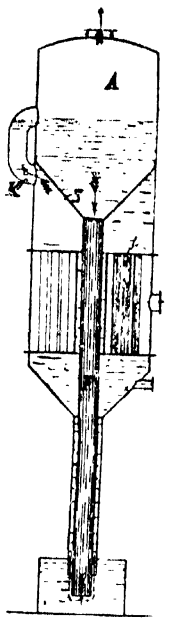
The furnace communicates, on the one hand, through openings in the bottom, with a channel running underneath the whole length of the furnace, for the purpose of removing the sulphate, and on the other hand, through openings in the roof, with an auxiliary condensing plant. Both sets of openings can be closed. When the hot sulphate is being removed from the furnace, the acid vapours are drawn through the auxiliary condensing plant.—A. S.

Alkali compound that can be easily converted into alkali hydroxide or alkali carbonate; Process for the electrolytic manufacture of — — and of chlorine. J. Wunder. Ger. Pat. 165,487, Sept. 14, 1904. XI.A., page 594.

Magnesium carbonate; Process for the production of voluminous normal ——. O. Brill. Ger. Pat. 164,882, April 4, 1905.

Basic magnesium carbonate obtained by precipitating a solution of a magnesium salt with alkali carbonate, is heated in a current of carbon dioxide, preferably to 150°—220° C. If dry carbon dioxide be employed, an anhydrous product is obtained.—A. S.

Saturator for the manufacture of ammonium sulphate. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 165,308, March 25, 1903. III., page 584.



Evaporator for salt solutions and the like; Vacuum ——, *with separate heating and evaporating chambers.* F. Juergens. Ger. Pat. 165,220, Sept. 29, 1903

The evaporator is shown in section in the figure. It has separate evaporating and heating chambers communicating only by a circulation tube, K. The evaporating chamber, A, is provided at the bottom with a fall-tube, F, and the heating chamber has vertical heating tubes, L. The bottom, E, of the evaporating chamber forms the cover of the heating chamber, and it is claimed that incrustations on the bottom of the evaporating chamber and in the fall-tube are in this way prevented.—A. S.

Sodium nitrate free from perchlorate; Process for the manufacture of ——. E. Egor. Ger. Pat. 165,310, May 19, 1904.

The crude Chile saltpetre is treated, with agitation, with a quantity of cold water exactly sufficient to dissolve the sodium nitrate, in order to obtain a solution of this salt free from impurities. In carrying out the process, the ground material is mixed with a small quantity of cold water (at 10°- 15° C.), and then further quantities of cold water are added gradually, with continuous stirring, until the mixture contains $(100-3a)$ kilos. of water for each 100 kilos. of crude nitre (a = percentage of "potassium nitrate" *plus* "potassium perchlorate"). On the first addition of water the temperature falls below 0° C., and then gradually rises again, so that a solution of sodium nitrate saturated at a relatively low temperature is obtained, and neither potassium nitrate nor potassium chlorate is dissolved.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 537.)

United States Patents.

Sheet-glass; Apparatus for the manufacture of ——. W. B. Keighley, Vineland, N.J. U.S. Pat 820,205, May 8, 1906.

The glass-making furnace or tank is provided with an adjustable block for varying the area of the discharge-outlet, the block having a wedge-bearing on the tank. Means are provided for projecting a fluid under pressure on to the under side of the sheet of glass to support it before it reaches a mechanical conveyor; an electrically-heated severing device, capable of being moved to and from the sheet of glass, is also provided, as well as means for projecting heating and cooling fluids alternately on to the glass, and means for projecting across the whole surface of the sheet a spray of fluid at a uniform temperature lower than that of the sheet.—A. G. L.

Glass sheets; Apparatus for drawing ——. J. H. Lubbers, Allegheny, Assignor to Window Glass Machine Co., Pittsburg. U.S. Pat. 821,724, May 29, 1906.

See Eng. Pat. 22,065 of 1904; this J., 1905, 29.—T. F. B.

Glass; Process and apparatus for drawing sheet ——. I. W. Colburn, E. Washburn, and C. W. Irwin, Franklin, Pa. U.S. Pats. 821,785 and 821,786, May 29, 1906.

See Eng. Pat. 13,788 of 1905; this J., 1905, 1306.—T.F.B.

FRENCH PATENT.

Glass-house pot furnaces, heated by gas. E. Derval. First Addition, dated Dec. 23, 1905, to Fr. Pat. 306,356, Dec. 18, 1900.

THE pot furnaces with a central column, described in the original patent, are, according to this addition, divided into two or more parts, by means of a transverse wall or partition, through which air can circulate, in order to allow of the continuous working of the furnace, and to facilitate the founding in the same furnace, and in the same "journey," of glasses of different compositions. By this arrangement, while the founding is proceeding in pots in one part, pots in another part of the furnace may be kept cool enough to be worked.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 538.)

Puzzuolanas; Methods for the determination of the hydraulic value of ——. E. Manzella. Gaz. chim. ital., 1906, **36**, 113—123.

VICAT in 1826 (Ann. Chim. Phys., 1826, 197) stated that the hydraulic power of a puzzuolana corresponds to the quantity of lime which it is capable of absorbing from lime-water in a given period of time. The author has examined the modifications of this method proposed by Giorgis and Alvisi (Gaz. chim. ital., **30**, [I], 96). He finds that the use of lime dissolved in a solution of sugar instead of in pure water offers no advantage. The absorptive power of a puzzuolana for lime in aqueous solution increases considerably as the time of contact is prolonged. It is true, as Giorgis and Alvisi found, that clay and "vegetable soil" absorb some lime when placed in contact with lime-water, but the amount absorbed does not increase as the time of contact is prolonged, so that these substances can be readily distinguished from true puzzuolanas. In carrying out Vicat's test, the time of contact of the puzzuolana with the lime-water should be prolonged to more than 12 days, and the mixture should be continually agitated.—A. S.

Concrete; Notes on ——. R. W. Leonard. J. Canadian Min. Inst., 1905, **8**, 102—110.

THE specification common in Canada for Portland cement used in making concrete requires that 95 per cent. shall pass through a 100-mesh sieve, and that the neat cement shall bear a tensile strain per sq. in. at three days of 300 lb; seven days, 450 lb.; twenty-eight days, 600 lb. The initial set should take place in one or two hours, and the final set in five to eight hours. The soundness is tested by a boiling pat test. The specification of the Canadian Society of Civil Engineers, Jan., 1903, is more lenient than the above, and does not include a boiling test. The amount of magnesia is generally specified to be less than 3 per cent.

For sand, it has been found that pit sands (rounded, and made up of different sized grains) are better than crushed granite or quartz (sharp); that a little clay is probably not detrimental; that coarse sand or crushed stone gives a higher tensile strength than fine sand, and that pit sand or crushed limestone gives better results when subjected to abrasion than does sharp granite sand.

The stone is generally specified to be broken so as to pass a two-inch ring, and screened, but a mixture of gravel and sand pumped up together is now often used, and gives good results.

The author praises reinforced concrete work, and gives some examples to show that it may be made watertight, even against considerable heads of water (up to 15 ft.).
—A. G. L.

ENGLISH PATENTS.

Tarring or asphalting roads; Product for ——, *and process for manufacturing the same.* L. Préaubert and G. A. Thubé, Nantes, France. Eng. Pat. 9422, May 4, 1905. Under Int. Conv., May 5, 1904.

SEE Fr. Pat. 342,898 of 1904; this J., 1904, 1029.—T. F. B.

Slates; Manufacture or ornamentation of ——. S. Kellett, Ilkley, F. W. Richardson, Bradford, and Buttermere Green Slate Co., Keswick, Cumberland. Eng. Pat. 15,753, Aug. 1, 1905.

THE slates are dipped in solutions of salts of metals having coloured oxides, and are then dried, and heated at temperatures up to a bright red or yellow heat, with or without access of air. By this treatment slates may be coloured in any way desired.—A. G. L.

UNITED STATES PATENTS.

Roofing, paving, &c.; Composition for ——. E. J. Yetter, Denver, Colo. U.S. Pat. 819,833, May 8, 1906.

GILSONITE, lime sludge, and asphaltum or an equivalent are combined in suitable proportions with an oil or flux, either incorporated in the asphaltum, or added as a separate ingredient.—A. G. L.

Roofing, paving, &c.; Composition for ——. E. J. Yetter, Denver, Colo. U.S. Pat. 820,162, May 8, 1906.

ELATERITE, lime sludge, and asphaltum or an equivalent are mixed with a suitable oil or flux, either incorporated in the asphaltum, or added as a separate ingredient.
—A. G. L.

Roofing, paving, &c.; Composition for ——. E. J. Yetter, Denver, Colo. U.S. Pat. 820,163, May 8, 1906.

ELATERITE, gilsonite, lime sludge or calcium carbonate, and asphaltum are mixed with a suitable oil or flux, either incorporated in the asphaltum, or added as a separate ingredient.—A. G. L.

Emery; Process for the manufacture of artificial ——. A. Gacon, Montval, France. U.S. Pat. 820,859, May 15, 1906.

SEE Eng. Pat. 23,492 of 1904; this J., 1905, 92.—T. F. B.

Building material; Composition ——. Z. B. Taylor, Orbisonia, Pa. U.S. Pat. 821,550, May 22, 1906.

THE artificial stone is composed of 60 parts of crushed slag, containing 34 parts of silica; 12 parts of alumina; 50 parts of lime, and 4 parts of magnesia; to these 20 parts of cement and 20 parts of clay, or clay and sand, are added, together with sufficient water to make the mass plastic for moulding, a suitable colouring material being also added.—W. C. H.

Cement clinker; Process of burning ——. H. L. Doherty, Madison, Wis. U.S. Pat. 820,484, May 15, 1906.

THE cement is burned in a rotatory kiln, into the lower end of which is injected a mixture of powdered coal with sufficient air for its complete combustion. The air is diluted with products of combustion, the quantity of which is varied from time to time, whereby a periodical shifting of the clinkering zone in the kiln is effected, and the formation of kiln incrustations is avoided. The introduction of air from extraneous sources is prevented.
—A. G. L.

FRENCH PATENTS.

Tiles and stone; Process of manufacturing artificial ——. E. Vajda. Fr. Pat. 361,208. Dec. 19, 1905.

A MIXTURE of 60 to 90 per cent. of cement or other hydraulic binding agent, 30 to 10 of asbestos or other mineral fibre, and 5 to 2 of steatite, is made with water, moulded under a pressure sufficient to expel all surplus water, and, if necessary, subjected to a second moulding under pressure. The addition of steatite is designed to prevent the subsequent absorption of moisture from the air by reason of the greasy nature of the material.
—A. G. L.

Roads; Dust-free and absolutely firm ——. K. Schmoll von Eisenwerth. Fr. Pat. 360,941, Dec. 26, 1905.

THE formation of dust may be prevented by watering roads already constructed with a 2 to 10 per cent. solution of alkali silicate, preferably sodium silicate, in water, whilst for roads to be made, sodium silicate is added to the water used in their construction.—A. G. L.

X.—METALLURGY.

(*Continued from page* 543.)

Blast furnace slags. O. Boudouard. Rev. gén. Chim., 1906, 137; Chem.-Zeit., 1906, **30**, Rep. 160.

THE author notes that in the production of a ton of cast iron, in general about 1200 kilos. of slag are produced at the same time. This makes an annual production of 60 million tons of slag from iron furnaces alone. If other metallurgical operations be taken into account, there is a yearly production of 100 million tons of slag. Blast furnace slags are now used for road-making and paving; also for mortar, non-conducting media (slag wool), cement, bricks, &c. Slag cement is cheaper than Portland cement. Slags may be divided into two classes:—1, Silicate slags, commercially the most important; 2, non-silicate slags, consisting of acids other than silicic acid (boric, hydrofluoric, phosphoric, hydrochloric, sulphuric, titanic, and vanadic acids) and more or less basic oxides. The importance of the knowledge of the fusibility, melting-point, and viscosity of slags, and its bearing on the production of a given metal is discussed. Some slags possess considerable viscosity over a large range of temperature, and it might be thought, therefore, that the determination of the melting point was of little practical value. The author points out, however, that as the fusibility of a slag is inversely proportional to the amount of heat required to fuse it, and this in turn depends upon the specific heat and melting point of the slag, the melting point is one of the chief factors in determining the fusibility. (See also this J., 1905, 675.)—F. SHDN.

Nickel ores; Chlorinating treatment of ——. F. N. Rutherford. J. Canadian Min. Inst., 1905, **8**, 336—342.

THE author has made a number of experiments on chlorinating roasting applied to low-grade nickel ores after roasting for sulphur. Different mixtures of the roasted ore with raw ore and salt, and with ferrous sulphate and salt, were made, but all gave poor results, especially the ores with very low percentages of nickel. The best result was obtained by heating a mixture of 100 grms. of roasted ore, 15 of salt, 5 of manganese dioxide, and 10 of sulphuric acid to 400° C. for 30 minutes, and leaching with boiling water, 59 per cent. of the nickel in the ore being recovered. Nickel chloride is very easily decomposed and rendered insoluble by heating in the presence of silicates, especially if air be admitted.—A. G. L.

Cobalt-nickel ores; Solubility of ——, *in ammonia.* G. S. Hanes. J. Canadian Min. Inst., 1905, **8**, 358—362.

THE author has made a number of experiments with Malzac's ammonia process for the extraction of nickel, cobalt, and copper from arsenical and sulphide ores. The process consists in treating the ore, crushed to pass a 120-mesh screen, with ammonia solution (one part of ammonia solution of sp. gr. 0·880 to two parts of water), and blowing air through the mixture. Oxidation takes place, and the hydroxides of the metals produced are dissolved by the ammonia. Nickel is acted upon before cobalt, and a rough separation may be made in this way. The air, after leaving the lixiviating apparatus, is passed through washing towers to recover the ammonia. From the solution the metals are conveniently obtained by electrolysis. Proceeding in this way, from a pyrrhotite ore, containing 5·20 per cent. of nickel, 10 hours' blowing yielded 40·0 per cent. of the nickel, and 20 hours' 87·5 per cent. An arsenide ore containing 27·9 per cent. of cobalt and nickel yielded practically the whole after 10 hours' blowing. A copper-nickel matte containing 39·75 per cent. of iron, 9·9 per cent. of copper, and 21·1 per cent. of nickel also yielded the whole of its copper and nickel after 10 hours. (For action of ammonia solution on metallic nickel and cobalt, see Hodgkinson and Baillars, this J., 1895, 160.)—A. G. L.

Antimony and tin; Alloys of ——. F. E. Gallagher. J. of Physical Chem., 1906, **10**, 93—98. Chem. Centr., 1906, **1**, 1690—1691.

REINDERS (Z. anorg. Chem. **25**, 113) has stated that antimony and tin form two compounds, Sb_4Sn_3 or Sb_3Sn_4, and SbSn, whilst Van Bijlert (Z. physik. Chem., **8**, 843) considers the alloy corresponding to the last-mentioned formula to be a solid solution. The author has made a detailed microscopic examination of the alloys, and constructed their cooling curves. He finds that antimony and tin do not form any chemical compound, but give solid solutions, of which α-, β-, γ- and δ- crystals are distinguished. Transformation points at 430° and 243° C. were observed, just as by Reinders, and also at 319° C., instead of the 310° C. given by that author. The cause of this discrepancy is stated to be that the nature of the solid alloy varies considerably according to the rate of cooling, and that under some circumstances unstable systems are formed. For example, the β-crystals are unstable below 313° C., but undergo transformation only very slowly.—A. S.

Sulphide ores; Economical treatment of ——, *For white lead*]. C. B. Jackes. XIIIA., page 596.

Mines and quarries: General report and statistics for 1905. *Part I. District statistics.* [Cd. 2974.] Price 7d. [T. R.]

THIS return, which forms the first part of the General Report on Mines and Quarries for 1905, contains statistics of the number of persons employed, of the output of minerals, and of accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. The total output of the under-mentioned minerals in the United Kingdom in 1905 as compared with 1904 was as follows:—

	1904.	1905.
	Tons.	Tons.
Coal	232,428,272	236,128,936
Clays and shale	15,948,915	15,134,754
Iron ore	13,774,282	14,590,731
Limestone (other than chalk)	12,043,135	12,501,780
Igneous rocks	5,988,821	5,956,900
Sandstone	5,306,363	5,639,566
Chalk	4,438,728	4,535,584

ENGLISH PATENTS.

Zinc retorts and other fireclay metallurgical vessels; Manufacture of ——. A. L. J. Quenean, South Bethlehem, Pa., U.S.A. Eng. Pat. 9877, May 10, 1905. Under Int. Conv., May 21, 1904.

SEE Fr. Pat. 354,319 of 1905; this J., 1905, 1071.—T. F. B.

Zinc or oxide of zinc; Process of extracting —— from its ores. F. W. Howorth, London. From Soc. Anon. Metallurgique Proc. de Laval, Frankfort on Maine, Germany. Eng. Pat. 14,573, July 14, 1905.

SEE Fr. Pat. 356,097 of 1905; this J., 1905, 1311.—T. F. B.

Furnace for roasting, desulphurising, chloridising [chlorinating], dehydrating or drying ores and other substances. A. V. Leggo, Ballarat, Australia. Eng. Pat. 17,370, Aug. 28, 1905.

SEE Fr. Pat. 357,661 of 1905; this J., 1906, 126.—T. F. B.

Furnaces for roasting, desulphurising, chloridising [chlorinating], dehydrating or drying ores, &c. A. V. Leggo, Ballarat, Australia. Eng. Pat. 21,160, Oct. 18, 1905.

THE furnace consists of two or more series of superimposed roasting chambers communicating with each other, and furnished with rabble-shafts carrying arms whereby the material under treatment is conveyed from one chamber to another. The material is fed into the furnace from a hopper, by means of fluted rollers, which can be driven at varying speeds. Solid, liquid, or gaseous fuel may be used. Specially constructed fire-boxes or combustion chambers are provided in certain cases at the discharge ends of the roasting chambers.—J. H. C.

Magnetic materials [Alloys]; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 22,130, Oct. 30, 1905. Under Int. Conv., June 8, 1905.

A MAGNETIC material having low hysteresis and eddy current is produced by alloying iron with silicon and a substance other than silicon, such as aluminium, to the extent of 0·35 per cent. up to 8 per cent. of the iron, the amount of this element (aluminium) amounting to from 25 to 75 per cent. of the silicon. The alloy so formed is heated to between 900° and 1100° C., allowed to cool, re-heated to between 700° C. and 850° C., and then left to cool slowly.—J. H. C.

Ores; Process for the balling together of pulverulent or dusty ——. J. E. Goldschmid, Frankfort on Maine, Germany. Eng. Pat. 26,170, Dec. 15, 1905. Under Int. Conv., Jan. 12, 1905.

SEE Fr. Pat. 360,576 of 1905; this J., 1906, 543.—T. F. B.

UNITED STATES PATENTS.

Metal-bearing materials; Process of treating ——. C. W. Merrill, Lead, S.D. U.S. Pat. 820,430, May 15, 1906.

MATERIALS containing precious metals, and especially such materials as also contain reducing agents, are crushed, and treated with a cyanogen-bearing solution in a closed vessel, "and the solution is removed from the interstitial spaces of the material." The material is then subjected to the action of an oxidising agent (air) under a pressure greater than that of the atmosphere, and afterwards again treated with a cyanogen-bearing material. —A. S.

Precious metals; Process of and apparatus for extracting —— from their ores. S. T. Muffly, Assignor to Philadelphia Cyanide Process Co., Philadelphia, Pa. U.S. Pats. 820,810 and 820,811, May 15, 1906.

ORES containing gold and silver are crushed, and then delivered into a neutralising chamber containing an alkaline solution for the purpose of neutralising any acid salts present. The ore is now carried by a conveyor through a valved conduit into a closed casing containing a stamp mortar, in which it is pulverised in an alkaline cyanide solution under a pressure of heated air greater than that of the atmosphere. The pulverised ore is conveyed continuously through a series of lixiviators containing cyanide solution under air pressure, and the solution and tailings are finally collected in separate receptacles. The air, before being discharged, is led through an absorbing chamber provided with a series of partitions forming a tortuous passage, and fed with a "compound alkaline cyanide and alkaline hydrate solution," whereby the hydrocyanic acid gas is absorbed, and vapours of base metals are condensed; the absorbing liquid is subsequently used for treating further quantities of ore. (See also following abstracts.)—A. S.

Lixiviator. S. T. Muffly, Assignor to Philadelphia Cyanide Process Co., Philadelphia, Pa. U.S. Pat. 820,812, May 15, 1906.

THE lixiviator consists of a horizontal receptacle or drum, having inlet and outlet pipes entering it, on opposite sides, at angles other than 90°, and also pipes for supply of compressed air and of solvent liquid. Inside the drum is a revolving device, provided with buckets, which carry the material under treatment, *e.g.*, ore-pulp, from the inlet to the outlet pipe. The air-supply pipe extends through the upper portion of the drum, and has a longitudinal slot, whereby the air is caused to exert a direct downward pressure upon the liquid contained in the drum. (See preceding abstract.)—A. S.

Condensing or dissolving gases and vapours; Process of, and apparatus for ——. S. T. Muffly, Assignor to Philadelphia Cyanide Process Co., Philadelphia, Pa. U.S. Pats. 820,813 and 820,884, May 15, 1906.

THE patents relate to a process of, and apparatus for recovering "gases and base or other metallic elements carried thereby in volatilised or finely-divided form." The gases, under pressure, are exposed to a solution of "a double cyanide of potassium and bromine," and are then passed through a series of thin films of the solution, while mixed with air under pressure. In the solution the base metal compounds are precipitated by an "alkaline hydrate solution containing ammonia." The apparatus consists of a closed chamber, having an inlet and outlet for the gases, and an inlet for compressed air. In the chamber is a series of vertical endless aprons, mounted on rollers, and extending downwards into the solvent liquid contained in the chamber. Between the aprons are vertical partitions reaching from the bottom nearly to the top of the chamber, and having openings to permit of the passage of liquid. The chamber has a false bottom of filtering material, and the space below has an outlet for the filtered solution. After leaving the chamber, the gases and air pass through a closed box fitted with baffle-plates, and provided with an automatic outlet valve, which opens periodically to allow the gases and air to escape. (See also preceding abstracts.)—A. S.

Iron; Process of manufacturing —— direct from its oxide. J. N. Whitman, Philadelphia, Pa., Assignor to M. T. Reynolds, Albany, N.Y. U.S. Pat. 820,898, May 15, 1906.

THE pulverised ore, after suitable mechanical treatment, is heated under oxidising conditions to eliminate the more volatile impurities, and then heated with a "reagent" to remove the remaining impurities. The purified ore is next subjected to heat and agitation "under de-oxidising and carburising conditions produced by the introduction of free carbon, to partially de-oxidise, carburise, partially reduce, and agglomerate the ore into coherent masses," and the product is then subjected to a higher temperature under reducing conditions to effect complete reduction. —A. S.

[Iron] Ores; Process of, and apparatus for smelting ——. J. A. Potter, San Francisco, Cal. U.S. Pats. 821,189 and 821,190, May 22, 1906.

THE apparatus consists of a smelting chamber with an open hearth, surmounted by a dome of refractory material. A conduit acting as a burner for fluid fuel, discharges over the hearth, and a vertical tubular retort, open at the bottom, extends upwards from the dome. The ore is ground with limestone and tarry hydrocarbonaceous material, and the mixture is fed from a hopper into the upper end of the retort. The mass is forced through the retort by means of a plunger, and the hydrocarbonaceous material is gasified, charred, and coked by means of the hot gases from the smelting chamber. The hardened mass issuing from the lower end of the retort falls on to the hearth of the smelting chamber, and is smelted, the molten iron and slag being drawn off at suitable intervals. —A. S.

Steel; Manufacture of ——. J. W. Spencer, Newcastle-on-Tyne. U.S. Pat. 822,082, May 29, 1906.

SEE Eng. Pat. 15,032 of 1903; this J., 1904, 664.—T. F. B.

Copper alloy. G. Chaudoir, jun., Vienna. U.S. Pat. 820,954, May 22, 1906.

SEE Fr. Pat. 335,838 of 1903; this J., 1904, 325.—T. F. B.

Copper and other values; Process of recovering —— from certain ores. T. J. Lovett, Chicago, Ill. U.S. Pat. 821,516, May 22, 1906.

THE patent relates to a combined dry and wet process of concentrating and collecting the non-magnetic sulphide and contained "values" in low-grade chalcopyrite ores containing a considerable percentage of magnetic iron. The ore is coarsely crushed, and treated in a magnetic separator, whereby the iron and the sulphides are roughly separated. The magnetic material is then ground with water, and again treated in a magnetic separator to recover adhering particles of sulphides.—A. S.

Slag; Apparatus for pulverising blast-furnace ——. H. Colloseus, Berlin. U.S. Pat. 821,609, May 29, 1906.

SEE Fr. Pat. 356,379 of 1905; this J., 1906, 26.—T. F. B.

Slag; Process for dissolving solid fluxes in fluid ——. F. C. W. Timm, Hamburg, Germany. U.S. Pat. 822,087, May 29, 1906.

See Fr. Pat. 356,252 of 1905; this J., 1905, 1308.—T.F.B.

Detinning; Method of ——. K. Goldschmidt and J. Weber, Assignors to Th. Goldschmidt, Essen on the Ruhr, Germany. U.S. Pat. 822,115, May 29, 1906.

See Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

French Patents.

Bronzo-nickel. Soc. Anon. du Bronzo-nickel. Fr. Pat. 360,910, March 18, 1905.

"Bronzo-nickel" is an alloy formed by melting together 10 parts of nickel, 65 of copper or of bronze, 25 of zinc, 5 of antimony, and phosphorus, borax, and magnesium to facilitate the mixing. The melting-point of the alloy formed is given as 1400° C.; it is said to resist the action of moisture, sea-water, and dilute acid.—A. G. L.

Furnace, reverberatory or blast; Process for carrying out chemical and metallurgical operations in a —— [*Furnace for casting steel, puddling, or reducing zinc, &c.*] *by introducing mixtures of gas and air at two or more points.* Schmidt and Desgraz. Fr. Pat. 361,189, Dec. 30, 1905. Under Int. Conv., June 5, 1905.

Mixtures of gas and air, varying in composition according to the nature of the operation to be carried out, are introduced into the furnace at two or more points. Thus, in a Bessemer convertor for steel, during certain stages of the blow, an oxidising mixture may be blown in from a lower tuyère and a reducing mixture from an upper tuyère, whilst towards the end of the blow the reverse procedure may be adopted.—A. G. L.

Silicon combined with calcium or its compounds; Thermic process based on the action of ——. J. Goldschmidt. Fr. Pat. 361,197, Dec. 30, 1905.

The invention consists in replacing the aluminium in thermite by a mixture of silicon and calcium. Thus, a mixture of 20 per cent. of calcium, 10 of silicon, and 70 of ferric oxide or magnetic iron oxide, will give a very liquid slag of calcium silicate and a large amount of metallic iron, considerable heat being evolved. Metallic aluminium or magnesium may be mixed with the calcium-silicon mixture, and other oxides, *e.g.*, of chromium, may be substituted for the ferric oxide, if it is desired to obtain different alloys, or (from the slag) different opaque or transparent products. Neither calcium nor silicon can be usefully employed alone.—A. G. L.

German Patent.

Cyanogen or ammonium compounds; Process for increasing the yield of —— in blast-furnace work. G. Reininger. Ger. Pat. 167,033, Sept. 16, 1904.

The process consists in introducing an alkaline earth carbide into that part of the furnace where the temperature is about 800°—1000° C.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 546.)

(A.)—ELECTRO-CHEMISTRY.

Ammonium sulphate; Conductivity of —— in mixtures of sulphuric acid and water. G. Boizard. Comptes rend., 1906, **142**, 1082—1084.

When ammonium sulphate is dissolved, *e.g.*, in the proportion of 1 per cent., in solutions of sulphuric acid of different strengths, the conductivity of the acid solution may be increased or diminished, according to the concentration of the acid. The author found that with solutions containing 100—95 per cent. of sulphuric acid, the addition of 1 per cent. of ammonium sulphate increases the conductivity; with acids containing 95—1·8 per cent. of sulphuric acid the conductivity is decreased, whilst with solutions containing 1·8—0 per cent. of sulphuric acid the conductivity is again increased. The effect of increasing the concentration of the ammonium sulphate varies according to the concentration of the sulphuric acid. With liquids containing over 3 per cent. of sulphuric acid an increase in the proportion of ammonium sulphate causes an increased difference in the conductivities. With acids of about 2 per cent. strength a high concentration of the ammonium sulphate may cause an increase of conductivity, whilst low proportions may cause a decrease. In other words, the point of change from solutions of less conductivity to solutions of greater conductivity than the solvent, which point lies at 1·8 per cent. of sulphuric acid when 1 per cent. of ammonium sulphate is added, can be raised by varying the proportion of ammonium sulphate. With rise of temperature in solutions containing 95—25 per cent. of acid, the ratio of the conductivities of solvent and product approaches unity. With acids of lower strength, increase of temperature has the opposite effect. It is noted that a very large number of substances other than ammonium sulphate have a similar effect on the conductivity of sulphuric acid solutions.—J. F. B.

Electro-chemical analysis; A simple form of rotating electrode for ——. F. M. Perkin. XXIII., page 609.

English Patents.

Electrolytic apparatus. G. G. Hepburn, Whitefield, and Mather and Platt, Ltd., Manchester, Lancs. Eng. Pat. 12,221, June 13, 1905.

The electrolytic apparatus described is designed for the use of bleachers in making hypochlorite, and is an adaptation of the "bell-jar" method on a small scale, and for intermittent working. The apparatus consists of a number of cells connected to a hydraulic main for filling and emptying by means of suitable valves and stop-cocks. Each cell may consist of two or more compartments, in each of which is placed an inverted vessel or "bell-jar," and each of which may be separately emptied or placed out of action by means of a siphon. Provision is also made for sweeping out of each cell the residual chlorine left after electrolysis has been stopped.—A. G. L.

Furnaces; Electric ——, *for treating gases by means of electro-magnetically or electro-dynamically actuated electric arcs.* A. J. Petersson, Sweden. Eng. Pat. 9164, April 18, 1906. Under Int. Conv., April 18, 1905.

This invention relates to an electric furnace for treating gases, by means of electric arcs struck between a central electrode and another electrode surrounding it, the arcs being made to rotate around the latter by the action of a magnetic field. The coil and iron core for producing the magnetic field are placed annularly around the reaction chamber. The winding of the coil may consist of a thick ribbon-shaped conductor wound spirally round the reaction chamber, the conductor being supplied with continuous current "of great volume," or with alternating current from a transformer. The primary winding of the latter is connected in series with the arcs, or the innermost turn of the coil may act as the outer annular electrode. Where alternating current is used for creating the magnetic field, the outer annular electrode may have the shape of an open ring. Modifications are described in which the coil surrounding the chamber, and also the pole surfaces of the ring-shaped iron core, have such a shape that the strength of the magnetic field, within the space enclosed by the outer annular electrode, decreases uniformly or approximately uniformly towards the centre. —B. N.

Ozonising atmospheric air; Apparatus for —— [*electrically*]. Ozonair, Ltd. and E. L. Joseph, both of London. Eng. Pat. 4579, Feb. 24, 1906.

This invention relates to a portable self-contained apparatus for ozonising air, and consists of a box divided into two compartments, one of which has its opposite ends open but fitted with wire screens above and below. The electrode structure consists of an open, square, vertical tube of flexible non-conducting material forming the dielectric, this being covered on its outer and inner

surfaces with sheets of wire gauze. The electrodes are mounted in the open compartment so as to leave air passages through the middle of the structure, and also between the electrodes and the sides of the compartment. The structure is secured in position in the box by means of a spider frame, made in two parts, which is inserted and expanded within the electrode structure, and the frame also supports at its centre an electric motor, the latter driving a fan which revolves between one of the wire screens and the corresponding end of the electrode structure. The closed compartment contains a step-up transformer, and upon the cover of this the two switches and connections are mounted for controlling the supply of current to the fan motor and, through the transformer, to the electrodes.—B. N.

United States Patents.

Furnace; Electric ——. J. E. Hewes, Plattsburg, N.Y. Assignor to C. H. Boone, Baltimore, Md. U.S. Pat. 820,574, May 15, 1906.

The hearth of the furnace consists of a series of trough-like plates, abutting against each other, and forming a rectilinear trough. On each side of the hearth are guides with two endless travelling chains or conveyers, travelling over and resting on them, and serving to move the hearth in a longitudinal direction under the electrodes, whereby the smelted materials are conveyed away from the electrodes. Stationary means are provided for feeding the materials to be smelted to the electrodes. One electrode is horizontal, and in line with the hearth and the second electrode, which is placed vertical, the latter being at a higher elevation so as to leave a space below it. A hood surrounds the electrodes and the hearth, and a depending shield fits down into the hearth and around the horizontal electrode, in order to close the hearth, yet permitting the latter to be moved forward.—B. N.

Conductors; Composition of matter for electric ——. W. G. Clark, New York, Assignor to Parker-Clark Electric Co., Jersey City, N.J. U.S. Pat. 821,017, May 22, 1906.

This invention relates to a substance which is a conductor of electricity when cold, and which consists of a dense, non-porous and non-crystalline combination of carbon and silicon less hard than carborundum. It is produced by decomposing gaseous compounds of carbon, in the presence of volatile compounds of silicon, at a temperature below the fusing point of carborundum.—B. N.

Contact substances used for catalytic action; Treating —— [*electrolytically*]. I. Kitsee, Philadelphia, Pa., Assignor to C. L. Hamilton and W. F. Hamilton. U.S. Pat. 821,042, May 22, 1906.

"Contact poisons," such as arsenic, are extracted from contact masses, such as platinum, by making the latter part of the anode in an electrolytic apparatus, and subjecting the mass to the action of the electric current; the contact poison is oxidised, and dissolved out of the mass.—B. N.

[*Calcium carbide*]. *Calcium oxide; Process of reducing* ——. T. L. Willson, New York, Assignor to Union Carbide Co., Va. U.S. Pat. 820,031, May 8, 1906.

An electric arc is established between suitable poles, one of which is the end of a depending carbon electrode. The arc is surrounded by a charge of calcium oxide and carbon in proportions suitable to form calcium carbide; the reduced carbide is accumulated into a mass, and used as one electrode, the arc being maintained by gradually moving the carbon electrode; unreduced portions of the charge are kept in contact with the arc and the electrode, so as to retain the heat of the arc, exclude air, and yet permit the escape of the gases produced by the reaction.—A. G. L.

Turpentine; [Electrical] Process of treating wood for the extraction of ——. F. T. Snyder. U.S. Pat. 821,264, May 22, 1906. XIII*B*., page 597.

French Patent.

Incandescent filaments (Vacuum arc lamps); Process of manufacture of ——. A. Franfurther and H. Kuhlmann. First Addition, dated Nov. 13, 1905, to Fr. Pat. 356,999, Aug. 17, 1905. II., page 583.

German Patents.

Alkali compound that can be easily converted into alkali hydroxide or alkali carbonate; Process for the electrolytic manufacture of ——, *and of chlorine*. J. Wunder. Ger. Pat. 165,487, Sept. 14, 1904.

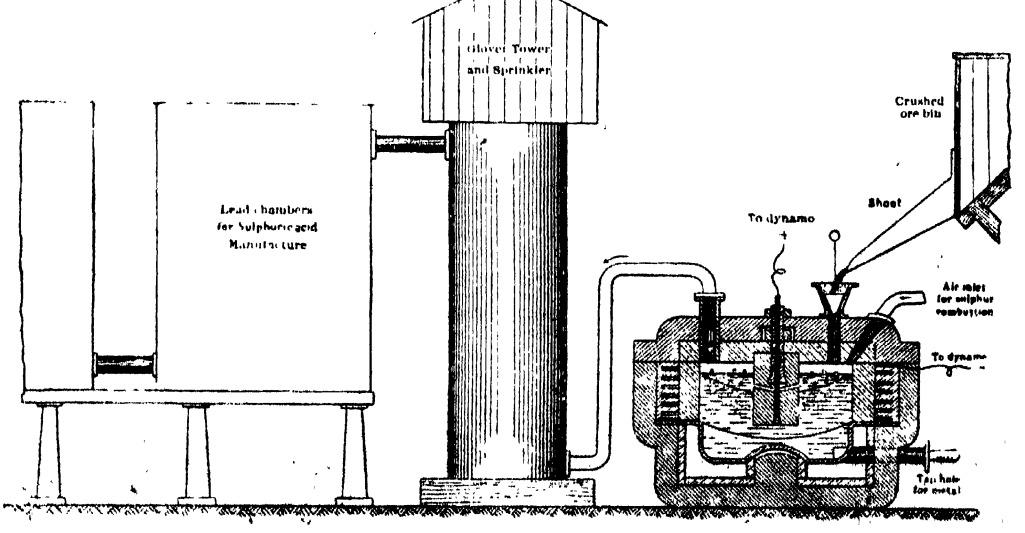
Mixtures of an alkali chloride and silica, free from sulphates, are electrolysed at about the melting temperature of the alkali chloride. The decomposition may be represented by the equation:—

$$6NaCl + 3SiO_2 = \underset{\text{at the cathode}}{Na_2Si} + \underset{\text{at the anode}}{2Na_2SiO_3 + 6Cl};$$

and it is claimed that the whole of the chlorine is obtained in the free state. A mixture of five parts of sodium chloride and two parts of silica is recommended.—A. S.

(B.)—ELECTRO-METALLURGY.

Fused electrolytes; Factory scale experiments with ——. E. A. Ashcroft. Electrochem. Ind., 1906, **4**, 178—180.



The author uses cells provided with means for magnetically rotating the fused bath during electrolysis. For the recovery of zinc from zinc sulphide, the ore is suspended in an electrolyte of fused zinc chloride, and by working at 450° C., the sulphide is resolved into its elements, sulphur distilling off, or being oxidised at the surface of the vat, and molten zinc depositing on the cathode at the bottom of the cell.

The plant as arranged for producing metallic zinc, and sulphuric acid, is illustrated in the figure.

So far as zinc is concerned, the process is not very promising, as most ores contain too much gangue and other impurities to be employed directly. With lead sulphide, electrolysed in a medium of fused zinc chloride or fused lead chloride, good results are obtained.

The reactions of ferrous chloride with lead are of some importance, as offering a method for eliminating iron in the mixed sulphide process. Below 450° C., iron appears to decompose lead chloride: $PbCl_2 + Fe = FeCl_2 + Pb$, but at about 600° C. the reaction is reversed, the iron is reduced, and alloys with the molten lead.

To overcome the difficulty of access to the contents in the cell illustrated above, a modified form has been devised, open at the top. When this is used for the electrolyses of fused chlorides with recovery of chlorine, the gas is drawn off through a tubular anode.—R. S. H.

Electrolysis of fused zinc chloride in cells heated externally. J. L. F. Vogel. Faraday Soc. Trans., May 15, 1906. [Advance proof.]

In 1898, in conjunction with O. J. Steinhart, a series of experiments was commenced with a view to preparing anhydrous zinc chloride, by dissolving oxide of zinc in hydrochloric acid, and subsequently electrolysing the fused salt in cells heated externally, a process suggested by the late F. Maxwell Lyte. At first, great difficulties were encountered in producing anhydrous zinc chloride, the complete dehydration of the salt proving to be very essential for the efficiency of the electrolysis. Finally, this was successfully accomplished by evaporation under a partial vacuum. In a small scale experiment, carried out in 1898 with 10 ampères at 3·3 volts a current efficiency of 93 per cent. was attained. In more recent experiments with a cell of fire-proof stoneware, taking 600 ampères at 4 to 5 volts., the current efficiency worked out at 91·5 per cent. over a period of 10½ days. The temperature of the cell was kept as near 500° C. as possible. The author points out the advantages of external heating, especially in the economy of electric energy, and considers that the field is still open for the commercial production of zinc and chlorine by such a process.—R. S. H.

United States Patent.

Copper; [Electrolytic] Recovery of —— from solutions containing it. B. Combs, Turin, Italy, Assignor to E. Casper, London. U.S. Pat. 820,555, May 15, 1906.

See Eng. Pat. 20,657 of 1902; this J., 1903, 1136.—T. F. B.

French Patent.

Sodium; Electrical conductor of metallic ——. A. G. Betts. Fr. Pat. 361,102, Dec. 19, 1905.

The conductor consists of metallic sodium protected from the air by a casing of copper or other metal. On account of the high coefficient of expansion of sodium, the conductors are best made in sections, several methods of joining these together being described. Since the specific gravity of copper is nine times that of sodium, whilst its electrical conductivity is only three times as high, it is claimed that a sodium conductor will carry as much current as a copper one three times its weight.—A. G. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Lipolytic enzymes in higher fungi. J. Zellner. Monatsh. f. Chem., 1906, **27**, 295—304.

From the results obtained with nine representative species the author concludes that the fats in the higher fungi contain a large proportion of free fatty acids. These can be detected even in the fats of the fresh fungi, and their amount increases on drying and keeping the fungi. As much as 80 per cent. of the fats may be hydrolysed, but complete hydrolysis has not yet been observed. In many cases it is possible to effect the hydrolysis of other fats by means of the powdered fungus. This was notably the case with *Lycoperdon gemmatum*, *Boletus elegans*, *Galerrheus vellereus*, and *Lepiota procera*, whilst *Cantharellus cibarius*, *Polyporus confluens*, and *Hydnum repandum* were almost without action upon rape oil. The hydrolysis is promoted by gentle heat (40° to 45° C.), and is checked by heating the fungus powder to 110° C., or by the addition of mercuric chloride. No enzyme could be isolated from the fungi.—C. A. M.

Service berry [Sorbus aucuparia]; Seeds and oil of the ——. L. van Itallie and C. H. Nieuwland. Arch. Pharm., 1906, **244**, 164.

The seeds of *Sorbus aucuparia* contain 21·9 per cent. of a fatty oil which can be extracted with petroleum ether. The seeds, freed from oil, gave the following results on analysis:—Water, 9·2; nitrogen, 5·44; albumin (nitrogen × 6·25), 34·0; cellulose, 13·2; ash, 5·21; carbohydrate (calculated as glucose), 24·2 per cent. The oil is a sweet-tasting, mobile, slightly yellowish liquid, which rapidly dries on exposure. It possesses the following constants:—Sp. gr. at 15° C., 0·9317; refractive index at 15° C., 1·4753; acid value, 2·35; saponification value, 208·0; iodine value, 128·5; iodine value of the fatty acids, 137·5; acid value of the fatty acids, 230·2. Ten grms. of the seeds, freed from oil, gave 7·29 mgrms. of hydrocyanic acid.—F. Shdn.

Camels' butter; Analytical values of ——. J. Vamvakas. Ann. chim. anal., 1905, **10**. 350. Z. Untersuch. Nahr.- u. Genussm., 1906, **11**, 630.

A specimen of camels' butter from Tripoli was of firm consistency, and had a light grey colour and a characteristic odour. The fat gave the following results:—M. pt., 38° C.; m. pt. of fatty acids, 47° C.; volatile fatty acids, 8·6 per cent.; insoluble fatty acids, 88·29 per cent.; saponification value, 208·0; iodine value, 55·1; and refractometer reading, 20.—C. A. M.

Elaidin and Elaidic Acid. Gawalowski. Pharm. Post., 1905, **38**, 97—98. Z. Untersuch. Nahr.- u. Genussm., 1906, **11**, 622—623.

A commercial specimen of oleic acid, which melted at 30·7° C. and contained 4 per cent. of unsaponifiable matter, yielded on treatment with mercury and nitric acid, an elaidic acid which consisted of a mixture of a crystalline and a liquid product. The oily portion was nearly colourless and had a not unpleasant odour. The solid portion gave the following analytical values:—Sp. gr., 0·930; m.pt., 38° C.; solidification point, 23·0° C., and unsaponifiable matter, 0·3 per cent. It yielded a hard white soap. The liquid portion melted at 16·5° C., and solidified at 14·9° C. It had a sp. gr. of 0·936, and contained 16·2 per cent. of unsaponifiable matter. It solidified after standing for some days at 15° C. In the author's opinion two distinct acids, stearo-elaidic and oleo-elaidic acids, are formed in the elaidin reaction.—C. A. M.

Fats; Action of iron and manganese salts in producing rancidity of ——. P. F. Dalezki. Russi Wratsch., 1904, **3**, 752. Z. Untersuch. Nahr.- u. Genussm., 1906, **11**, 625—626.

Experiments were made with butter fat, cacao butter, and almond oil, freed from proteids and other impurities. Precautions were taken to exclude any bacterial action, air, light, and heat being the only factors in addition to the iron or manganese stearate. These salts were nearly

insoluble in cold almond oil, and in the fats at their melting points. In the experiments the admixture was made on the water-bath. It was found that both salts increased the oxidation process, the influence of manganese being greater than that of iron. The salts that had dissolved in the fats had a greater oxidising effect than the undissolved salts. The action was judged to be purely catalytic, the salts acting as conveyors of the atmospheric oxygen. The process of oxidation appeared to follow a somewhat different course with manganese than with iron. It proceeded more slowly at first, whilst heat accelerated the oxidation. When kept at the ordinary temperature with the admission of light and air, the fats became rancid, the iodine value decreasing, and the acid, saponification, and Reichert-Meissl values increasing. In the case of cows' butter, however, the last value remained almost constant.—C. A. M.

Cocoa-nut fat in butter; The "silver-value" method for the detection of ——. F. Jean. XVIII*A*., page 604.

Cholesterol; Halogen derivatives of ——. J. Mauthner. XXIV., page 611.

Soap in Turkey. Oil, Paint and Drug Reporter, May 21, 1906. [T.R.]

According to the new regulations, which are based upon a report received from the faculty of the Imperial College of Medicine, the maximum percentage of solids (salt, soda and earthy matters) allowed in soap is 2 per cent., and of water 4 per cent. Soaps in which these percentages are exceeded are regarded as adulterated, and the manufacturers are liable to prosecution. The manufacture of soaps containing sodium silicate is forbidden. Merchants selling wares coming within the above prohibition are liable to prosecution for the sale of an adulterated article. Considerable trouble has been caused of late years to importers of soap into Turkey on account of the rigid requirements in regard to the chemical analysis of the goods before they are liberated from the customs. Three consignments of well-known brands of English soap were held for a long period, on the ground that the proportion of caustic soda exceeded 0·5 per cent., and that talc was present.

Turkey produces most of the common grades of soap required for ordinary consumption, but there is a considerable importation of the finer qualities, chiefly from Great Britain and France, and to some extent also from Italy and Germany. These importations at Smyrna reach an annual figure of about 315 tons. There is a large exportation from this section of cheap grades of soap made from olive oil, in which American purchasers are taking a steadily increasing share. An important market for this exportation has just been closed by the recent decree of the Bulgarian Government shutting out the soaps of this region on the ground that they are manufactured from materials of foreign origin.

The reason for the small imports of soap into Arabia is that the natives use a strong alkali substitute called "hootum." This is derived from an evergreen shrub growing plentifully on the desert, and called "shagar" by the Arabs. It is burned and the residual ash is incorporated with black mud into lumps. The prevailing use of this alkali explains why only 3,854 lb. of soap were imported into Aden last year, nearly all of it from France.

Fish oil industry; Japanese ——. Oil, Paint and Drug Reporter, May 14, 1906. [T. R.]

After boiling, the fish are put into wooden presses about 3 ft. square and 2½ ft. deep, the sides and bottom of which are composed of slats having a small opening between them. The cover is put on, and pressure is exerted by means of levers or stones put on top of the cover, the oil and water pressed from the fish running into a tank, where the water, going to the bottom, is first drawn off, and the oil afterward put into cans, soldered up, and is then ready for shipment.

The fish, after being pressed, is in the shape of a hard sodden mass, which is removed from the press, broken into small pieces, and spread out on mats in the sun and dried. When dry it is packed in straw mats, and shipped. It is estimated that not more than 60 per cent. of the oil is extracted from the fish, while in drying the manure, more than half of the phosphates, the most valuable part, are lost.

The oil is nearly all exported to Holland and England, but the manure is all used in Japan, and the amount annually produced is not sufficient to supply the demand.

Olive oil. U.S. Customs Decisions. [T. R.]

The following decisions on olive oil have been issued by the Treasury Department:—

(1) Mere presence or absence of free fatty acids in olive oil does not determine whether or not such oil is fit for use as an article of human food. Rancidity may exist in such oil before the formation of free fatty acids, and such acids may exist long before the oil becomes rancid.

(2) Olive oil in condition to be filtered, and blended with cottonseed oil, and when so blended fit to be used as an article of human food, is dutiable at the rate of 40 cents per gall., under the provisions of paragraph 40 of the tariff.

English Patents.

Bones, skins, &c.; Treatment of various substances such as —— for obtaining useful products [Grease, glue, and manure] therefrom. J. Harger. Eng. Pat. 9779, May 9, 1905. XIV., page 597.

Soap and detergent compounds; Manufacture of ——. H. J. Armstrong, M. R. Armstrong, both of Ashton on Ribble, and H. H. Armstrong, Penwortham. Eng. Pat. 16,406, Aug. 12, 1905.

Claim is made for the incorporation with the soap of carbon tetrachloride, either by itself, or together with hydrocarbon solvents. The carbon tetrachloride may be mixed with fatty acids before saponification with alkali, or it may be incorporated with the still fluid soap-mass obtained from fixed oils, whilst volatilisation may be prevented by carrying out the process in covered vessels. Detergent preparations are obtained by pulverising a soap containing carbon tetrachloride with a suitable quantity of sodium carbonate.—C. A. M.

French Patent.

Soap; Manufacture of a dry —— *from colophony and soda [for paper-sizing].* M. Douxami. Fr. Pat. 361,154, Dec. 29, 1905.

Colophony (100 parts) is melted and treated, little by little, with sodium carbonate (20 to 25 parts), and the mixture, which contains a slight excess of alkali, heated and stirred until nearly solid.—C. A. M.

German Patent.

Aldehydes, alcohols, and [fatty] acids; Process of producing —— . Chem Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 167,137, Jan. 16, 1904. XX., page 608.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 547.)

(A.)—PIGMENTS, PAINTS.

Sulphide ores; Economical treatment of —— *[for white lead].* C. B. Jackes. J. Canadian Min. Inst., 1905, 8, 244—258.

The author proposes to apply Kingsley's white lead process (Eng. Pat. 23,909; this J., 1905, 681) to the enormous sulphide deposits of Canada which cannot profitably be worked in the ordinary way on account of their remoteness from smelting works. Briefly, the method consists in acting on the concentrated galena with 30 per cent. nitric acid containing some nitrous acid, at a temperature of 80° C., lead nitrate, sulphur, and nitric oxide being formed. The last is oxidised by air to nitrogen peroxide, which, in presence of air and water, again yields nitric

acid containing nitrous acid, and is used over again. The solution of lead nitrate is run off from the sulphur and gangue, freed from iron by adding a little basic lead carbonate (white lead), and then precipitated by a mixture of caustic soda and sodium carbonate, white lead and sodium nitrate being formed. From the latter, the nitric acid is recovered by acting on it with sulphuric acid formed from the sulphur liberated in the first stage of the process, the nitric acid being distilled off, and condensed in pipes which serve to heat the mixture of ore and acid to the proper temperature. Apart from losses in working, the whole of the nitric acid used is thus recovered.—A. G. L.

(*B.*)—RESINS, VARNISHES.

ENGLISH PATENT.

Rosin and rosin oils; Process for treating ——. K. Bosch, Stuttgart, Germany. Eng. Pat. 26,176, Dec. 15, 1905.

SEE Fr. Pat. 357,391 of 1905; this J., 1906, 82.—T. F. B.

UNITED STATES PATENT.

Turpentine; [Electrical] Process of treating wood for the extraction of ——. F. T. Snyder, Oak Park, Ill. U.S. Pat. 821,264, May 22, 1906.

THE wood is enclosed in a vessel, having air-tight sides and top, and the vessel is inserted in a furnace, also provided with air-tight sides and top, through an opening in the bottom of the furnace. Heat is developed electrically in the interior of the latter, sufficient to produce destructive distillation of the wood, and the vapours, containing turpentine, are drawn off through the bottom of the vessel, and collected. The vessel, containing the remaining charcoal, is removed through the bottom of the furnace, the vessel being maintained in an upright position so as to prevent the escape of the heated vapours and consequent admission of air. Another vessel containing wood for treatment is placed in the furnace, the heat of the latter being thus maintained, and the charcoal is removed in a heated condition without damage by the external air; the charcoal is subsequently cooled apart from the furnace and out of contact with air.—B. N.

(*C.*)—INDIA-RUBBER, ETC.

Balata; Reactions of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 844.

WHEN the pure hydrocarbon of balata is subjected to prolonged treatment with chlorine in chloroform solution, and the resulting product reprecipitated several times from benzene solution, a white, microcrystalline body is obtained which answers to the formula $C_{10}H_{12}Cl_6$. It is soluble with difficulty in benzene, and is not attacked by concentrated nitric acid. By dissolving balata hydrocarbon in fuming nitric acid, precipitating with water, and reprecipitating the product several times with ether from acetone solution, a yellow amorphous body of an acid nature is obtained, which contains 53·17 per cent. of carbon, 6·46 per cent. of hydrogen, and 8·59 per cent. of nitrogen. (See also Caspari, this J., 1905, 1274.)—W. A. C.

India-rubber; Influence of light magnesia as a filling material upon ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 816.

FIVE experimental mixings of Para rubber with 10 per cent. of sulphur and rising percentages of light magnesia were vulcanised and tested as before (this J., 1906, 487). Both strength and elasticity are greatly enhanced by 25 per cent. of light magnesia, the former more than 10 times and the latter about 2½ times, as compared with a blank experiment. The increase, up to 25 per cent. of admixture, is quite steady.—W. A. C.

Rubber; Methods of colouring ——. E. W. Lewis. J. Soc. Dyers and Col., 1906, **22**, 184—187.

THE following methods are considered in detail: (1) The incorporation of coloured pigments with the rubber mass during the ordinary process of mixing, either dry or in the presence of solvents, (2) the staining of vulcanised rubber goods subsequent to curing, by means of soluble colours, and (3) the admixture of colours, soluble in the ordinary solvents of rubber, with rubber solutions intended for use in the preparation of dipped or spread goods.—D. B.

Ebonite; Analysis of ——. R. Thal. XXIII., page 610.

UNITED STATES PATENT.

Rubber; Dissolving and regenerating ——. P. Alexander, Charlottenburg, Germany. U.S. Pat. 841,394, May 22, 1906.

SEE Eng. Pat. 14,681 of 1905; this J., 1905, 1244.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 548.)

Quebracho industry of Argentina. For. Off. Ann. Ser., 1906, No. 3605. [T.R.]

ABUNDANCE of quebracho wood is to be found in the forests of the Charo district of Argentina, and also in some parts of the North and West Provinces. The following are the figures for the export of quebracho in its various forms for the last two years:—

		1904.		1905.	
		Quantity.	Value.	Quantity.	Value.
			Dol.gold.		Dol. gold.
Quebracho—					
Sleepers..	Number	4,047	3,245	21,385	17,452
Logs	Tons .	49,076	490,762	166,931	1,669,310
Boards ..	Number	—	—	23,642	236,420
Posts ...	,,	—	—	2,442	1,221
Extract .	Tons .	921	18,426	6,226	124,505
Total .	—	—	512,433	—	2,048,908

Tanning materials; Duty-free importation of ——, *into Germany.* Board of Trade J., May 31, 1905. [T.R.]

THE Bundesrath has authorised the duty-free importation, under the conditions governing "improvement" trade, of quebracho and other tanning woods, and of tanning materials generally, destined either to be cut up in small pieces, and re-exported, or for use in the manufacture of tanning or colouring extracts for exportation.

ENGLISH PATENT.

Bones, skins, &c.; Treatment of various substances such as ——, *for obtaining useful products [Grease, glue, and manure] therefrom.* J. Harger, Market Harborough. Eng. Pat. 9779, May 9, 1905.

THE apparatus employed consists of a horizontal rotating cylinder constructed of perforated metal plates or gauze, mounted upon a central shaft, and surrounded by a fixed cylinder provided with a steam-jacket. The material, such as bones or skins, is placed in the inner cylinder, a manhole being provided for the purpose, and the space between the two cylinders is about one-third filled with benzene. Steam is then turned into the steam-jacket until the benzene boils, the inner cylinder being slowly rotated. The benzene vapours pass out of the cylinder, and are condensed in a separate apparatus, fresh quantities of the solvent being introduced as required. When the bones have been freed from grease, the solvent containing the oil is run off, and all the benzene removed by the introduction of a current of steam. Manholes in the outer cylinder are now opened, and air is allowed to pass through the cylinders, the inner one being rotated so that all dirt, meat, &c., is rubbed off, and falling through the gauze, is removed by brushes affixed to the outer part of the inner cylinder. The bones are then subjected to the action of steam and water to remove gelatinous

substances, and are afterwards dried by reducing the pressure in the cylinders. The inner cylinder is finally rotated rapidly until the bones are sufficiently disintegrated to pass through the gauze and a perforated plate fixed in the manhole of the outer cylinder.—W. P. S.

UNITED STATES PATENT.

Leather; Oil dressing for ——. H. Schowalter, Ladenburg, Germany. U.S. Pat. 821,260, May 22, 1906.

SEE Fr. Pat. 357,527 of 1905; this J., 1906, 130.—T.F.B.

FRENCH PATENT.

Tanning and colouring materials; Automatic extractor for ——. L. F. Jury. First Addition, dated Dec. 19, 1905, to Fr. Pat. 358,783, Oct. 7, 1905.

IN this addition, the ball-floats which are provided in the original specification (this J., 1905, 327), for the automatic control of the admission of liquors into the various tanks, are replaced by shafts carrying cams, which are placed in positions so that they open, at the right moment, sluice valves situated either in the diffuser or in the liquor reservoirs.—J. F. B.

GERMAN PATENT.

Gelatin; Process of hardening objects of ——, *so that they retain their shape.* H. Rumpel. Ger. Pat. 167,318, Oct. 16, 1904.

GELATIN objects can be permanently hardened by the action of formaldehyde, acrolein, and chromium compounds, dissolved in alcohol, acetone, or ether.—T. F. B.

XV.—MANURES, Etc.

(*Continued from page* 549.)

Over-limed soil; Regeneration of ——. S. Maki and S. Tanaka. Bull. Coll. Agric., Tokyo, 1906, **7**, 61—65.

IT has been shown previously, that in order to obtain the best yield of plants, a certain ratio of available lime to magnesia is necessary. In the case of cereals, the proportion of magnesia should be equal to that of lime, if the former be present as magnesite, which is similar to the lime compounds present in most soils in its behaviour to solvents. The authors have examined the action of magnesium sulphate, which is much more readily available than magnesite, in restoring the efficacy of over-limed soils. It was found that on both sandy and loamy soils, 14 parts of crystallised magnesium sulphate have the same effect as 100 parts of magnesite.—A. S.

Manure; Influence of the reaction of —— *upon the yield.* K. Aso and R. Bahadur. Bull. Coll. Agric., Tokyo, 1906, **7**, 39—46.

WAGNER has shown that a mixture of superphosphate with ammonium sulphate, which latter is physiologically acid, does not give good results unless some calcium carbonate is applied to counteract the evil effect of the acid reaction on the roots of the plants. The authors have compared the effects of the (neutral) disodium phosphate with the (acid) monosodium phosphate, and with calcium superphosphate in presence of ammonium sulphate (physiologically acid) and of sodium nitrate (physiologically alkaline). Experiments with peas and barley showed that the combination of several acid manures or of several alkaline manures does not lead to good results, but that a mixture of acid and alkaline salts acts beneficially on the yield. The best results with sand cultures of barley and peas were obtained with a mixture of sodium nitrate and monosodium phosphate, whilst in the case of paddy-rice, a mixture of ammonium sulphate and disodium phosphate proved the most satisfactory. In experiments with soil cultures of onions, ammonium sulphate, in the presence of disodium phosphate and potassium carbonate, yielded a far better result than sodium nitrate, and the results also confirmed the observations of other investigators, that ammonia under suitable conditions is as efficacious as nitrate, and that nitrification is not necessary. The general conclusion drawn by the authors is that small changes in the reaction of the manure have often a much greater influence on the yield than might be presumed, and that the effects differ with different crops.—A. S.

Calcium cyanamide; Efficacy of ——, *[as fertiliser] under different conditions.* R. Inamura. Bull. Coll. Agric., Tokyo, 1906, **7**, 53—55.

CALCIUM cyanamide is an alkaline manure since, on decomposition in the soil, it yields calcium carbonate and ammonia, the latter in turn being soon transformed into ammonium carbonate. As ammonium sulphate, though of neutral reaction, is physiologically acid, it appeared probable that the most suitable conditions for obtaining satisfactory results would be different with the two compounds, and accordingly the efficacy of mixtures of calcium cyanamide with the acid double superphosphate and the neutral disodium phosphate respectively, was determined. The best results were obtained with the superphosphate mixtures, whereas in the case of ammonium sulphate, the neutral disodium phosphate mixtures are superior to those containing double superphosphate (see preceding abstract).—A. S.

Calcium cyanamide; Manurial value of ——. K. Aso. Bull. Coll. Agric., Tokyo, 1906, **7**, 47—52.

COMPARATIVE experiments on rice ("upland" and "paddy"), sesamum, and hemp with calcium cyanamide (19·2 per cent. of nitrogen), Chili saltpetre, and ammonium sulphate, showed that in general the cyanamide gave rather better results than equivalent quantities of the sodium nitrate and ammonium sulphate. The only unsatisfactory result with cyanamide was in the case of paddy rice on a soil rich in humus, and of a similar character to moor soils, which have been shown by Tacke and Feilitzen not to yield such satisfactory results with calcium cyanamide as other soils do.—A. S.

Potassium compounds; Manurial value of different —— *for barley and rice.* K. Aso. Bull. Coll. Agric., Tokyo, 1906, **7**, 67—72.

THE author has compared the manurial effect of four potassium compounds—the carbonate, sulphate, chloride, and silicate—in three consecutive years on barley and paddy rice. Potassium chloride was found to accelerate the flowering process and increase the grain production, giving the highest quotient of yield, in the case of barley; but with rice it caused a decrease in the yield. In several cases with rice plants, potassium silicate proved to be the most efficacious of the four compounds. Potassium sulphate favoured the production of straw rather than of grain. Potassium carbonate was inferior to sulphate in all cases, when applied together with disodium phosphate, a physiologically alkaline manure.—A. S.

Silica; Function of —— *in the nutrition of cereals.* A. D. Hall and C. G. T. Morison. Roy. Soc. Proc., 1906, **77B.**, 455—477.

EXPERIMENTS extending over a series of years show that whilst silica is not an essential constituent of plant food, it may play a definite part in the nutrition of cereal plants, such as barley, which contain normally a considerable proportion of silica in their ash. A free supply of soluble silica (sodium silicate) causes an increased and earlier formation of grain, and thus acts in a similar manner to phosphoric acid. The effect of the silica is not a direct one, but is due to an increased assimilation of phosphoric acid by the plant. Apparently, the silica within the plant does not cause a more complete utilisation of the phosphoric acid that has already been assimilated, or promote the migration of food materials from the straw to the grain, but it gives the plant such a stimulus that more vigorous development and an increased assimilation of the phosphoric acid contained in the soil are possible. The results of water cultures of barley, and direct experiments on the effect of sodium silicate on the constituents of the soil, show that the silicate has no chemical action on the soil phosphates.—A. S.

Beetroots; Substitution of soda for potash in the ash of ——. J. Urban. XVI., below.

Superphosphates; Determination of the soluble and total phosphoric acid in ——. K. Rohm. Chem.-Zeit., 1906, 30, 542—543.

A COMPARISON of the digestion and agitation methods of determining the soluble phosphoric acid shows the latter to give higher and more constant results, especially when the agitator is run at a speed of 32—40 revolutions per minute, the differences in that case being only 0·04—0·08 per cent. of phosphorus pentoxide. In the determination of the total acid, the three methods generally used for dissociation (namely, nitrohydrochloric acid, nitric acid, or nitric and sulphuric acids) gave very concordant results, whereas results obtained with hydrochloric acid (tried for comparison) came out too low and irregular. Where no stirring apparatus is available, it is essential that the precipitate should be left for 24 hours to subside, before filtering, owing to the irregularity in the results otherwise obtained.—C. S.

ENGLISH PATENTS.

Bones, skins, &c.; Treatment of various substances such as ——, *for obtaining useful products [Grease, glue, and manure] therefrom.* J. Harger. Eng. Pat. 9779, May 9, 1905. XIV., page 597.

Fertiliser; Manufacture of a ——. R. Hooton and J. Noble, both of Ashton-under-Lyne. Eng. Pat. 10,733A, May 23, 1905.

CLAIM is made for the use of the residue left in the retort on carbonising cottonseed husks or the like, either by itself or with the addition of substances containing phosphates. A substance such as oil or resinous waste may be mixed with the husks prior to carbonisation to render the residue cohesive.—C. A. M.

UNITED STATES PATENT.

Manure from peat: Process of producing ——. C. H. J. von Haeften, The Hague, Holland. U.S. Pat. 821,555, May 22, 1906.

SEE Eng. Pat. 10,023 of 1905; this J., 1906, 327.—T. F. B.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 550.)

Beetroots; Substitution of soda for potash in the ash of ——. J. Urban. Z. Zuckerind. Böhmen., 1906, 30, 397—402.

THE author has examined some beetroot plants grown in a sandy-humus soil manured only with Chili saltpetre. These beets showed an abnormally large development of the green organs, the weight of which was double that of the root, whereas in normal beets the ratio is reversed. The colour of the foliage of these abnormal beets was exceptionally dark green. The author concludes that the composition of the ash, both of the roots and the green portions, is liable to change according to the soil, fertilisation, and other conditions. In the case of the abnormally developed beets the plants had taken up a very high proportion of sodium salts, the quantity of which considerably exceeded that of the potash; at the same time the quantity of total alkali was approximately the same as in normal beets. But although the soda can thus replace an equal amount of potash in the composition of the plant, it was established that the former alkali is not equivalent to the latter so far as the sugar-producing value is concerned. The author shows that the most favourable condition for sugar-production exists when the ratio of potash (K_2O) to nitrogen is about 1:1. The peculiar characters noted in the abnormal beets mentioned above, are attributed to a great preponderance of nitrogen over potash, the ratio of K_2O to N being 1:3·1. —J. F. B.

Sugar beet; Growth of ——, *in Germany during* 1905. Hollrung. Zeit. Ver. deut. Zuckerind., 1906, 446—451.

FOLLOWING the dry weather of 1904, the year 1905 was characterised by low temperature and much rain. The cold, dry April weather was most unfavourable for the sprouting of the beet, which requires at this stage moisture and a free supply of warm air; factors which can, to some extent, be supplied in bad years by ensuring a loose, moist soil. On the whole, the roots were free during the year from any very serious animal or vegetable pests; those observed are mentioned in detail in the paper. In East Germany, there was a marked growth of the beetroots above the surface of the soil due to the dryness and hardness of the ground a short depth below the surface, which prevented the roots from piercing downwards, so that growth forced them out of the ground. Owing to the prevalence of disease among cattle fed on the green leaves of the beet, these leaves were examined for poisonous fungi without such being found. The disease, inflammation of the bowels, is probably due to the fact that a lack of sunshine prevailing, the soluble and deleterious potassium oxalate of the unripe leaves has not been converted into the insoluble and harmless calcium oxalates which occurs in the ripening process. The paper concludes with a series of mechanical analyses of soils from sugar beet farms.—E. F. A.

Sugar beet; Influence of environment on the composition of ——. H. Wiley. U.S. Dept. of Agriculture, Bureau of Chemistry, Bulletin No. 96, 1905.

THIS is a summary of work extending over the five seasons 1900—1904. During this period, a number of experimental stations have collaborated to collect data bearing on the influence of environment on the sugar content of the beet, in order to determine the average potency of such factors as latitude, temperature, rainfall, &c.

Preliminary reports have been issued each year. The same seed—of the Kleinwanzlebener variety—was furnished to each station. Determinations have been made of the yield per acre, percentage of sugar in the beet, and purity coefficient; also of the mean temperature, rainfall, number of clear days, and sunshine. The results are given in tabular form, and also plotted graphically. In spite of many minor modifying circumstances, it has been possible to determine with considerable accuracy the effect of the major features of environment on the composition of the beet.

As a whole, the observations show that latitude, or, in other words, temperature, is the most potent element of the environment in the production of a beet rich in sugar. "As the temperature rises, the proportion of sugar falls." There appears to be but little relation between the percentage of sunshine and the amount of sugar, but the curve for the length of day, which of course is only a function of the latitude, shows a very close correspondence to that for the sugar content, an increase in the hours of daylight corresponding to a larger yield. The influence of this last factor, however, is somewhat modified by the influence of altitude, which affects very materially the sugar without altering the length of day. It is difficult to trace accurately the influence of altitude, but the observations indicate the tendency of the high altitude to compensate for low latitude, and so increase the sugar.

In considering the apparent relationship shown between the total rainfall and the sugar, it must be remembered that the distribution of the rainfall over the year is quite as important a factor as the total fall. The results indicate that the total fall is really greater than the crop would require, if it could be distributed evenly and at the proper times. The rainfall in reality only incidentally affects the amount of sugar in the beet, its great function being related to the magnitude of the crop.

It is an interesting fact that "a small yield, or small sized beets tends to increase abnormally the percentage of sugar in the beet." This, the author states, is due to the fact that the beet has acquired, as the result of long continued selection, a habit of producing sugar, which it exercises even under the most adverse circumstances. The storage room in the small beet being less than in the

large, it becomes more fully charged with the abnormal amount of sugar produced.

For this reason, a deficiency in the rainfall, such as to cause a small crop of undersized beets, has incidentally a tendency to increase the percentage of sugar, whereas an abundant and well-distributed rainfall, by supplying the conditions to grow a beet of abnormal size, will have the opposite effect of diminishing the percentage of sugar in the beet. The same relations govern any direct effect that soil may have on the sugar. An excess of plant food will tend to produce an overgrowth and diminish the sugar content and *vice versa*.

The total changes induced by the rainfall may determine whether or no favourable economic results will be obtained; special interest, therefore, attaches to the experiment on irrigated lands, inasmuch as the control by irrigation of the distribution of water renders the production of a crop practically certain.

Lastly, the experiments bring out in a most convincing manner, that the purity of the juice increases as the proportion of sugar rises.—E. F. A.

Sugar; Storage of beet ——. A. Vermehren. Z. Ver. deut. Zuckerind., 1906, 513—517.

The author has examined from time to time three specimens of sugar stored for a year under proper conditions. Of the specimens, No. 1 was a very dark coloured sugar already a year old, whilst Nos. 2 and 3 were low-grade sugars containing a good deal of calcium salts, and with an acid reaction towards phenolphthalein. After a year, all the sugars had kept excellently: in No. 1, the quotient of purity remained unaltered, and the sample retained its alkalinity towards phenolphthalein. The cupric-reducing power had increased considerably unless the solution tested was precipitated previously with lead acetate; this increase is attributed to the dark colouring matter of the sugar. In No. 2, there was a fall of 0·45 in the quotient of purity, but practically no difference otherwise in spite of the fact that the sugar had an acid reaction when stored; the acidity had only slightly increased, whilst the alkalinity to rosolic acid, though decreasing, was maintained almost to the end. The third sample behaved in a similar manner.—E. F. A.

Lime in sulphited sugar products; Determination [Soap test] of ——. J. de Grobert. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1100—1102.

The determination of lime in the filtered juices from the carbonating process is frequently made by the soap test as employed for the determination of hardness in water. In testing sulphited juices in this manner, it often appears as if the quantity of calcium salts in solution had risen to almost double the value found before sulphitation. Control determinations of the lime as calcium oxalate, show that this apparent increase is really an error, due to the action of the constituents of the sulphited juice on the soap solution. The alkali sulphites in the juice are dissociated on heating, so that a juice which is distinctly alkaline to litmus when hot, may be acid when cold, and therefore capable of decomposing soap. Normal results can be obtained by adding acetic acid to the sulphited juice until it is slightly acid to litmus, and then adding dilute ammonia until the reaction is slightly alkaline.

It is remarked that under normal conditions the soap test always yields rather lower values for lime than the real values determined as calcium oxalate, and that the results require correction by a coefficient which can be established in each particular factory.—J. F. B.

Cane-molasses; Decolorisation [by hypochlorite] of —— for analysis. H. Pellet and C. Fribourg. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1128—1139.

The authors have subjected the process of decolorising sugar solutions and cane molasses by means of calcium hypochlorite to an exhaustive critical study. They find that it is preferable to employ normal lead acetate for defecation in conjunction with the solution of bleaching powder. These reagents when used either separately or together, have no influence on the direct polarisation of the liquid, even in the case of molasses rich in reducing sugars. The hypochlorite when used alone, sensibly increases the lævo-rotation of the solution after inversion for the Clerget test. This action, however, is gradually neutralised by the addition of normal lead acetate, so that when the reagents are used in approximately equal proportions, the polarisation of the inverted acid solution is the same as that of a similar solution without reagents.

In another series of experiments, the authors show that sodium hyposulphite (hydrosulphite) has no useful decolorising effect on solutions of molasses for analysis.—J. F. B.

Molasses; Recovery of sugar from ——. *Utilisation of the "Schleudersalz" [Strontium hydroxide] for washing the saccharate.* K. Andrlik. Z. Zuckerind. Böhmen., 1906, **30**, 402—405.

"Schleudersalz" is the strontium hydroxide which crystallises out when the insoluble strontium "bisaccharate" is decomposed by treatment in the cold, with the production of the soluble "monosaccharate." The utilisation of a hot solution of this strontia, either for the treatment of fresh molasses, or for washing the crude precipitate of strontium "bisaccharate," is rendered very difficult by the fact that the filtration of its solutions is extraordinarily slow. This difficulty has been supposed to be due to the presence of viscous substances, but the author considers that it is caused by the very fine slimy precipitate which is suspended in the solutions, and which clogs the filters. The precipitate is composed mainly of strontium "bisaccharate," strontium carbonate, and calcium carbonate. When the "Schleudersalz" is dissolved, sucrose and raffinose are present, both in the filtrate and in the precipitate, but mainly in the latter. The simplest way of clarifying solutions of "Schleudersalz" is by decantation, for which purpose a pair of settling tanks should be provided above the "bisaccharate" filters. One part of salt dissolved in 5—6 parts of hot water yields a sediment in a quarter of an hour which occupies about one-tenth of the total volume. The clear liquid, containing 15—16 per cent. of $Sr(OH)_2 + 8aq.$, can then be used with perfectly satisfactory results for washing the crude precipitate of strontium "bisaccharate," whilst the sediment can be added to the washed "bisaccharate," and treated with it in the cold chamber.—J. F. B.

Raffinose; Hydrolysis of —— by citric acid. J. Piersaerts. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1143—1146.

The regulated hydrolysis of raffinose by acids yields a mixture of lævulose and melibiose, the specific rotatory power of the products being, according to several observers, $[\alpha]_D^{20^\circ} = 53{\cdot}0^\circ—53{\cdot}5^\circ$. The complete hydrolysis of raffinose requires a much more profound attack, and cannot be effected by acids in a quantitative manner owing to the destruction of the lævulose, and the formation of reversion products. The author has studied the hydrolysis of raffinose by citric acid under the following conditions:—50 c.c. of a 5 per cent. solution of raffinose and 10 c.c. of a 20 per cent. solution of citric acid were heated under a reflux condenser in a round-bottomed flask of 250 c.c. capacity. The specific rotatory power decreased as the time of ebullition was prolonged, from 56° after seven minutes to 43·2° after three hours, at the end of which time the liquid had become yellow owing to the decomposition products of the lævulose. It was observed, however, that there is a period of ebullition, lasting from 10 to 30 minutes, during which the specific rotatory power of the solution remains practically constant between 53·8° and 53·0°, corresponding to a quantitative resolution into lævulose and melibiose. Longer heating with acid of the above concentration, or shorter heating with more concentrated acid caused a partial hydrolysis of the melibiose, increasing with the time. The latitude afforded under the conditions described above is more than sufficient for analytical purposes, and no destruction of the lævulose was perceptible until long after the melibiose stage of hydrolysis had been reached.—J. F. B.

Beetroots; Industrial yield of alcohol from ——. D. Sideršky. XVII., page 603.

Saccharose and raffinose in presence of invert sugar and dextrose; Determination of ——. H. Pellet. XXIII., page 610.

ENGLISH PATENTS.

Sugar; Method of clarifying juices in the manufacture of ——. R. J. Thomas and W. F. S. Howe, Mosman, Queensland. Eng. Pat. 8661, April 22, 1905.

SEE Fr. Pat. 353,568 of 1905; this J., 1905, 1024.—T.F.B.

Sugar; Process of refining ——. K. Dorant, Grodzisk, Russia. Eng. Pat. 21,072, Oct. 17, 1905.

SEE Fr. Pat. 358,659 of 1905; this J., 1906, 276.—T. F. B.

Starch; Process for producing an improved ——. F. Drittler, Rutherford, N.J., U.S.A. Eng. Pat. 7705, March 30, 1905.

ONE hundred parts of dry corn-starch are treated with about 80 parts by weight of a liquid hydrocarbon, and thoroughly mixed. By the term "hydrocarbon" the patentee includes paraffins, olefines, compounds of the benzene series, and some of their substitution products, and, by preference, employs carbon tetrachloride or a mixture of the same with crude paraffin oil. From 40 to 50 parts by weight of sodium hydroxide solution (30° B.) are then added to the starchy mixture when a voluminous dry powder is obtained. From this the hydrocarbon may be removed by evaporation, and the alkali may be neutralised by the addition of a suitable quantity of acetic, tartaric, citric, or other organic acid. The resulting product, either alkaline or neutral, retains the unbroken epidermis of the original starch grains, and is capable of swelling in cold water.—W. P. S.

UNITED STATES PATENT.

Massecuite or syrup; Process of purifying ——. M. Weinrich, Yonkers, N.Y. U.S. Pat. 822,171, May 29, 1906.

SEE Addition of June 9, 1905, to Fr. Pat. 325,882 of 1902; this J., 1905, 1182.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 553.)

Barley; Different diastatic capacities of malt from large-corned and small-corned varieties of ——. G. Ellrodt. Woch. f. Brau., 1906, 23, 243—244.

SINCE the number of embryos in a given weight of a small-corned barley is very much greater than in the same weight of a large-corned barley, and since the diastase is secreted by the embryo, it follows that small-corned malts are far richer in diastase than large ones, and that the former are more suitable for distilleries, where malt is used mainly for conversion purposes, whilst the latter are more suitable for breweries, where the extract of the malt is the chief factor. Haymann has experimented with two types of barley containing approximately the same percentage of nitrogen. The large-corned barley had a weight per 1000 corns of 44·9 grms., and a germinative power of 96 per cent., whilst the small-corned barley had a weight per 1000 corns of 29·5 grms., and a germinative power of only 87 per cent. Both barleys were steeped and germinated under identical conditions, and the diastatic powers were determined at different stages of the growth with the following results:—

Age of green malt.	Diastatic units per 100 grms.	
	Large-corned barley.	Small-corned barley.
days.		
1	120	162
3	195	183
5	356	386
7	485	603
8	502	739

Taking the price of the large-corned brewing barley at 15 marks per 100 kilos. and that of the small-corned distillery barley at 12 marks, it is calculated that the unit of diastase costs double as much in the large-corned malt as in the small-corned malt, and, consequently, the choice of the latter for distillery purposes is justified in spite of its lower germinative capacity.—J. F. B.

Malt; Sterilisation of ——. J. E. Brauer. Chem.-Zeit., 1906, 30, 529—530.

THE author recommends "bacillol," a product prepared by dissolving tar-oil in soap solution, and containing about 52 per cent. of cresols, as a disinfectant for malt, and states it to be capable of killing all fungi and bacteria without either interfering with the growth of the grain and activity of the diastase, or importing any taste or odour to the mash. After preliminary steeping of the malt for three hours with water, and subsequent washing, the grain is soaked for three hours with a $\frac{1}{4}$ to 1 per cent. solution of "bacillol" in water whereby all micro-organisms are destroyed. "Bacillol" is also applicable for sterilising the malt room, which is best effected by allowing the concentrated solution to evaporate in shallow pans.—E. F. A.

Diastatic saccharification; New researches on ——. L. Maquenne and E. Roux. Comptes. rend., 1906, 142, 1059—1065.

STARCH pastes of different origins were saccharified by malt at a temperature of 50° C., and the proportions of maltose produced were determined at intervals during four days, the results being calculated per cent. of the original weight of dry starch taken. The conditions of alkalinity of the media were varied in a definite manner, being either "normal," *i.e.*, the natural alkalinity of the starch and malt extract, "optimum" *i.e.*, with the addition of acid to the extent indicated in this J., 1906, 192, or "neutral" to methyl orange. The "optimum" condition of alkalinity, recognised in the dextrinification of the starch paste, is also found to be the most favourable for the production of maltose. Saccharification does not really stop at any intermediate stage, but proceeds to the end if sufficient time be allowed. The reaction can, however, be divided into two very distinct phases, the first of which takes place with extreme rapidity, and corresponds to the conversion of 70—85 per cent. of the starch into maltose, whilst the second phase, in which the remaining 15 per cent. of the original starch is saccharified, proceeds very slowly, and may extend over several days. This is regarded as evidence of the existence in crude starch of two constituents unequally sensitive to the action of amylase, one of the components, *i.e.*, pure amylose, being very readily saccharified, whilst the other, *i.e.*, amylopectin, is saccharified with great difficulty, but is nevertheless a true maltosane, distinguished from amylose by its insolubility in alkalis. The addition of small quantities of acid to malt extract lowers the power of resistance of the amylase to heat (temperature 58° C.) to an extent corresponding with the degree of neutralisation of the natural alkaline reaction by the acid. Hence the falling off of the saccharification when the medium is fully neutralised by acid is due to the rapid destruction of the amylase. The influence of the addition of acid to a malt extract, intensifying at first, and subsequently destructive, suggests to the authors that the amylase exists in the form of an unstable salt or compound with the basic mineral or nitrogenous constituents, *i.e.*, as a partially dissociated zymogen, more stable than the free amylase itself. The acid function recognised in starch is probably sufficiently pronounced to liberate the amylase from the zymogen. The extreme instability of free amylase would account for the fact that a slight alkalinity, equal to about two-thirds of the natural alkalinity, must be retained if the maximum intensity of saccharification is desired. Owing probably to the amphoteric nature of the amino-acids produced by the proteolytic enzyme, the reaction of the medium tends to re-adjust itself by a species of auto-regulation during saccharification. If the initial alkalinity is very high, as in the case of rice starch pastes, the alkalinity decreases in the course of saccharification; on the other hand, if the

initial alkalinity be reduced to the "optimum," or neutralised altogether by the addition of acid, it will be found to have increased at the end of the saccharification.
—J. F. B.

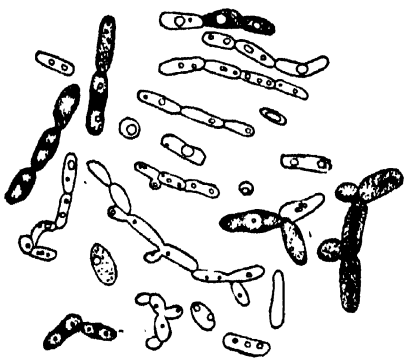
Mycoderma; Influence of —— on the reproductive and fermentative properties of yeast. I. A Kossowicz. Woch. f. Brau., 1906, **23**, 262—263.

In experiments made with a view of testing the existence of Wildier's "bios," the author made the observation that infection by mould fungi favoured the development of very minute quantities of yeast cells in mineral nutrient media under conditions in which similar or even larger quantities of pure yeast failed to develop. Mycodermæ also have a similar effect. Moulds and mycodermæ, even when they have no fermentative power, are capable of assimilating ammonium salts, and they excrete large quantities of invertase; they thereby assist the yeast in artificial media composed of cane sugar and saline nutrients. Mixtures of yeast and mycoderma can produce fermentation more readily than either in the pure state. It was found that a small quantity of yeast, which in the pure state showed a very small reproductive development, and produced no visible fermentation, multiplied a thousand times more strongly when mixed with a few cells of mycoderma, and set up a vigorous fermentation under the same conditions.

Lindner remarks, in connection with the above observation, that in the pressed yeast ("Lufthefe") industry, the practical man knows that the highest yield of yeast is obtained when there is a slight infection by mycoderma. It has always been assumed that such yeast is of inferior quality, but possibly this is not really the case. Perhaps the two organisms work together more vigorously than otherwise, owing to the fact that the mycoderma is able to assimilate the more or less poisonous metabolic excretion products of the yeast.—J F. B.

Mycoderma yeast; New variety of —— as a cause of saké disease. T. Takahashi. Bull. Coll. Agric., Tokyo, 1906, **7**, 101—104.

The author has recently examined a "turned" saké,



which proved to be infected with a new mycoderma yeast, which the author has named *Mycoderma saprogenes saké*. The saké contained 8·1 per cent. of alcohol by vol., 0·36 per cent. of free acid, and 1·5 per cent. of extractive matters. Pasteurised saké containing 17 per cent. of alcohol by volume was attacked when inoculated with this mycoderma yeast; after 10 days at 20°—28° C., the amount of alcohol was reduced to 9·37 per cent. *Mycoderma saprogenes saké*, as obtained by Lindner's droplet method, forms elliptical filamental or sausage-shaped cells, rarely globular (see figure). Two or three fat globules are frequently seen in the large cells. The yeast assimilates dextrose, levulose, sucrose, maltose, and galactose; ferments dextrose and galactose very feebly, but not levulose, sucrose, and maltose; and does not assimilate nitrates or nitrites. It rapidly oxidises alcohol to carbon dioxide and water, with formation of only a trace of organic acids. The growth of the yeast on koji-extract-agar, koji-extract-gelatin, wort-agar, bouillon-agar, wort-gelatin, and saké-agar is described. The yeast develops best at 25° C. It is distinguished from other varieties of mycoderma by its inability to ferment levulose, sucrose, and maltose, and also by the growth of stab-cultures on saké-agar. Also it differs from *Mycoderma cerevisiæ vini.* in that it develops readily on Mayer and Nägeli's solution containing 9 per cent. of alcohol, whilst Hayduck's solution containing 2 per cent. or 4 per cent. of acetic acid is unfavourable for its growth. The yeast is destroyed by exposure to a temperature of 70° C., or on exposure to 55° C., for five minutes. Its resistance to alcohol is considerably diminished by long artificial culture.—A. S.

Emulsin; Secretion of —— by yeast. L. Guignard. Bull. des Scien. pharmacol., 1906, **13**, 75; Woch. f. Brau., 1906, **23**, 252.

The fresh juice of elderberries contains no emulsin, and is entirely without action on amygdalin. But after the juice has started fermenting, the presence of hydrocyanic acid can be detected after 48 hours, and the reaction increases in intensity with the time. The author has isolated from the fermenting juice a species of yeast which appears to be *S. Pastorianus*, and which, like bakers' yeast, possesses the property of splitting up amygdalin. The yeast cells, therefore, secrete emulsin or a similar enzyme during the process of fermentation.—J. F. B.

Sarcina [in brewery yeast]. N. H. Claussen. Z. ges. Brauw., 1906, **29**, 339—342.

The sarcina of Bettges and Heller (this J., 1906, 227) agrees in properties with the author's *Pediococcus damnosus* (this J., 1904, 332). Like the latter, the above sarcina is also resistant to the action of acid ammonium fluoride, as is shown by the experiments of Bettges and Heller, although these authors arrive at the opposite conclusion. In some cases pediococcus forms apparently die when cultivated on gelatin plates, but this is due to lack of space preventing the organisms from developing. That these micro-organisms require room for their development is shown by the fact that the largest colonies always form in the body of the gelatin, where the concentration of cells is least.—T. H. P.

Milk and beer: The ropy fermentation of ——. F. C. Harisson. Rev. gen. du lait, 1906, **5**, 145; Woch. f. Brau., 1906, **23**, 252.

The author has studied a number of species of bacteria from ropy milk, and a species, *B. lactis aërogenes*, from ropy beer. These bacteria were isolated from a dairy in which ropy fermentation had become established. The author divides the bacteria into four classes: those previously studied by other authors and those isolated for the first time by himself, all from ropy milk; those belonging to the group of *B. lactis aerogenes*, and lastly, two coccus forms which were isolated from milk, and from the gullet of a dog. The nature of the ropy substance developed in the milk is not perfectly understood, but it is intimately connected with the body-substance of the organisms themselves, which possess a more or less strongly developed capsule. This substance is precipitated by acetic or hydrochloric acid. Alkalis dissolve the ropy masses; the ropiness of the liquid is not diminished by heating for 20 minutes at 100° C. The ropiness is developed just as much under aërobic conditions as in absence of air; oxygen has no influence on its formation. As a general rule the ropiness is proportional to the degree of development of the bacteria, so long as the reaction of the medium does not become acid.—J. F. B.

Champagne wines; Biological studies on ——. F. A. Cordier. Bull. des Scien. Pharmacol., 1906, **13**, 77; Woch. f. Brau., 1906, **23**, 252.

The wines of the Champagne and northern districts of France are generally fermented by only a single species of yeast, whilst those of the southern districts are always fermented by several species. In the Champagne wine there is a residue of lævulose remaining after the primary fermentation. This sugar is then fermented only with

great difficulty, and forms an obstacle to the rapid clarification of the wine; it also makes the wine particularly liable to ropy fermentation. In order to effect the rapid fermentation of the lævulose, the author has cultivated the typical yeast of the Champagne district for a prolonged period on solid artificial media containing no other sugar than levulose.—J. F. B.

Sachsia suaveolens: the wine-bouquet fungus. P. Lindner. Woch. f. Brau., 1906, **23**, 258—260.

Sachsia suaveolens was discovered by the author 18 years ago on the walls of the fermentation room of a distillery. It grows either in yeast-like forms or in mycelial threads with hyphæ like the mould fungi, and it produces a pleasant odour of fruity ethers. The fungus, when grown on wort-gelatin, gradually assimilates the whole of the culture medium, and forms a tough film of greenish colour. In presence of air a considerable accumulation of fat globules is observed. One of the most striking properties of this fungus is its very high attenuating power in beer wort. It is far stronger in this respect than the ordinary culture yeasts, and is equal to *Schizzosacch. Pombe* and *octosporus*. It ferments dextrin, dextrose, levulose, cane sugar, and maltose strongly, galactose, milk sugar, and β-methylglucoside moderately, and mannose and raffinose slightly. If air be excluded from a wort which has already been fermented by *Sachsia*, a further development of the fungus takes place, but the cells assume quite a different morphological form and manner of growth. The fungus produces an appreciable quantity of acid in the course of fermentation. In hopped wort of 14·3° Balling. it produced 6·9 per cent. of alcohol by volume, and the product had the flavour of porter. The most favourable temperature for its development lies between 20° and 25° C.; very little growth takes place above 30° C. In de-alcoholised beer the fungus produced a further quantity of 3·2 per cent. of alcohol by volume, Wibiral has invented a non-alcoholic drink by developing the fungus in apple juice or in a mixture of apple juice and wort soured by the lactic acid ferment. The growth is stopped as soon as the fungus film has been formed and alcoholic fermentation has commenced. The liquid is filtered, and saturated with carbon dioxide; the product somewhat resembles Moselle wine.—J. F. B.

Vinegar factory; Annual report of German experimental ——. F. Rothenbach. Woch. f. Brau., 1906, **23**, 260—261.

The report for 1906 deals with the introduction of pure cultures of bacteria in the experimental acetifiers. In the ordinary acetifiers the vinegar comes out with an acidity of 14·7—14·5 per cent. The vinegar from the acetifiers working with pure cultures is not so strong. *B. xylinum* can be detected in nearly all the acetifiers, although no visible formation of slime is observed either in the acetifiers or in the vinegar. The presence of enzymes in the acetifying bacteria could not be ascertained with certainty by the guaiacum and hydrogen peroxide test, since the bacteria yielded a blue coloration even after boiling. A wine-vinegar bacterium which yields on the large scale a vinegar of 8·0—8·5 per cent. strength has been isolated; this has even been acclimatised to an acidity of 11·2 per cent. Henneberg has obtained several species of bacteria from wine-vinegars which will acetify wine-vinegar worts up to 9 per cent. acidity, and are therefore useful in practice; they are being prepared and sold in the form of pure cultures. According to Henneberg, a temperature of 48°—50° C. maintained for a few minutes is sufficient to pasteurise "lager vinegar" effectively. The observation of Buchner and Meisenheimer that vinegar fermentation is due to the activity of enzymes secreted by the bacteria is confirmed. The tendency of some vinegars to frothing is attributed to a deficiency of carbon dioxide in their composition. Carbon dioxide is one of the fermentation products of the "quick" vinegar process. A vinegar of moderate acidity dissolves iron at the ordinary temperature; defective enamelled iron vessels are not suitable for the storage of vinegar.—J. F. B.

Beetroots; Industrial yield of alcohol from ——. D. Sidersky. Bull. Assoc. Chim. Suer. Dist., 1906, **23**, 1090—1092.

As the result of a prolonged period of very careful control of the weights and composition of the beetroots taken into work in the distillery, it was established that in the season 1905–6, 10,403 tons of beets were employed, and 6951 hectolitres of absolute alcohol, measured in the phlegms, were obtained: a yield of 66·81 litres per ton of beets. The beets were treated by diffusion, and the above weight represents cleaned beets ready for treatment; the loss of sugar in the diffusion amounted to 0·33 per cent. From the above data it is calculated that the yield amounted to 59·22 litres of absolute alcohol per 100 kilos. of sugar entering the factory, or 60·10 litres per 100 kilos. sent into the fermentation system. The author suggests that in beet-juice distilleries, the development of the yeast takes place without any appreciable expenditure of the saccharine constituents of the juice.
—J. F. B.

English Patents.

Kilns or oasts for drying hops, malt, and the like; Impts. in ——. The Electric and Ordnance Accessories Co., Ltd., Birmingham, R. Hancock, London, and R. F. Hall. Eng. Pat. 15,691, Aug. 1, 1905.

The air for drying the hops is passed through a tubular heater placed within the kiln, but at such a distance below the perforated drying floor that the materials are not directly influenced by the tubular heater. The latter is heated by steam from an external source of supply, and fans may be used to force the air through the heater.
—W. H. C.

Ethereal oils from blooms of hops; Extraction of ——. L. Nathan, Zurich, Switzerland. Eng Pat. 519, Jan. 8, 1906. Under Int. Conv., Jan. 19, 1905.

The essential oils of the hop blooms are extracted by a current of heated carbon dioxide, the gas being subsequently cooled to obtain the oils. The dried hops are added to the wort before boiling, and the oils extracted can be advantageously added after the boiling.—F. Shdn.

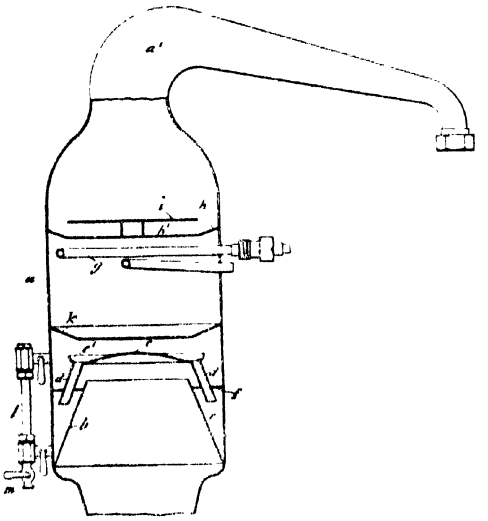
Beer, ale, and other liquids; Process and apparatus for fermenting ——. A. E. Edwards, London. From The Pfaudler Co., Rochester, N.Y., U.S.A. Eng. Pat. 18,658, Sept. 15, 1905.

The fermentation vessel consists of a closed iron tank, enamelled internally. The pitched wort is introduced into the tank up to a certain level, and is then stirred and aerated intermittently every three or four hours by the passage of a relatively strong current of air introduced near the bottom of the tank. The air is cooled, sterilised, and filtered by pumping it through a system of cooling pipes, then through towers containing gravel and a sterilising solution, *e.g.*, permanganate, and finally through cotton-wool. When fermentation has set in, a white foam forms on the top of the wort; the air current is then connected with a very fine distributing nozzle, and aeration of the wort is continued steadily for six to eight hours. As fermentation proceeds, after aeration is finished, the gas escaping from the pipe in the head of the tank gradually becomes richer in carbon dioxide, and when a test shows that this gas is approximately free from air, it is diverted by means of a 3-way cock into a pipe leading to the compressor. Fermentation is continued for five to six days, the maximum temperature being limited to 11° C. by means of an attemperator. When the gravity has fallen to 1 per cent. above the desired final gravity, holes in the upper part of the tank just above the level of the liquid are opened, and a current of sterilised air is admitted to the top of the tank by way of the gas-escape pipe. The whole of the carbon dioxide is thus expelled, and the last stages of fermentation are conducted in the presence of a gentle stream of pure air. After the beer is well "broken," its temperature is lowered to about 4° C., and it is drawn off through a racking device situated in the bottom of the tank into a chip-cask; the residue of yeast is then removed. The total duration of fermentation in the tank is seven to eight days.—J. F. B.

Fusel oils; Manufacture of ——. E. A. Mislin, Prague, and L. Lewin, Vienna. Eng. Pat. 10,435, May 18, 1905.

See Fr. Pat. 354,807 of 1905; this J., 1905, 1121.—T. F. B.

Distilling apparatus [Alcohol, &c.]; Impts. in ——. J. H. Covell, Montague, Cape Colony. Eng. Pat. 15,371, July 26, 1905.



The still head, *a*, has a horizontal cooling coil, *g*, for the purpose of causing the condensation of the higher boiling portions of the vapour coming from the still. Baffle plates, *i*, *h*, the latter being perforated as shown at, h^1, are arranged above the coil to assist in the condensation, and the condensed liquid is directed by the cone, *k*, on to the drip-plate, *c*, c^1, from which it flows by the pipes, *d*, into the chamber, *e*, formed by the cone, *b*, and the plate, *f*. The heavier liquids collect in, *e*, and when the gauge glass, *l*, shows that sufficient liquid has accumulated, it is drawn off through the tap, *m*. The uncondensed vapours pass on by the "swan neck," a^1, to the condenser.—W. H. C.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, sewage, waste or spent dyes, and the like, the evaporator being also applicable as a smoke washer. A. B. Lennox and P. Dawson. Eng. Pat. 9572, May 6, 1905. XVIII*B*., page 605.

Distillery refuse known as "pot ale" or spent wash; Treatment of ——, *for the production of fuel.* J. T. Connell, F. F. Haldane, and J. Thomson, all of Edinburgh. Eng. Pat. 13,914, July 6, 1905.

The spent wash, after being evaporated to a syrupy or viscuous condition, is forced by suitable means into a boiler furnace already containing a bright hot coal fire. The syrup may also be mixed with powdered coal, cinders, peat, or the like, and pressed into cakes or briquettes for use as fuel in ordinary grates.—W. P. S.

United States Patent.

Distillery "slop"; Desiccated ——, *and process of making same.* G. F. Ahlers. U.S. Pat. 821,326, May 22, 1906. XVIII*A*., next column.

German Patent.

Wood spirit; Continuous process for the preparation of pure, concentrated ——. J. Farkas. Ger. Pat. 166,360, Aug. 11, 1904.

Crude wood spirit is distilled, and the vapours are first passed through lime water, then through a warm, concentrated alkali solution (15°—20° B.), afterwards washed with stearic or other fatty acid, and finally with alkali to remove any entrained fatty acid. This treatment has the effect of removing all the aldehydic resins, higher alcohols, ketones, &c., which formerly had to be eliminated in a separate process.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 555.)

(*A*.)—FOODS.

Cocoa-nut fat in butter; The "silver-value" method for the detection of ——. F. Jean. Ann. Chim. anal. appl., 1906, **11**, 121—124. Chem. Centr., 1906, **1**, 1716.

The author states that whilst Wijsman and Reijst's method (this J., 1906, 324) may be useful for confirming the presence of cocoa-nut fat in butter, results obtained by it indicating the absence of cocoa-nut fat are of no value. In 12 cases, in which the presence of cocoa-nut fat was shown by Müntz and Coudon's method (this J., 1904, 704), Wijsman and Reijst's method failed to detect it, and the untrustworthiness of the process was further confirmed by tests with mixtures prepared artificially. —A. S.

Fats; Action of iron and manganese salts in producing rancidity of ——. P. F. Dalczki. XII., page 595.

Camels' butter; Analytical values of ——. J. Vamvakas. XII., page 595.

Milk and beer; The ropy fermentation of ——. F. C. Harisson. XVII., page 602.

English Patents.

Liquids [Milk, &c.]; Method of treating ——, *by means of hydrogen peroxide.* F. Z. Franzén, Stockholm. Eng. Pat. 9703, May 8, 1905. Under Int. Conv., June 23, 1904.

See Fr. Pat. 355,457 of 1905; this J., 1905, 1184.—W.P.S.

Flour; Method of and apparatus for treating —— *with gases.* M. A. and C. P. Eybert, Livron, France. Eng. Pat. 26,777, Dec. 22, 1905. Under Int. Conv., July 18, 1905.

See Addition of July 18, 1905, to Fr. Pat. 353,179 of 1905; this J., 1905, 1319.—T. F. B.

United States Patent.

Distillery "slop"; Desiccated ——, *and process of making same.* G. F. Ahlers, Covington, Ky. U.S. Pat. 821,326, May 22, 1906.

A dry fodder is prepared from distillery slop by separating the latter into solid and liquid portions. The solid portions are dried to a granular and absorbent condition, whilst the liquid portions are concentrated to a syrup, which is then incorporated with the absorbent granular portion, and the whole is dried. The product may be mixed with starchy materials to form a properly balanced foodstuff.—J. F. B.

(*B*.)—SANITATION; WATER PURIFICATION.

Water gas and other gases in factories; Memorandum as to the use of ——. Home Office Memorandum (Form 827), May, 1906. [T.R.]

This memorandum contains a short summary of the accidents which have occurred through carbon monoxide poisoning during the last seven years, with a list of the causes to which they were traced. An account of the symptoms of this poisoning, and preventive measures to be adopted are given, and a notice, intended to serve as a model of one to be posted up near the place where danger exists, is appended.

English Patents.

Evaporator for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, sewage, waste or spent dyes, and the like, the evaporator being also applicable as a smoke washer. A. B. Lennox, Newcastle-on-Tyne, and P. Dawson, Glasgow. Eng. Pat. 9572, May 6, 1905.

The evaporator, which may consist of several compartments of increasing area, is fitted either within the furnace flue or other source of heat, or connected with the flue, or within a casing fitted over and adapted to constitute part of the flue between the furnace or other source of heat and the chimney or outlet. The evaporator consists of a series of open-ended iron pipes or square casings fixed approximately smoke-tight into suitable orifices in a plate or plates adapted to cover the orifice from the flue, so that the hot gases travelling towards the chimney, pass through the pipes or casings. The liquid to be evaporated is sprayed into the interior of the outer casing, above the upper end of the evaporator, and passes down through the tubes, the remaining liquid being collected, and re-delivered through the sprays. Means for cleaning the evaporator tubes are provided, and a fan may be employed when the natural draught is not sufficiently strong. When the apparatus is used as a smoke washer, the smoke from the furnace is subjected to the scrubbing action of pure liquid.—T. H. P.

Ammoniacal liquor obtained by washing illuminating and heating gases; Treatment of certain products of ——. J. Radcliffe. Eng. Pat. 10,075, May 13, 1905. III., page 584.

French Patent.

Water and other liquids; Apparatus for the purification of ——. P. G. Griffith. Fr. Pat. 360,970, Dec. 27, 1905. Under Int. Conv., Dec. 31, 1904.

The invention relates to an apparatus by means of which water or other liquid is heated to a temperature of from 65° to 85° C. for a period of not more than 25 seconds, and then rapidly cooled, in order to destroy any pathogenic organisms present. The water to be treated is received in a tank, provided with a ball-tap, and from this flows down a pipe to a space at the bottom of a cylindrical vessel fitted with a large number of tubes. The number of the latter is such that the space between the tubes and the walls of the cylinder is about equal to the capacity of the tubes. The tubes project through the top and bottom covers of the cylinder so that the water delivered by the above mentioned pipe passes upwards through them, and is then led into the lower part of a heating apparatus. This consists of four concentric cylinders connected with one another, the innermost one being heated by a flame placed under it. A small chamber placed at the top of the innermost heating cylinder is provided with a valve, regulated by a capsule containing a liquid of constant boiling point, which allows the water to escape only when heated to the desired temperature. The heated water is then conducted to the space in the tubular apparatus outside the tubes, where it is cooled by the water flowing through the tubes. Corrugated metallic sheets may be placed in this space to accelerate the cooling. A second valve is provided at the top of the heating chamber to allow of the escape of air. The water leaves the cooling cylinder through a pipe at the bottom, which pipe extends upwards so as to keep the cylinder full of water. (See also Eng. Pat. 17,984 of 1904; this J., 1905, 811.)—W. P. S.

(C.)—DISINFECTANTS.

Phenol [as a disinfectant]; Efficacy of ——, *compared with other poisons.* Th. Bokorny. Chem.-Zeit., 1906, **30**, 554—556.

The author has compared quantitatively the effects of certain organic poisons on simple organisms such as yeast. The first four items in the following table are his results, the others being collected for comparison:—

	Weight in grms. required to kill 10 grms. of yeast.
Phenol	0·05 —0·1
Formaldehyde	0·02 —0·04
o-Hydroxybenzaldehyde	0·25 —0·5
Acetic acid	0·2 —0·4
Copper sulphate	0·001—0·0025
Mercuric chloride	0·005—0·01
Silver nitrate	0·01 —0·02
Lead acetate	0·05 —0·1
Caustic soda	0·05 —0·1
Potassium permanganate	0·02 —0·05
Chlorine	0·015—0·03
Tannic acid	0·5 —1·0

Substances, such as acetaldehyde, which act as a poison to moulds when present in sufficient quantity, may in more dilute solutions act as a food, assisting their growth.—F. Sodn.

Disinfectants from naphthols. H. Schneider. Z. Hyg., 1906, **52**, 534—538. Chem. Centr., 1906, **1**, 1680.

The naphthols can be dissolved in alkali carbonate solutions, and the author states that such solutions contain the naphthol in the free state, not combined with the alkali, and have a considerably greater disinfecting power than solutions of alkali naphtholates. Dry mixtures of naphthol and anhydrous sodium carbonate can be kept for any length of time without undergoing alteration. The most effective mixture is one containing equimolecular proportions of naphthol and carbonate; with such a mixture, a 1 per cent. solution of the naphthol is the strongest obtainable. By increasing the proportion of sodium carbonate, more naphthol can be dissolved, but the disinfecting power of the dissolved naphthol is reduced. The solutions exert a disinfecting action on vegetative forms of anthrax, more than twice as great as that of "Lysol." Staphylococci and typhus bacilli are destroyed in a very short time by 0·5 and 1 per cent. solutions of β-naphthol and alkali carbonate. α-Naphthol has a similar action, but is not so useful in practice as β-naphthol, owing to its dearer price and its inferior keeping qualities.—A. S.

English Patents.

Gaseous mixture [Sulphur dioxide, &c.] for extinguishing fire, killing insects, &c.; Apparatus for the production and distribution of a ——. R. Marot, Paris. Eng. Pat. 9536, May 5, 1905.

The claims relate to improvements in the apparatus described in Eng. Pat. 14,372 of 1904 (this J., 1904, 879). The improvements consist mainly in arrangements for the rapid production of a large quantity of sulphur dioxide, liquid sulphurous acid being employed. The vaporised acid is mixed with a regulated supply of air, the cold produced by the vaporisation of the acid being used to cool the water-jacket of the motor. The mixture of gases then receives the addition of a further quantity of heated sulphur dioxide before being led into the chamber where it is subjected to the electric discharge (see original specification). A fan is provided to draw the mixture from the electric chamber, and to discharge it wherever required. When the motor is only used for re-aspirating the mixture of gases from the place where it is required, an arrangement is provided, by means of which the water-jacket of the motor is separately cooled. Besides being heated by the combustion gases of the motor, the heating chamber is also supplied with a source of heat from a series of Bunsen burners.—W. P. S.

Vegetation; Materials for the destruction or retarding of ——. [*Weed-killer.*] A. Blackie, Tunbridge Wells. Eng. Pat. 10,450, May 18, 1905.

The claims of this patent are for the use of solutions of boric acid and soluble borates, or mixtures of the same as weed-killers. Other substances may be added to the solutions.—W. P. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page 556.*)

Cellulose acetates; Studies on ——. H. Ost. Z. angew. Chem., 1906, 19, 993—1000.

THE three processes for preparing soluble acetates of cellulose which have been investigated by the author, *viz.*, Cross and Bevan's process by the action of zinc acetate and acetyl chloride, Lederer's process by the action of acetic anhydride and sulphuric acid on hydrocellulose, and Bayer's process by the action of the same reagents on normal cellulose, all yield the same product, triacetylcellulose $C_6H_7O_5(C_2H_3O)_3$. At the same time, the author is inclined to doubt whether a triacetate of normal cellulose really exists, and to regard these products as the triacetates of a series of hydrocelluloses of varying degrees of degradation, the position of any member in the series being determined by the relative viscosity of its solution, and the elasticity of its films. The author estimates that the relation of such a hydrocellulose to the normal cellulose may be expressed by the fixation by hydrolysis of 1 mol. of water on to 6 mols. of cellulose. The incipient hydrolysis of the cellulose which appears to be a condition necessary for the esterification, may be effected either simultaneously, as in Bayer's process, or in a separate preliminary operation, as in Lederer's process. The author contends that the cellulose acetate obtained by Cross and Bevan's process is not a tetracetate as asserted by the discoverers, but a triacetate identical with the other products. The error which is thus stated to exist in the latter authors' work is attributed to the fact that the saponification of these esters by boiling aqueous-alcoholic potash is accompanied by the production of acids at the expense of the cellulose residue, and that the results of saponification are too high. The author prefers to effect the hydrolysis by means of equal volumes of sulphuric acid and water, acting in the cold for about 48 hours, and to distil off the acetic acid in a current of steam for 4—5 hours. The production of all these triacetates is preceded by the production of diacetates, which can be isolated by stopping the reaction whilst still incomplete. The analogy between the acetate and nitrates of cellulose is complete; in both cases the highest limit of esterification corresponds with the substitution of three hydroxyl groups in each C_6 unit, the products not being esters of normal cellulose but of modified, hydrolysed, or oxidised derivatives of cellulose.
—J. F. B.

ENGLISH PATENT.

Polychloranilines; New derivatives of certain —— [*Substitutes for camphor in manufacture of celluloid*]. Badische Anilin und Soda Fabrik. Eng. Pat. 8077, April 3, 1906. XX., page 608.

UNITED STATES PATENT.

Paper; Watermarking of ——. W. K. Trotman, Wood Green. U.S. Pat. 821,206, May 22, 1906.

SEE Eng. Pat. 13,184 of 1905; this J., 1905, 1320.—T. F. B.

FRENCH PATENTS.

Cellulose preparations; Apparatus for boiling impure liquids, especially those which, during the heating, deposit sediment or solid matter of any kind, and in particular ——. H. Kestner. Fr. Pat. 361,248, Dec. 4, 1905.

THE liquid to be evaporated is heated in a number of tubes set at a slight angle to the vertical. The upper ends of these tubes open out into a wide vessel, and the lower ends communicate by means of a wide bent pipe with a horizontal cylindrical vessel, which is joined by another wide vertical pipe to the upper vessel. The liquid rises through the heating tubes, carrying with it the solids separating out, which are buoyed up by bubbles of steam. On emerging into the upper vessel, these bubbles break, and the liquid *plus* suspended matter falls through the wide vertical pipe into the lower cylinder, where the suspended matter collects, the liquid again circulating upwards through the heating tubes, and being further concentrated.—A. G. L.

Soap; Manufacture of a dry ——, *from colophony and soda* [*for paper sizing*]. M. Douxami. Fr. Pat. 361,154, Dec. 29, 1905. XII., page 596.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page 560.*)

Aconitine and aconine from Aconitum napellus. H. Schulze. Arch. Pharm., 1906, 244, 136—159.

THE author gives a complete historical survey of previous investigations of aconitine and aconine. The author used aconitine obtained from *Aconitum napellus*, and after crystallising from methyl alcohol the m.pt. was 197°—198° C. Analyses of the base and its derivatives point to the formula $C_{34}H_{47}NO_{11}$, or $C_{34}H_{45}NO_{11}$. The base was hydrolysed by heating under 6—7 atmospheres pressure in an autoclave, when there was an 85 per cent. yield of aconine. Aconine hydrochloride, $C_{25}H_{39}NO_9,HCl,2H_2O$, or $C_{25}H_{41}NO_9,HCl,2H_2O$, melted at 175°—176° C. The hydrobromide, $B,HBr,1\frac{1}{2}H_2O$ (taking B, as alkaloid base) melted at 225° C. Aconine contains one N-methyl group and four methoxyl groups. Although a tertiary base, it does not react with methyl iodide or methyl sulphate. The free hydroxyl groups are alcoholic in character, not phenolic. By treating aconine with acetyl chloride, tetra-acetylaconine, $C_{33}H_{43}NO_{13}$, or $C_{33}H_{47}NO_9$, m.pt. 231°—232° C., is obtained. The author finds that tetra-acetylpikraconitine (=triacetylaconitine) m.pt. 207°—208° C., gives an amorphous gold salt of normal constitution. If aconitine be heated with methyl alcohol in a sealed tube to 120°—130° C., a methoxyl group takes the place of the acetyl group. The hydrobromide of the new base, $C_{32}H_{47}NO_{10},HBr,3H_2O$, melts at 188°—189° C. The hydrochloride, $B,HCl,3H_2O$, melts at 190° C. On heating this base with water for 24 hours to 150°—160° C., it decomposes into benzoic acid, methyl alcohol, and aconine. The author considers that the acetyl and benzoyl groups in aconitine are in neighbouring positions. Aconitine is stable to permanganate in acid solution. By oxidation with chromic acid a small quantity of a base was obtained, together with a larger proportion of a substance possessing acid and basic properties. The hydrochloride of the base, $C_{24}H_{37}NO_8,HCl,3H_2O$, or $C_{24}H_{35}NO_8,HCl,3H_2O$, melted at 213° C. It is oxidised by permanganate in acid solution.—F. SHDN.

Aconitine and aconine from Aconitum napellus. H. Schulze. Arch. Pharm., 1906, 244, 165—196.

IN this paper the author gives the experimental details of the results recorded in a previous paper (see previous abstract). The analytical figures and the melting point of the aconitine obtained by the author from the roots of *Aconitum napellus* agree with those obtained by Freund and Beck (this J., 1904, 1042). A crystallographic examination of aconitine was made. From his results the author concludes that the aconitine obtained by Dunstan from English aconite root is identical with the German crystalline aconitine. This is opposed to the view recently expressed by Dunstan (this J., 1905, 1252).—F. SHDN.

Ephedrine; Conversion of —— *into pseudo-ephedrine.* E. Schmidt. Arch. Pharm., 1906, 244, 239—240.

EPHEDRINE can be converted into pseudo-ephedrine by heating with 25 per cent. hydrochloric acid on the water-bath for 12 hours. The transformation is not complete, but good yields of pseudo-ephedrine are obtainable. The pseudo-ephedrine thus produced, is chemically, optically, and crystallographically identical with the natural base. Whilst ephedrine is lævo-rotatory, pseudo-ephedrine is more strongly dextro-rotatory. Both substances on exhaustive methylation yield an unsaturated alcohol, C_9H_9OH, but the alcohols differ in their boiling points.
—F. SHDN.

Musk; *Presence of an odorous ketone, muskone in* ——. Schimmel's Report, May, 1906, 94—96.

500 GRMS. of musk, when submitted to prolonged distillation with steam, gave 1·4 per cent. of strong smelling brown oil on shaking out the aqueous distillates with ether, and evaporating the solvent. The chief constituent of this oil is a ketone. This was isolated by saponifying the oil, washing with water, in order to remove fatty acids and fats, and then subjecting it to fractional distillation under 2 mm. pressure, when the ketone distilled at 142°—143° C. It forms a viscous colourless oil with an intense and pure musk odour. Under 752 mm. pressure it boils at 327°—330° C.; sp. gr. at 15° C. 0·9268; $a_D = -10° 6'$; $n_D^{25°} = 1.47900$; soluble in alcohol in all proportions. It gives analytical figures agreeing with the formula $C_{15}H_{28}O$ or $C_{16}H_{30}O$. It forms crystalline compounds with hydroxylamine and with semicarbazide; the semicarbazone, purified by recrystallisation from alcohol, has the m. pt. 133°—134° C. The fine white prisms of the semicarbazone are absolutely odourless, but develop the powerful odour of muskone when a trace is heated with dilute sulphuric acid. Muskone is considered to be the sole odorous principle of value in musk, other odorous bodies present being unpleasant.—J. O. B.

Oils of Galician fennel and Laurus mobilis leaves; *Essential* ——. Schimmel's Report, May, 1906, 36—39; 43.

IN addition to the previously recorded constituents of fennel oil, camphene and α-phellandrene have been detected, together with traces of basic constituents in the first portion of the distillate. A small quantity of aldehydes was also found. Cymene, stated by Tardy to occur, was not present in the oil examined.

Linalôol and eugenol methyl ether are added to the number of the constituents of oil of sweet bay leaves.

—J. O. B.

Aluminium phenolate. A. N. Cook. J. Amer. Chem. Soc., 1906, **28**, 608—617.

THE best method of preparing aluminium phenolate is to heat from 100 to 500 grms. of phenol in a flask attached to a reflux condenser, and to add the aluminium gradually in the form of strips. An analysis showed that the phenolate contains 9·3 per cent. of aluminium, a quantity somewhat larger than that calculated for the formula $Al(OC_6H_5)_3$, and probably due to the high temperature resolving some of the aluminium phenolate into aluminium oxide and phenyl ether. Aluminium phenolate is a translucent, brittle solid, which keeps fairly well in closed vessels. It melts at 265° C., has a sp. gr. of 1·23, and is soluble in chloroform, carbon bisulphide, aniline, carbon tetrachloride, and acetone and in methyl, ethyl, and amyl alcohols, if these be entirely free from water. It is also soluble in hot benzene, toluene, and xylene. Water decomposes aluminium phenolate with the evolution of heat, various hydrates being formed according to the temperature of the solution; bromine decomposes it, tribromophenol and tribromophenol bromide being formed. When treated with nitric acid, aluminium phenolate yields orthonitrophenol, 1.2.4-dinitrophenol, and picric acid, the quantities of each produced depending on the concentration, the temperature, and the time employed in the reaction. Aluminium phenolate dissolves in anhydrous alcohol without evolution of heat. On adding a little water, a bulky precipitate of aluminium alcoholate, $Al(OC_2H_5)_3$, is thrown down, the alcohol radical simply taking the place of the phenyl. A similar reaction takes place in the case of ether. Hydrochloric, sulphuric, and hydrofluoric acids decompose the compound, phenol being liberated and the corresponding aluminium salts formed. Acetic acid attacks it but slowly, and the weaker organic acids have no action on it. By distilling aluminium phenolate, a small quantity of benzene, phenol, a varying amount of phenyl ether, and some higher boiling substances are obtained. (See also Gladstone and Tribe, Chem. Soc. Trans., 1881, 9.)—W. P. S.

Mercury oxycyanide. K. Holdermann. Arch. Pharm., 1906, **244**, 133—136.

THE author considers that the formula CN.Hg.O.Hg.CN well represents the constitution of solid mercury oxycyanide. In solution, a molecule of water is taken up, and a hydroxycyanide, Hg(OH)CN is formed, which dissociates into hydroxyl-ion and the complex ion, $HgCN$. Mercury oxycyanide can be readily prepared by a method suggested by Prussia (Gazz. chim. ital., 1898, **28**, II., 116). 125 grms. of mercuric acetate and 105 grms. of mercuric cyanide are dissolved in about a litre of boiling water. On adding N/1-caustic soda solution till the liquid is alkaline to phenolphthalein, a crystalline precipitate of mercury oxycyanide is formed.—F. SHDN.

Bismuth chloride; *New organic double salts of* —— L. Vanino and F. Hartl. Arch. Pharm. 1906, **244**, 216—220.

BISMUTH chloride is dissolved in alcohol, acetone, or ether, and the solution made clear by the addition of a little hydrochloric acid. This solution is heated, and a hot concentrated solution containing a molecular proportion of a base is then added. The double salts are immediately precipitated. *Diphenylamine bismuth chloride*, $(C_6H_5)_2NH$, $BiCl_3$, forms well-defined monoclinic crystals. *p-Nitrosodiphenylamine bismuth chloride*, $(C_6H_5)_2N.NO$, $BiCl_3$, comes down as dark crystals. *2-Nitrosodimethylaniline-3-bismuth chloride*, $2C_6H_4.NO.N(CH_3)_2$, $3BiCl_3$, is a microcrystalline powder. *Aldehyde ammonia bismuth chloride*, $(CH_3.CH.NH)_3$, $3BiCl_3$, is obtained as a yellowish-brown precipitate. *Methylamine hydrochloride bismuth chloride*, $3CH_3NH_2HCl$, $2BiCl_3$, forms long hexagonal needles. *Rheumatine bismuth chloride*, $C_{34}H_{44}N_2O_7$, $2BiCl_3$, forms small matted needles. *Quinaphenine bismuth chloride*, $2C_6H_5NH.CO.O.C_{20}H_{23}N_2O$, $5BiCl_3$, is obtained as a yellow precipitate. *Piperazine bismuth chloride*, $2C_4H_{10}N_2$, $3BiCl_3$, forms small quadratic crystals.

—F. SHDN.

Phosphorus; *Bologna* ——. L. Vanino. J. pr. Chem., 1906, **73**, 446—448.

PHOSPHORESCENT calcium sulphide or zinc sulphide, laid on black paper which covers a photographic plate, affects the plate; but if it be contained in a celluloid case it is without action. Since a radio-active lead preparation affects the plate almost equally whether laid directly on the black paper or contained in the celluloid case, it appears that celluloid is transparent to the β- or γ-radiation, and the action of the phosphorescent sulphide is not due to the emission of these rays, but possibly to minute quantities of hydrogen sulphide, which penetrate the black paper.

The author finds that in preparing phosphorescent calcium sulphide, the presence of calcium fluoride in the mixture enables a good phosphorescent preparation to be obtained at a much lower temperature than without it. He also finds that a mixture which on heating only produces a small proportion of the sulphide, or a mixture of the sulphide with a considerable proportion of inert substance, may show a very strong phosphorescence.

—J. T. D.

Oil of mustard; *Determination of allyl isothiocyanate in essential* ——. Schimmel's Report. XXIII., page 610.

Chloroform; *Determination of alcohol in* ——. M. Nicloux. XXIII., page 611.

ENGLISH PATENTS.

Aminobenzoic acid alkamine esters and derivatives thereof; *Manufacture of* ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-am-Main, Germany. Eng. Pat. 17,162, Aug. 24, 1905.

THE new aminobenzoic acid alkamine esters are stated to be valuable local anæsthetics. The esters are produced by reducing nitrobenzoic acid alkamine esters, by reducing azo and azoxybenzoic acid alkamine esters, by heating amino-

benzoic acid esters with alkamines, by treating aminobenzoic acids with alkamines according to the well-known methods for the manufacture of esters, or by heating aminobenzoic acid esters of halogen substituted alcohols with ammonia, or primary and secondary amines.
—F. Shdn.

Polychloranilines; New derivatives of certain ——. [*Substitutes for camphor in manufacture of celluloid*]. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 8077, April 3, 1906.

This invention relates to the manufacture of a new class of alkyl-acyl derivatives of polychloranilines containing three or more atoms of chlorine, two of which are in the ortho positions to the amino group. These new derivatives can be obtained by the action of an acid chloride or acid anhydride on the corresponding alkyl derivatives. Or, the alkali salts of the acyl compounds can be treated with a halogen alkyl compound. The new compounds of this class can be used as substitutes for camphor in the production of substances like celluloid. The methods of preparation of the following derivatives are described in this patent; *s*-methyl-acetyl-trichloranilide, m.pt. 89°—90° C.; *s*-mono-ethyl-acetyl-trichloranilide, m.pt. 50°—51° C.; *s*-ethyl-benzoyl-trichloranilide, m.pt. 127°—128° C.; *as*-ethyl-acetyl-tetrachloranilide, $N(C_2H_5)(C_2H_3O):Cl:Cl:Cl:Cl = 1:2:3:4:6$, m.pt. 73°—74° C.; *as*-methyl-acetyl-tetrachloranilide, m.pt. 96°—97° C.; *s*-benzyl-acetyl-tetrachloranilide, m.pt. 97° C.; benzyl-benzoyl-tetrachloranilide, m.pt. 134° C.; *s*-benzyl-acetyl-trichloranilide, m.pt. 61° C.—F. Shdn.

Phosphoric acid; Manufacture of an officinal preparation of ——. J. Nicolaïdi, Paris. Eng. Pat. 15,118, July 22, 1905.

A preparation, stated to be solid and quite stable, and containing free phosphoric acid, is obtained by mixing phosphoric acid with milk sugar, adding sufficient gum arabic to give the mixture the necessary consistency, adding a further quantity of phosphoric acid, macerating the mixture for a few hours, granulating, and finally drying the product at 45°—50° C. The most suitable proportions are given as 100 c.c. of phosphoric acid, 37·5° B., for each kilo. of milk sugar.—T. F. B.

United States Patents.

Alkamine ester [*of alkylaminobenzoic acids*]. F. Stolz and B. Reuter, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 820,830, May 15, 1906.

See Eng. Pat. 17,162 of 1905; preceding these.—T.F.B.

Benzoylsuccinylperoxide and process of making same. A. C. Houghton, Syracuse, N.Y. U.S. Pat. 821,291, May 22, 1906.

Benzoylsuccinyl peroxide is a monobasic compound, obtained by the action of benzoic peracid on succinic anhydride; it is a colourless, crystalline substance, possessing an aromatic odour and powerful germicidal properties. It is soluble in alcohol, benzene and chloroform, and insoluble in petroleum spirit; its m.pt. is 96°C. It is slowly decomposed by water into benzoic peracid and succinic acid.—T. F. B.

Dialkylbarbituric acids; Process of making ——. W. Traube, Berlin. U.S. Pat. 822,165, May 29, 1906.

See Eng. Pat. 14,161 of 1905; this J., 1905, 1188.—T. F. B.

German Patents.

Anhydrides of monobasic organic acids; Process of preparing ——. Verein f. Chem. Industrie. Ger. Pat. 167,304, June 26, 1902. Addition to Ger. Pat. 161,882, March 30, 1902 (this J., 1905, 1323).

The mixture of alkali salt and alkaline earth salt is treated with a mixture of sulphur dioxide and chlorine, instead of with sulphuryl chloride. In presence of traces of moisture, a small quantity of organic acid is liberated, which acts as "contact material" for the formation of sulphuryl chloride; the apparatus is cooled externally during the process, and the anhydride finally isolated by distillation. (See also Ger. Pat. 163,103; this J., 1906, 392).—T. F. B.

Hæmoglobin preparation of the colour of arterial blood; Process for producing a stable, palatable ——. Kalle und Co., A.-G. Ger. Pat. 167,081, Oct. 16, 1903.

A current of sterilised air at the ordinary temperature is blown through an ethereal solution of hæmoglobin, obtained by extracting defibrinated blood with ether.
—T. F. B.

Aldehydes, alcohols, and [*fatty*] *acids; Process of producing* ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 167,137, Jan. 16, 1904.

The liquid products obtained by passing air, oxygen, or ozonised air through oils or fats are treated by any known method for the isolation of the acids, alcohols, and aldehydes which they contain; the aldehydes and alcohols are said to include, amongst others, those of the C_6 series, hitherto only obtained with difficulty. The products are stated to be applicable to medicine, perfumery, &c.
—T. F. B.

Hydroxy-derivatives of the benzene series and their substitution products; Process for preparing ——. Soc. Chim. des Usines du Rhone, St. Gilliard, P. Monnet, et Cartier. Ger. Pat. 167,211, Jan. 30, 1904.

Hydroxy-compounds of the benzene series are easily obtained by heating an aqueous solution of the corresponding diazonium salt and copper sulphate; the diazonium compound may be slowly added to a boiling aqueous solution of copper sulphate, the temperature being maintained by direct heat, or by passing a current of steam through the solution.—T. F. B.

p-Dialkylaminobenzhydralamines; Process for preparing ——. E. Merck. Ger. Pat. 167,463, Feb. 20, 1904. Addition to Ger. Pat. 167,462, Jan. 9, 1904.

p-Dialkylaminobenzhydralamines are produced by the action of potassium phthalimide on the halogen acid esters of *p*-dialkylaminodiphenylcarbinols, the phthalic acid radical being subsequently eliminated, preferably in ammoniacal solution. The yield is stated to be considerably higher than when ammonia is used in place of phthalimide.
—T. F. B.

Copaïba balsam; Process for preparing neutral preparations from ——. Knoll und Co. Ger. Pat. 167,170, May 29, 1904.

Copaïba balsam, or the resinous saponifiable product from which the illurinic acid has been extracted, is converted into a neutral substance, insoluble in alkali, by esterification or by acidylation, *e.g.*, with acetic anhydride, benzoyl chloride, &c. The product is said to possess no irritant properties, and not to be decomposed in the digestive tract.—T. F. B.

Aminoguanidine; Process of preparing —— *from nitroguanidine.* C. F. Boehringer und Soehne. Ger. Pat. 167,637, Aug. 17, 1904.

Aminoguanidine may be obtained by the electrolytic reduction of nitroguanidine in a neutral suspension, using a tin cathode; other cathodes may be employed, provided that tin powder or a tin salt be present.—T.F.B.

Cyanamide and urea; Process for preparing acidyl derivatives of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 167,138, Dec. 6, 1904.

By the action of cyano- or halogenated acetic esters on cyanamide, cyano-acetylcyanamide, $CN.CH_2.CO.NH.CN$, is produced; in the case of most monoalkylcyanamide derivatives, however, an acidylurea derivative is formed, *e.g.*, with methylcyanamide, the following reactions take place—

$$NC.CH_2COOH + NC.NH.CH_3 =$$
$$NC.CH_2.CO.N:C(OH)NH.CH_3 =$$
$$NC.CH_2.CO.NH.CO.NH.CH_3.$$

—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page 560.*)

ENGLISH PATENT.

Photographic pictures; Impts. in ——, in the process of making them, and in sensitive plates therefor. G. N. Pifer, Cleveland, U.S.A. Eng. Pat. 22,735, Nov. 6, 1905.

SEE U.S. Pats. 804,038 and 804,039 of 1905; this J., 1905, 1255.—T. F. B.

UNITED STATES PATENTS.

Photographs in natural colours; Process for the production of ——. J. Szczepanik, Vienna. U.S. Pat. 821,200, May 22, 1906.

SEE Eng. Pat. 10,812 of 1902; this J., 1902, 1097.—T. F. B.

Photographic sensitive emulsions; Base or support for ——. J. Findlay, Ilford. Assignor to Bromar, Ltd., London. U.S. Pat. 822,107, May 29, 1906.

SEE Eng. Pat. 5948 of 1904; this J., 1905, 512.—T. F. B.

FRENCH PATENTS.

Lighting compositions for photography in artificial light; Preparation of ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. First Addition, dated March 21, 1905, to Fr. Pat. 360,588, March 2, 1905.

THE use of antimony chromate (1 part) mixed with magnesium powder (2 to 3 parts) is especially claimed in this addition. It is further specified that two or more of the chromates named in the principal patent (see this J., 1906, 560) may be added to magnesium, or to a mixture of magnesium and aluminium.—T. F. B.

Lighting compositions for photography in artificial light; Preparation of ——. Soc. Anon. des Plaques et Papiers Photographiques, A. Lumière et ses fils. Second Addition, dated March 22, 1905, to Fr. Pat. 360,588, March 2, 1905.

OXIDES of copper, iron, cobalt, &c., obtained by heating the nitrates or other neutral salts of acids possessing an oxidising action, may replace the chromates in the principal patent (this J., 1906, 560) to form lighting compositions which burn rapidly, giving flashes of great actinic power, but making slightly more noise and smoke than those prepared with chromates. The proportions used are one part of magnesium and one to two parts of the metal oxide.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page 561.*)

Explosion of nitroglycerin in waste acid; Circumstances attending an ——, which occurred at the chemical works of Messrs. F. W. Berk and Co., Ltd., at Abbey Mills, Stratford-by-Bow, in the County of Essex, on Jan. 15, 1906. By Capt. J. H. Thompson, H.M. Chief Inspector of Explosives.

A QUANTITY of waste acid from the manufacture of nitroglycerin had been sent from the factory of the Explosive and Chemical Products Co. for denitration, and the plug of one of the drums was being loosened by hammering, when a violent explosion occurred, killing a workman. The cause of the explosion is traced to the presence of a film of nitroglycerin on the surface of the acid, separation having probably occurred during transit. The acid had not been allowed to stand in after-separators, but to prevent separation of the dissolved nitroglycerin, 2—3 per cent. of water had been added, a precaution which has been looked on by many as sufficient. Since the behaviour of waste acid under varying conditions of cold is not definitely known, experiments were carried out for H.M. Inspector at Waltham Abbey and Ardeer which indicate that even after long standing in after-separators a considerable quantity of nitroglycerin still remains in solution, which is apt to separate on lowering the temperature. The addition of water serves to keep the nitroglycerin in solution, but as much as 5 per cent. of water should be added to prevent separation on cooling. For safety, however, nitroglycerin waste acid should not be transported until it has first been denitrated by the action of heat.—B. J. S.

ENGLISH PATENTS.

Smokeless powders; Impts. in ——. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 15,565, July 29, 1905.

CLAIM is made for the use of olive oil as an ingredient of propellants to lower the temperature of combustion together with vaseline, if necessary, to diminish the rate of burning. Thus, in the manufacture of cordite, the usual 5 per cent. of vaseline is replaced by a mixture of 3·75 per cent. of vaseline and 2·5 per cent. of olive oil. It is stated that the resulting powder possesses great stability.—B. J. S.

Smokeless powders; Impts. in ——. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 15,566, July 29, 1905.

AN alkali carbonate or alkaline-earth carbonate is introduced into a propellant in order to neutralise the acid products of combustion, and lubricate the gun-barrel. In the case of potassium and sodium carbonates, excessive smoke is produced, whilst with barium, strontium, and calcium carbonates, the lubricating effect is not so good. By using a mixture so that the residue on explosion contains 2·8 per cent. of barium carbonate and 0·55 per cent. of potassium carbonate, it is possible to combine the useful properties of both carbonates. This is best accomplished by incorporating into the powder 4 per cent. of barium tartrate and 0·9 per cent. of potassium tartrate in a very fine state of division.—B. J. S.

Noxious or poisonous fumes, or gases, in blasting operations; Means for neutralising the —— in mines and the like. H. Walker, Knights, Transvaal. Eng. Pat. 24,002, Nov. 21, 1905.

TEN pounds of potassium permanganate, 1 drm. of potassium chlorate, if used in the form of fine crystals, or 2 drms if used in the form of powder, and ½ to 1 drm. of ammonium chloride, are intimately mixed, and made up into cartridges. These cartridges are placed in the blasting holes together with the dynamite, &c., one ½-lb. cartridge of the mixture being used for every five ½-lb. dynamite cartridges. The function of the potassium chlorate is to act as detonator to the permanganate in the mixture.—A. G. L.

UNITED STATES PATENT.

Blasting-powder. B. Eberle, Passaic, N.J. U.S. Pat. 820,854, May 15, 1906.

THIS invention relates to a blasting compound consisting of 4 lb. of saltpetre, 1½ lb. of potassium chlorate, 1½ lb. of sugar, 3 oz. of phosphorus, ½ lb. of sulphur, and ½ lb. of "manure."—B. N.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page 563.*)

APPARATUS, ETC.

Electrochemical analysis; A simple form of rotating electrode for ——. F. M. Perkin. Faraday Soc. Trans., June 12, 1906. [Advance proof.]

TWO concentric coils of platinum-iridium wire of 1 mm. thickness serve as electrodes, the central cathode being rotated. Nickel wire cathodes have also been used with some success.—R. S. H.

ENGLISH PATENT.

ts; Apparatus for use in analysing ——. E. Schatz, Frankfort on Maine, Germany. Eng. Pat. 25,466, Dec. 7, 1905. Under Int. Conv., Dec. 7, 1904.

E Fr. Pat. 359,352 of 1905; this J., 1906, 394.—T. F. B.

INORGANIC—QUALITATIVE.

ckel; Detection of ——. *New reaction.* C. Reichard. Chem.-Zeit., 1906, **30**, 556—557.

IE substance is mixed with dry methylamine hydrochloride or a few drops of its concentrated solution, and e mixture heated carefully in a small porcelain capsule til white fumes are evolved. A deep blue colour slowly velops which disappears on cooling, and appears again reheating as long as any methylamine remains. Cobalt der similar circumstances gives a dark-blue colour, t this does not disappear immediately on cooling, a haviour which is characteristic of nickel. The reaction is tremely delicate.—F. Sodn.

n; Detection of ——, *in woollen goods.* D. Paterson. J. Soc. Dyers and Col., 1906, **22**, 189—190.

E method consists in examining the strongly heated n of the woollen thread or fabric for any appearance of a aracteristic indigo-blue iridescence or metallic reflex. has been possible to detect by this test the presence tin in a small thread of olive-coloured carpet yarn ighing only 0·01 grm., and containing about 0·00015 n. of tin.—D. B.

INORGANIC—QUANTITATIVE.

ecipitates suspended in liquids; Pyknometric determination of weight and volume of ——. H. Gillot and A. Grosjean. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1148—1166.

L methods for the pyknometric determination of the ume or weight of precipitates suspended in any liquid, uire, as a necessary condition, that there should be no sotive accumulation or absorption of any of the disved substances, or solvent, on the surface of the precipie. The present method is based on the fact that if the ve condition be fulfilled, an intimate proportionality sts between the weight of the precipitate and the differe between the density of the mixed system and that the clear filtrate.

Thus: $p=(D-d')V\times k$, where p = the weight of the cipitate, D = the density of the mixture (liquid and cipitate), d′ = the density of the clear filtrate, V = the al volume, and k = a constant which has to be determined for any given precipitate. The value of

$$k=\frac{p}{(D-d')V}$$

ndependent of the concentration, but decreases as the sity of the precipitate increases. When the density the precipitate is not known, its volume is calculated m the expression

$$v=V-\frac{P-p}{d'}$$

ere v = the volume of the precipitate and P = the total ight of the mixture. On testing the method for the ermination of the values of k, it was found that accurate ults were obtained for lead sulphate, barium sulphate, oric hydroxide (when precipitated in presence of a nute proportion of sugar), and aluminium hydroxide, in the case of calcium oxalate, the method gave very oneous results, owing to a considerable adsorption of dissolved salts by the precipitate. The authors ve drawn a curve illustrating the connection between values of k and the densities of the precipitates; y hope to extend the method to the determination of the ume of the precipitates formed in saccharine solutions various defecating agents.—J. F. B.

ine titrations; "Back reactions" in ——. J. H. Davies and E. P. Perman. Chem. News, 1906, **93**, 225.

the titration of solutions containing iodine by thiosulphate or arsenious acid, using starch as indicator, the end-point of the reaction is frequently uncertain owing to the reappearance of the blue colour on standing for a short time. This "back reaction" is most marked when the iodine has been set free by copper sulphate or potassium bichromate, and is due to the comparative slowness (and incompleteness) of the liberation of iodine from dilute solutions of potassium iodide by these substances. If the concentration of the iodide solution be increased, the reaction becomes nearly instantaneous, and the "back reaction" is avoided. Suitable quantities of potassium iodide are 1 grm. in 10 c.c. of water for 25 c.c. of N/10 solution of potassium bichromate, and 2 grms. in 20 c.c. of water for 1 grm. of copper sulphate crystals in 50 c.c. of water.—A. S.

ORGANIC—QUANTITATIVE.

Ebonite; Analysis of ——. R. Thal. Chem.-Zeit., 1906, **30**, 499—501.

THE ash and total sulphur are determined in the usual manner.

Resin and substitute are determined together. One grm. of ebonite is boiled under a reflux condenser for four hours, with 100 c.c. of 8 per cent. alcoholic caustic soda. The residue is thoroughly washed with hot water, and weighed on a tared filter after drying at 100°—105° C. Blanks are necessary to ascertain the extracting effect of the alcoholic caustic soda on the filter and on the free sulphur in the ebonite, and the amount of soda retained by the ebonite.

Ebonite cannot be dried for more than two hours without gaining weight by oxidation. Good surgical ebonite should not contain more than 0·6 per cent. of ash, and the fact that samples exceeding this limit fail to yield clear solutions in nitric acid, affords a useful preliminary test.—W. A. C.

Saccharose and raffinose in presence of invert sugar and dextrose; Determination of ——. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1906, **23**, 1140—1141.

THE reducing sugars of molasses may be composed of varying proportions of dextrose and levulose, sometimes one being in excess and sometimes the other. Fogelberg has proposed a method for the determination of the saccharose and raffinose, which is quite independent of the relative proportions of dextrose and levulose in the reducing sugars, since all these sugars are eliminated by the destructive action of alkali. For this purpose he employs barium hydroxide at the rate of 12 grms. for half to twice the normal weight of molasses. The materials are mixed with 120—130 c.c. of water, and the whole is heated on the water-bath at the boiling temperature for 10—15 minutes, whereby the reducing sugars are entirely destroyed. The liquid is then cooled, neutralised with acetic acid, decolorised with a little hypochlorite, and diluted to 200 c.c. The saccharose and raffinose are then determined by polarisation before and after inversion. Grzybowski has modified this method by precipitating the baryta by mercuric sulphate and the excess of mercury by a tin salt. The author points out that he proposed a similar method for the destruction of the reducing sugars by means of potash (see this J., 1898, 187).—J. F. B.

Oil of mustard; Determination of allyl isothiocyanate in essential ——. Schimmel's Report, May, 1906, 45—46.

THE official process of the Ph.G. IV. for the determination of allyl isothiocyanate in mustard oil gives results which are about 8 per cent. too low, so that no essential oil of mustard can meet the German official requirements. More accurate results are obtained by the following method:—

About 5 grms. of a 2 per cent. by weight solution of the oil in alcohol are treated with 50 c.c. of N/10 silver nitrate solution and 10 c.c. of solution of ammonia (sp. gr. 0·960) in a 100 c.c. flask. The mixture is allowed to stand in the dark, after closing the flask, for 24 hours. The flask is then immersed in a water-bath at 80° C. for 30 minutes, with frequent agitation, and subsequently cooled to the normal temperature. After adjusting the volume of the solution to 100 c.c. by the addition of distilled water, 50 c.c. are filtered off, and titrated in the usual manner

with N/10 ammonium thiocyanate solution, after adding 6 c.c. of nitric acid, sp. gr. 1·153, employing iron alum as indicator.

When a = the number of c.c. of N/10 silver nitrate solution used up, and b = the weight of alcoholic solution of mustard oil taken, $\frac{a \times 24.7875}{b}$ = the percentage of allyl isothiocyanate present.

Natural mustard oil should give about 94 per cent. by this method, the synthetic oil about 98 per cent.

—J. O. B.

Chloroform; Determination of alcohol in ——. M. Nicloux. Bull. Soc. Chim., 1906, **35**, 330—335.

Five c.c. of the chloroform under examination are agitated with 20 c.c. of water, and the alcohol determined in the aqueous extract by titration with potassium bichromate solution (19 grms. per litre) in presence of sulphuric acid, the end point of the reaction being detected by the change of colour of the solution from blue-green to yellowish-green.—T. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 564.)

Platinum black; Some catalytic actions of ——. O. Loew and K. Aso. Bull. Coll. Agric., Tokyo, 1906, **7**, 1—6.

Experiments with a very active preparation of platinum black, obtained by treatment of platinum chloride with formaldehyde in presence of a considerable quantity of alkali (see this J., 1890, 550), showed that platinum black is capable of effecting the transformation of labile compounds, *e.g.*, of maleïc acid into fumaric acid. The reducing action of platinum black upon nitrates in the presence of dextrose (this J., 1890, 634) is found to take place also with dilute free nitric acid. A solution of 2 grms. of dextrose in 100 c.c. of water was treated with 2 c.c. of dilute nitric acid (0·08 grm. of HNO_3) and 10 grms. of platinum black, and heated on the water-bath for three hours. On distillation with magnesia, 0·012 grm. of ammonia was obtained. In another trial 0·049 grm. of ammonia was obtained from 2 c.c. of nitric acid of sp. gr. 1·3, 10 c.c. of water, 5 grms. of dextrose, and 10 grms. of platinum black. Chlorates, perchlorates, and iodates are also reduced by platinum black in presence of dextrose, chlorides and iodides respectively, being produced. It has been shown previously that platinum black, moistened with pure caustic potash solution forms traces of nitrous acid and ammonia from the nitrogen of the air (see this J., 1890, 979). After similar experiments with distilled water in place of caustic potash solution, traces of ammonia and of nitric acid (probably by oxidation of nitrous acid) were detected.—A. S.

Hexamethylethane, a new octane. L. Henry. Comptes rend., 1906, **142**, 1075—1076.

Hexamethylethane, $(CH_3)_3C.C(CH_3)_3$, is obtained as a by-product in the preparation of pinacolic alcohol by the action of acetaldehyde on tertiary butyl magnesium bromide. It is evidently formed without the intervention of the acetaldehyde, merely by the reaction of the butyl bromide with its own magnesium compound. It is a well crystallised body, with a sharp and very penetrating odour. It evaporates rapidly on exposure to the air, its vapour tension at 14° C. being equal to 20 mm. of mercury. It melts at 103°—104° C., and boils at 106°—107° C. under a pressure of 765 mm.

Cholesterol; Halogen derivatives of ——. J. Mauthner. Monatsh. Chem., 1906, **27**, 305—314.

It was shown by Suida and the author (Monatsh. Chem., 1894, 374) that cholesterol and cholestene yielded crystalline chlorine derivatives on treatment with alcoholic hydrochloric acid, but the nature of the cholesterol compound was not determined owing to its composition being variable, and the readiness with which it decomposed. The author has now found that the hydrochloric acid combines with the double bond, forming addition compounds from cholesterol itself, cholesteryl chloride, and cholestene. *Chlorcholestanol* (cholesterol hydrochloride), $C_{27}H_{45}ClO$, crystallises in fine silky needles, melting at 154°—155° C., with the evolution of gas. It is fairly soluble in chloroform, ether, benzene, and carbon bisulphide; less soluble in alcohol. *β-Dichlorcholestan*, $C_{27}H_{44}Cl_2$, crystallises from the mother liquor after separation of the chlorcholestanol, being formed by the replacement of the hydroxyl group in the chlorcholestanol by chlorine. It melts at 117° C., and is readily soluble in ether, benzene, chloroform, and carbon bisulphide, and with more difficulty in alcohol. It is slowly attacked by cold sulphuric acid, but is not acted upon by fuming nitric acid. *Chlorcholestan* (cholesteryl chloride) is obtained in flat prismatic crystals by the action of gaseous hydrochloric acid on a solution of cholestene in chloroform. It begins to melt at about 80° C., and is completely fused at 91° C., becoming crystalline again on cooling. Its solubility in ordinary solvents is similar to that of β-dichlorcholestan. It melts to a colourless oil in boiling alcohol.—C. A. M.

Trade Report.

South African Customs Union Convention. [Cd. 2977.]

The Customs Union Convention provisionally agreed to by the representatives of the South African Customs at a Conference held at Pietermaritzburg in March, 1906, was presented to both Houses of Parliament last week, and has been published by the Stationery Office. The following is an abstract:—

Class I.—*Special Rates.*

—		Rebate upon Goods the Growth, Produce, or Manufacture of the United Kingdom and Reciprocating British Colonies.
	£ s. d.	£ s. d.
Acetic acid ..... per Imp. gall.	0 3 3	0 0 3
Lard, including compound lard, cottolene, nuttose, and other similar substances for use as food....per lb.	0 0 1½	0 0 0½
Milk, condensed, desiccated, or preserved milk or cream—		
(*a*) Full cream .....per 100 lb	0 5 2	0 1 0
(*b*) Skimmed or separated .per lb.	0 0 6	—
Oils, mineral, illuminating and burning ..... per Imp. gall.	0 0 1	—
Soap, soap powders and extracts per 100 lbs.	0 4 9 (or 25 per cent. *ad valorem* whichever shall be the greater)	0 0 7 (or 3 per cent. *ad valorem* as the case may be)
Turmeric.....per lb.	0 0 2½	0 0 0½
Spirits—		
(*a*) Perfumed .... per Imp. gall.	1 2 6	—
(*b*) Liqueurs, cordials and mixed spirits, exceeding 3 per cent. of proof spirit .... per Imp. gall.	1 0 0	—
(*c*) Other sorts, exceeding 3 per cent. of proof spirit, per Imp. proof gall.	0 19 0	—
Note.—No allowance will be made for underproof in excess of 15 per cent.		
Note.—Medicinal and toilet preparations and essences (liquid), and syrups and tinctures containing over 3 per cent. of proof spirit to be classed as spirits under item (*b*).		
Blasting compounds.....per lb.	0 0 2½	0 0 0½
Candles .....per 100 lb.	0 5 0	0 0 10
Cement .....per 400 lb.	0 1 3	0 0 3
Gunpowder and other explosives for firearms.....per lb.	0 0 6 and 15 per cent. *ad valorem*	3 per cent. *ad valorem*

CLASS II.—25 *per cent. ad valorem.*

Beverages:—

(*a*) Waters, aerated, mineral, and table.

(*b*) Fruit juices, cordials, and syrups not elsewhere enumerated.

(*c*) All other kinds not exceeding 3 per cent. of proof spirit.

CLASS III.—25 *per cent. ad valorem.*

Extracts and essences of all kinds for food, flavouring, or perfumery not elsewhere enumerated, including concentrated soup.

Oils, essential or perfumed, including eucalyptus.

CLASS IV.—3 *per cent. ad valorem.*

Ammonia, anhydrous, carbonate, chloride (sal ammoniac) and nitrate, in bulk.

Assay apparatus and assay mabor.

Barytes and pumice in bulk.

Calcium carbonate, caustic, chloride, chlorate, bisulphate (in bulk).

Carbonic-acid gas.

Collodion, cotton, and glycerin, and kieselguhr in bulk for manufacturing purposes.

Confectioners' requisites—*viz.*, glucose, moulding-starch, gelatin, and unsweetened desiccated cocoanut in bulk.

Crucibles.

Cyanide of potassium and sodium, sulphocyanide of potassium, sodium, and calcium.

Disinfectants in bulk (provided they are of a standard approved by the various Governments of the Union).

Glue in bulk.

India-rubber, manufactured.

Magnesium sulphate in bulk.

Potassium and sodium carbonate, bicarbonate, caustic and silicate, chlorate, chloride, bichromate, permanganate, red and yellow prussiate (in bulk).

Resin in bulk.

Sheep-dip, sheep-dipping powders, materials suitable only for dip and dipping-tanks.

Substances for destroying pests or diseases in stock, such as copper sulphate, arsenic, arsenious acid, arseniate of soda (in bulk).

CLASS V.—*Free.*

Included in this are: Alum, borax, bromine, litharge, manganese dioxide, mercury (all in bulk), dye nuts, gambier, myrabolans, sumach, valonia, and dyestuffs for leather; guano and other substances, animal, mineral, or vegetable, artificial or natural, suitable for use as fertilisers or manures; nitrates in bulk (except nitrate of ammonium) for manufacturing purposes or for fertilisers; palm oil, palm-kernel oil, cotton-seed oil (in bulk); chloride of platinum, sulphur (in bulk), sulphurous anhydride, paraffin wax and stearin, and stearin grease for use in the manufacture of candles or explosives.

Articles.	Unit.	General Tariff.
		Yen Sen
Milk sugar	100 kin	8 80
Alcohol	litre	0 65
Musk, artificial	kin	16 50
Gum tragacanth	100 kin	15 20
Phosphorus, red and yellow	—	Free
Pyrogallic acid	100 kin	134 00
Tannic acid	,,	14 20
Potash, chlorate or cyanide of, and cyanide of soda	—	Free
Glycerin	100 kin	6 50
Chloroform	,,	22 00
Saccharin and other similar sweetening agents	kin	60 00
Acetanilide	100 kin	9 50
Antipyrine	kin	0 80
Morphine, hyd. and sulphate	,,	8 90
Cocaine, hyd. and sulphate	,,	25 00
Guaiacol carbonate	100 kin	98 60
All other drugs, chemicals and medicines (not otherwise provided for)	*ad val.*	20%
Citronella oil	100 kin	32 30
Lavender oil	,,	120 00
Bergamot oil	,,	120 00
Cod-liver oil	*ad val.*	30%
Castor oil	,,	20%
Castor oil in tins, casks or jars	100 kin	2 00
Vaseline	,,	2 95
Paraffin wax (below 50° C. m.pt.)	,,	Free
All other kinds	,,	1 30
Inks, writing	,,	10 00
Filter paper	,,	19 70
Photographic paper—		
Albuminoid and sensitised	,,	65 90
Bromide and platinum paper	,,	112 00
All other kinds	,,	89 40
Photographic dry plates	100 kin	18 20
Philosophical, chemical and other scientific instruments, microscopes (and parts thereof), balances, measuring-scales and tapes, thermometers and barometers	*ad val.*	20%
Sealing-wax	,,	20%
Celluloid, manufactures of—	100 kin with	
Combs	packages	67 50
All other kinds	*ad val.*	40%
Photographic films	,,	40%
Manures, (bran, oil-cake, bone-meal, guano, superphosphate of lime, &c.)	—	Free

The following articles, among others, are admitted under conventional tariffs which exist with Great Britain, Germany, and France:—

Articles.	Unit.	General Tariff.	Conventional Tariff.	Contracting States.
		Yen Sen	Yen Sen	
Acid salicylic	100 kin	11 80	10 % *ad val.*	Germany
Saltpetre	,,	1 88	0 490 per kin	G.B. & G.
Potassium bromide	,,	18 80	0 093 per kin	Germany
Bismuth subnitrate	,,	86 90	0 206	,,
Quinine, sulph. or hyd.	kin	2 08	8% *ad val.*	,,
Filter paper	100 kin	19 70	10% *ad val.*	,,
Caoutchouc, manufactures of	,,	40%	,,	G.B.
Aniline dyes	,,	12 30	,,	G. & F.
Alizarin dyes—				
Dry	,,	27 80	,,	Germany
In liquid or paste	,,	9 50	,,	,,
Soaps, toilet	,,	24 70	per kin 0 070	France

N.B.—Kin = 600 grms. = 1·323 lb. avoir. Yen = 100 Sen = 2s.

JAPANESE TARIFF; NEW ——.

Chem. and Drug., June 2, 1906.

The following is an excerpt from the new Japanese Import Tariff, which comes into force on October 1st next:—

EGYPTIAN VALUATION TARIFF.

Bd. of Trade J., June 7, 1906.

"The Egyptian "Journal Officiel" for May 19, contains the following revised Valuation Tariff for use in assessing import duties on certain oils, colours, &c., which came into operation on May 22:—

Articles.	Valuation per kilo. (net).*
	Millièmes.†
Cotton-seed oil, "prime winter yellow"	22
" " refined and "summer yellow"	20
Linseed oil, raw	21
" " boiled	22
Zinc white (first quality), including "Vieille Montagne"	26
Zinc white (second quality), including "Nouvelle Montagne"	*ad val.*
Red lead	19
Cochineal	*ad val.*
Cocoanut oil, raw or refined	"

* Duty is levied on these valuations at the rate of 8 per cent.
† 1000 millièmes = £E 1 = 1*l.* 0*s.* 6*d.*

BORDEAUX; TRADE OF —— IN 1905.

For. Off. Ann. Series, No. 3616.

The amount of pure olive oil exported from Bordeaux in 1905 was 29,979 cwts., an increase of 2,507 cwts., 9,794 cwts. being sent to the United Kingdom against 9,486 cwts. of 1904. Ground nut or "Arachide" oil showed an increase as compared with 1904 of 11,365 cwts., the total exported being 38,126 cwts., of which 15,606 cwts. were sent to the United Kingdom, an increase from 1904 of 2,731 cwts. Oils other than pure olive and ground nut oil, were exported to the total of 12,633 cwts., being a small increase upon 1904. Hardly any of these found their way to the United Kingdom.

Exports of raw sugar in 1905 amounted to 29,225 cwts., or more than double the trade in 1904; of refined sugar to 80,170 cwts., a decrease of 9,415 cwts. Exports to the United Kingdom showed an increase compared with 1904 of 5,025 cwts. of raw sugar and a falling-off of 2,867 cwts. of refined. The entire amount exported to the United Kingdom in 1905 was:—Raw sugar, 8,233 cwts.; refined, 10,367 cwts.

The following table shows the most important chemical products exported in 1904—05:—

Articles.	Total.		Increase or decrease in 1905.	United Kingdom.		Increase or decrease in 1905.
	1904.	1905.		1904.	1905.	
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Acids	21,402	31,629	+ 10,227	9,130	4,060	— 5,070
Oxides	4,804	5,157	+ 353	985	2,486	+ 1,503
Salts, &c.	18,170	32,164	+ 13,994	1,903	24	— 1,879
Acetate of copper	2,835	1,861	— 974	587	317	— 270
Glycerin	5,044	7,016	+ 1,972	1,126	2,880	+ 1,754
Kermes (mineral)	1,216	3,086	+ 2,870	25	20	— 5
Wine lees	2,028	8,250	+ 6,222	1,057	2,325	+ 1,268
Crude tartar	38,147	67,759	+ 29,612	20,774	30,380	+ 9,606
Cream of tartar	33,974	50,974	+ 17,000	30,076	46,194	+ 16,118
Superphosphate of lime	28,574	192,286	+ 163,712	—	—	—
Tannin extracts	280,646	347,340	+ 66,694	206,129	266,005	+ 59,876

Exports of gums in 1905 amounted to 28,655 cwts., an increase upon 1904 of 2,911 cwts. The quantity purchased by the United Kingdom was 12,082 cwts., a decline compared with 1904 of 2,970 cwts.

Exports of resin and pitch in 1905 amounted to 898,458 cwts., an increase of 563,039 cwts. upon the figures for 1904. Of this the United Kingdom purchased to the amount of 332,798 cwts., an increase compared with 1904 of 197,705 cwts. The demand for common strained resin was good, the article being somewhat difficult to obtain in October. Turpentine exports in 1905 were estimated at 145,250 cwts., an increase from 1904 of 97,036 cwts. The United Kingdom purchased 35,864 cwts., compared with 8,518 cwts. in 1904. The market in this commodity was most unsteady and excited. The amount of vegetable tar exported in 1905 was 2,174 cwts., a decline from 1904 of 5,422 cwts. Exports to the United Kingdom showed a falling off of 4,742 cwts., the total being 1,034 cwts.

Arsenic is manufactured near Carcassonne and shipped to the United Kingdom *via* Bordeaux. The amount exported was 3,165 tons, an increase of 2,950 tons upon 1904. Of this amount 2,615 tons were purchased by the United Kingdom.

Shipments of porcelain from Bordeaux in 1905 showed a decline of 3,518 cwts. compared with 1904, the total exportation being 84,785 cwts., of which 67,598 cwts. were sent to the United Kingdom, a falling off from 1904 of 5,280 cwts. Pottery and faïence had also declined, the total exported under this head in 1905 being 5,963 cwts. In the exportation of glass (chiefly bottles), there was an increase for 1905 of 38,828 cwts., the total amounting to 292,174 cwts., of which 53,134 cwts. were taken by the United Kingdom.

New Books.

THE ELEMENTS OF CHEMICAL ENGINEERING. By J. GROSSMANN, M.A., Ph.D., F.I.C. With a Preface by Sir William Ramsay, K.C.B., F.R.S. Chas. Griffin and Company, Ltd., Exeter Street, Strand, London. 1906. Price 3s. 6d.

8vo. volume containing 148 pages of subject matter, and the alphabetical index. There are 50 illustrations. The general treatment of the subject may be gathered from the sub-divisions of the text, which are as follows:—I. The Beaker and its technical equivalents. II. Distilling flasks; Liebig condensers; Fractionating tubes and their technical equivalents. III. The Air-Bath and its technical equivalents. IV. The Blowpipe and the Crucible and their technical equivalents. V. The Steam-Boiler and other sources of power. VI. Application of Heat in Chemical Engineering. VII. The Funnel, Mortar, Measuring Instruments, and their technical equivalents. VIII. Materials used in Chemical Engineering, and their Mode of Application. IX. Technical Research, and the Designing of Plant. X. Current prices of Chemicals and Materials.

REPORT ON THE INCIDENCE OF ANTHRAX IN THE MANIPULATION OF HORSEHAIR AND BRISTLES. By T. M. LEGGE, M.D., H.M. Medical Inspector of Factories. Wyman and Sons, Fetter Lane, E.C.

THE particulars contained in this Report with regard to the number of cases of anthrax due to the use of the materials (horsehair and bristles) during the last seven years show that the risk of infection to the persons employed in handling them is serious, and indicate the need for preventive measures being taken. The method by which the risk can be minimised by means of steam disinfection, is briefly described, and it is suggested that the process of disinfection could be most effectively,

and presumably most cheaply, carried out before the distribution of the raw materials to the manufacturer. The Secretary of State proposes to take into consideration the question of issuing Regulations under section 79 of the Factory and Workshop Act, prohibiting the use of dangerous classes of horsehair and bristles unless they have first been submitted to some efficient system of disinfection by steam; but before framing Regulations he would be glad to receive and consider any observations which manufacturers in the industries affected may desire to make, especially with regard to the suggestion mentioned.

FINAL REPORT OF THE DEPARTMENTAL COMMITTEE ON THE ROYAL COLLEGE OF SCIENCE, &c. Vol. II. Minutes of evidence, Appendices (II.—XIII.) and Index. [Cd. 2956.] Wyman and Sons, Fetter Lane, E.C. Price 1*s.* 11*d.*

A FOOLSCAP volume of 231 pages, containing minutes of evidence taken before the Departmental Committee of the Board of Education, 12 appendices on various allied subjects, and an index to the various subjects dealt with in the report, minutes and appendices.

JOURNAL OF THE

Society of Chemical Industry.

No. 13.—Vol. XXV. SUPPLEMENT. JULY 16, 1906.

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Samuel Hall, East London Soap Works, Bow, E.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie., 55, Rue des Francs-Bourgeois, Paris (3e).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

List of Members Elected.

July 11, 1906.

Crowther, R. E., c/o Mark Fletcher & Sons, Ltd., Moss Lane, Whitefield, Manchester, Chemist.

Greene, George M., c/o Colgate & Co., Jersey City, N.J., U.S.A., Chemist.

Haefele, J. Ernest, 5, Marion Street, New York City, U.S.A., Chemist.

Henius, Dr. Max, 327, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

Herig, Harry W., 14, Van Houten Avenue, Jersey City, N.J., U.S.A., Chemist.

Hulme, Robert B., c/o Kentucky Refining Co., Louisville, Ky., U.S.A., Chief Chemist.

Johnson, Oliver L., Jewett City, Conn., U.S.A., Dye Works Manager.

Kremers, William, Holland, Mich., U.S.A., Sugar Mill Superintendent.

Morris, A. H., 77, Beverley Road, Bolton, Lancashire, Brewer.

Peverley, Frank, Holly Lea, Longfield Road, Urmston, near Manchester, Dyer.

Shaw, Ronald W. F., Hooghly College, Chinsurah, Bengal, India, Principal.

Sinclair, Edmund E., 3, Marion Street, New York City, U.S.A., Printing Ink Manufacturer.

Stokes, Francis J., 704, Locust Avenue, Germantown, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

Wahl, Dr. Robert, 327, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.

Zdanowicz, Joseph, 5, Place de la Station, Alost, Belgium, Chemical Engineer (Artificial Silk).

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

Baker, John T.; Journals to Phillipsburg, N.J., U.S.A.

Bartripp, G. F., l/o South Woodford; 20, Grove Road, Wanstead, Essex.

Benjamin, Albert A., l/o Bolton; Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.

Birwith, L. W., l/o Dover, N.J.; c/o E. I. du Pont and Co., Central National Bank Building, Wilmington, Del., U.S.A.

Brettell-Vaughan, E.; Journals to 18, Queen Street, London, E.C.

Breyer, Theodor, l/o Waukegan; 842, Lunt Avenue, Rogers Park, Chicago, Ill., U.S.A.

Broome, Jos., l/o Bayonne; 5, Webster Terrace, Roselle Park, N.J., U.S.A.

Buchanan, E. F., l/o Berlin; c/o Dresdner Bank, Frankfurt a/Main, Germany.

Davidson, C., l/o Pollokshields; 328, Golfhill Drive, Dennistown, Glasgow.

Dibdin, W. J., l/o Sutton; "Purley Bury," Purley Downs Road, Sanderstead, Surrey.

Duryea, C. B., l/o New York; c/o Edwardsburg Starch Co., Cardinal, Ont., Canada.

Evans, Sir John, K.C.B., F.R.S., l/o Hemel Hempstead; Britwell, Berkhamstead, Herts.

Fuller, C. J. P., l/o Brownlow Road; 603, Chorley New Road, Horwich, near Bolton.

Guthrie, Alan; Journals to c/o Cooper, Allen and Co., Cawnpore, India.

Hodgkins, D. H., l/o La Fayette Avenue,; 80, Paulison Avenue, Passaic, N.J., U.S.A.

Hudson, A. W., l/o Vancouver Island; retain Journals.

Jones, Chas. H., l/o Crouch End; c/o Capillitas Copper Co., Muschaca, near Andalgala, Prov. Catamarca, Argentina.

Labonde, Dr. Leon, l/o Rochester; Los Angeles, Cal., U.S.A.

Lachmann, Dr. Arthur, l/o San Francisco; Petaluma, Cal., U.S.A.

Lindsay, Robt., l/o Johannesburg; Cyanide Works, Durban Roodepoort G. M. Co., Roodepoort, Transvaal.

McGovney, C. S., l/o West La Fayette; Engineering Experiment Station, Urbana, Ill., U.S.A.

Matthews, Dr. J. Merritt, l/o South Street; 320, South Broad Street, Philadelphia, Pa., U.S.A.

Miller, J. Carlile, l/o Bridgeton; 188, St. Vincent Street, Glasgow.

Morris, Edgar F.; all communications to c/o Cornbrook Chemical Co., Ltd., Color Works, Stockport.

Myles, C. D.; Journals to Ossory Lodge, Kingstown, Co. Dublin.

Novarina, J. L., l/o Main Street; 289, Myrtle Avenue, Brooklyn, N.Y., U.S.A.

Payne, Allen G. C., l/o Peckham; 63, Plassey Street, Penarth, near Cardiff.

Proctor, C., l/o 27; 43a, London Road, Forest Hill, S.E.

Pullin, S. R., l/o Leeds; Attasi Mines, Prinsisu, Dunkwa Station, Sekondi, Gold Coast Colony.

Shuler, D. P., l/o Detroit; R.F.D. No. 7, Box 146, Los Angeles, Cal., U.S.A.

Siebold, Alf., l/o Alloa; c/o British Dyewood and Chemical Co., Ltd., Lacovia P.O., Jamaica.

Symmes, Whitman, l/o San Francisco; 2231, Piedmont Avenue, Berkeley, Cal., U.S.A.

Thompson, Dr. J. Fairfield, l/o New York; c/o Orford Copper Co., New Brighton, N.Y., U.S.A.

Tighe, Arthur, l/o Darling Point; Springfield, Darlinghurst Road, Sydney, N.S.W., Australia.

Walpole, G. Stanley, Journals to 140, Warwick Street, Pimlico, S.W.

Change of Address Required.

Pollitt, R. B., l/o Johannesburg.

Deaths.

Orsman, W. J., of Gathurst, Wigan; at Port Said. June 21st.

Russell, David, at Silverburn, Leven, Fife. June 2nd.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 13,984. Moore. *See under* VIII.

" 14,032. Wolf. Filters. June 19.

" 14,049. Forder. Pumps for raising or forcing liquids. June 19.

" 14,186. Elmore. Separation of certain constituents of finely divided material. June 20.

" 14,505. Fischer. Filter.* June 25.

" 14,573. Wood. Underfeed furnaces. June 26.

" 14,574. Wood. Forced draught furnaces. June 26.

" 14,637. Brooke. Regenerator furnaces. June 27.

" 14,653. Blackie. Method of rendering certain powders readily miscible with water. June 27.

[C.S.] 12,874 (1905). Gery. Tunnel kilns. June 27.

" 15,139 (1905). Shew and Jones. Kilns for drying hops and malt. July 4.

" 18,444 (1905). Johansson. Centrifugal liquid separators. July 4.

" 19,378 (1905). Thompson (Schmitz). Apparatus for the continuous supply of two liquids to a vessel. July 4.

" 27,155 (1905). Briscoe. Apparatus for screening, straining or filtering fluids. June 27.

" 7816 (1906). Gebbi. Apparatus for filtering water or other liquids. July 4.

II.—FUEL, GAS, AND LIGHT.

[A.] 13,956. Justice (Deutsche Gasglühlicht A.-G.). Metallic filament for electric glow lamps and method of treating same.* June 18.

„ 14,209. Lynde. Production of gas from petrol or other hydrocarbons. June 21.

„ 14,281. Wilke, and The Simon-Carves Bye-Product Coke Oven Co. Vertical flue coke ovens. June 22.

„ 14,365. Parker. Fuel. June 22.

„ 14,425. Sander. Manufacture of filaments for electric incandescent lamps. June 23.

„ 14,437. Hill. Mantles for incandescent gas burners. June 23.

„ 14,496. Flössel. Purifying blast-furnace and other impure gases.* June 25.

„ 14,640. Ritchie. Manufacture of mantles for incandescent gas lighting. June 27.

„ 14,665. Bourdos. Incandescent gas mantle. June 27.

„ 14,677. Forster. Gas producers. June 27.

„ 14,714. Collet and Whitfield. Manufacture of producer gas. June 27.

„ 14,731. Cranmer. Apparatus for producing gas for illuminating, heating or power purposes. June 28.

„ 14,790. Parker. Destructive distillation of coal. June 28.

„ 14,799. Allport. Coke oven plant. June 28.

„ 14,816. Deutsche Gasglühlicht A.-G. (Auerges.). Method of producing metallic incandescence bodies for electric glow lamps. [Ger. Appl., Oct. 28, 1905.]* June 28.

„ 14,901. Deutsche Gasglühlicht A.-G. (Auerges.). Method of producing metallic electrical incandescence bodies. [Ger. Appl., Oct. 28, 1905.]* June 30.

„ 14,947. Siemens. Regenerative gas furnaces.* June 30.

[C.S.] 12,468 (1905). Delage. *See under* IX.

„ 13,013 (1905). Dieckmann, Ormrod, Curle and Stackard. Burners for liquid fuel. June 27.

„ 14,575 (1905). Foster and Greener. Gas producers. July 4.

„ 20,330 (1905). British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges.). Arc lamp electrodes. July 4.

„ 22,382 (1905). Bowmer. Suction gas producers. June 27.

„ 24,080 (1905). Van Vriesland. Treatment of the woven tubes or yarns used in the manufacture of incandescent mantles. July 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 14,567. Kuess. Manufacture of candles or other illuminating bodies by means of petroleum or other mineral oils.* June 26.

„ 14,568. Kuess. Solidification of petroleum or other mineral oils and the transformation of the solidified hydrocarbon into soap.* June 26.

„ 14,896. Vincent. Recovery of benzine and other volatile products disengaged during certain industrial operations. [Fr. Appl., July 3, 1905.]* June 30.

[C.S.] 13,151 (1905). Spaltholz. Emulsions of tar oils, phenols, and similar products. July 4.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 14,057. Kalle und Co. Manufacture of a sulphur containing red colouring matter from thio-indoxyl carboxylic acid and from thioindoxyl. [Ger. Appl, Dec. 22, 1905.]* June 19.

„ 14,191. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur, and of leuco compounds thereof. June 20.

„ 14,192. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur, and of leuco compounds thereof. June 20.

„ 14,507. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. June 25.

„ 14,921. Newton (Bayer und Co.). Manufacture of new azo dyestuffs. June 30.

[C.S.] 20,780 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of amidosulphonic acids of phenyl-1,2-naphthimidazole or homologues or derivatives thereof. July 4.

„ 23,316 (1905). Johnson (Kalle und Co.). Manufacture of red sulphur-containing colouring matter. July 4.

„ 10,405 (1906). Imray (Soc. Chem. Industry in Basle). Manufacture of red vat dyeing dyestuffs. June 27.

„ 11,760 (1906). Imray (Soc. Chem. Industry in Basle). Manufacture of red, violet and blue vat dyeing dyestuffs. June 27.

„ 13,057 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series and of colouring matter therefrom. July 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 13,966. Haddan (Valette). Manufacture of non-inflammable and non-explosive artificial silk. June 18.

„ 14,018. Jones and Dyson. Powder for fireproofing cotton fabrics. June 19.

„ 14,087. Vittenet. Apparatus for the manufacture of artificial silk. [Fr. Appl., June 19, 1905.]* June 19.

„ 14,261. Kalle und Co. Dyeing and printing red on textile fibres [Ger Appl., June 26., 1905.]* June 21.

„ 14,343. Rohner. Manufacture of alkali salts of formaldehyde sulphoxylic acid.* June 22.

„ 14,344. Wood. Apparatus for cleaning, dyeing and otherwise treating wool, hair, cotton and other materials.* June 22.

„ 14,918. Spenle. Bleaching kiers. June 30.

[C.S.] 13,356 (1905). Hardcastle. Treatment of fabrics, felts, yarns, slivers and the like with liquids, emulsions, gases, &c. June 27.

„ 14,866 (1905). Asher. Method of dyeing sponges. July 4.

„ 21,114 (1905). Thornhill, and Moseley and Sons. Production of patterns on cloths and other fabrics. June 27.

„ 26,054 (1905). Lake (Companhia Manufactora Flumineuse). Machines for printing fabrics and wall papers. June 27.

„ 26,962 (1905). Bethmann. Process for dyeing animal fibres and fibre mixtures containing wool, with Aniline Black. June 27.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[C.S.] 26,054 (1905). Lake (Companhia Manufactora Flumineuse). *See under* V.

,, 2998 (1906). Martinet and Dulac. Apparatus for dyeing hides and skins. June 27.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 13,882. Walkey. Conversion of tribasic phosphate of lime into monobasic phosphate and oxide of lime, and separation of the two. June 18.

,, 13,970. Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of aluminium hydroxide and aluminates. June 18.

,, 14,278. Dennis and Co., Ltd., and Dennis. Copper sulphate coolers. June 22.

,, 14,279. Dennis and Co., Ltd., and Dennis. Copper sulphate coolers. June 22.

,, 14,323. Newton (Bayer und Co.). Manufacture of bromine preparations. June 22.

,, 14,339. Reisert. Separation of sulphuric acid and sulphates from aqueous solutions.* June 22.

,, 14,489. Bloxam (Kirchhoff und Neirath). Manufacture of peroxides or peroxidised compounds. June 25.

,, 14,586. Kintner. Ozone producers. [U.S. Appl., June 28, 1905.]* June 26.

,, 14,601. Machtolf. Manufacture of amorphous carbon.* June 26.

,, 14,847. Piffard. Manufacture of ammonia. June 30.

[C.S.] 13,127 (1905). Hargreaves. Manufacture of salt. June 27.

,, 16,279 (1905). Holloway. Preparation of common salt. June 27.

,, 17,198 (1905). Hurlbutt and Hurlbutt. Packing for hydrochloric acid and gas treating towers. June 27.

,, 19,986 (1905). Johnson (Chem. Fabr. Griesheim Elektron). Concentration of dilute nitric acid. June 27.

,, 3536 (1906). Ponthus. Manufacture of a double acetate of copper and lime. July 4.

,, 6122 (1906). Pezzolato and de Felice. Separation of sulphate of alumina and sulphate of potash from solutions. June 27.

,, 7870 (1906.) Pauling. Production of nitric acip or nitric oxide from atmospheric air. June 27.

,, 7871 (1906). Pauling. Production of pure nitric acid. June 27.

,, 11,371 (1906). Tchorniac. Separation of alkali cyanides from their solutions in water. July 4.

,, 11,767 (1906). Cons. f. Elektrochem. Industrie. Method of producing calcium hydride. June 27.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 13,984. Moore. Furnaces for glass manufacture and like purposes. June 19.

14,250. Wainford. Kilns or ovens for pottery and like ware. June 21.

14,674. Bottomley and Paget. Manufacture of fused silica ware. June 27.

[C.S.] 5605 (1906). Sievert. Glass melting and pouring apparatus. July 4.

,, 8888 (1906). Marks (Theisen et Cie.). Method of obtaining moiré effects on glass. June 27.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 14,001. Czarnikow. Manufacture of substances with a high resistance to moisture especially for building purposes.* June 19.

,, 14,030. Hamblet. Arched kilns for burning bricks and the like. June 19.

,, 14,173. Clark (American Hydrolit Co.). Manufacture of magnesium cement.* June 20.

,, 14,233. Liebold, Wittig and Grimm. Manufacture of cement. [Ger. Appl., June 22, 1905.]* June 21.

[C.S.] 12,468 (1905). Delage. Manufacture of refractory bodies for use in gas fires. June 27.

,, 13,036 (1905). Brewerton. Kilns for burning bricks, tiles and the like. June 27.

,, 1105 (1906). Bohn. Method and apparatus for cleaning and separating clays. July 4.

,, 2345 (1906). Kelly. Heat insulating materials. June 27.

X.—METALLURGY.

[A.] 13,916. Angel. Treatment and reduction of complex sulphide and other ores. June 18.

,, 13,917. Angel. Furnace for treating sulphide and and other ores. June 18.

,, 13,931. Cattaneo and Faggian. Preparation for converting iron into steel and for tempering steel.* June 18.

,, 13,935. Cattaneo and Schlesinger. Drying blast air for metallurgical purposes. June 18.

,, 14,062. Siemens und Halske A.-G. Production of technically pure ductile tantalum. [Ger. Appl., Aug. 19, 1905.]* June 19.

,, 14,401. Fyfe. Apparatus for arresting and depositing fumes from ores. June 23.

,, 14,708. Paterson and Ford (Miller). Treatment of refractory ores. June 27.

,, 14,710. Koch. Smelting process and furnace therefor. [Ger. Appl., June 27, 1905.]* June 27

,, 14,840. Boddam and Burt. Magnetic apparatus for separating ores in the wet state. June 30.

[C.S.] 10,881 (1905). Vautin. Production of fused metals and alloys from oxides and other compounds. July 4.

,, 12,868 (1905). Goldschmidt and Weber. Detinning of tinned plates. June 27.

,, 12,869 (1905). Goldschmidt and Weber. Detinning of tinned plates. June 27.

,, 12,870 (1905). Goldschmidt and Weber. Detinning of tinned plates. July 4.

,, 13,433 (1905). MacIvor, Fradd, and Metals Extraction Corporation, Ltd. Treatment of complex ores containing gold. July 4.

,, 15,375 (1905). Timm. Process for dissolving solid fluxes in fluid slag. June 27.

,, 17,651 (1905). Leitch. Furnaces for separating metals. June 27.

,, 1356 (1906). André. Method of and apparatus for manufacturing steel. July 4.

,, 6484 (1906). Tropenas. Manufacture of steel by the pneumatic process. June 27.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 26,813 (1905). Ashcroft. Electrolysis of metallic compounds or ores. June 22.

,, 13,949. De Ferranti. Electric furnaces. June 18.

,, 13,965. De Ferranti. Electric furnaces. June 18.

,, 13,972. Cowper-Coles. Electrodeposition of copper. June 18.

,, 13,979. Berend (Schmitt). Insulating materials. June 18.

,, 14,259. Moscicki. Electric plant for producing chemical reactions. [Ger. Appl., Jan. 17, 1906.]* June 21.

,, 14,420. Cornelius and Fehn. Electric resistance furnaces. June 23.

,, 14,668. Tanne and Papenbruch. Electro-synthetic process and apparatus employed therein. June 27.

,, 14,803. Bradley, Powel, Donaldson and Wingfield. Electric deposition of metals or alloys. June 28.

,, 14,922. Roberts. Electrolytic diaphragms.* June 30.

,, 14,925. Wellard. Electric cells and the like. June 30.

[C.S.] 5408 (1905). Ashcroft. Electrolytic cells. June 27.

,, 11,654A (1905). Schanschieff. Accumulator plates. June 27.

,, 12,367 (1905). Sahlström. Electric ozonisers. June 27.

,, 17,152 (1905). Clarke. Apparatus for agitating electrolytic solutions. July 4.

,, 17,238 (1905). Jocl. Electrodes for secondary batteries. June 27.

,, 7597 (1906). Allmänna Svenska Elektriska Aktiebolaget. Electrically heated shaft furnaces. July 4.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 14,255. Abel (Act.-Ges. f. Anilinfabr.). *See under* XIX.

,, 14,263. Emery. Lubricating compounds.* June 21.

,, 14,368. Kuess. *See under* III.

,, 14,784. Henderson. Manufacture of soap. June 28.

[C.S.] 4088 (1906). Kösters. Manufacture of viscid or fluid emulsions of oils, fats, or the like. July 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[C.S.] 16,490 (1905). Brunet. Manufacture of antimony and arsenic colours. July 4.

,, 7819 (1906). Ephraim. Process for rendering lithopone more stable against light. July 4.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 14,319. Betz. Production of a horn-like substance from casein or casein-like or albuminous substances.* June 22.

,, 14,395. Marter. Manufacture of an insulating composition resembling vulcanite. June 23.

,, 14,602. Kohl. Manufacture of leather.* June 26.

[C.S.] 18,328 (1905). Thomas. Manufacture of films and sheets from casein compounds. July 4.

,, 21,664 (1905). Bauer (Maschinenfabr. Moenus Akt.-Ges.). Machines for cleaning and dressing hides. July 4.

,, 23,209 (1905). Flöring and Lennoberg. Process for rendering chrome leather waterproof and durable. June 27.

XV.—MANURES, ETC.

[A.] 13,882. Walkey. *See under* VII.

,, 14,171. Hartje, Nilsen and Spencer. *See under* XVIII.A.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 13,915. Schalk. Process and apparatus for fermenting wort.* June 18.

,, 14,512. Faulkner. Treatment of mash mixture or brewers' grains or draff for the production of material for use as an ordinary malt wort. June 25.

[C.S.] 15,139 (1905). Shew and Jones. *See under* I.

,, 18,393 (1905). Nycander. Production of distillers' yeast from the raw materials for and products of the manufacture of tapioca, sago, arrowroot flour, and the like. June 27

,, 20,246 (1905). Chew, and H. J. West and Co. Production of non-deposit beer and the like. July 4.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

[A.] 14,067. Temple. Process of treating yeast for bread making and the like.* June 19.

,, 14,171. Hartje, Nilson and Spencer. Treatment of fish and fish offal for the production of fish meal, fertilisers, &c. June 20.

,, 14,931. Parker. Manufacture of extract of germ of wheat. June 30.

[C.S.] 12,642 (1905). Krause and Lenk. Method of preserving animal and other organic substances. June 27.

,, 13,245 (1905). Sherman. Process for preserving fruit. July 4.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 14,464. Candy. Purification of water. June 26.

(*C.*)—DISINFECTANTS.

[A.] 14,818. Hume. Sheep dips.* June 30.

[C.S.] 6676 (1906). Smith and Davis. Disinfectants and deodorisers. July 4.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 14,177. Monin. Loading or filling substances for use in the manufacture of paper. June 20.

,, 14,255. Abel. (Act.-Ges. f. Anilinfabr.). Manufacture of cellulose esters of fatty acids. June 21.

[C.S.] 6942 (1906). Van den Bosch, van den Bosch, and Müller. Direct production of coloured cellulose articles. June 27.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 14,122. Lynde. Manufacture of saccharin. June 20.

,, 14,322. Wellcome, Jowett and Pyman. Manufacture of new therapeutic compounds. June 22.

,, 14,438. Chem. Fabr. Grünau, Landshoff und Meyer A.-G. Manufacture of concentrated formic acid. [Ger. Appl., July 1, 1905.]* June 23.

[C.S.] 13,601 (1905). Jules Jean et Cie., and Raverat. Process for the recovery of ether vapours. July 4.

,, 18,582 (1905). Cooper (Bayer und Co.). Manufacture of pyrimidine derivatives. July 4.

,, 772 (1906). Elektrochemische Werke Ges. m.b.H. Manufacture of formates. June 27.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 14,435. Bloxam (Neue Photographische Ges.). Photographic pigment paper.* June 23.

[C.S.] 5780 (1905). Little. Negative plates for photographic printing. June 27.

XXII.—EXPLOSIVES, MATCHES, ETC.

[C.S.] 6314 (1906). Lake (Dynamit Akt.-Ges. vorm. A. Nobel und Co.). Nitroglycerin explosives. July 4.



FIG. 2.—0·5 % As.

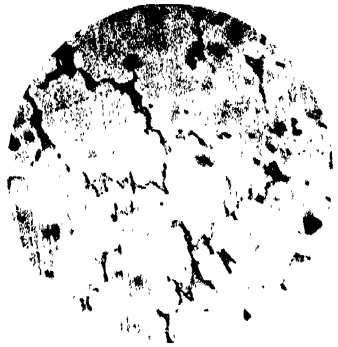


FIG. 3.—7 % As.



FIG. 4.—17·1 % As.

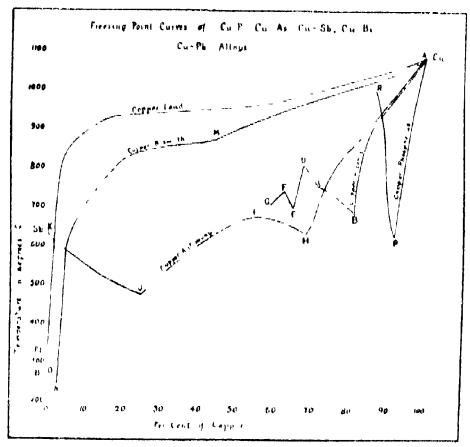


FIG. 1.



FIG. 5.—10·2 % As.



FIG. 6.—23·2 % As.



FIG. 7.—28·34 % As.



Fig. 8.—32.2 % As.



Fig. 9.—34.4 % Arsenic.



Fig. 10.—37.2 % As.



Fig. 11.—41 % As.



Fig. 12.—0.4 % Antimony.

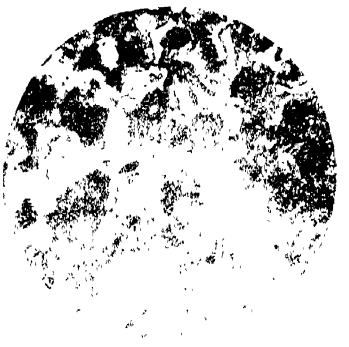


Fig. 13.—9 % Antimony.



Fig. 14.—30 % Antimony.



Fig. 15.—31.5 % Antimony.



Fig. 16.—34 % Antimony.

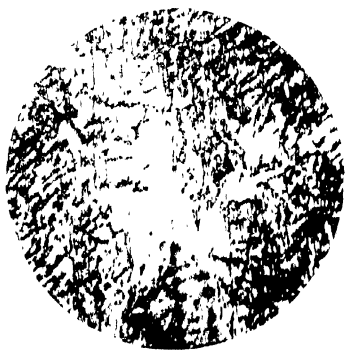


Fig. 17.—46 % Antimony.



Fig. 18.—56 % Antimony.



Fig. 19.—63 % Antimony.



Fig. 20.—75 % Antimony.

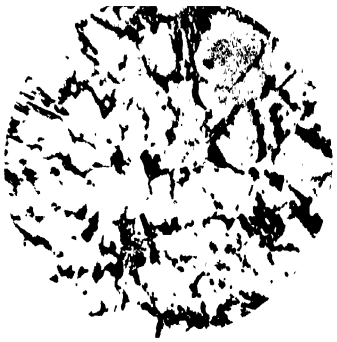


Fig. 21.—90 % Antimony.

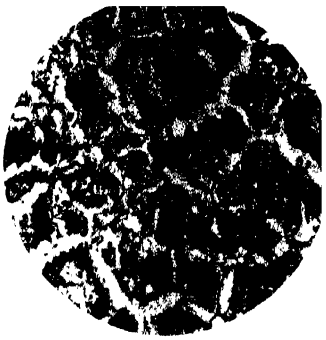


Fig. 22.—0.41 % P.



Fig. 23.—0.82 % P.



Fig. 24.—2.5 % P.

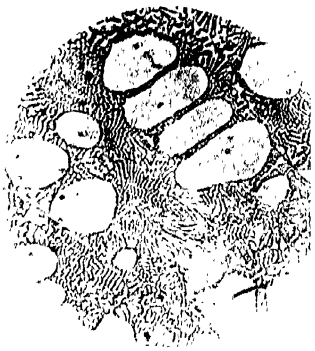


Fig. 25.—5.8 % P.



Fig. 26.—7.4 % P.



Fig. 27.—8.21 % P.



Fig. 28.—10.7 % P.



Fig. 29.—14 % P.

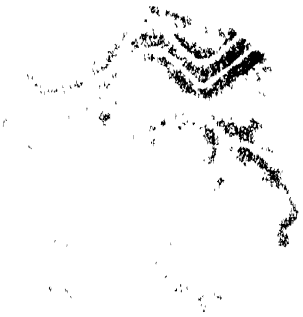


Fig. 30.—0.4 % Bismuth.



Fig. 31.—4 % Bismuth.



Fig. 32 – 10 % Bismuth



Fig. 33 – 25 % Bismuth.



Fig. 34 – 40 % Bismuth

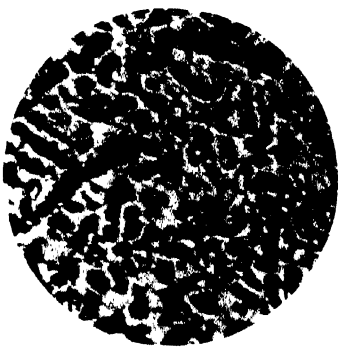


Fig. 35.– 57 % Bismuth.

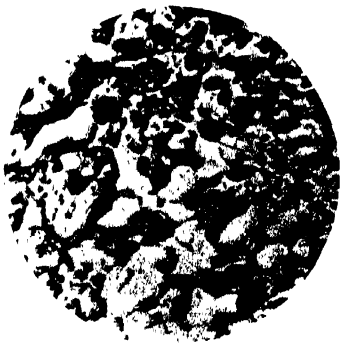


Fig. 36.–62 % Bismuth



Fig. 37 – 85 % Bismuth.

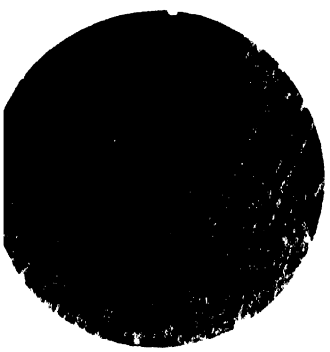


Fig. 38 – 97·2 % Bismuth.

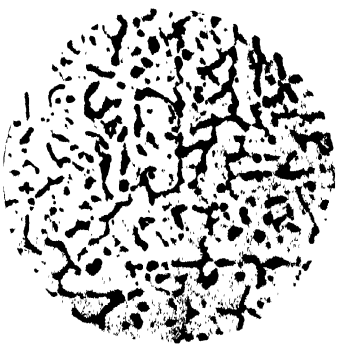


Fig. 39.–5 % Pb.



Fig. 40. – 15 % Pb.



Fig. 41.—40 % Pb.

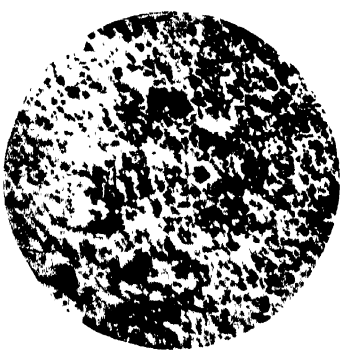


Fig. 42.—50 % Pb.

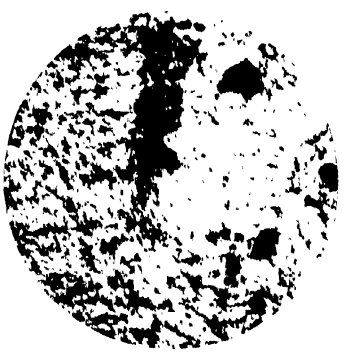


Fig. 43.—60 % Pb.

Deaths.

Orsman, W. J., of Gathurst, Wigan; at Port Said. June 21st.

Russell, David, at Silverburn, Leven, Fife. June 2nd.

Birmingham and Midland Section.

Meeting held at Birmingham on Wednesday, May 16th, 1906.

PROF. P. F. FRANKLAND, F.R.S., IN THE CHAIR.

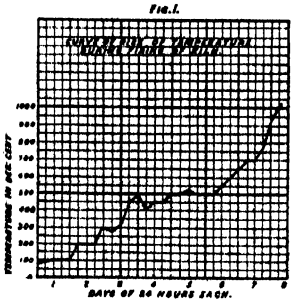
SOME TEMPERATURE OBSERVATIONS DURING THE BURNING OF FIRE-CLAY GOODS.

BY WALTER C. HANCOCK, B.A. (CANTAB.), F.I.C.

Clays, in their natural state, contain both moisture and combined water. In the course of manufacture more water is introduced to render the clay plastic, but the bulk of this is removed during the drying process, and is accompanied by the contraction known as "air shrinkage." What little added water remains when the goods are ready for burning may be treated as "moisture." Moisture is driven off from clay at from 100° to 150° C; the expulsion of combined water begins at about 350° to 400° C. and is complete at from 600° to 700° C. By the determination of this "temperature of dehydration," according to Le Chatelier, hydrated aluminium silicates are capable of better classification than by chemical analysis. Le Chatelier has also shown that besides the usual absorption of heat on dehydration, which checks the rise of temperature, there is at certain temperatures, a brisk evolution of heat due to physical change. On heating, clays also lose carbon dioxide, sulphur dioxide, organic matter, &c. Kennedy (Transactions of the American Ceramic Society, 1902, 4, 146) found that pure kaolin briquettes up to 600° C. lost weight equally with briquettes of 70 per cent. kaolin and 30 per cent. chalk, but that the latter lost further in weight up to about 900° C., showing that the carbon dioxide was driven off between 600° and 900° C.

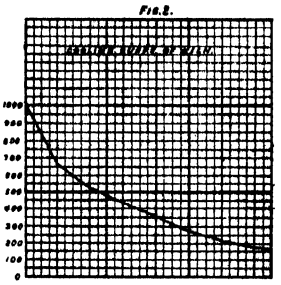
In order to follow the temperature changes occurring during the burning of an ordinary circular down-draught kiln, an electrical pyrometer was inserted in the centre of the crown of the kiln, and extended to a depth of about 1 ft. inside. Observations were recorded every two hours, with the results shown in Fig. 1.

FIG. 1.



The first reading was taken at 80° C., when the grates were half full and the top of the "wicket" still open. The fires in the grates were increased by regular additions to the top, and the temperature rose gradually to 500° C. At this point the top of the wicket was bricked up, and 1 in. of draught put on the chimney. The temperature then fell to 400° C., evidently due to insufficient draught. After 24 hours, however, with a 2-in. draught, the temperature of 500° C. was regained. For the next 32 hours the temperature of the kiln remained stationary at 500° C., although the firing was steadily maintained and the 3rd and 4th inches of chimney draught were added. This stationary temperature indicated absorption of heat, due to dehydration of the clay, and this observation, made on a kiln containing some 27 tons of material, practically confirms observations made on a laboratory scale by Le Chatelier and others. From this point the temperature rose steadily until the maximum of 1000° C. was reached. The readings of the electrical pyrometer corresponded fairly closely with the fusing points of

FIG. 2.



some Seger cones also contained in the kiln. Fig. 2 shows the cooling curve of the kiln.

An electrical pyrometer enables the changes occurring in the kiln to be followed without opening it. By its use the workman's attention to the firing can be checked, the supply of heat controlled, and the temperatures known at which absorption or disengagement of heat occurs. This critical temperature of dehydration should be known to all burners of clay articles as A. E. Barnes has already pointed out. In kilns closely set, as with bricks, a large quantity of steam is rapidly set free, and becomes in a measure superheated. The action of this steam upon the cooler parts of a kiln and the ventilation and construction of kilns to meet this emergency, all demand further study. With regard to some of the points here mentioned, the use of an electrical pyrometer would give information. At the same time, as Prof. H. Ries mentions in a report upon "The Clays and Clay Industry of New Jersey," the price, delicacy of the instrument, and lack of realisation of its importance, have all tended to restrict its use—though many of the larger clay-working plants of New Jersey are adopting it, an example, which from my own personal experience, I would commend to the careful consideration of English manufacturers.

My thanks are due to Messrs. Chance, Brothers and Co., Ltd., for kindly allowing the results of these observations, made on their works, to be published.

DISCUSSION.

Dr. SLATER PRICE asked if the curve obtained when the kiln was being heated up was the only one taken, or whether others had been taken, all showing a similar peculiarity at a temperature of about 500° C.

The CHAIRMAN asked whether a similar curve had been taken showing the effect of firing upon an empty kiln. Was it absolutely certain that the effect was entirely due to the charge?

Mr. ALEX. TUCKER said that he had seen, near Dusseldorf, an interesting control for high temperatures applied to a kiln, which depended on the flotation of a bar of iron in mercury. The mercury was placed in a by-pass from the main flue, and in this way the temperature to which it was exposed was reduced considerably. The iron bar actuated a differential valve as a kind of relay, and by a damper controlled the chimney outlet of the furnace, and so regulated the heat of the kiln.

Mr. ROSSITER asked whether any temperatures had been taken with the pyrometer in different positions in the kiln? He had had some experience in taking tem-

peratures in furnaces and he found there could be enormous differences in just shifting the pyrometer from one place to another; in fact, a small shift of the pyrometer would sometimes make a great difference in the temperature. It appeared to him that if a kiln were charged with a quantity of fire-clay goods, the temperature at the crown of the kiln, or 2 ft. below the crown of the kiln would be different from the temperature at the same time 2 ft. from the floor of the kiln.

Mr. PAGE said that the pyrometer was not placed in the most desirable position for the purpose. The fluctuations in the temperature of the fuses at this point were considerable, due to the conditions of "firing." The fire mouths had no doors, and the quantity of air admitted over the fire was very variable, and of course such variation would be very pronounced at the point where the pyrometer was placed. This would be evident had the sketch shown the relative position of the fire holes or furnaces of the pyrometer.

The question of dehydration had been dealt with recently by Mr. Jos. Burton in a paper read before the English Ceramic Society. The method he adopted was to burn small tiles (previously dried at 105° C.) to temperature intervals of 20° C., and so find the loss in weight. These experiments showed that the combined water was driven off as follows, taking each 40° interval:—120° C., 0·32 per cent. of the total combined water; 160° C., 0·51 per cent.; 200° C., 0·62 per cent.; 240° C., 0·67 per cent.; 280° C., 0·86 per cent.; 320° C., 1·40 per cent.; 360° C., 2·30 per cent.; 400° C., 2·82 per cent.; 440° C., 2·96 per cent.; 480° C., 4·24 per cent.; 520° C., 9·59 per cent.; 560° C., 10·18 per cent.; 600° C., 10·69 per cent.; 700° C., 11·15 per cent.; 800° C., 11·42 per cent.; and at 1200° C., 12·01 per cent.

The temperatures were taken with a carefully calibrated Le Chatelier pyrometer, and it would be noticed that nearly half of the combined water was driven off between 480° and 520°, which would agree with Mr. Hancock's conclusions. As to the fact that the temperature curve showed a retardation about 500°, this was fully recognised by a competent kiln man, and so far from trying to increase the temperature at this point, he kept the fire mouths open, thus admitting a large quantity of air over the fire, and made no attempt to force the heating until he was satisfied that the rush of this so-called "second steam" was past. The beginning and the end of this critical period were easily observed in cases where the ordinary down draught kilns had independent chimneys. The indication was the discharge from the chimney of a yellowish vapour. It was this vapour, too, which gave rise to the bluish haze often observed when one looked down on a brick yard lying in a valley or depression.

Mr. H. L. HEATHCOTE referred to a method of measuring the temperature in kilns and other hot places. Mr. Hancock had mentioned the well-known advantages of the pyrometer, but the pyrometer generally employed could not be moved about, and it measured the temperature at a particular place in the kiln. In conjunction with Mr. John Pugh, of the Rudge Whitworth Co., he had perfected a pyrometer which enabled one to tell the temperature quite accurately at any part of the kiln that could be seen from the outside—it was very simple and only involved the employment of solutions which were contained in glass cylinders half an inch in diameter and half an inch in thickness. These were so made and so composed that if one looked at a red hot body through a pair of these cells, it would be invisible because the light was entirely absorbed. If the hot body rose in temperature it would just become visible. These were so made, too, that they gave the same reading with another person's eyes, because the rods were not stimulated. A number of pairs could be placed in front of the eyes, which were protected from extraneous light by a stereoscope-like hood. Each pair corresponded to one temperature. The instrument could be hooked to the ears like spectacles.

Mr. L. ARCHBUTT asked whether Mr. Heathcote's pyrometer was made commercially, and where it could be obtained.

Mr. HEATHCOTE replied that the instrument was at present being perfected for other materials besides iron and steel, and that it would be put on the market, although not immediately.

Mr. W. C. HANCOCK, in reply, said that he was quite aware that there was one rather weak point in this communication, and that was that the curves which he had shown simply represented the observations upon one kiln. His explanation was that he was not now in a position to follow up the subject. With regard to the question as to what would be the variations of the pyrometer supposing the kiln to be empty, he had no data, as no such experiment had been tried, but he must say that he failed to see why for 32 hours that particular temperature should have been maintained, considering the fact that the amount of heat which was being communicated to the kiln was being continually increased. He was certain from personal observation of the kiln that it would not remain stationary from any actual neglect on the part of the workmen. He was exceedingly interested to hear of the instrument described by Mr. Tucker, and also of the method of measuring the temperatures, which was quite new to him; he should be very pleased to hear more of the matter. He was, of course, quite willing to admit the difficulties attending the use of this pyrometer, and the fact that it simply recorded the temperature of one point in the kiln. But he thought, regarding the symmetry of such a kiln, that the point he had chosen was the best at which to take the observations. He was fully aware of the difference which existed between the temperature at the top and the bottom of a kiln, but this kiln also contained a number of Seger cones which were placed on the top of some materials in the kiln, and consequently about 3 or 4 ft. lower than the junction of the thermo-couple, and the temperatures at which these cones fused corresponded fairly closely with the readings of the pyrometer. For example, a 01 cone, the fusing point of which is 920° C., was noticed to go down when the reading of the pyrometer was about 925°, and another cone corresponded pretty closely with 990° C. With reference to the method Mr. Page referred to, he himself had made some observations on a large scale in the same way. He could see no explanation for the curve remaining practically constant for 32 hours except that it was due to some physical change that was taking place in the materials in the kiln, and he was certainly confirmed in that opinion by the fact that on the laboratory scale Le Chatelier had obtained the same result. Of course he did not maintain that the temperature was accurate within a few degrees; it would vary with different clays, especially in the case of fire-clays, which were more complex than ordinary clays.

EFFECT OF CERTAIN ELEMENTS ON THE STRUCTURE AND PROPERTIES OF COPPER.

BY ARTHUR H. HIORNS.

Much work has been done in recent years in investigating the influence of various metals when alloyed with copper in different proportions, notably by Charpy, Stead, Le Chatelier, Gautier, Stansfield, Roberts-Austen, Baykoff, Heycock and Neville, Campbell, and the author. The present research has special reference to the alloys of copper with arsenic, antimony, bismuth, lead and phosphorus. Some of these alloys, viz., Cu-As, Cu-Sb, Cu-P, form chemical compounds, others exist as solutions, and some form mere mixtures or emulsions.

The mode of procedure was to melt pure copper and then add the alloying element. Two methods of treatment were employed, viz., the freezing point method and the microscopic examination of the alloys, one method confirming the results of the other.

For the preparation of the alloys carbon crucibles were employed. After melting the metals together they

were vigorously stirred with a charred stick, covered with powdered charcoal and a lid, and then allowed very slowly to cool. Another portion was cooled quickly. For microscopic examination a slice was cut right through the centre of the ingot, and the surface selected for polishing was that at right angles to the cooling surface. For obtaining the freezing point of a series the freezing points of the separate metals were first determined, and then that of the various alloys.

The types of pattern visible on the etched surface of the metal depend upon the position of the freezing-point on the curve. For alloys whose freezing-points are on or near the summit of a curve the whole of the section is composed of one substance, generally made up of crystal-grains having fine boundaries. When by the addition of either constituent a summit of a curve is left, the lines between the crystal-grains widen and become filled with a network of matter differing from that of the crystals and generally showing a more or less striated structure, characteristic of eutectics. As the bottom of a curve leading from a summit is reached, the eutectic occupies the whole surface. Any deviation from the eutectic proportion causes the breaking up of this striated pattern, and grains of one of the constituents appear in the eutectic matrix. The nature of these grains will depend on which side of the eutectic angle the alloy belongs to. These grains are primary bodies; they crystallise out first on the cooling of the alloy, and often arrange themselves in rows at right angles to each other, forming a dendritic structure. They are probably skeleton crystals, which are gradually filled up from the matrix by addition from one of the constituents as a true chemical compound or a pure metal is approached.

The freezing-points of the various alloys were determined by a protected thermo-junction, and the readings taken from a graduated scale.

Curves of freezing-points.—The curves recording the freezing-points are shown in Fig. 1. The composition is given in percentages. The alloys were analysed and micro-sections taken before and after the re-melting.

Arsenic.—The addition of arsenic lowers the melting point of copper uniformly down to 14 per cent., when a steep fall occurs, reaching its lowest point at 685° C. This alloy contains 19·2 per cent. of arsenic, which corresponds to the formula Cu_5As. The alloy with 22 per cent. of arsenic freezes at 708°, and the curve gradually rises until the alloy with 28·4 per cent. is reached at 747°. This is the chemical compound Cu_3As, and is distinguished by several characteristics, which will be referred to when describing the micro-sections.

At 847° C. another chemical compound freezes, having the formula Cu_5As_2, and containing 32·2 per cent. of arsenic. This is a well-marked body, as shown by its colour, fracture, melting point, and internal structure; it solidifies at one temperature like a pure metal. Beyond this proportion the temperature falls to a minimum with about 35 per cent. of arsenic. The curve then rises to another summit at 740° with 37·34 per cent. of arsenic, forming the compound Cu_2As. From this position the curve descends to 702°, with the alloy containing 41 per cent. of arsenic. This is near the practical limit of the direct combination of copper with arsenic.

The information furnished by the curve may be stated as follows: The line is practically straight from 0 to 14 per cent., then falls rapidly to the eutectic mixture B. At C, the first chemical compound, Cu_5As, crystallises out as a pure substance. This is soon followed by the compound Cu_5As_2 at D. At E another eutectic mixture occurs and at F we get the compound Cu_2As. Beyond G the constituents form mere mechanical mixtures, the arsenic rapidly burning off.

In Watts' Dictionary of Chemistry, vol. 2, 1882, it is stated that the chemical compound Cu_3As occurs native as domeykite in Chili and Cornwall. The compound Cu_2As is known as white copper or white tombac, obtained by heating an arsenite or arseniate of copper with charcoal. The compound Cu_2As_2 may be produced by passing arsenuretted hydrogen over dry cupric chloride.

Table of Alloys.

No.	Per cent. of arsenic.	Freezing point in degrees centigrade.	Notes.
1	0·1 to 0·2	Between 1060 and 1020	
2	0·3 to 0·4		
3	0·5 to 1·0		
4	2·0 to 3·0		
5	4·0 to 5·0	1010	
6	6·0 to 10·0	1000 to 965	
7	11·0 to 13·0	950 to 920	
8	13·0 to 15·0	920 to 900	
9	16·0 to 18·0	810 to 790	
10	19·2	685	
11	20·0 to 23·0	690 to 720	
12	23·0 to 27·0	720 to 748	
13	28·34	747	The compound Cu_5As
14	32·19	807	,, Cu_5As_2
15	33·0 to 35·0	780 to 695	
16	37·24	740	,, Cu_2As
17	41·0	702	
18	43·0	—	Extreme limit of combination.

Friedrich (Metallurge 2, 477, 1905), has investigated the alloys of copper and arsenic, and gives three eutectics and four horizontals in the cooling curve. The former at 688°, 711°, and 603°. He says the compound Cu_3As does not exist.

Antimony.—The addition of antimony to copper lowers the freezing-point more or less rapidly down to 31·5 per cent., when the eutectic mixture is formed, Fig. 1, H. As the antimony is increased above this limit the freezing-points rise in temperature, reaching a maximum at, I, with about 46 per cent. of antimony, which is midway between the compounds Cu_3Sb and Cu_2Sb. There should be a break in the curve in the points representing these compounds, but it is probably too small to be recorded by the instrument. The point, I, must consist of a solid solution which decomposes into two separate bodies on cooling to 410° C. Beyond the alloys with 50 per cent. of antimony the fall is continued to, J, with 75 per cent., which has the lowest melting point of the series, and is therefore the true eutectic mixture. With still more antimony the temperature rises until the freezing-point of pure antimony is reached at 632°.

The alloys of copper and antimony have been studied by Charpy, Stead, Le Chatelier, Stansfield, and Baykoff.

Baykoff (Soc. d'Encour. pour l'Indus., 1903) gives both micro-sections and cooling curves. He considers that the curve consists of four branches, each corresponding to a special solid phase. That the branch, I—J, has a slight arrest at 586°, corresponding to the transition of $SbCu_3$ into $SbCu_2$. His highest point is at 681° with the compound $SbCu_3$. This is not confirmed by the author's experiments. On cooling the alloys with 46½ to 32 per cent. of antimony, a low arrest at 410° is observed. The nearer the alloy approaches to $SbCu_3$ the longer are the arrests. The action is reversible, from which Baykoff concludes that $SbCu_3$ is dimorphous, and designates them as *alpha* and *beta* modifications. Alloys with excess of antimony contain crystals of the *beta* form.

Table of Alloys.

No.	Per cent. of antimony.	Freezing point in degrees centigrade.	Notes.
1	0·1 to 2·0	1080 to 1064	
2	0·2 to 5·0	1064 to 1025	
3	5·0 to 9·0	1025 to 970	
4	9·0 to 13·0	970 to 920	
5	15·0 to 19·0	905 to 863	
6	22·0 to 25·0	840 to 800	
7	25·0 to 27·5	800 to 740	
8	30·0 to 31·0	655 to 637	
9	31½·0 to 32·0	630	The eutectic mixture.
10	34·0 to 37·5	645 to 655	
11	38·64	660	The compound $SbCu_3$.
12	40·0 to 46·0	665 to 670	
13	47·0 to 48·0	665 to 660	
14	48·3	655	,, $SbCu_3$.
15	50·0 to 55·0	650 to 630	
16	55·0 to 60·0	630 to 600	
17	60·0 to 74·0	600 to 480	
18	75·0	470	The eutectic mixture.
19	76·0 to 97·0	480 to 595	
20	98·0 to 99·5	600 to 622	

Phosphorus.—According to Percy, copper is capable of taking up 11 per cent. of phosphorus, and this alloy is stated to be so hard that it can scarcely be touched with a file. This statement is not correct for the 11 per cent. P alloy, but it is true if applied to the 14 per cent. alloy, which is probably the one Percy must have tested. (Percy's Metallurgy I., 279.)

Abel obtained a greyish-black crystalline substance by passing hydrogen over monocupric phosphate, to which he gave the formula Cu_3P_2, and found that it changed to Cu_6P_2 on ignition. He also remarks that the 14 per cent. alloy, Cu_3P, is the highest phosphide of copper that can exist at a red heat. (Chem. Soc. J., xiv., 183.)

Rose obtained the compound Cu_3P_2 by passing phosphoretted hydrogen over heated cupric chloride, or through a solution of cupric sulphate. He also obtained the compound Cu_3P by passing phosphoretted hydrogen over cuprous chloride or sulphide. (Pogg. Ann., xiv., 188; xxiv., 321.)

Since Abel's time great attention has been given to the preparation of phosphor-copper for commercial purposes, especially by Dr. Kunzel, but, so far as the author is aware, no elaborate research giving the freezing-points and micro-structure has been printed.

The freezing-point curve shows that phosphorus rapidly lowers the freezing-point of copper, reaching a minimum at the point, P, with 8·21 per cent. phosphorus. With an increase of phosphorus beyond this limit the temperature gradually rises, reaching a maximum at, R, with 14 per cent. phosphorus. As this is the saturation point of phosphorus in copper no further tracing of the curve is possible.

Table of Alloys.

No.	Freezing points in degrees centigrade.	Per cent. phosphorus.	Notes.
1	1082	0·0	Pure copper.
2	1070	0·25	
3	1050	0·41	
4	1035	0·82	
5	995	2·50	
6	920	4·11	
7	820	5·75	
8	765	7·39	
9	620	8·21	Eutectic.
10	650	9·03	
11	690	9·85	
12	795	10·67	
13	860	11·30	
14	950	12·00	
15	990	13·00	
16	1005	14·00	Cu_3P.

Bismuth.—From A, the freezing-point of pure copper, the curve falls gradually to 868° with 57 per cent. of bismuth. This forms a transition point, beyond which the curve forms a nearly horizontal line till about 70 per cent. is attained. In this region two possible chemical compounds may be present, viz., Cu_3Bi_2 at 68·64 per cent., and Cu_2Bi at 62 per cent., but there are no well marked indications of such, either in the freezing-point curve or in the micro-sections. The point, M, is the transition point between solutions of bismuth in copper and copper in bismuth, and at this point the two solutions probably have the same freezing-point, forming a mixture, which here exists in equilibrium.

It may be remarked that the solid solutions are only constant for a given temperature, so that the constitution of these alloys undergoes continuous variation, especially as the miscibility is necessarily restricted. With regard to the freezing-point curve, it may be noted that the liquid portion is not in equilibrium with a pure metal except in the branches A M and N O. The solid component copper can dissolve the component bismuth until the concentration of the latter has reached a certain value as given by the transition point, M. Addition of a further amount of bismuth may not alter the composition of the solid solution, but there will be formed a second solid solution, consisting of a solution of copper in bismuth, and at, M, we have the three phases—solution with excess of copper; solution with excess of bismuth; and copper. It is probable that in most of the copper-bismuth alloys, the solid solutions which are deposited from the liquid mass, lose their homogeneity at lower temperatures, even when quickly cooled. With regard to that branch of the curve which contains 60 to 70 per cent. of bismuth, it is possible that the compounds Cu_3Bi_2 and Cu_2Bi may be formed, but can only exist in contact with solutions containing excess of bismuth. As the temperature falls the compounds are converted into another solid phase.

Table of Alloys.

No.	Freezing point in degrees centigrade.	Per cent. of bismuth.	Notes.
1	1075 to 1055	1 to 5	
2	1030 to 1000	10 to 20	
3	985 to 940	25 to 40	
4	910	45	Possible chemical compound Cu_4Bi.
5	880	52·3	Possible compound Cu_3Bi.
6	875 to 860	55 to 60	
7	858	62·1	Possible compound Cu_2Bi.
8	850	68·64	Possible compound Cu_3Bi_2.
9	850 to 820	70 to 80	
10	775	85	
11	700 to 600	90 to 95	
12	245	97·2	Eutectic mixture.
13	250 to 255	98 to 99	

Lead.—When lead and copper are melted together, well stirred, and allowed slowly to cool, a separation of the two constituents takes place; one, a rich alloy of copper containing a little lead, the other a rich alloy of lead containing a little copper. If the alloys are poured into an iron mould and quenched in cold water on solidification an apparently homogeneous product is obtained in the alloys from 0 to 50 per cent. of lead. The freezing-point curve shows that lead gradually lowers the freezing-point of copper down to about 40 per cent. of lead, and that from about 45 to 80 per cent. of lead the curve only deviates a little from the horizontal. There is no chemical compound nor eutectic mixture.

The curve indicates a series of solid solutions, the components of which are copper and lead. In all the alloys from 5 to 98 per cent. of lead there is a second arrest in the cooling at about 326° C., due to the separation of pure lead.

Heycock and Neville (Phil. Trans., 189, 1897) state that in alloys with 40 to 86 per cent. of lead the curve forms a straight line, the freezing-point being constant at 954°. This does not accord with the results obtained in the present investigation, although the deviation is not great, yet a slight gradual fall over this range was obtained. They consider that the sloping parts of the curve correspond to the separation of solid matter from a homogeneous liquid, and that in alloys on the flat portion the liquid separates into two conjugate liquids at some temperature above the freezing-point, consequently these alloys are qualitatively identical, and, therefore, freeze at the same temperature.

Gautier (Soc. d'Encour., Oct., 1896) gives a curve showing eutectics at 50 and at 0·15 per cent. of copper, but this is evidently incorrect.

Table of Alloys.

No.	Freezing point in degrees centigrade.	Per cent. of lead.	Notes.
1	1076 to 1020	1 to 20	From 95 per cent. Cu down to 0 per cent. there is a second freezing-point at 326° C.
2	990 to 960	30 to 45	
3	960 to 940	45 to 70	
4	930	80	
5	880 to 845	90 to 95	
6	780 to 500	97 to 99	

Microscopic study of the alloys.—The sections selected for examination were usually transverse, and cooled very slowly. Some were also cooled quickly for purposes of comparison, or in order to fix the condition prevailing at the freezing-point.

The photo-micrographs were taken with an arc lamp, and the illumination in the microscope was normal. The descriptions which follow are based on what was visible under the microscope rather than on the photographs. For one thing, the photographs cannot show the delicate tints of colour that are a striking feature of many copper alloys.

Arsenic.—The polished sections when viewed in full daylight are all copper coloured in those with little arsenic and gradually get paler as the arsenic is increased. When the 19·2 per cent. alloy is reached the surface shows a pale blue colour, and this is continued up to the compound Cu_3As with 28·34 per cent. of arsenic, which is of a deeper blue colour. The alloy with 30 per cent. of arsenic is of a light purple colour, and when the compound Cu_5As_2 is reached, containing 32·2 per cent., a full reddish-purple colour is obtained, and this colour prevails up to the limit of these experiments with 43 per cent. of arsenic, but gets gradually paler.

The chemical compounds referred to above have a structure more or less uniform, and differ from the intermediate alloys. In most of the alloys the structure is revealed by simple polishing, but intensified by the etching liquid.

The following is a detailed description of the various alloys. From 0·5 to 19 per cent. the grains become gradually smaller, and the structure finer in appearance. The compound Cu_5As_2 is entirely crystalline and this kind of structure prevails up to the limit of these experiments.

0·1 *to* 1 *per cent. of arsenic.*—These alloys consist of dark coloured grains of nearly pure copper, bounded by a lighter coloured but harder material, which is probably a solid solution of arsenic in copper, and structureless. Fig. 2 contains 0·5 per cent. of arsenic.

2 *to* 5 *per cent. of arsenic.*—The grains are smaller and lighter coloured than the preceding ones and more oxidisable. The boundaries are wider, more irregular in shape, and in their interior a new structureless constituent of a pale blue colour appears, evidently due to decomposition of the substance of the boundaries. This is probably the compound Cu_3As.

6 *to* 13 *per cent. of arsenic.*—The light coloured solid solution now ceases to enclose grains and forms a matrix, through which branching masses of the blue compound are distributed. Fig. 3 contains 7 per cent. of arsenic.

14 *to* 18 *per cent. of arsenic.*—The solid solution not only contains masses of the blue compound, but assumes a roughly striated appearance, made up of the solid solution and the blue compound. The portions occupied by the compound are also striated in the usual manner of a eutectic mixture. Fig. 4 contains 17 per cent. of arsenic.

19·2 *per cent. of arsenic.*—This is the eutectic mixture of the compound Cu_3As and the solid solution. Fig. 5.

20 *to* 27 *per cent. of arsenic.*—The compound now crystallises out from the eutectic mixture and increases in amount until at 27 per cent. only a small portion of this eutectic is seen. Fig. 6 contains 23 per cent.

28·34 *per cent. of arsenic.*—This alloy differs entirely from all the preceding ones in being of a deeper blue colour and much more brittle. The surface is structureless and contains many cracks. Fig. 7. It is the chemical compound Cu_3As.

32·19 *per cent. of arsenic.*—This is the reddish-purple compound Cu_5As_2. It is composed of large crystals, in the interior of which are a number of smaller ones, which are probably secondary crystals, and in each of these are fine lines, assumed to be lines of cleavage. This is shown in Fig. 8.

33 *to* 36 *per cent. of arsenic.*—The purple compound largely occupies the ground, being the first to crystallise out, but a eutectic mixture is also present and increases in quantity with increase of arsenic. It is composed of alternate striæ of white and purple, that is, of the white compound Cu_2As and the purple compound Cu_5As_2. Fig. 9 contains 34 per cent. of arsenic.

37·24 *per cent. of arsenic.*—This is the nearly white compound Cu_2As. It is composed of structureless grains of irregular shape. Fig. 10.

39 *to* 41 *per cent. of arsenic.*—This section is composed of pale purple grains, surrounded by a eutectic mixture of pale purple and black striæ, which in the 41 per cent. alloy occupies about one-third the ground. Fig. 11.

43 *per cent. of arsenic.*—This is the limit of combination of arsenic with copper by direct union. Much of the surface is covered with a eutectic mixture. It probably contains the compounds Cu_2As and Cu_3As_2, but the latter compound I have not been able to produce. It may be a mechanical mixture of different bodies.

Antimony.—With respect to the micro-structure of this series, Stead (J. Soc. Chem. Indus., Dec., 1898) and Charpy (Soc. d'Encour. pour l'Indus., 1897) differ with regard to the alloys near the intermediate summit of the freezing-point curve. Charpy gives the alloy with about 60 per cent. of copper as Cu_2Sb, while Stead rightly gives it as 51·5 per cent.

Baykoff has gone further than the above authorities, and gives both micro-sections and cooling curve. He states that alloys with 0 to 51 per cent. of copper have all the same structure whether cooled quickly or slowly. That alloys with more than 51 per cent. differ with the rate of cooling. That quenched alloys with 53½ to 69 per cent. have the same structure when suddenly cooled. That alloys with more copper have a heterogeneous structure with the exception of the alloy $SbCu_3$, which is homogeneous whether cooled quickly or slowly. That the effect of quenching depends on two transformations—the decomposition of solid solutions (separation of $SbCu_3$) and of the polymorphism of $SbCu_3$. (Soc. d'Encour. pour l'Indus., 1903.)

Polished sections of copper-antimony alloys are all copper coloured from 0 to 15 per cent. of antimony. With 17 to 30 per cent. a bronze colour prevails. From 32 to 38·7 per cent. the colour is a pale blue. From 39 to 59 per cent. the colour is purple, with its deepest tint at about 49 per cent. and palest at 59 per cent. With more antimony than this the colour is greyish-white with a bluish tint.

The following is a detailed description of the alloys examined:—

0·1 *to* 1 *per cent. of antimony.*—The structure consists of dark polygonal grains of nearly pure copper, bounded by a lighter coloured and harder material. In the centre of these boundaries a whitish substance is present forming in some parts a division and has probably separated during slow cooling. The antimony evidently exists in the boundaries in solid solution, and this white substance may be segregated antimony. Fig. 12 contains 0·4 per cent. of antimony.

2 *to* 16 *per cent. of antimony.*—The grains are irregular in shape and the boundaries contain a bluish-grey constituent in isolated patches, which are composed of the compound Cu_3Sb separated from the solid solution. This compound increases in quantity with increase of antimony. Fig. 13 contains 9 per cent. of antimony.

17 *to* 28 *per cent. of antimony.*—A change now occurs in the colour of the polished sections owing to the greater preponderance of the bluish-grey compound, which gets paler in colour as the antimony increases. The surfaces of the sections are seen to consist of two constituents, the grey compound and the solid solution.

28·5 *to* 30 *per cent. of antimony.*—The grey compound occupies the greater part of the surface in which the solid solution of antimony in copper appears in the form of dendrites. Fig. 14 contains 30 per cent. of antimony.

31 *to* 32 *per cent. of antimony.*—The surface is largely covered with a eutectic mixture, composed of $SbCu_3$ and a solid solution. Fig. 15.

33 *to* 37 *per cent. of antimony.*—The grey compound occupies the greater part of the field with some patches of eutectic, which is composed of the grey compound and a white constituent, which turns to a light purple on etching with hydrochloric acid. These alloys are extremely brittle. Fig. 16 contains 34 per cent. of antimony.

38·64 *per cent. of antimony.*—This is an extremely brittle alloy, of a light grey colour, and having dark

boundary lines surrounding the grains. It is the chemical compound Cu_2Sb.

40 *to* 47 *per cent. of antimony.*—The alloys now assume a purple tint increasing in intensity as the antimony is increased up to a maximum at 48·5 per cent. In the 40 per cent. alloy the grains are bounded by white lines. As the antimony increases the grains become less and interspersed with more and more of a eutectic mixture, Fig. 17, with 46 per cent. of antimony, consists almost entirely of a eutectic mixture of the two compounds Cu_2Sb and Cu_2Sb.

48·5 *per cent. of antimony.*—This is the well-known purple alloy termed "Regulus of Venus." It is the compound Cu_2Sb. It is structureless and very brittle.

49 *to* 56 *per cent. of antimony.*—These alloys consist of purple elongated grains bounded by white lines. The grains are the compound Cu_2Sb and the white lines a solid solution of copper in antimony. Fig. 18 contains 56 per cent. of antimony.

61 *to* 73 *per cent. of antimony.*—The purple compound now forms straight bands running across the surface in different directions. The matrix consists of more or less triangular patches of a eutectic nature, composed of the compound Cu_2Sb, and the white solid solution. White lines also traverse the purple bands, as seen in Fig. 19, with 63 per cent. of antimony.

75 *per cent. of antimony.*—The whole surface is composed of a eutectic mixture of Cu_2Sb, and the white solid solution. Fig. 20.

76 *to* 99 *per cent. of antimony.*—The white solid solution now separates in larger and larger crystals, as seen in Fig. 21 with 90 per cent. of antimony. That the white body is a solid solution and not pure antimony is indicated by the fact that brown specks appear on the white surface after oxidation. Possibly the alloys near 100 per cent. of antimony may consist of pure antimony.

Phosphorus.—The polished sections are copper-coloured from 0 to 3 per cent. of phosphorus, the colour getting gradually paler with increase of phosphorus. From 4 to 7 per cent. a bronze colour prevails, and from 8 to 14 per cent. a bluish-grey colour prevails. The following is a detailed description of the various alloys:—

0·08 *to* 0·25 *per cent. of phosphorus.*—In the slowly cooled samples are seen crystals of copper with more or less sharply defined boundaries, and distributed over the surface are circular spots of phosphide. These spots are also present in the quickly cooled samples.

0·4 *to* 0·6 *per cent. of phosphorus.*—The structure consists of rough dark polygonal grains, evidently consisting of impure copper. These grains are surrounded by continuous walls of a light colour, and in some places are seen lines of a greyish-blue colour running along the centre of the boundaries. The boundaries are composed of a solid solution of phosphorus in copper, from which the chemical compound Cu_3P partially separates during slow cooling. In the quickly cooled samples there is an absence of boundaries, the phosphorus compound separating in isolated globules. Fig. 22 contains 0·41 per cent. of phosphorus.

0·8 *to* 1·5 *per cent. of phosphorus.*—The phosphide is here present in larger isolated masses, and as there are no definite grains or boundaries, the phosphide must have chiefly separated and collected in the elongated patches shown in Fig. 23, with 0·8 per cent. of phosphorus.

2 *to* 3 *per cent. of phosphorus.*—The phosphide is now present in considerable quantity, in some parts forming a continuous boundary to the grains of copper, but for the most part in isolated patches. The phosphide has evidently separated from a solution, as seen by the darker portions. The phosphide Cu_3P is of a light blue colour and associated wih streaks of copper, forming a eutectic mixture in the slowly cooled samples. Fig. 24 contains 2·5 per cent. of phosphorus.

4 *to* 6 *per cent. of phosphorus.*—Definite grains of copper are present, of an elongated shape and clearly defined outline. These grains are embedded in a eutectic matrix, consisting of alternate strie of Cu_3P and copper. This eutectic increases in quantity with increase of phosphorus and the copper grains correspondingly diminish in size. Fig. 25 contains 5·8 per cent. of phosphorus.

6·5 *to* 8 *per cent. of phosphorus.*—The structure is similar to the preceding ones, but the eutectic mixture is much greater in amount and the grains of copper get very small. In the quickly cooled samples the copper forms dendrites in a light bluish-grey structureless matrix, which is a solid solution of copper and the copper compound Cu_3P, which is resolved into a eutectic mixture on slow cooling. Fig. 26 contains 7·4 per cent. of phosphorus.

8·2 *per cent. of phosphorus.*—This is the eutectic mixture, composed of alternate laminæ of copper and Cu_3P in different degrees of coarseness. Fig. 27.

9 *to* 13 *per cent. of phosphorus.*—The compound Cu_3P now crystallises out first, the crystals increasing in size with the increase of phosphorus, and become very large in the 13 per cent. alloy. Fig. 26 contains 10·7 per cent. of phosphorus.

14 *per cent. of phosphorus.*—This is the compound Cu_3P. It is extremely brittle, of a greyish-blue colour, and composed of fairly large crystals. It is very hard and can only be filed with difficulty. Under the microscope it is seen to consist of well-defined crystals of irregular shape, separated by fine boundary lines. Fig. 29.

Bismuth.—The polished sections are all copper-coloured from 0 to 55 per cent. of bismuth. At 56 per cent. the colour is paler, and at 57 per cent. the alloy has a bronze tint. This is the transition point marked, M, on the cooling curve, where mixed crystals rich in copper pass into mixed crystals rich in bismuth. From this point, up to 80 per cent., the bronze colour is maintained. From 80 to 95 per cent. the colour gets gradually paler, and at 97 per cent. is greyish-white. Beyond this the colour resembles pure bismuth. From an unaided view of the polished sections one might infer that the alloys of copper and bismuth were simply mixtures of the two metals, in which the colour of the copper predominates over that of the white bismuth. There are no purple or blue-coloured alloys like those of the copper-arsenic and copper-antimony alloys.

0·1 *to* 1 *per cent. bismuth.*—Copper with small percentages of bismuth consists of polygonal grains of copper, the cell walls of which are of a light copper colour, and in the 0·4 per cent. and upwards the cell walls contain a dividing line or lines down the centre. These lines are probably very rich in bismuth, and may account for the brittleness of these alloys, for when the metal is struck with a hammer the lines of fracture follow the same direction. If these alloys, especially those with the higher percentages, are kept for a very long time just below the freezing-point, the rich bismuth alloy segregates in irregular patches. Fig. 30 contains 0·4 per cent. of bismuth.

2 *to* 4 *per cent. of bismuth.*—In these alloys there are two constituents, one copper-red and the other of a darker colour, forming grains with gradually increasing boundaries as the bismuth increases. The structure is shown in Fig. 31, which contains 4 per cent. of bismuth.

5 *to* 10 *per cent. of bismuth.*—A complete change from the former alloy has now occurred. Large crystals of light copper-coloured solid solution are surrounded by segregated irregular patches of a light blue body, which is not uniform, but composed of a dark-coloured constituent mixed with the blue. Fig. 32 contains 10 per cent. of bismuth.

15 *to* 25 *per cent. of bismuth.*—The 15 per cent. alloy has extremely well-defined crystal grains, the interior of which has a fine eutectic structure. The boundary walls are comparatively thin and contain a light green eutectic mixture, forming irregular patches at the junction of three grains. This change to the light green from the light blue is evidently due to the decomposition or solution of the light blue body in the increased percentage of bismuth. Fig. 33 contains 25 per cent. of bismuth.

30 *to* 40 *per cent. of bismuth.*—In these alloys the green eutectic mixture has largely increased and surrounds the copper-coloured grains. Fig. 34 contains 40 per cent. of bismuth.

40 *to* 55 *per cent. of bismuth.*—In the slowly cooled alloys the constituents are the same as in the preceding, but in the quickly cooled sample there is an additional constituent of a dark bluish-grey colour, distributed over the surface in small grains, which are larger and more abundant.

in the alloys with more bismuth. As the 45 per cent. alloy contains proportions corresponding to the compound Cu_4Bi and the 52·3 per cent. alloy to the compound Cu_3Bi, the above-mentioned bluish-grey body may be a chemical compound which can only exist in the solid state by very rapid cooling, and is decomposed on slow cooling.

56 *to* 57 *per cent. of bismuth.*—In the 56 per cent. alloy the light green eutectic mixture is replaced by a light grey body, and the dark blue body (? chemical compound) only exists in minute quantity. In the 57 per cent. alloy the dark blue body is absent, even when the alloy has been suddenly cooled. The whole surface is composed of grains if two solid solutions, the light grey and the light red. They are probably dilute solutions forming a coarse eutectic mixture. Fig. 35 contains 57 per cent. of bismuth.

60 *to* 67 *per cent. of bismuth.*—These alloys are composed of two solid solutions, one light red and the other greenish-white. These are not homogeneous, but contain substances of unequal oxidisability both in the slowly and the quickly cooled samples. Dark blue grains are also present in the quickly cooled specimens and increase in amount with increase of bismuth. They may be due to the compound Cu_2Bi. Fig. 36 contains 62 per cent. of bismuth.

68·64 *per cent. of bismuth.*—This corresponds to the formula Cu_3Bi_2, but instead of being homogeneous, it is composed of about two-thirds of the above-mentioned greyish-white body and a eutectic mixture of the light red and greyish-white constituents. It was quenched in water at the freezing-point.

70 *to* 90 *per cent. bismuth.*—There are two main constituents of these alloys, consisting of a light red solid solution and the eutectic mixture, which gradually increases with increase of bismuth. Fig. 37 contains 85 per cent. of bismuth.

95 *per cent. of bismuth.*—This structure is very characteristic of an alloy bordering on a eutectic mixture. The matrix is largely eutectic and in it are dark red dendrites evidently containing much bismuth, as they are readily oxidised.

97·2 *per cent. of bismuth.*—This is a eutectic mixture, of a granular character, both constituents being very readily oxidised, even by simple polishing on a rouge pad. The structure is shown in Fig. 36.

The structure of the alloys containing 98 per cent. of bismuth and upwards resemble pure bismuth, revealing the tabular planes of cleavage characteristic of bismuth. The colour is white and the white crystals are surrounded by the above-mentioned eutectic mixture.

Lead.—A series of alloys was prepared containing from 0·1 to 99·9 per cent. of lead and treated in two different ways—one was cooled very slowly and the other quenched immediately after solidification. The following is a detailed description of the various alloys:—

0·1 *to* 0·5 *per cent. lead.*—In the slowly cooled samples the surface was composed of homogeneous copper-coloured grains, in the boundaries of which the lead appears in isolated dark blobs, mostly round, but in the form of roughly-formed triangles in some places. In the quickly cooled samples the copper ground mass is studded with fine dark markings, which, judging from the quantity present, must consist of lead with a considerable quantity of copper in solid solution. There is no eutectic structure.

1 *to* 2 *per cent. lead.*—In the slowly cooled sample the copper grains are of an elongated shape, with dark boundaries containing the lead. These boundaries become more continuous as the lead is increased, and the grains of a clearer copper colour. In the quickly cooled samples the structure is the same as in the 0·5 per cent. alloy, but the solid solution is greater in amount.

3 *to* 4 *per cent. lead.*—The grains of copper now begin to show signs of containing free lead which separates out in small black patches on their surface, but the chief portions are in the boundaries of the grains. In these boundaries occur some light blue triangular lakes. In the quickly cooled samples small grains are formed with more or less continuous boundaries.

5 *to* 9 *per cent. of lead.*—Both the slowly and the quickly cooled samples have the same structure, the latter of course being the finer. There are but few segregated patches. The grains are larger and the dark boundaries thicker than in the previous samples. Fig. 39 contains 5 per cent. of lead and has been quickly cooled.

15 *to* 25 *per cent. of lead.*—In the slowly cooled alloys are large grains of copper, from which the lead or solid solution has separated in small specks, giving it a resemblance to a eutectic mixture. These impure copper grains are surrounded by wide boundaries of apparently pure copper, and up the centre of these run disconnected dark lines of varying thickness. In some parts are segregated patches of lead, which increase in size with increase of lead. In the quickly cooled sample the whole surface shows a dendritic structure. Fig. 40 contains 15 per cent. of lead.

30 *to* 40 *per cent. of lead.*—When slowly cooled the lead segregates in large patches. There are no regular boundaries or definite structure. In the quickly cooled samples the structure is very fine, especially in the 40 per cent. alloy. Fig. 41. The surface is composed of fine striations, with some lateral ramifications, which may be confounded with a true eutectic structure.

50 *to* 70 *per cent. lead.*—In the slowly cooled alloys there is a complete absence of structure, the dark lead and the red copper patches being unequally distributed over the surface, forming a mechanical mixture. The lead patches increase in amount with increase of lead. When quickly cooled the fine striations referred to in the previous paragraph are interspersed with patches of lead. Fig. 42 contains 50 per cent. and Fig. 43 contains 60 per cent. of lead.

80 *to* 99·9 *per cent. of lead.*—The slowly and the quickly cooled alloys are the same in structure, being simply mixtures of copper and lead. Even in the 99·9 per cent. of lead, minute crystals of copper can be detected distributed over the surface of the lead, when viewed with a high power.

Effect of small quantities of arsenic, antimony, phosphorus, bismuth, and lead on copper.—It will be seen from the foregoing results that when the impurity is less than 1 per cent. the freezing-point is lowered in every case, being greatest with phosphorus and least with lead, which exhibits no tendency to form a chemical compound with copper, so that the chemical affinity between an element and copper has an influence in lowering the freezing-point in proportion to its intensity. It will be observed from the curve Fig. 1, that the fall is greatest with phosphorus, less with arsenic, and still less with antimony. Now, in the case of phosphorus, a compound is formed at 14 per cent., in arsenic at 28·3 per cent., and in antimony at 38·5 per cent., so that while the chemical compound may be formed and exist in the smallest percentages, it has the greatest influence on the alloy the lower the percentage at which the whole alloy is composed of this compound. Now, chemical compounds of metals are invariably brittle bodies, and it may be concluded that the presence of a brittle constituent in an alloy tends to diminish the malleability and make it harder in proportion to the quantity present. In accordance with this view phosphorus, as mentioned above, should, for a given percentage, be the most energetic in reducing the malleability of copper. But the reverse is the case, as will be shown by subsequent experiments.

It naturally follows from this that with the addition of equal parts of phosphorus and antimony to pure copper the former would be by far the most effective. Arsenic will exert an influence intermediate between these extremes.

It is generally recognised that bismuth is extremely injurious to copper. The foregoing experiments revealed no permanent chemical compound of bismuth and copper, and with very small portions, when the copper is slowly cooled, minute globules of bismuth separate out, and therefore break the continuity of the copper crystals. That is, the copper crystals are separated by an extremely brittle envelope, and the malleability of the whole mass is effected. Much the same remarks apply to lead, which, although not brittle in itself, is very weak and thus lowers the tenacity of the whole mass.

Phosphorus, arsenic, and antimony influence copper in virtue of their chemical action, while the action of lead

in entirely mechanical and that of bismuth may be partly chemical and partly mechanical, since in some of the alloys certain compounds are probably present in solution at certain temperatures and separate out at lower temperatures.

In order to ascertain the effect of small quantities of the above-mentioned elements on the malleability of copper, free from oxide, 0·5 per cent. of each element was added separately to pure copper and cast into a plate mould, forming ingots 2½ in. by 1 in. by ¼ in. Each ingot was carefully annealed and then rolled. No further annealing was done during the stages of rolling. Each strip was rolled, one after the other with exactly the same pinch in each case, so as to make the results strictly comparable. The following are the results:—

Phosphorus—very malleable, with quite smooth edges.

Arsenic—very malleable, with slightly serrated edges.

Antimony—malleable, with serrated edges.

Lead—imperfectly malleable and badly cracked on edges.

Bismuth—non-malleable and completely shattered.

Another series was prepared containing two elements in the copper, with 0·2 per cent. of each, making 0·4 per cent. of total impurity:—

Arsenic and antimony—very malleable, with smooth edges.

Arsenic and phosphorus—very malleable, with slightly serrated edges.

Arsenic and lead—malleable, but cracked on edges.

Arsenic and bismuth—imperfectly malleable, badly cracked on edges.

Antimony and phosphorus—malleable, but with serrated edges.

Antimony and lead—malleable, but with serrated edges.

Antimony and bismuth—moderately malleable, cracked on edges.

Phosphorus and lead—malleable, with small serrations on edges.

Phosphorus and bismuth—moderately malleable, with cracks on edges.

The above results indicate that phosphorus does not alter the malleability of copper except in so much as it makes it harder. That arsenic only slightly diminishes the malleability. That antimony makes copper less malleable than phosphorus and arsenic. That lead renders copper imperfectly malleable and bismuth makes it quite unworkable.

Arsenic and antimony together are as good as arsenic alone, and better than antimony alone. Arsenic or antimony added to copper containing bismuth diminishes the brittleness caused by the bismuth alone. Arsenic or antimony added to copper containing lead diminishes the brittleness caused by lead alone. Phosphorus improves the malleability of copper containing antimony, bismuth, or lead.

The above effects refer to the action of elements upon pure copper, but commercial copper contains cuprous oxide and the first action of the element would be to deoxidise this compound and form oxide of the added element, so that only that portion of the element which is in excess of that required for the deoxidation can act directly on the copper to form a copper compound.

Assuming that the higher oxides are formed in removing oxygen from copper by the addition of phosphorus, arsenic, or antimony, namely, P_2O_5, As_2O_5, Sb_2O_5, then 62 of phosphorus, 160 of arsenic, and 244 of antimony would be required respectively in combining with the same quantity of oxygen, or a ratio of 1:2.4:4; that is, 1 part of phosphorus would effect the same result as 4 parts of antimony.

Discussion.

The Chairman congratulated Mr. Hiorns upon his exhaustive paper, the final conclusions of which must be of the greatest importance to those who were working with these alloys.

Prof. T. Turner said, when seeing the photo-micrographs on the screen he had felt sorry that colour-photography was not available, because in the copper alloys colour played such an important part. He had had an opportunity of seeing a number of the copper-arsenic specimens prepared by Mr. Hiorns, and the colours of the blue and purple constituents were extremely brilliant, so that a very inadequate conception of what the alloys are really like was obtained from the ordinary photographs. Shepherd, of America, had criticised the results obtained by Mr. Hiorns, and some of the points were still in doubt. Of course, arsenic in copper alloys was difficult to deal with, because arsenic was volatile and no doubt there might be different compositions in different parts of the alloys. The antimony copper curve of Mr. Hiorns agreed nearly with that given by Charpy in the well-known report "Sur les Alliages." The shape of the bismuth and lead curves were, of course, very different from the other three given, and they corresponded with the facts, which were already well-known, particularly in the case of lead, that copper and lead tend to separate on cooling, and that there is a different constitution altogether in these cases.

Mr. A. E. Tucker said that he should have wished that Mr. Hiorns had included the element iron in his subject, because the effect of iron on copper was very important. A few years ago the presence of arsenic in copper was regarded as exceedingly inimical to its properties, but arsenic up to a quarter and even up to 0·4 per cent. was now stipulated for in the specification for Admiralty and locomotive tubes owing to its reducing properties. Similarly the beneficial effects of phosphorus were to be attributed to its reducing action. Some brass-founders in Birmingham had so recognised the importance of phosphorus to the manufacture of ordinary brass castings, that they purposely used copper containing some 10 to 14 per cent. in their commonest castings, since it so increased the strength and general mechanical properties of their castings, that they could reduce their sections, and, further, the amount of wasters was so lessened by the addition that, although an expensive material, its use was economical. He agreed with Mr. Hiorns in fixing the possible percentage of phosphorus in copper somewhere about 14 or 14½ per cent. He was aware that German phosphor copper of 15 per cent. was being advertised for the London market, but he had occasion recently to analyse and determine the phosphorus in such samples, and he had found that although the phosphorus itself sometimes reached 15 per cent., it existed, curiously enough, partly in the form of red phosphorus and exterior to the true alloy, and by slightly warming it one could actually smell the phosphorus in such assumed alloy.

Mr. W. Rosenhain considered that a good many of the statements made by Mr. Hiorns were a little risky; the data he had given did not seem adequate to establish the results based upon them. The author had only given the actual freezing-point curves, and those only for alloys at rest, or at all events in the absence of inoculation which would prevent errors arising from surfusion. Thus considerable errors might creep into the freezing-point determinations. He (Mr. Rosenhain) was led to make this remark by Mr. Hiorns' statement that one of his results appeared to be at variance with the phase rule. The summit of the curve in question seemed to him to be far too flat to justify such a statement. Had Mr. Hiorns given more complete thermal data, he might have much further confirmation as to the various compounds, solid solutions, and eutectics occurring in these alloys. While Heycock and Neville had practically been the first to give a complete investigation of a system of binary alloys, the methods had been adopted, and to some extent advanced, by Tammann. The additional data required by these more complete methods were the temperature range and time occupied by the initial solidification and the temperature and duration of the eutectic arrest. The temperature interval between the beginning and end of the initial crystallisation served as a criterion of the presence of solid solutions, since in all these the interval in question was large as compared with that in a pure substance. Further, the duration of the eutectic arrest point for a given mass of alloy was a maximum for alloys at or near the composition of the eutectic in question, while it fell to zero for alloys of the composition of a pure compound. Mr. Hiorns had further made two statements which it was difficult to

accept. One of these referred to a copper-arsenic alloy which, while said to be a chemical compound, was described as having a heterogeneous structure. Discrepancies of this sort between the results of microscopic examination and the indications of the freezing-point curve had often been observed by metallurgists, but it had always been found that the micro-structure was the truer guide; when a heterogeneous structure was found where a simple body was expected, a chemical change in the alloy at a temperature below the freezing-point had often been detected. The other statement was that a solid solution of copper and a copper-phosphorus compound crystallised out as such and resolved itself into the eutectic on slow cooling. Now, as a matter of definition, the solid phase or phases crystallising at a minimum point were the eutectic, whatever their structure, but if Mr. Hiorns had discovered a eutectic having a homogeneous structure like that of a solid solution when rapidly cooled and resolving itself into the usual banded structure on slow cooling, it was a remarkable fact which should be strongly emphasised. The statement as it stood, that a solid solution crystallised at the lowest point of a freezing-point curve, and became transformed into a eutectic on slow cooling, could hardly be accepted.

Dr. T. S. PRICE said he was much struck by the apparent regularities for the three curves, copper-phosphorus, copper-arsenic, and copper-antimony. According to the curves, the first compounds formed as the percentage of element added to the copper increases are respectively Cu_3P, Cu_3As, and Cu_3Sb. The lowering of the freezing-point of the copper was due to the presence of the compounds, as far as the first portions of the curves were concerned, and if the depressions observed in any one curve were taken, it ought to be possible to calculate those for the other curves, since the depression depended on the number of molecules of the dissolved substance.

The observations made on the copper-antimony alloys were probably the most correct; they were consequently taken as the basis of calculation. Bismuth was also included in the calculation, assuming that the compound Cu_3Bi was formed. The formula used in the calculation was readily obtained, and was

$$\frac{3100}{P} - 221.5 = \frac{7500}{As} - 265.5 =$$

$$\frac{12000}{Sb} - 310{\cdot}5 = \frac{20850}{Bi} - 399$$

where P, As, Sb, Bi were respectively the percentages of the corresponding elements for any definite lowering of the freezing-point.

The agreement between calculation and experiment, considering that the freezing-point laws are only valid for dilute solutions, was very good in the case of phosphorus, but not so good, although satisfactory, in the case of arsenic; with bismuth there was no agreement.

The conclusion therefore seemed justified, that the lowering of the freezing-point of the copper in the first three cases was due to the compounds Cu_3P, Cu_3As, and Cu_3Sb, and this agreed with the freezing-point curves. The case of the alloys of copper and bismuth was interesting, since it was somewhat difficult to draw definite conclusions from the freezing-point curves or from the micro-photographs. The break in the curve at 57 per cent. Bi might be due either to the separation out of the new solid phase Cu_3Bi (52·3 per cent. Bi), which would then be capable of existence only in the presence of an excess of bismuth, or it might be caused by the formation of two conjugate solutions (as in the copper-lead alloys), one of bismuth in copper, and the other of copper in bismuth. In the former case the curve, assuming that no other compound between copper and bismuth was formed, would be continuous down to the eutectic point, 97·2 per cent. Bi; in the latter case the curve would remain horizontal as long as the two conjugate solutions existed, and then it would show a break and fall continuously to the eutectic point. An examination of the curve would show that no definite conclusion with respect to these points could be arrived at, nor did the micro-photographs help in the matter, since they were in all probability complicated by changes which had taken place in the solid on cooling. The above calculation, however, would point to the non-formation of the compound Cu_3Bi, so that the bismuth probably dissolved in the copper without uniting with it.

If this were so, it would be easy to calculate whether the bismuth was present as single or double molecules. The following table gives the calculated percentages of bismuth necessary to produce a given lowering of the freezing-point, assuming that bismuth is (*a*) monatomic, (*b*) diatomic, in solution. The copper-antimony alloys were again taken as the basis of the calculation:—

Lowering of the freezing point.	Found.	Per cent. Bi Calc. for Bi.	Calc. for Bi_2.
55°	11·5	9·1	16·6
105°	28·5	16·5	28·4
175°	52·0	29·8	46·0

The figures were in favour of the association of bismuth when dissolved in copper, agreeing with what Ramsay found for the solution of bismuth in mercury and with what Heycock and Neville found for the solution of bismuth in tin. Much valuable information with respect to the interpretation of Mr. Hiorns' results in the light of the phase rule, and of the micro-photographs, would have been obtained if the complete cooling curves of the various alloys had been observed, and not simply the freezing points. Baykoff's curves for the copper-antimony alloys were readily interpreted by the phase rule, but Mr. Hiorns had never been able to obtain curves which agree with those of Baykoff.

Mr. F. H. ALCOCK said that the close analogy between the formulæ and figures relating to the various elements and their place in the periodic system had struck him. Some figures were given for phosphorus, arsenic, and antimony, *viz.*, 14 per cent., 28 per cent., and 38 per cent. respectively, and these bore a strong relation to the atomic weights, while the same remark applied to the formulæ. That lead did not come within the same category could be thus explained, because its place in the periodic table was very different from that of the other three elements.

Mr. E. LEWIS said that in the last part of his paper, Mr. Hiorns seemed to overlook the point that in practice there were two distinct methods of making copper: there was the copper cast direct from the refinery furnace, and that which was cast from the crucible. If phosphorus was added in the refining furnace in order to get a good casting, the copper would be absolutely spoilt, but in crucible furnaces if the copper were of good quality phosphorus might be added. But one could not cast good copper tubes from crucibles with ordinary copper such as Mr. Hiorns seemed to suggest. Then, with regard to the statement that metals like lead existed as oxide in commercial copper, lead oxide was a very fusible and brittle substance, and if lead were present as oxide it was rather improbable that copper containing it would be a tough metal. It seemed more probable that the lead present in commercial copper existed as metallic lead dissolved in the copper oxide eutectic, the same as lead was dissolved in the copper-arsenic eutectic in arsenical copper.

Mr. HIORNS, in reply, said he felt extremely grateful to Mr. Rosenhain for pointing out some of the probable errors in the paper, or rather in the manner in which certain points were interpreted. He also thanked Dr. Price for showing by calculation how the experimental work agreed in some of the cases with the calculations. With regard to Mr. Lewis's remarks, he only claimed for his experiments the properties obtained under the conditions of the experiments, that was, with perfectly pure copper, and he purposely did not go into the question of the exact manner in which elements occurred in commercial copper. He had only stated the view as to impurities assumed to exist as oxides, but from what he had brought forward and from the examination of these curves it would be seen that it was probable that some

of these compounds did not exist as oxides but in some other form. The readiness with which phosphorus combined with copper was apparent, and the question was whether the compound was decomposed in the presence of small quantities of oxygen.

London Section.

Meeting held at Burlington House, on Monday, June 11th, 1906.

MR. A. G. SALOMON IN THE CHAIR.

PURIFYING AND STABILISING GUNCOTTON.

BY R. ROBERTSON, M.A., D.SC.

In the manufacture of guncotton the material, after nitration, is purified and rendered stable by a process commonly referred to as the boiling of guncotton. This process has been the subject of a considerable amount of experimental work at the Royal Gunpowder Factory, in the course of which trial has been made of many different schemes of boiling. The description of some of these and of the method adopted as a result of the trials forms the subject of the present paper, which is contributed by permission of the Superintendent.

It is the object of such a process to secure a guncotton of the greatest possible chemical stability in the minimum of time and with the least decomposition of the substance.

When dealing with the question of the stability of guncotton, experience has conclusively shown that results of small scale experiments, whether with laboratory apparatus or with small wooden vessels, arranged to simulate the conditions obtaining in the large boiling vats, are altogether misleading and useless; the conclusions arrived at in the present instance will, therefore, be founded on results obtained on the large scale, when quantities of 1,000 kilos. of guncotton are boiled in large vats with 10,000 kilos. of water or other solution.

In these experiments, the cotton was nitrated by the displacement process, and was treated with cold water till apparently neutral, before transferring to the boiling vats.

The objects of the next operation—boiling of the guncotton—are to free the material from certain impurities, such as traces of free acids, unstable products of the nitration of the cellulose, among which are mixed cellulose nitro-sulphuric esters, possibly cellulose nitrous esters and unstable bodies arising from the action of the nitrating acids, both on the cotton cellulose itself, and on the less resistant celluloses which inevitably occur as traces of seed husk, etc., in the cotton used for the manufacture.

Of these impurities the possibility of the presence of nitro-sulphuric esters in nitration products of cellulose was recognised by Cross and Bevan (Ber. 34,2496 [1901] and later, Ber. 38, pp. 1859 and 3531 [1905]), and to the presence of these mixed esters the instability of some nitro-celluloses was ascribed by C. Napier Hake and R. J. Lewis (Journal of Society of Chemical Industry, 24, 374 [1905]). Lunge and Bebie (Zeits. fur angew. Chemie 22, p. 539 [1901]) considered the possibility of the formation of cellulose nitrous esters, and made experiments on the stability of guncotton prepared from acid mixtures, both free from and with the addition of nitric peroxide, and Berthelot (Comptes Rendus, 17th Sept., 1900) has also suggested the formation of nitrous esters. Of other impure products of nitration of cellulose, nitrated sugars of small stability are indicated by the work of Will and Lenze (Ber. 31, p. 68 [1898]), and the solubility of products of liqueous character in nitrating acids, and instability of the nitrate formed, are dealt with in "Cellulose," p. 132 and, in "Researches on Cellulose," p. 131, by Cross and Bevan.

For many years guncotton at Waltham Abbey has been purified by boiling with water in large vats, the water being raised to the boiling point by steam introduced and distributed below the false bottom of the vat. At the finish of one boiling, the water is run off, and replaced by fresh water, which is again raised to the boiling point by steam, the actual time of ebullition being taken as the duration of the particular boiling.

Investigations as to the best method of purification have been made in two main directions. In the first place, the effects of variations in the relative duration of the different boilings with water were studied, and, secondly, experiments were made with various alkaline treatments. The investigation involved a large amount of analytical and experimental work, as for each of the boilings, of which there would be from seven to sixteen in one experiment, (*a*) the wash waters were examined for free acid or alkali, sulphates, nitrates, and nitrites, and (*b*) the corresponding guncotton was examined for nitrogen-content, insolubility in ether-alcohol, solubility in acetone, percentage of sulphate present, mineral matter, and tested for purification and stability by the Abel, Will, Bergmann, and Junk, fume and other tests. From the results of this examination of the wash waters and of the progress of the guncotton in stability with each successive boiling, deductions were then drawn as to the relative merits of the different methods of boiling.

I. *Boiling with water alone.*—The newly nitrated guncotton, after it has received a washing with cold water, although apparently neutral to litmus (unless pressure be applied) in reality contains a considerable quantity of the nitric and sulphuric acids of the nitrating mixture still adhering to the fibre, amounting to about 1 per cent. of acid (as H_2SO_4) calculated on the guncotton. As will appear later, this acid is found to play an important part in the economy of the process, so that if there were a thorough elimination of nitrating acid by the cold water washing, an addition of acid to the initial boilings would be advisable. The water used for boiling was ballast-filtered water containing lime as carbonate to the extent of 20 parts per 100,000, and sulphuric acid in the form of calcium sulphate to the extent of 6 parts H_2SO_4 per 100,000.

Experiments were made to determine which of the two processes was to be preferred, namely, (A) a scheme of boiling characterised by long boilings at the beginning with shorter boilings at the end, and (B) one with short boilings at the beginning and long boilings later. The former of these treatments was found to be in every way the better, as the following comparison will show.

	Treatment A. Long followed by short boilings.	Treatment B. Short followed by long boilings.
Wash Waters:		
Elimination of free acid	First and second boilings acid.	First to third or fourth boilings acid.
Alkalinity	Soon reaches a constant.	Towards end decreases from a maximum.
Nitrite	Rises to a maximum, then decreases.	Steadily increases.
Sulphate	Reaches minimum earlier than in B.	
Guncotton:		
Nitrogen	Practically the same as B.	
Solubility in ether-alcohol	Tendency to be lower than with B.	
Free acid in G/C of early boilings	Small in quantity after first boilings.	Not reduced to same extent till after third.
Sulphuric acid organically combined	Noticeable only after first boiling and small in quantity.	In much greater quantity in early boilings persisting till the third or fourth.
Abel heat test at 76·4° C.	Over 10′ at third boiling.	Over 10′ at sixth boiling.
Paste (G/C+N/G) heat test at 76·4° C.	Over 10′ at fourth boiling.	Over 10′ at seventh boiling.
Stability tests (Will. Bergmann and Junk, fume and other tests)	Stability is attained at an earlier stage than with treatment B.	

From this comparison it is evident that the longer boilings at the beginning (two periods of 12 hours in this case) are superior to short initial boilings (of 4 or 2 hours for example). Examination of the results of analyses of the wash waters brings out the advantage of the more prolonged initial acid treatment in hydrolysing impurities, as is shown by the earlier attainment of the normal minimum of sulphate in the water, and also points to the disadvantage of prolonged later boilings (two periods of 12 hours in this case) as tending to decompose the guncotton, for under these conditions the nitrites in the wash waters are found to increase with simultaneous disappearance of the alkalinity of the water. If the later boilings be prolonged, the nitrous acid produced either by the intrinsic decomposition of the guncotton at this temperature, or by the hydrolysis of the nitric ester by the calcium carbonate in solution, may neutralise the latter so that the guncotton is being treated in a neutral or even slightly acid solution.

Turning next to the guncotton itself, the importance of a thorough boiling in the solution of dilute acid which proceeds from the traces of nitrating acids retained by the guncotton is again apparent. Thus, by this treatment, the sulphate organically combined with the guncotton has practically disappeared after boiling for 12 hours, whereas with the shorter initial boilings its gradual elimination by hydrolysis can be followed step by step. Experiments with the Will and other tests have shown that guncotton containing this sulphuric ester is in a highly unstable condition; its early removal is, therefore, a matter of importance. The guncotton was also examined after each boiling as to its progress in purification and stability by the numerous tests mentioned in the Table, and it was found that the scheme in which long boilings in dilute acid were followed by gradually shorter neutral or faintly alkaline boilings, was superior to that in which short initial boilings were succeeded by long final ones, inasmuch as not only by the "trace" tests but also by those tests which involved a wider decomposition of the guncotton such as the tests of Will, Bergmann and Junk, etc., purification and stability of the material were obtained more readily and earlier by the former treatment than by the latter.

II. *Alkaline Treatments.*—Practically speaking, the alkalis that would be chosen for trials in connection with the boiling process, are sodium and calcium hydrate, of the caustic alkalis, and sodium and calcium carbonate of the carbonated alkalis.

Effect of boiling in caustic liquors.—In an experimental boiling in which lime water was employed, this solution was used in the vat for displacing the water present in the guncotton. After this the guncotton was given four 3-hour boilings with saturated lime water, boiling being thereafter continued with the ordinary water.

A well-marked feature in this experiment was the tendency of the wash waters to develope free sulphuric acid after having been alkaline. The following table shows the nature of the change.

The first change towards acidity (at the 7th boiling) occurred in the usual course of boiling, but the second (at the 13th boiling) after the vat had been standing for a week. The sulphuric acid thus developed and found in the vat water is doubtless derived from the decomposition of sulphuric acid organically combined with the guncotton. Besides this, the method of boiling in question was found to have many other disadvantages. Although the strength of even a saturated solution of Ca (OH_2) is small (0.16 per cent.), the hydrolysis of the nitric ester was considerable. This was shown by the abnormal proportion of nitrites found in the earlier boilings when caustic lime solution was used, for example 0·04 per cent. as HNO_2 in the 4th, and by the rise in solubility in ether-alcohol of the guncotton. The greater activity of hydroxyl over hydrogen ions in the saponification of esters has been shown by Wijs (Zeit. für Phys. Ch. 12, 514 [1893]) to be in the ratio of 1,400 to 1, and is no doubt the cause of this breaking down of the nitric ester as well as of the fact that the guncotton underwent a physical change, losing its strength of fibre, and becoming short and friable.

As regards stability, the guncotton treated in this way gave distinctly poor results, when tested by Abel, Will, and other tests.

These objections—the somewhat drastic hydrolysis of the ester with rise in solubility in ether-alcohol and breaking down of the fibrous structure of the guncotton having been confirmed on a smaller scale with dilute caustic potash solution, it was not thought to be necessary to proceed farther on the large scale in the direction of boiling with other caustic alkaline solutions.

Effect of boiling with alkaline carbonates.—A process for boiling guncotton which was employed by a private company in this country until within the last few years, consisted in boiling the pulped guncotton with chalk in iron vessels, but the results obtained as regards the stability of the product—which was submitted to the Superintendent of the R.G.P.F. for examination—were so poor that the process of boiling was abandoned by the company.

Indications as to the effect of boiling in presence of $CaCO_3$, and of its failure to effect stability without an initial acid treatment, have been frequently observed. Thus, in the experiment with caustic lime solution, a considerable quantity of $CaCO_3$ was formed by the action of the CO_2 present in the steam on the $Ca(OH_2)$ and the succeeding boilings may be considered as being examples of boiling in presence of excess of $CaCO_3$. The result was nevertheless unsatisfactory, as was shown. Again, it has not been found that any marked improvement in stability has resulted from continued boiling of guncotton with the usual water which contains a small quantity of $CaCO_3$.

With sodium carbonate solution, an experimental boiling has been made. The scheme of boiling consisted in two 4-hour boilings with Na_2CO_3 solution of 0·5 per-

Guncotton in vat heated with $Ca(OH)_2$ solution to displace water and boiled 3 hours with 4 changes of this solution; then boiled with ordinary water.

Boiling.		Wash Waters.					
No.	Time Hours.	Nature of water after boiling.	Alkalinity of water as per cent. $CaCO_3$.	Acidity of water as per cent. H_2SO_4.	Total sulphuric acid in water per cent. H_2SO_4.	Nitrite water as per cent. HNO_2.	H_2SO_4 in G/C as per cent. H_2SO_4.
4 alkaline boilings							
5th (water)	4	Neutral	—	—	0·014	0·019	—
6th	4	Alkaline	0·0020	—	0·012	0·019	0·43
7th	4	Acid	—	0·002	0·015	0·011	—
8th	4	Acid	—	0·001	0·015	0·013	—
9th	4	Acid	—	0·002	0·015	0·014	—
10th	2	Alkaline	0·0005	—	0·012	0·013	0·35
11th	2	Alkaline	0·0030	—	0·013	0·012	—
12th	2	Alkaline	0·0008	—	0·012	0·008	0·25
13th	4	Acid	—	0·017	0·036	0·001	—
14th	4	Acid	—	0·003	0·016	0·012	—
15th	2	Neutral	—	—	0·013	0·010	—
16th	2	Alkaline	0·0008	—	0·010	0·005	0·20

cent. strength, followed by eight 4-hour boilings and three 2-hour boilings, all of 0·2 per cent. strength.

Examination of the wash waters showed that the alkali originally present to the extent just mentioned had almost disappeared by the end of each boiling, while the proportion of nitrite (as HNO_2) was 0.05 per cent. or about ten times the quantity found in the later boilings with water.

Examination of the guncotton showed that the solubility in ether-alcohol had risen to a high figure (17·1 per cent. as against 5.4 per cent. in a control experiment with the usual boiling) and that the guncotton, even after ten boilings, still contained more than three times the quantity of sulphate that is found under the usual conditions. The quantity of Na_2CO_3 which disappeared was about 6 kilos. per hour. It was also observed that the guncotton fibre became disintegrated at an early stage, to a less extent than with calcium hydrate, but still to a much greater extent than in the usual process.

It is therefore evident that the hydrolysis of the nitric ester in the dilute solution of Na_2CO_3 employed, is of too drastic a nature and produces finally an unsatisfactory guncotton.

This investigation has afforded the following information on the boiling of guncotton. The experimental boilings have shown that for the elimination of impurities from the guncotton and the rapid attainment of a stable product, boiling in dilute acid at the beginning of the process is superior to an alkaline treatment. This acid boiling should not be unduly curtailed, or elimination of impurities will be rendered difficult. In the present instance, an initial 12 hours' acid boiling has been found efficacious. The quantity of acid left in the guncotton from the nitrating process, will depend on the nature of its treatment after nitration, and on the alkalinity of the water. It is important to avoid pushing this elimination too far, as actual experiments have shown that deficit of acid in the first boiling retards the purifying and stabilising process. It would not be possible to give a figure applicable to all cases, but it may be mentioned that good results have been obtained when the first wash water is found to contain acids equal to 1 per cent. (as H_2SO_4) calculated on the guncotton present.

If, in the process of manufacture, the quantity of acid in the first boiling were found to be too small, the addition of a small quantity of acid would be advisable.

As showing the degree of elimination of one of the impurities—the cellulose nitro-sulphuric ester—the percentages of total sulphate in three guncottons, manufactured at the time of writing, may be quoted. These are 0·09, 0·07, 0·05, 0·07 per cent., and fall much below the proportions found by Hake and Lewis (*loc. cit.*, p. 377) even after removal by them of sulphates soluble in water and dilute acids.

After the acid period has passed and the guncotton is being boiled in water faintly alkaline from the presence of dissolved calcium carbonate, it is inadvisable to prolong this process unduly as no improvement in stability is produced, and the guncotton is slightly decomposed.

The alkaline treatments which were investigated did not prove so efficacious as the initial acid boiling in removing impurities, and had the additional disadvantage of producing a considerable hydrolysis of the nitric ester itself.

As a result of these experiments, the present method of boiling was adopted at the R.G.P.F., namely, 12+12+4+4+4+4+4+2+2+2 hours, with a cold water washing between the first and second, and second and third boilings.

Discussion.

Col. Nathan said it was not perhaps his place to criticise a paper which had originated in his laboratory, but he might add a word or two of explanation as to its origin. When the manufacture of guncotton was started at Waltham Abbey by what was now called the displacement process, it was evident that the guncotton, as it went to the boiling vats, was capable of being stabilised with less boiling than guncotton made by the old Abel process, and they came to the conclusion that it was time to thoroughly investigate the chemistry of the purifying process. Dr. Robertson went to work, not in the laboratory, but on the manufacturing scale. They used the ordinary guncotton vats of 1,000 kilos. capacity, and submitted the guncotton to various treatments in their vats, and this paper had given the results obtained. One practical result had been to reduce the time of boiling from 72 to 50 hours, which of course meant a considerable economy in steam. He did not say the same results would follow the adoption of that system in other factories, because purification no doubt depended to a great extent on the character of the water which was used, but he fancied that, as they had made such a big reduction in the time of boiling it would be possible for other factories to do the same if they adopted the process, which he thought was a chemically sound one. Being desirous at all times of assisting the trade, he came to the conclusion that the results of these experiments should be made known, and there was no better way of doing it than to arrange for Dr. Robertson to read a paper before the Society of Chemical Industry, and the sanction of the War Office to his doing so had therefore been obtained. He hoped it might be of use to the trade, and trusted that from time to time they would be able to give information on other points which might come to light in the course of their investigations.

Prof. W. R. Hodgkinson said he gathered that the author had been using a little acid to help in the hydrolysis of what he considered the most serious matter in connection with guncotton, sulphates of cellulose, which undoubtedly remained in and were the cause of slow or rapid decomposition. A slight amount of acid in the earlier hot washing was more active in hydrolysing some of these sulphates than water alone.

Mr. W. F. Reid said that in 1881-2 he had carried out numerous experiments on this subject, but the endeavour to get the material alkaline in the first stage had probably been the cause of failure. Was the separation of the water from these numerous boilings carried out simply by draining off, or were other steps taken to diminish the quantity of residual water, because it became a matter of importance when the water available was not pure?

Mr. J. F. Briggs stated that together with Messrs. Cross and Bevan (this J., 1905, 685, 1251) he had investigated this matter in another aspect in connection with the aceto-sulphates of cellulose. They found that even under the action of cold distilled water and still more of boiling water, the sulphuric acid residue of these mixed esters was gradually split off, whereas on treatment with alkaline solutions the whole of the acetic acid residue could be eliminated by saponification whilst the combination between the cellulose and the sulphuric acid remained intact in the form of a cellulose sulphate. This behaviour was explained by the fact that the sulphuric acid residue in these esters exists in the form of $-SO_4H$, which is readily hydrolysed by the action of water or acids, but which becomes $-SO_4M'$ in presence of alkalis, towards which it is remarkably stable. Further, by treating guncotton with the sulphating reagent they had succeeded in combining quantities up to 10 per cent. of sulphuric acid with the cellulose, displacing a corresponding quantity of the nitric acid. Thus they had been able to study the properties of the mixed sulphuric esters of cellulose in the gross, rather than in the minute proportions in which they occur in guncotton.

Dr. Robertson in reply said it was not possible to go into the matter of the organically combined sulphuric acid, but when the paper was published it would be seen that organic sulphate was undoubtedly present in some products of nitration, and about the instability of guncotton containing this organic sulphate there was no doubt whatever. Experimental products had been obtained which, although they gave a good Abel test, were proved by storage trials and other tests to be quite unstable, and in these the organic sulphate was present in considerable quantity. The method of reducing it to an almost vanishing point on the large scale was the method of acid hydrolysis at the start. In reply to Mr. Reid, the water was strained off from the vats.

ELECTRO-CHEMICAL PROBLEM OF THE FIXATION OF NITROGEN.

BY PROFESSOR P. A. GUYE.

ERRATUM.

This J., June 30, 1906, p. 571, col. 1, line 4, for "1850 kilos. HNO_3" *read* "1174 kilos. HNO_3."

New York Section.

Meeting held at Chemists' Club, on Friday, April 20th, 1906.

DR. RUSSELL W. MOORE IN THE CHAIR.

ANALYSES OF JALAP.

BY RUSSELL W. MOORE, M.A., M.SC.

At the reading of a paper by me on this subject before the Section on March 25th, 1904 (this J., 1904, 412) in which the average resin content of ninety-eight samples of jalap was given as 12·60 per cent., some discussion arose as to whether this was not an excessive average for the jalap to be found in the market. One member of great experience, in dealing with crude drugs, gave it as his opinion that jalap testing as high as 12·60 per cent. of resin was not easily obtainable, and that the ordinary jalap of commerce averaged from four to seven per cent. of resin. Since the former paper was written I have had occasion to test a much larger number of jalap samples, the results of which are here given, the different lots being separated by lines:—

1	4·82*	58	4·70	116	4·75	172	7·00	230	5·14
2	6·70	59	5·12	117	6·75	173	5·31	231	4·76
3	2·10	60	8·89	118	4·89	174	5·94	232	6·64
4	5·00	61	5·12	119	3·00	175	5·70	233	5·87
5	6·70	62	3·87	120	6·75	176	4·50	234	6·86
		63	4·20	121	5·00	177	4·00	235	4·14
6	4·94	64	5·31	122	4·70	178	5·89	236	3·80
7	6·75	65	6·62	123	6·00	179	6·44	237	4·14
8	5·47	66	6·75	124	5·00	180	6·25	238	5·64
9	8·3	67	7·50	125	7·06	182	7·38	239	3·36
10	4·25	68	6·39	126	11·75	183	5·38	240	5·00
11	6·25	69	4·62	127	5·61	184	11·38	241	5·30
12	6·19	70	6·25	128	6·56	185	15·63	242	8·14
13	5·82	71	4·00	129	5·25	186	13·50	243	7·00
14	3·69	72	4·87	130	3·12	187	13·13	244	5·14
15	6·00	73	5·31	131	4·81	188	4·56	245	4·86
16	4·00	74	4·75	132	3·62	189	4·50	246	5·93
17	5·12	75	4·87	133	5·12	190	2·56	247	4·75
18	6·20	76	5·00	134	4·00	191	4·63	248	4·64
19	6·12	77	4·00	135	4·56	192	5·63	249	4·93
20	11·60	78	7·37	136	6·50	193	4·31	250	7·00
21	6·20	79	5·62	137	3·20	194	5·00	251	4·14
22	7·80	80	8·12	138	5·06	195	8·76	252	3·71
23	4·75	81	5·62	139	9·18	196	4·31	253	5·00
24	8·06	82	7·25	140	6·31	197	3·50	254	4·00
25	7·31	83	5·37	141	7·75	198	5·38	255	4·77
26	3·70	84	5·75	142	5·31	199	3·94	256	6·71
27	6·98	85	3·94	143	6·62	200	5·38	257	6·43
28	5·10	86	5·50	144	5·88	201	6·80	258	8·86
29	6·62	87	7·50	145	3·50	202	4·88		
30	5·40	88	4·37	146	4·38	203	4·13	259	12·00
31	5·25	89	7·20			204	4·88	260	14·00
32	5·75	90	5·70	147	6·00	205	6·88	261	11·80
33	4·20	91	8·06	148	5·81	206	5·44	262	10·20
34	6·81	92	4·38	149	6·94	207	5·44	263	14·30
35	3·90	93	3·38	150	7·48	208	3·99	264	11·20
36	5·12	94	4·38	151	3·94	209	4·25	265	10·00
37	5·00	95	5·38	152	5·88	210	3·94	266	11·00
38	5·62	96	6·12	153	6·44	211	9·00	267	11·80
39	5·87	97	4·50	154	6·25	212	2·94	268	13·60
40	4·50	98	5·00	155	5·38	213	5·38	269	8·80
41	5·50	99	6·62	156	6·33	214	5·13	270	10·40
42	6·50	100	4·94	157	5·81	215	5·06	271	13·43
43	4·62	101	7·78	158	4·69	216	3·89		
44	5·12	102	3·69	159	6·69	217	6·00	272	9·29
45	4·06	103	4·62	160	5·19	218	4·25	273	10·26
46	4·87	104	6·62	161	6·94	219	4·81	274	7·43
47	4·37	105	4·89	162	5·81	220	2·19	275	10·43
48	4·25	106	3·50	162	9·19	221	4·88		
49	4·87	107	5·75	163	5·25	222	8·44	276	4·82
56	5·50	108	4·89	164	5·50	223	5·38		
51	5·19	109	6·06	165	6·53	224	4·38	Maximum	
52	4·70	110	5·25	166	9·19			15·63	
53	6·12	111	4·93	167	4·94	225	3·86	Minimum	
54	4·87	112	4·88	168	4·19	226	4·70	2·10	
55	3·50	113	6·31	169	7·00	227	3·00		
56	5·25	114	6·06	170	6·88	228	2·86	Average	
57	4·81	115	7·55	171	4·89	229	9·71	5·95	

* No. 1 was an average of ten samples.

Of the 276 samples examined, only fifteen were equal to or above the standard of 11 per cent. of resin prescribed by the Treasury regulations. This result and the average content of 5·95 per cent. of resin go to confirm the statement that low-grade jalap is of frequent occurrence, and show the extremely variable character of the drug as imported into this country. An inspection of the results obtained in packages of the same lot also show that they vary greatly.

ADDITIONAL ANALYSES OF ASSAFŒTIDA.

BY RUSSELL W. MOORE, M.A., M.SC.

The analyses here given are for the purpose of comparison with those previously published in this Journal. The method of analysis followed was identical with that described (this J., 1899, 987). The samples represent many lots imported at ports other than New York, the separate lots being indicated by lines. The following results were obtained:—

No.	Per cent. Resin.	No.	Per cent. Resin.	No.	Per cent. Resin.	No.	Per cent. Resin.	No.	Per cent. Resin.
1	32·85	35	47·80	61	60·18	84	17·70	120	16·60
2	50·00	36	45·45	62	62·45	85	21·00	121	18·45
3	40·90	37	57·30	63	28·90	86	16·50	122	17·00
4	37·40	38	47·55	64	64·00	87	16·50	123	19·50
5	40·00			65	65·15	88	27·45	124	15·00
6	40·40	39	38·80			89	18·80	125	26·75
7	45·40			66	40·90	90	16·50	126	36·90
8	50·50	40	34·00	67	43·75	91	18·30	127	14·50
9	32·70			68	55·15	92	18·60	128	19·40
10	42·30	41	36·53			93	21·00	129	28·30
11	37·80	42	21·90	69	13·55	94	13·10		
12	41·90	43	34·70	70	24·40	95	30·00	130	18·50
		44	48·10			96	17·40	131	18·75
13	36·90			71	25·90	97	17·50	132	16·50
14	28·20	45	38·60			98	15·25		
15	34·75			72	20·00	99	18·90	133	20·80
16	33·80	46	45·90			100	17·60	134	21·20
17	28·60			73	18·80	101	18·30	135	22·65
18	44·20	47	19·20	74	21·05	102	17·10	136	18·80
19	39·20					103	18·15	137	21·65
20	53·00	48	21·13	75	30·10	104	17·30	138	21·75
21	20·05					105	11·80	139	15·55
22	32·80	49	33·20	76	33·00	106	14·25	140	12·25
23	24·50					107	18·95	141	10·80
24	28·30	50	31·40	77	60·40	108	17·25	142	12·60
						109	27·00		
25	44·15	51	57·30	78	51·70	110	18·50		
26	42·80							Maximum	
27	36·50	52	55·10	79	36·60	111	19·05	65·15 per	
28	48·10	53	58·55			112	16·20	cent.	
29	42·00	54	60·55	80	22·50	113	18·90		
30	43·40	55	47·20			114	14·95	Minimum	
31	51·60	56	57·80	81	52·50	115	9·35	9·35	
32	54·90	57	39·60			116	21·20		
		58	50·00	82	24·00	117	13·20	Average	
33	43·00	59	63·20			118	31·50	31·45	
34	48·25	60	58·00	83	16·50	119	15·10		

These results have been tabulated for the purpose of comparison with previously published results.

The figures in Table A, show only a total of 15·49 per cent. of the samples examined to contain the 50 per cent. of resin required by the Treasury regulations, and indicate the necessity of frequent chemical examinations of the importations of this drug. Much of the inferior drug met with is fictitious in character, consisting of impure gypsum cemented together with assafœtida resin. Other samples were of an inferior quality, plainly due to crude and imperfect methods of collecting the drug. Several samples of assafœtida resin were also tested, with the following results:—

Resin from Assafœtida.

No.	Resin.	No.	Resin.
1	....91·87 per cent.	3	....91·67 per cent.
2	....92·60 per cent.	4	....94·89 per cent.

TABLE A.

Per cent. of Resin.	No. of Samples.			Per cent.		
	1st Set, 1890.	2nd Set, 1900.	3rd Set, 1901–5.	(1) 1899.	(2) 1900.	(3) 1901–5.
1 to 10	13	0	1	7·93	0·0	0·70
10 to 15	49	0	9	29·88	0·0	6·34
15 to 20	61	5	39	37·19	3·33	27·46
20 to 25	19	3	17	11·58	2·00	11·97
25 to 30	7	6	8	4·27	4·00	5·63
30 to 35	4	10	13	2·44	6·67	9·16
35 to 40	3	18	11	1·83	12·00	7·75
40 to 45	2	25	13	1·22	16·66	9·16
45 to 50	0	12	9	—	8·00	6·34
50 to 55	Above 50,	37	8	—	24·67	5·63
55 to 60	6	21	7	3·66	14·00	4·93
Above 60		13	7	—	8·67	4·93
Total	164	150	142	100·00	100·00	100·00

Yorkshire Section.

Meeting held at the University, Leeds, on June 18th, 1906.

PROF. A. G. GREEN IN THE CHAIR.

THE DIRECT ESTIMATION OF NITROGLYCERINE IN CORDITE, &c.

BY OSWALD SILBERRAD, PH.D., HENRY ARLETT PHILLIPS, AND HENRY JOHN MERRIMAN.

No method has hitherto been devised for the direct estimation of nitroglycerine in cordites and allied explosives. It is customary to extract the nitroglycerine and mineral jelly with ether, and to weigh the residual nitrocellulose. Methyl alcohol is used to separate the nitroglycerine and mineral jelly, the latter being weighed and the former determined by difference. The disadvantages of having no direct method for the estimation of such an important constituent of cordite as nitroglycerine are manifest.

Firstly, the methods for the determination of mineral jelly are somewhat unsatisfactory. Thus, on keeping a powder, a certain portion of the mineral jelly becomes soluble in methyl alcohol, and is therefore estimated as nitroglycerine; and secondly, it not infrequently occurs that the powder contains some additional ingredient, the presence of which precludes the estimation of nitroglycerine by difference.

The chief difficulties met with, in attempting to estimate nitroglycerine in cordite directly, are due to the unavoidable presence of a volatile solvent used for its separation. Such solvents interfere with the reactions of nitroglycerine to such an extent that all previous attempts to devise quantitative methods have been fruitless.

The present method is based on the reduction of the saponification products of nitroglycerine to ammonia, and will be found to be satisfactory and accurate.

Saponification alone does not give quantitative results. In this connection Hay's work (Monit. Scient. [3] 15, 424) should be referred to. According to this author the saponification may be represented by the following equation:—

$$C_3H_5(ONO_2)_3 + 5KOH = KNO_3 + 2KNO_2 + CH_3COOK + HCOOK.$$

The present work has shown, however, that this reaction is not quantitative, ammonia and other products always being simultaneously formed.

EXPERIMENTAL.

Direct evaporation of ethereal solution of nitroglycerine.—A series of experiments in this direction showed:—

(*a*) That ether cannot be removed from nitroglycerine without loss of the latter.

(*b*) That the loss is reduced to a minimum when the removal of the ether is carried out at a low temperature in a current of air.

(*c*) That even under the most carefully controlled conditions constant results cannot be obtained.

As an example, the following experiment may be cited:—

Weighed quantities of nitroglycerine were dissolved in ether, the ether evaporated in a current of air, and the nitrogen estimated by Lunge's method in the residue.

0·4508 grms. of nitroglycerine originally taken gave 140·8 c.c. of nitric oxide at 758·9 mm. and 19° C. = 18·24 per cent. N.

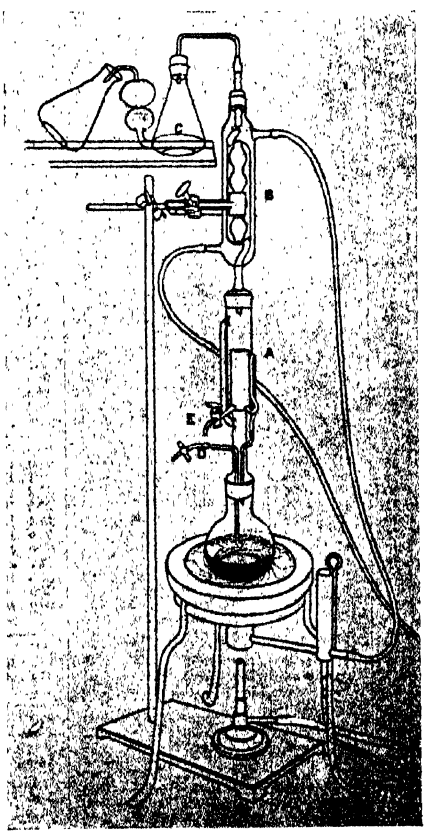


FIG. 1.

0·4501 grms. of nitroglycerine originally taken gave 140·5 c.c. of nitric oxide at 762·2 mm. and 22·8° C. = 18·07 per cent. N.

This corresponds to 98·58 and 97·69 per cent. of nitroglycerine respectively. Experiments were therefore carried out with a view to devising a direct method for estimating nitroglycerine in an ethereal solution. The results which ultimately led to the development of a satisfactory method are briefly summarised in the following table:—

From the above results it will be seen that it is possible to overcome the difficulties attending the direct estimation of nitroglycerine in ethereal solution (as obtained in the analysis of cordite) by reducing the saponification produots with zinc, iron, and caustic soda; under these conditions the nitrogen is quantitatively converted into ammonia.

The apparatus* used is depicted in the accompanying

* To be obtained of Messrs. Townson and Mercer (34, Camomile Street), or Messrs. Muller and Co. (6, Orange Street, Red Lion Square).

Experiments on the quantitative estimation of nitroglycerine in ethereal solution.

Conditions of experiment.	Percentage, of the nitro glycerine taken, found by experiment.	Molecular proportion of reagent per molecule of nitroglycerine taken.	Remarks.
I. Saponification by boiling the ethereal solution with alcoholic caustic soda:			
Experiment 1 product titrated unfiltered	86·35*	4·32 NaOH	The reaction was hardly complete after 24 hours boiling.†
„ 2 „ „ „	86·48*	4·32 NaOH	
„ 3 „ filtered	88·46*	4·42 NaOH	
„ 4 „ „ „	89·10*	4·45 NaOH	Ammonia was evolved and in three cases estimated:
II. Saponification by boiling the ethereal solution with alcoholic caustic potash for 28 hours:			(1) 1·39 per cent. of the total nitrogen present was evolved as ammonia.
Experiment 1 product titrated unfiltered	84·65*	4·23 KOH	(2) 1·65 per cent. „ „ „
„ 2 „ „ „	85·10*	4·25 KOH	(3) 2·09 per cent. „ „ „
III. Saponification by heating the ethereal solution with alcoholic caustic potash in a sealed tube:			
Experiment 1 for 6 hours at 100° C...	81·75*	4·09 KOH	
IV. Saponification by warming the ethereal solution with sodium ethylate:			The reaction proceeds much more readily than in the above cases, being fully completed in 6 hours. Ammonia was invariably evolved and estimated in two cases:
Experiment 1	86·16*	4·31 C_2H_5ONa	(1) 1·5 per cent. of the total nitrogen present was evolved as ammonia.
„ 2	86·53*	4·33 C_2H_5ONa	(2) 0·61 per cent. „ „ „
V. Saponified by heating the ethereal solution with alcoholic ammonia in a sealed tube:			The reaction is obviously incomplete, as at least 3 molecules of ammonia must be required.
Experiment 1 for 6 hours to 100° C...	—	1·88 NH_3	
VI. Reduction of ethereal solution to ammonia by means of a copper zinc couple:			Traces of unchanged nitroglycerine could still be detected in the flask after prolonged boiling.
Experiment 1 in alkaline solution	69·51	—	
„ 2 in acid solution	54·20	—	
VII. Reduction of ethereal solution to ammonia with zinc dust and sulphuric acid in presence of salicylic acid:			Reaction was very violent and altogether unsuited for quantitative work. Results are therefore not included.
Experiment 1	—	—	
„ 2	—	—	
VIII. Reduction to ammonia by boiling ethereal solution with tin and hydrochloric acid.			Reduction was carried on for 3 hours.
Experiment 1	66·39	—	
IX. Reduction to ammonia by heating ethereal solution with stannous chloride and hydrochloric acid; excess of stannous chloride estimated by titration with 1/10-normal iodine solution.			In all cases, the quantity of stannous chloride used is insufficient to account for the reduction of all the nitroglycerine present.
Experiment 1 at boiling point of ethereal solution	—	5·63 $SnCl_2$	
„ 2 „ „ „ „	—	6·40 $SnCl_2$	
„ 3 for 6 hours at 100° in sealed tube	—	9·76 $SnCl_2$	
„ 4 „ „ „ „	88·35	9·76 $SnCl_2$	
„ 5 „ „ „ „	81·49	9·66 $SnCl_2$	
X. Reduction of ethereal solution to nitric oxide by boiling with ferrous sulphate and sulphuric acid:			The nitric oxide was mixed with excess of air, the nitric peroxide produced collected in standard caustic soda solution, and the excess of alkali titrated with N/10 acid. It was found impossible to bring about the completion of the reaction event after prolonged boiling; whilst unchanged nitroglycerine invariably found its way into the absorption flask.
Experiment 1	34·60	—	
XI. Estimation of nitroglycerine as ammonia produced by the reduction of its saponification products with zinc iron and caustic soda.			Calculated to nitrogen this is—
Experiment 1	100·18	—	18·53 per cent. } Theory
„ 2	99·43	—	18·39 per cent. } 18·50 per cent.
„ 3	99·78	—	18·46 per cent. }

* These figures are calculated on the generally accepted equation for the saponification of nitroglycerine according to which 1 mol. of this substance requires 5 mols. of alkali.

† In aqueous solution, the saponification is far slower and less complete, whilst the presence of alcohol prohibits the use of hydrogen peroxide. The method recently published for the estimation of nitrogen in nitrocellulose by means of "nitron" (M. Busch, Ber. 38, 1906, 1401) is therefore not applicable.

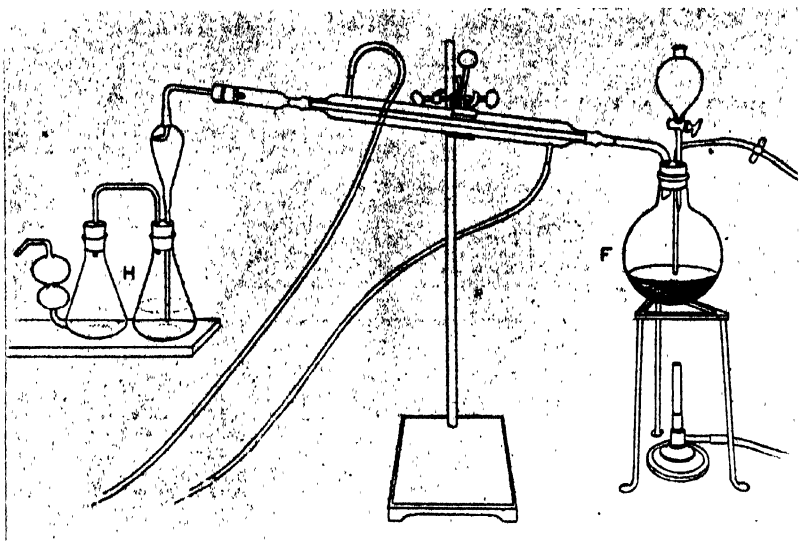


FIG. 2.

diagrams. Fig. 1 is the apparatus used for extracting and saponifying the nitroglycerine, and Fig. 2 that used for reducing the products to ammonia. It will be noticed that the apparatus used for extraction and saponification is fitted throughout with ground glass joints and supplied with a very efficient condenser—these precautions are necessary in order to avoid loss of nitroglycerine, which is readily carried away in the ether vapour.

The direct estimation of nitroglycerine in a cordite is carried out as follows:—A weighed quantity of the ground cordite, sufficient to yield about 2 grms. of nitroglycerine, is placed in a thimble in the Soxhlet extractor, A, which is fitted up as shown in the diagram. Eighty c.c. of absolute ether is poured into the flask, and extraction carried out in the usual manner. After the extraction of the cordite is complete, the thimble containing the residual nitrocellulose is washed with a little fresh ether, and removed from the extractor. The absorption flasks, C, containing 10 c.c. of N/10 acid are now affixed, and excess of sodium ethylate (about 50 c.c. of a solution prepared by dissolving 5 grms. of sodium in 100 c.c. of absolute alcohol) run into the flask little by little through the side tube, D. The reaction takes place rapidly, and is completed by warming on the water-bath for about six hours; its course may be followed by periodically drawing off small samples by means of the tap, E, and examining them for nitroglycerine by means of diphenylamine in sulphuric acid. The ether is then distilled up into the Soxhlet and run off by means of tap, the residue is dissolved in water and made up to 250 c.c., the aqueous Soxhlet and ether washings being also added to the solution.

Fifty c.c. of the solution are transferred to the flask, F, of the reduction apparatus (Fig. 2). Fifty grms. of a mixture of powdered zinc (2 parts) and reduced iron (1 part) are added together with 50 c.c. of 40 per cent. caustic soda solution and the ammonia distilled off in a slow current of air and collected in standard acid (about 75 c.c. N/10 acid) in the absorption flask, H. The excess of acid is then titrated back. One c.c. of N/10 acid corresponds to 0·00757 grm. of nitroglycerine.

The following examples, which show the nitrogen present as nitroglycerine, will serve to illustrate the degree of accuracy of the method. Nitrogen estimations were also carried out by Dumas' ultimate method on the original explosive and also on the nitrocellulose, separated by ether extraction, and the nitrogen present as nitroglycerine, calculated from these data, is given for comparison.

Explosive.	Nitrogen determinations by Dumas' method.			Nitrogen present as nitroglycerine.	
	Nitrogen in original cordite, &c.	Nitrogen in extracted nitrocellulose.	Percentage of nitrocellulose.	Calculated from results by Dumas' method.	Found by new method.
Experimental cordite F. 140	14·77	12·82	36·33	10·11	10·02
Experimental cordite 4296	15·53	13·22	31·83	11·32	11·35
Experimental cordite 2614	13·90	12·85	65·43	5·49	5·47
Blasting gelatine	17·21	11·81	8·26	16·24	16·00

The slight discrepancy (0·249) between the results obtained by the two methods when applied to blasting jelly is due to the fact that Dumas' method invariably gives high results when applied to this explosive; the new method is evidently accurate in this case also.

Our thanks are due to the Explosives Committee and the Director of Artillery for permission to publish these results.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 581.)

ENGLISH PATENTS.

Separating apparatus; Centrifugal ——. Aktiebolaget Separator, Stockholm. Eng. Pat. 10,874, May 24, 1905. Under Int. Conv., May 27, 1904.

SEE Fr. Pat. 354,416 of 1905; this J., 1905, 1162.—T.F.B.

Separation of solid bodies from liquids by cooling, and apparatus therefor. P. Porges, Vienna, and R. Neumann, Brünn-Königsfeld, Austria. Eng. Pat. 23,424, Nov. 14, 1905.

THE liquid to be cooled is introduced into a vessel in which a number of hollow bodies, through which the cooling medium is caused to flow, are arranged. These may be of any convenient shape so long as their exterior surfaces can be reached by a series of scrapers, mounted on a common shaft, and caused to rotate. The scrapers serve to keep the contents of the vessel agitated, as well as to remove the deposited solids from the surface of the cooling bodies.—W. H. C.

Evaporating apparatus; Vacuum ——. F. Jürgens, Sangerhausen, Germany. Eng. Pat. 18,130, Sept. 7, 1905.

SEE Ger. Pat. 165,220 of 1904; this J., 1906, 589.—T.F.B.

Drying by means of rays of light; Process for ——. W. E. Evans, London. From Ges. f. Trockenverfahren, Berlin. Eng. Pat. 19,795, Sept. 30, 1905.

SEE Ger. Pat. 162,696 of 1904; this J., 1906, 59.—T. F. B.

Lixiviation processes; Machines for ——. A. E. W. Constans, Nelson, B.C., Canada. Eng. Pat. 20,941, Oct. 16, 1905.

SEE U.S. Pat. 805,635 of 1905; this J., 1906, 8.—T. F. B.

UNITED STATES PATENTS.

Blast-flame furnace. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York. U.S. Pat. 821,994, May 29, 1906.

THE furnace consists of an inclined rotary combustion chamber, with means for supplying material to be calcined to the upper end, and a discharge outlet at the lower end. The main flame of the furnace, derived from a blast-nozzle, connected with a receptacle for powdered coal, is directed axially into the combustion chamber, and passes over the material in it, in a direction opposite to that in which the material is travelling. By means of an auxiliary nozzle, comprising two concentric pipes, the inner of which is connected with an air-compressor, and the outer with a fan-blower, a secondary flame is directed into the combustion chamber at an angle to the axis of the main flame, and directed on to the floor of the chamber. By this arrangement the main flame gives a region of relatively low temperature, and the secondary flame one of relatively higher temperature, near the discharge end of the furnace, and these can be relatively adjusted longitudinally of the furnace. By means of damper mechanism attached to the stack of the furnace, the position of the main flame can be varied within the combustion chamber.—W. C. H.

Kiln; Continuous ——. W. A. Butler, San Francisco, Cal. U.S. Pat. 822,580, June 5, 1906.

A SUCCESSIVE series of burning-chambers is arranged in the form of an elongated oval, with combustion-chambers in the lower part of the walls at each side. The combustion-chambers are separately supplied with fuel, and are inclined downward; they communicate with the burning-chambers by depressed channels at each side the floor, the products of combustion being direc upwards into the burning-chambers by deflecting wa Separate, damper-controlled air supplies are provic for both the combustion- and burning-chambers, a the latter are connected to the main flue to the stack damper-controlled gas passages. Any burning-cham in which the process is completed can be shut off fr its combustion-chamber by a "gate" or damper, a the partitions between the burning-chambers can be ea removed to allow access to the interior.—W. H. C.

Dryer. G. E. Chamberlain, St. Louis, Mo. U.S. P 822,185, May 29, 1906.

THE apparatus comprises a rotary drying chamber a a feed conveyor, geared together so as to move sim taneously. The material to be dried is supplied to feed conveyor, which is arranged in the lower port of a flue communicating with the drying chamber. Th is also a flue-cleaning conveyor in the bottom of the fl to deliver material into the cylinder in a position mingle with that delivered by the feed conveyor. —W. C. H

Drying chamber. A. Schröder, Assignor to A. Krau Berlin. U.S. Pat. 822,990, June 12, 1906.

SEE Fr. Pat. 357,768 of 1905; this J., 1906, 113.—T. F.

Suction-filter. P. Argall, Denver, Colo. U.S. P 822,812, June 5, 1906.

THE claim is for a series of suction-filters with porc sides, and provided with inlet and outlet pipes, the lat being connected to a suction-producing apparatus. T filters are rigidly supported, and are enclosed in a remc able open-ended tank, which, when in position, has open end closed by a fixed plate at one end of the ser of filters. The liquid to be filtered is fed into the tar and the clear portion is drawn through the porous filte leaving the sludge adhering to their outer surfaces. series of tanks to hold the various fluids, and a mechani for moving the enclosing tank are included in the clair —W. H. C.

Separators; Liner for centrifugal liquid ——. Ljungström, Assignor to Aktiebolaget Separat Stockholm. U.S. Pat. 822,904, June 12, 1906.

SEE Eng. Pat. 9417 of 1905; this J., 1906, 523.—T. F.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 583.)

Coal briquettes and briquette pitch; Chemical methods judging ——. E. J. Constam and R. Rouge Gluckauf, 1906, **42**, 481; Chem.-Zeit., 1906, **30**, Re 178—179.

1. *Yield of coke.*—After examining and comparing vario methods, the authors state that the crucible used for t Muck test must be at least 24 mm. across the botto or the results will come out 2—3 per cent. of coke t high. The Bochum intumescence test is less delica the yield of coke being on the average 1—3 per cer lower, but the results agree more closely with gasificati tests made in gasworks. The least concordant resu are furnished by the Belgian method (heating for h an hour in a covered porcelain crucible in a gas muffl On the other hand, the American method (1 grm. undried substance heated for seven minutes in a cover platinum crucible weighing 20—30 grms., and plac about 6—8 cm. above a burner nozzle giving a Buns flame 20 cm. high) gives a coke yield most nearly appro mating to practical working.

2. *Briquette pitch.*—The Bochum method is best f

determining the amount of coke residue, but owing to the difficulty of burning the final traces of volatile matter, a second flame should be directed close to the opening in the crucible lid, to see whether ignition occurs. The yield of coke afforded by the pitch is important, any yielding 45 per cent. being unsuitable. The percentage of constituents soluble in carbon bisulphide forms a good criterion of the proportion of binding constituents present. The yield of such constituents varies between 60·4 and 95 per cent., with 79·8 per cent. as the average. Furthermore, pitch with a lower heating value than 8550 cal., and over 5 per cent. of water, is of low binding power.

3. *Determination of the percentage of binding medium in briquettes.*—The substance is extracted twice for 24 hours in a Soxhlet apparatus, with carbon bisulphide, *i.e.*, using a fresh quantity of bisulphide each extraction, and the residue dried over phosphorus pentoxide *in vacuo* for about three days. When the extract falls below 5 per cent. of the total weight of substance, the briquettes are deficient in pitch. A complete calorimetric and chemical examination should also be made. The calorific value should be not less than 7700 heat units (calculated to dry substance); ash content not over 8 per cent.; percentage of matter soluble in carbon bisulphide not less than 5 per cent.; and volatile constituents not less than 16 per cent.—C. S.

Acetylene burners; Some incandescent —— : their behaviour and illuminating power. F. H. Leeds. J. Gas Lighting, 1906, **94**, 781—784.

In the ninety-two German villages now provided with public supplies of acetylene, incandescence lighting is very largely used. The Schimek burner, recently introduced, has been used by the author in his experiments, and is found to behave satisfactorily. At a pressure of 4 ins., and a consumption of 0·472 cb. ft. (13·35 litres) per hour, a "10 litre" burner gave an illuminating effect of 46·0 candle-power, equal to an efficiency of 97·4 candles per cb. ft. On increasing the pressure, the efficiency increased very much, amounting to 106·4 candles per cb. ft. at 4·5 ins., and 113·7 candles per cb. ft. at 5 ins.; but at the latter pressure the burner began to "roar" slightly. Using a "15 litre" burner, at 4 ins. pressure and a consumption of 0·663 cb. ft. (18·8 litres) per hour, the candle-power was 70·0, equal to 105·5 candles per cb. ft. An efficiency of 100 candles per cb. ft. can therefore be obtained easily, even with small incandescence acetylene burners. Mantles which have been used at abnormally high pressures (4·5—5 ins.), and have thus shown higher efficiencies, appear to maintain these efficiencies when subsequently used at 4 ins., possibly because the mantles have shrunk to the most advantageous shape at the higher pressures.—H. B.

Carbon; Alterations of condition experienced by amorphous ——, under the influence of temperature, and under the action of oscillations of temperature. O. Manville. VII., page 637.

English Patents.

Tar [for briquettes, &c.]; Method of solidifying —— S. G. Coulson, Rotherham. Eng. Pat. 4427, Feb. 23, 1906.

The process claimed is an improvement on that described in Eng. Pat. 2102 of 1904 (this J., 1904, 780), and consists in eliminating the crude naphtha by distillation before treating the tar with concentrated sulphuric acid.—D. B.

Oxygen; Producing ——, for internal combustion engines. P. Winand, Cologne. Eng. Pat. 3121, Feb. 8, 1906. Under Int. Conv., Feb. 9, 1905.

For working internal combustion motors under exclusion of air, an oxygen carrier, such, for instance, as potassium chlorate, preferably mixed with a liquid to facilitate its regular feeding, is supplied, continuously or at intervals, to the place of production, in proportion to the quantity of oxygen required. Hot combustion gases, or combustible substances, are conveyed to the place of delivery of the oxygen carrier, in order to provide, by their heat of combustion, for the steady evolution of oxygen from the latter. The invention is described as applicable to vessels that are to be propelled in a submerged condition, such as submarines.—E. S.

Carbonisation of coal in vertical or inclined retorts, and apparatus therefor. H. W. Woodall, Wimborne, and A. McD. Duckham, Upper Parkstone, Dorset. Eng. Pat. 10,954, May 25, 1905.

To regulate the quantity of steam that passes up through the coal, on using a vertical or inclined retort the lower end of which dips into water, a branch or by-pass pipe is provided, connecting the lower part of the retort, near the surface of the water, with the gas-outlet pipe at the top of the retort. By adjusting a valve on the by-pass pipe, the whole, or any desired proportion, of the steam generated by the hot coke may be led off, and prevented from rising through the fuel.—H. B.

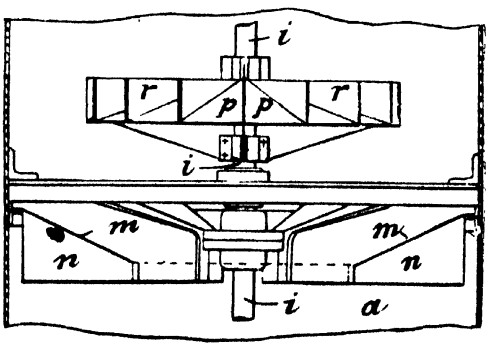
Gas producer plants; Suction ——. T. A. Goskar and L. Burn, Charlton, Kent. Eng. Pat. 11,725, June 5, 1905.

Water is sprayed into the cylinder of the engine connected to the producer, so as to generate steam in the exhaust gases, and the latter are then admitted into the producer along with just sufficient air to generate the required heat by combustion. In this manner the heat of the exhaust gases is utilised to generate steam, and the carbon dioxide they contain is converted into carbon monoxide. The plant is preferably provided with exhaust silencers, serving as anti-pulsation chambers, before the producer and the inlet of the gas-engine cylinder.—H. B.

Gas producers; Impts. in ——. L. Wilson, Greenock. Eng. Pat. 12,563, June 17, 1905.

In a gas producer having a superheating chamber through which the gases are led, so as to convert tarry matters into permanent gases, the superheating chamber is provided with apertures to admit steam or air blasts, for the purpose of cleaning out the passages in the chamber.—H. B.

Absorption or solution of soluble substances by liquids; Apparatus for promoting the ——, suitable (inter alia) for use in the purification of illuminating and other gases. F. Clark, Southend-on-Sea. Eng. Pat. 11,776, June 5, 1905.



The gases to be washed are passed up a tower, the construction of which will be seen from the figure, which is a vertical section of a portion of the tower, and the washing or absorbing liquid flows down the tower. Through the centre of the tower, *a*, a shaft, *i*, passes, which is rotated by spur wheels from below, and which carries a number of superposed distributing cones, *p*, *p*, provided on their upper surfaces with vertical division plates, *r*, *r*. Between each of the rotating cones is fixed the frustum of an inverted cone, *m*, also having vertical division plates, *n*, and attached to the sides of the tower, *a*. The liquid and the gas are caused to alternately approach and recede from the centre of the tower, and at each change of direction, the gas is obliged to pass through a veil or film of the liquid.—W. H. C.

Tar; Apparatus for extracting ——, from illuminating gas. P. F. Holmes, E. D. Holmes, and E. G. Cameron, Huddersfield. Eng. Pat. 4230, Feb. 20, 1906.

TAR-EXTRACTING drums of the kind referred to in Eng. Pats. 25,493 of 1901 and 20,677 of 1903 are modified in construction by securing the sets of plates, constituting the drum, between corner-posts bolted to the drum top and cover-strips secured to the corner-posts, for the purpose of facilitating the cleaning of the drum and the alteration of the spacing or number of the plates.—H. B.

Vessels for containing gas under pressure; Impts. in ——. A. Boas, C. Rodrigues-Ely, and E. Gauthier, Paris. Eng. Pat. 4824, Feb. 27, 1906. Under Int. Conv., Oct. 12, 1905.

THE claim is for an improved method of closing the cylinders or vessels in which compressed gas is stored. The outlet pipe, provided with its valve, passes through and is secured to the vessel by the collar which holds the closing plug of the vessel in position; the outlet pipe also passes through the perforated closing plug. The outlet pipe is easily accessible for cleaning purposes, and the closing plug can be easily and safely loosened. Further, a filtering chamber is attached to the end of the outlet pipe which projects into the gas cylinder, so that the gas may be passed through any desired filtering agent. —W. H. C.

Gas calorimeters · Impts. in ——. S. E. Page, London. From H. L. Doherty, Madison, Wis., U.S.A. Eng. Pat. 8866, April 12, 1906.

THE calorimeter comprises a vertical, cylindrical combustion-chamber, the walls of which are constructed of four concentric cylinders forming three annular compartments, in the innermost and outermost of which water circulates; an annular tank, surrounding the combustion-chamber, and adapted to contain the gas to be tested; a Bunsen burner fixed centrally in the lower part of the combustion chamber, and supplied with gas from the annular tank; water-supply pipes, with constant-level devices, for maintaining a flow of water through the apparatus; and thermometers for indicating the temperatures of the inflowing and outflowing water, of the waste gases, and of the atmosphere. By means of a series of vertical baffle-plates arranged in the middle annular compartment surrounding the combustion chamber, the products of combustion are caused to pursue a zig-zag course, so as to be cooled to the atmospheric temperature before escaping. The cooling water from the combustion-chamber flows into the annular tank, the heated water thus driving out its own volume of gas. The calorimeter is used without a meter. On starting a test, the annular tank is first filled with gas, by filling it with water, and then admitting the gas to be tested, the water being run to waste. Water is now allowed to flow through the apparatus; as it fills the tank, the gas is expelled through the Bunsen burner, and is there burned, the water and gas streams being so regulated that the pressure within the tank remains constant, water displacing gas, volume for volume. The temperature difference between the inflowing and outflowing water gives the calorific value directly, irrespective of the actual rate of consumption of the gas, since, in a given time, the volume of water flowing through the annular compartment surrounding the combustion chamber is exactly the same as that of the gas burned.—H. B.

UNITED STATES PATENTS.

Gas producing and consuming apparatus. C. Ellis, New York, Assignor to Combustion Utilities Co., New York. U.S. Pat. 821,995, May 29, 1906.

IN the apparatus described, the gas is obtained from a producer, adapted to contain a deep bed of fuel, and burned in a metallurgical furnace, to which it is supplied through a heat-insulated pipe. The burned gases, or a portion of them, are drawn from the furnace through a heat-insulated pipe by means of a power-driven fan, and returned below the bed of fuel in the producer. On the suction side of the fan, is a valve-controlled air inlet, opening to the atmosphere, by which air is admixed with the burned gases prior to their introduction into the producer, to which regulated proportions of burned gases and cold air are thus supplied. (See also U.S. Pat. 813,629, Feb. 27, 1906; this J., 1906, 307.)—W. C. H.

Gas generator. A. H. Jones, Hartford City, Ind. U.S. Pat. 822,132, May 29, 1906.

THE gas-generating chamber is arranged on a supporting base, and is divided into several generating compartments to which oil and coal-dust are supplied, together with a mixing arrangement and compartment, into which the gas is drawn and mixed; there are "breaker walls" in the compartments, which are formed by transverse partitions in the generator, apertures at the lower ends of the partitions forming passages between the compartments. Means are provided for injecting coal-dust, and igniting it and the oil. The gas is passed into wet scrubbers arranged on the base, and then into dry scrubbers. Oil and steam are injected into one of the generating compartments by a centrifugal mixing and injecting device, consisting of a cylindrical casing, in which a turbine wheel is mounted, above which is a perforated plate. Steam is introduced through a pipe, tangential to the wheel, and oil is admitted through a pipe in the top of the casing, and a steam and coal discharge pipe is arranged in the side of the casing opposite the steam inlet, and communicates with the generating compartment.—W. C. H.

Gas producing apparatus. J. Bueb, Dessau, Germany. U.S. Pat. 822,246, June 5, 1906.

SEE Fr. Pat. 356,974 of 1905; this J., 1906, 11.—T. F. B

Gas; Revolving kiln for generating ——. S. E. Sieurin, Högenäs, Sweden. U.S. Pat. 822,394, June 5, 1906.

SEE Fr. Pat. 356,615 of 1905; this J., 1906, 11.—T. F. B.

Gas furnace; Regenerative ——. F. Siemens, Dresden, Germany. U.S. Pat. 822,486, June 5, 1906.

SEE Eng. Pat. 5866 of 1903; this J., 1904, 317.—T. F. B.

Gas; Process of manufacturing ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 822,531, June 5, 1906.

OIL is sprayed by means of a jet of compressed combustible gas into a chamber filled with refractory material which has been previously raised to a high temperature. When the temperature has fallen to a point at which the oil is no longer gasified, the supply is cut off, and the refractory material heated again by admitting air, and burning the residual oil along with a portion of the gas produced. These operations are repeated alternately as long as it is desired to produce gas.—W. H. C.

FRENCH PATENTS.

Furnaces; Device for consuming smoke in ——. N. Birck. Fr. Pat. 362,116, Jan. 2, 1906

ON either side of the furnace is arranged a series of cast iron boxes of [-section, through which air ascends from below the fire-bars, and is discharged above the layer of fuel in such a manner that the mutual impact of the two air currents causes the smoke to descend on to the burning fuel, and be consumed. The boxes are set in refractory brickwork, and means are provided for bonding them into the brickwork and each other, as well as for preventing the ashes, &c., falling through the grate from choking the inlets.—C. S.

Gas generator for high or low combustion, with apparatus for drying damp fuel. Maschinenfabrik und Mühlenbauanstalt G. Luther Akt.-Ges. Fr. Pat. 362,267, Jan. 9, 1906. Under Int. Conv., Dec. 13, 1905.

SEE Eng. Pat. 1295 of 1906; this J., 1906, 464.—T. F. B.

GERMAN PATENT.

Gases, especially producer gas; Process for filtering ——, through layers of fibrous substances. H. Apel. Ger. Pat. 166,613, Nov. 22, 1904.

THE gas is passed through a layer of coarse-fibred absorbent

material ("wood wool") to remove tarry matter, then through a dense layer of fibrous material, such as horsehair, to separate particles of dust, and afterwards through a layer of sponge or similar material to remove moisture. If desired the gas may be finally passed through a layer of felt or similar material.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 584.)

Petroleum in New Zealand. Times Finan. Supp., June 25, 1906. [T.R.]

In several places in New Zealand, but notably at New Plymouth on the west coast of the North Island, and near Greymouth on the west coast of the South Island, there are indications that reservoirs of oil exist at considerable depths from the surface. In the New Plymouth district, oil was discovered near the sea coast, some miles from the base of the extinct volcano known as Taranaki, or Mount Egmont. The history of boring for petroleum in that district extends back to the year 1865. It was one of general failure. Further unsuccessful efforts were made to obtain British capital to continue the boring. Eventually a New Zealand syndicate was formed. A bore was put down in the vicinity of the abandoned workings to a depth of 905 ft.; oil was struck, but water was also present in the bore, and as the water rose and fell with the tide, it was evident that there was a fissure running out to sea. Operations were continued in another direction, and a bore put down to 905 ft. yielded a flow of ten barrels a day. The continual falling in of a soft layer of "papa" rock, however, soon stopped the flow of oil. In 1896 a fresh bore was put down, and, at a level of 1976 ft. a considerable flow of oil was struck; but again the water interfered with the flow, and, eventually, the derrick and works were destroyed by an explosion and fire. More recently the operations were continued, and, a few days ago, it was announced that all difficulties had been overcome, and that excellent oil, with a total absence of water, was flowing from the well. The first flow was at the rate of about 30 barrels a day, but there was a great quantity of mud and sand mixed with the oil. On April 30, however, it was found that there was an enormous pressure of gas, and that the oil was flowing at the rate of 400 barrels a day. The bore is down to a depth of 2331 ft. The company has secured rights over 5000 acres of land in the vicinity, and, as the present storage capacity of 10,000 galls. has been almost filled, the well has, for the present, been sealed down. The company, however, intends to erect a refinery, and hopes within eighteen months to have six other bores sunk and working. The company's expert anticipates a yield of 4000 or 5000 barrels a day from the present bore.

Asphaltum; Action of light on ——. V. Vojtech. XXI., page 654.

Erratum.

Petroleum production of California. For. Off. Ann. Series. No. 3564. This J., May 31, 1906, p. 467. Instead of "gallons" *read* "barrels" throughout first paragraph.

English Patent.

Acetone; Manufacture of ——. L. A. A. Pagès and E. C. A. Camus, Paris. Eng. Pat. 8757, April 11, 1906. Under Int. Conv., April 14, 1905.

The invention consists in causing a continuous current of distilled pyroligneous acid to pass over a heated acetate, capable of forming acetone by dry distillation, which acetate is continuously regenerated by the vapours of acetic acid contained in the pyroligneous acid, and then again decomposed by heat.—D. B.

German Patent.

Mineral oils; Process for working up ——. L. Landsberg. Ger. Pat. 166,452, Sept. 24, 1904.

The oils are extracted with acetone or its homologues, the solution is separated from the tarry and asphaltum-like constituents which remain undissolved, and the solvent recovered by distillation. The process is stated to be specially suitable for the treatment of crude petroleum containing only small quantities of light constituents (benzine, illuminating oils, &c.), and also for heavy oils and residues.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 585.)

Gallocyanine dyestuffs; Condensation of ——. *with aminosulphonic acids.* E. Grandmougin. Z. Farben.-Ind., 1906, **5**, 201.

If gallocyanine dyestuffs, such as Prune or Celestine Blue, be heated on the water-bath in aqueous suspension with sulphanilic acid, *o*- or *p*-toluidinesulphonic acid, β-β-naphthylaminesulphonic acid, or other amino-sulphonic acids, new dyestuffs are formed which can be printed on cotton with a chromium mordant, or dyed on wool from an acid bath, or on a chromium fluoride mordant. The dyeings obtained are much bluer than those of the original substances, but possess, it is stated, little technical interest, as they are not fast to light.—H. L.

1.4-*Anthraquinone.* C. Liebermann. Ber., 1906, **39**, 2089—2090.

A reply to Lagodzinski with reference to the discovery of the above compound (this J., 1906, 300 and 530).

—D. B.

English Patents.

Colouring matter [dyestuff] of the triphenylmethane series; Manufacture of a new ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 22,021, Oct. 28, 1905.

See Fr. Pat. 359,002 of 1905; this J., 1906, 369.—T. F. B.

Dianisidine and diphenetidine; Manufacture of disulphonic acids of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 22,697, Nov. 6, 1905.

See Fr. Pat. 359,214 of 1905; this J., 1906, 424.—T. F. B.

Colouring matters containing halogen [Anthracene dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 22,519, Nov. 3, 1905.

See Seventh Addition, dated Nov. 9, 1905, to Fr. Pat. 349,531 of 1904; this J., 1906, 471.—T. F. B.

United States Patent.

Dyestuff; Vat ——, *and process of making same.* K. Schirmacher, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 823,294, June 12, 1906.

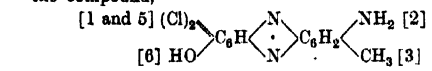
See Fr. Pat. 360,292 of 1905; this J., 1906, 471.—T. F. B.

French Patents.

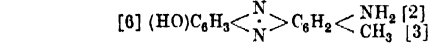
Dyestuffs; Process for making red to violet sulphide ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 360,437, Feb. 23, 1905.

Compounds containing sulphur but free from halogen elements are obtained by heating halogen-substituted hydroxyazines with alkali sulphides. These, when heated in alkali sulphide solution with sulphur, are converted into sulphur dyestuffs of shades varying from red to violet. The halogenated hydroxyazines may be directly trans-

formed, in one operation, into the sulphur dyestuffs by heating them with alkali polysulphides. They yield dyestuffs at temperatures considerably lower than do the corresponding halogen-free hydroxyazines; thus, the compound,



gives at 100°—108° C. a red dyestuff free from chlorine, while the compound



requires to be heated at 130° C. to yield a brownish-purple sulphur dyestuff. A mixture of dibromosafraninone (30 parts), crystallised sodium sulphide (150 parts), and sulphur (75 parts), gives when heated at 140°—150° C. a dyestuff which, from an alkali sulphide bath, dyes cotton in violet shades.—E. B.

Dyestuff; Process of making a bisulphite compound of the [azo] —— of Fr. Patent 304,694. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,322, April 3, 1905.

SEE U.S. Pat. 795,058 of 1905; this J., 1905, 885.—T. F. B.

Lakes [from azo dyestuffs]; Production of red ——, fast to light. L. Cassella und Co. Fr. Pat. 361,313, March 31, 1905. XIIIA., page 644.

Anthraquinone dyestuffs; Manufacture of new ——. Farbenfabriken vorm. F. Bayer et Cie. First Addition dated Dec. 5, 1905, to Fr. Pat. 355,326, June 17, 1905 (this J., 1906, 1223).

BY nitration of the urethanes of amino-anthraquinone or of their derivatives, dinitro derivatives having the nitro groups in the same benzene nucleus are obtained; and by nitration of the diurethanes of the diamino-anthraquinones, the tetranitro derivatives are produced. By hydrolysis of these nitro-urethanes the corresponding polynitrated amino-anthraquinones are produced which are of great value in the preparation of dyestuffs. The nitro-amino-anthraquinones mentioned above give tri- and hexa-amino-anthraquinones on reduction.

Example.—Ten kilos. of the urethane of β-amino-anthraquinone are dissolved in 50 kilos. of nitric acid (95 per cent.), and the solution heated to 40° C. for half an hour until the nitro derivative, precipitated by addition of water to a sample of the reaction mixture, dissolves to an almost colourless solution in concentrated sulphuric acid. The whole mass is then thrown into water, and the precipitate purified by crystallisation from glacial acetic acid. The urethanes are hydrolysed by heating on a water-bath with ten times their weight of sulphuric acid (66° B.) until the evolution of carbon dioxide has ceased. The nitrated amino-anthraquinones are precipitated by running the mixture into ice water. The tri- and hexa-amino-anthraquinones are produced by treating the nitro compounds with reducing agents such as sodium sulphide, zinc dust and alkali, &c.—A. B. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 586.)

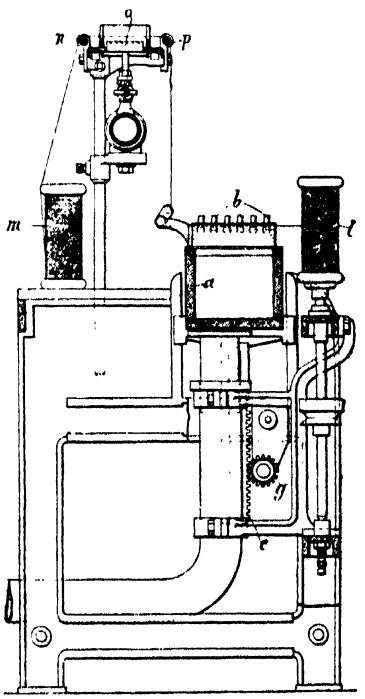
α-Naphthylamine Claret; Discharging of ——, with aid of iron salts. R. Koechlin. Rev. Gen. Mat. Col., 1906, 10, 166—167.

INSTEAD of adding a large amount of ferric citrate, sodium nitrite, and sodium ricinoleate to the hydrosulphite-formaldehyde discharging-mixture (see Baumann and Thesmar, this J., 1906, 371 and 473), it is, according to the author, cheaper first to prepare the cloth with Turkey-red oil, and to add to the hydrosulphite-formaldehyde only a small quantity of a ferrous salt, *e.g.*, 5 grms. of ferrous sulphate together with 20 grms. of sodium nitrite. Such a mixture may be kept for at least a fortnight in cold weather. Ferrous nitrite, which is formed in the printing mixture, is an unstable salt subject to spontaneous decomposition, with evolution of nitric oxide or, in the presence of hydrosulphite, of nitrous oxide. The printing mixtures are ineffective as soon as ferrous nitrite is no longer present, but as the decomposition is slow, they may be kept for some time. The printing mixture is much more stable and thoroughly effective if the components of ferrous nitrite are separated. A perfectly pure white is produced, for instance, by printing a hydrosulphite-formaldehyde paste containing only 10 grms. of sodium nitrite per litre, on to cloth previously prepared with a solution containing 10 c.c. of neutralised ferric citrate and 50 grms. of sodium ricinoleate per litre. The reverse method, however, *viz.*, printing a mixture of hydrosulphite-formaldehyde with ferric citrate on to cloth prepared with sodium nitrite and sodium ricinoleate, gives very imperfect results. The author points out that in general the presence of sodium ricinoleate, which acts as a solvent, is advantageous, as a purer white is obtained, particularly on unmercerised cloth. Mercerised cloth is more readily discharged, and oiling is therefore less necessary.—H. L.

Copper alkali cellulose. W. Normann. XIX., page 652.

ENGLISH PATENTS.

Machine; Glossing and gassing ——, for silk and other fine threads. C. Mann, Waldshut, Germany. Eng. Pat. 22,940, Nov. 8, 1905. Under Int. Conv., Nov. 11, 1904.



IN the drawing showing the apparatus in front view, the dust-box, *a*, rests on toothed racks, *e*, which can be moved correspondingly up and down the entire length of the reel by means of a shaft provided with a toothed wheel, *g*, and receiving a forward and backward motion. The thread travels from the spool, *m*, over the bar, *n*, to the burner, *o*, and over the rod, *p*, to the glossing head, *b*. It then passes in a straight line to the spool, *l*,

on which it is wound up. By this arrangement breakages are prevented, as the thread is always exposed to uniform tension.—D. B.

Wood and textile or fibrous substances; Chemically impregnating ——, for preventing putrefaction, rot, and fungus. F. Hasselmann. Eng. Pat. 11,294, May 30, 1905. IX., page 638

UNITED STATES PATENTS.

Wool-scouring machine. J. H. Tillinghast, Stockton, Cal. U.S. Pat. 821,139, May 22, 1906.

THE machine comprises a tank in which is a pair of forks consisting of fork-bars with tines extending therefrom. The fork-bars are mounted in carrier-bars through which a transverse shaft passes. Cams on the shaft engage with rollers on the carrier-bars, whereby a vertical to-and-fro motion is imparted to the latter. A horizontal to-and-fro movement is also imparted to each fork in succession, and means are provided for regulating the movements so that the forks do not touch each other when passing in opposite directions. At the end of each forward movement, the fork-bar is caused to rotate in the carrier-bar, whereby an upward movement is imparted to the tines of the fork, in order to enable them to scoop up the wool. The wool is fed towards the forks by a rake consisting of a transverse bar with teeth extending therefrom, and provided with means for imparting an upward scooping movement to the teeth.—A. S.

Wool-scouring machine. T. A. Jones, Essendon, near Melbourne. U.S. Pat. 822,954, June 12, 1906.

SEE Eng. Pat. 17,026 of 1905; this J., 1906, 473.—T. F. B.

Silk; Apparatus for ungumming ——. P. Schmid, Basle, Switzerland. U.S. Pat. 822,774, June 5, 1906.

SEE Addition of Jan. 21, 1905, to Fr. Pat. 345,173 of 1904; this J., 1905, 475.—T. F. B.

FRENCH PATENTS.

Silk, artificial; Rendering ——, waterproof and non-inflammable. P. Germain. Fr. Pat. 360,396, Feb. 22, 1905.

ARTIFICIAL silk, as it is manufactured, and before it is reeled and twisted, is immersed first in a bath of a salt, such as ammonium phosphate, ammonium bicarbonate, or magnesium bicarbonate, capable of yielding, when heated by a flame, a gas or gases which have the property of hindering combustion. It is next passed through a solution of "colourless celluloid and nitrocellulose," to cover the fibres with a waterproof coating, after which it is reeled and twisted.—E. B.

Silk and other fine threads; Glossing and gassing machine for ——. C. Mann. Fr. Pat. 359,059, 1905.

SEE Eng. Pat. 22,940 of 1905; preceding these.—T.F.B.

Wool-carbonising device. E. Dupont. Fr. Pat. 360,457, Dec. 12, 1905.

THE carbonising chamber is provided with two lattice-work shelves, with a set of heating pipes below the lower shelf, and with a receptacle for holding "acid." It communicates with a chimney that can be closed by a damper. The acid-receptacle is furnished with a heating coil. The wool to be carbonised is introduced through doors in the side of the chamber, and is spread upon the lattice-work shelves, the chimney-damper is closed, and a heating agent is supplied to the heating pipes and to the coil in the acid-receptacle. The hot acid vapours rise through the wool on the shelves, escape through a pipe in the top of the chamber, and are returned by a fan through another pipe, which discharges them into the chamber between the heating pipes and the lower shelf.—A. S.

Tanning of skins and mordanting tissues; Substance for use in ——. O. H. Nowak, E. N. Eaton, and J. M. McVean. Fr. Pat. 360,854, Dec. 22, 1905. XIV., page 647.

Fabrics; Blocks for embossing or printing ——. E. Roudet. First Addition, dated Feb. 21, 1905, to Fr. Pat. 348,836 of Feb. 24, 1904 (this J., 1905, 617).

INSTEAD of the cylindrical or prism-shaped "pins" of uniform diameter described in the main patent, "pins" of various diameters, along with intervening sheets of metal of various thicknesses, are employed to compose the bodies of printing blocks. The sheets of metal are either straight or curved, and are placed, parallel to the axes of the pins, with the ends of the latter projecting beyond their ends, to form the pattern which is to be impressed. They are chiefly intended for use in the decoration of velvets. —E. B.

Fabrics; Process for making ——, impermeable. E. Geisenberger. Fr. Pat. 361,284, Dec. 21, 1905. Under Int. Conv., Sept. 20, 1905.

To render fabrics such as are employed for balloons impermeable to air, gas, moisture, &c., the material is placed in a closed vessel, and submitted to the action of a vacuum to remove the various volatile substances contained in the pores of the fibres. Heat is sometimes applied at the same time. The liquid employed for making the fabric impermeable is then run into the vessel by some suitable device, and fills up the pores and spaces between the fibres. This process may be repeated if necessary either with the same or another liquid, after which the excess is removed, and the fabric dried. Various substances can be employed, such as fats, varnishes, tannin, rubber, silicates, &c., or the fabric may be soaked in gelatin, and then tanned.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 532.)*

ENGLISH PATENT.

Leather; Printing on ——. M. C. Lamb and J. D. G. Rennie, London. Eng. Pat. 11,049, May 26, 1905.

To print or dye leather in pattern or design in one or more colours by the use of coal-tar and natural dyestuffs, the latter are applied in the form of ink in alcoholic or aqueous solution either alone or in conjunction with a thickening agent, such as gelatin, gum tragacanth, linseed, farina, starch alginates, soaps, "sulphated" oils, and the like. The inks are applied to the relief surface from which an impression is to be taken by any suitable method.—D. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 580.)

Hydrofluoric acid. E. Deussen. Z. anorg. Chem., 1906, **49**, 297—300.

HYDROFLUORIC acid solutions behave like those of the other acid halides: weak solutions gradually become concentrated on distillation, strong solutions gradually weaken, till an acid of constant composition and boiling-point ultimately distils. At 750 mm. pressure this acid contains 43·2 per cent. of hydrogen fluoride, and boils at 111° C. Its sp. gr. at 18° C. is 1·138.—J. T. D.

Calcium sulphate; Solubility of ——, in magnesium sulphate solutions. F. K. Cameron and J. M. Bell, J. Physical Chem., 1906, **10**, 210—215. Chem. Centr., 1906, **1**, 1776.

WEIGHED pieces of selenite ($CaSO_4.2H_2O$) were fixed to the ends of pieces of glass rod, and these were passed through corks closing flasks containing magnesium sulphate solutions of different concentrations. The flasks were rotated in a horizontal position until the selenite was no longer dissolved. The results obtained at 25° C. with solutions ranging from a saturated solution of crystallised

magnesium sulphate, $MgSO_4,7H_2O$, to pure water, are shown in the following table:—

Sp. gr. at 25° C.	Magnesium sulphate. grms. per litre.	Calcium sulphate. grms. per litre.
1·0032	0·00	2·046
1·0055	3·20	1·620
1·0118	10·64	1·471
1·0419	42·68	1·558
1·0626	64·14	1·608
1·1190	128·28	1·627
1·1377	149·67	1·597
1·1537	171·2	1·474
1·2095	232·1	1·254
1·2624	298·0	0·860
1·3028	355·0	0·501

These results, together with others obtained previously, show that the injurious effect on the solubility of calcium sulphate of different sulphates increases with rising atomic weight in the series: $H^{\cdot}$, $Mg^{\cdot\cdot}$, $NH_4^{\cdot}$, $K^{\cdot}$, $Na^{\cdot}$. —A. S.

Potassium ferricyanide; Reduction of ——. D. Venditori. Atti. R. Accad. dei Lincei Roma, 1906 [5], **15**, 370—373.

ACCORDING to Williamson (Annalen, **57**, 237) the reduction of potassium ferricyanide by hydrogen sulphide proceeds according to the equations:—

$$8K_3Fe(CN)_6 + 3H_2S = 6K_4Fe(CN)_6 + 2H_3Fe(CN)_6 + 3S = 6K_4Fe(CN)_6 + 2Fe(CN)_3 + 6HCN + 3S.$$

The author finds, however, that there is formed, together with potassium ferrocyanide, a greenish precipitate, changing to bright blue. This precipitate, when freed from adhering sulphur, proved to be potassium-ferrous ferrocyanide, $K_2Fe_2(CN)_6$. It yields ferrous hydroxide and potassium ferrocyanide when boiled with caustic potash solution. One hundred parts of potassium ferricyanide yield 71·28—73·9 parts of potassium ferrocyanide, and 17·82—18·4 parts of potassium-ferrous ferrocyanide, corresponding approximately to the equation:—

$$6K_3Fe(CN)_6 + 3H_2S = 4K_4Fe(CN)_6 + K_2Fe_2(CN)_6 + 6HCN + 3S.$$ —A. S.

Copper sulphate; Decomposition of ——, *by methyl alcohol.* V. Auger. Comptes rend., 1906, **142**, 1272—1274.

COPPER sulphate, either crystallised or anhydrous, is decomposed by methyl alcohol at all temperatures from 0° C. to the boiling point of the alcohol. With small proportions of methyl alcohol, the salt, $CuSO_4,CH_3OH$, is obtained, mixed with traces of basic copper sulphate. As the quantity of alcohol is increased, the amount of basic salt formed rises rapidly, with the simultaneous decomposition of the methyl salt. Zinc sulphate also gives a notable quantity of basic salt when treated with methyl alcohol, whilst cobalt and nickel sulphates yield but traces. Ethyl alcohol is much more feeble than methyl alcohol in its action on copper sulphate.—W. P. S.

Cæsium; Direct oxidation of ——. *Properties of cæsium peroxide.* E. Rengade. Comptes rend., 1906, **142**, 1149—1151.

EVEN when perfectly dry, cæsium unites at ordinary temperatures with perfectly dry oxygen, the reaction being so violent, even when the pressure of the oxygen is only a few centimetres of mercury, that the metal and its oxide become incandescent. As the temperature is lowered, the reaction becomes less violent, and at —80° C. cæsium only tarnishes slowly in dry oxygen.

If, after the violence of the reaction at ordinary temperature has subsided, the product be heated in a stream of dry oxygen, it absorbs more of the gas, and yields ultimately a fused mass which on cooling becomes a yellow crystalline substance of formula Cs_2O_4. This peroxide melts, in an atmosphere of oxygen, at 515° C. It is readily dissociated, decomposes water with formation of cæsium hydroxide and hydrogen peroxide, and evolution of oxygen, yields cæsium carbonate and oxygen when heated in a stream of carbon dioxide, and is reduced by hydrogen at 300° C., with production of cæsium hydroxide, water, and oxygen.

The dry peroxide has no action on the aluminium boat in which it is formed, but attacks the metal rapidly if any moisture be present.—J. T. D.

Carbon; Alterations of condition experienced by amorphous, ——, *under the influence of temperature, and oscillations of temperature.* O. Manville. Comptes rend., 1906, **142**, 1190—1193.

A SPECIMEN of crayon charcoal ("fusain"), containing 89 per cent. of carbon, was powdered, sifted, and freed from occluded gas by heating *in vacuo*. When this charcoal was heated in a current of oxygen (about 1 litre per hour), carbon dioxide and carbon monoxide were produced, the temperatures of formation of the two compounds being 85° C. and 140° C., respectively. It was found that if the carbon were now heated *in vacuo* from 15° C. to 350° C., and then allowed to cool slowly, the temperatures of formation of its oxidation products were displaced in a definite manner, and after repeating these operations a certain number of times, attained constant values different from those originally observed. Thus, after heating *in vacuo* from 15° to 350° C., twenty times, followed in each case by slow cooling, the temperatures of formation of the carbon dioxide and carbon monoxide had attained constant values of 240° C. and 300° C. respectively. On now heating the carbon *in vacuo* to 450° C., and cooling slowly, the temperatures of formation of the oxidation products were considerably reduced, *viz.*, to 97° and 220° C., respectively; and then on again subjecting the carbon to a fresh series of oscillations of temperature identical with the first series, the temperatures of formation were again displaced, attaining after twenty such oscillations, constant values slightly higher (245° C. and 307° C., respectively) than those observed previously.

It was further observed that the condition of amorphous carbon at a given temperature differs according to whether that temperature has been reached by heating or by cooling. On cooling from a higher temperature, the rate of evolution of carbon dioxide is much greater at a given point than on heating from a lower temperature; for example, with the specimen of carbon under investigation, carbon dioxide is first formed at 85° C. on heating the carbon from the ordinary temperature, whilst on cooling, evolution of gas still takes place at 60° C.—A. S.

Bromine industry of the United States. Oil, Paint, and Drug Reporter, June 16, 1906. [T.R.]

THE bromine industry in 1905 was more active than in 1904, the output exceeding that of the preceding year by nearly 50 per cent., according to the annual report of the U.S. Geological Survey. The production in 1905 amounted to 1,192,758 lb., valued at $178,915, as compared with 897,100 lb., valued at $269,130, in 1904. The greater part of this product was made in Michigan, at Midland, Mt. Pleasant, St. Charles, and St. Louis.

In Michigan the brominiferous brines of commercial prominence come from the Marshall sandstone of the Upper Carboniferous, and contain from 0·1 to 0·3 per cent. of bromine. At Midland and Mount Pleasant are works manufacturing large quantities of bromine and bromides. The bromine in the brine varies in quantity from 0·1 to 0·2 per cent., and is freed from its usual combinations with alkali bases by an electric current. The free bromine is removed from the brine by a current of air, and is then absorbed by caustic soda. The output by this process in 1905 was more than half of the total product of the United States.

Bromine is made as a by-product in the salt industry at Pomeroy and Syracuse, Ohio, and at Hartford and Mason, W. Va. At Malden, on the Kanawha River, a few miles south-east of Charleston, W. Va., is another factory, also supplied from the Pottsville horizon.

At Pittsburg, Pa., there is a plant of average size which extracts bromine from brine derived from Pocono horizon. Pennsylvania was the pioneer state in the manufacture of bromine, and began it at Freeport, Armstrong County, in 1846. In Ohio the manufacture began at Pomeroy about 1868. It was also begun at Canal Dover, Tuscarawas County, in 1888, but has been abandoned at that point, and is now confined to Pomeroy and Syracuse.

The following table shows the increase of the production of bromine during the past decade:—

	Quantity. Pounds.	Value. $
1896	546,580	144,501
1898	486,979	126,614
1900	521,444	140,790
1902	513,893	128,472
1904	897,100	269,130
1905	1,102,758	178,914

Graphite discovery in Godavery. Bd. of Trade J., June 21, 1906. [T.R.]

According to the "Madras Mail," graphite in large quantities has been discovered at Seethareddipadu, in British territory, 70 miles from Godavery, and there is every probability of its proving remunerative. One of the leading European firms in Madras has sent out an expert to sink shafts and report results.

Large quantities of graphite have also been discovered on and below the hills between Perakoonds in the Nizam's Dominions and the Godavery River. No one has yet tried to prospect the place, but experts assert that any company will do well to work the graphite mines on the spot indicated. Graphite mines are also being worked about 80 miles from Godavery.

English Patents.

Sulphuric acid; Process for the concentration of ——. A. Gaillard, Barcelona, Spain. Eng. Pat. 23,841, Nov. 18, 1905.

See Fr. Pat. 359,442 of 1905; this J., 1906, 374.—T. F. B.

Endothermic chemical compounds; Process of and apparatus for producing ——. R. Pawlikowski, Görlitz, Germany. Eng. Pat. 26,728, Dec. 21, 1905.

See Fr. Pat. 361,119 of 1905; this J., 1906, 536.—T. F. B.

Cyanogen compounds; Recovering ——, *from waste waters, solutions, and the like, and rendering the liquids innocuous.* H. Noerdlinger and F. Noerdlinger, Flörsheim-on-Maine, Germany. Eng. Pat. 1764, Jan. 23, 1906. Under Int. Conv., Jan. 24, 1905.

The waste waters or very dilute solutions containing thiocyanogen or cyanogen compounds, are acidulated, for instance, with sulphuric acid (but not with nitric acid), and if thiocyanates are present, an oxidiser, such as manganese dioxide, is added. Through the solution, contained in a suitable apparatus, air is then blown, and the hydrocyanic acid evolved is condensed in alkaline or other solutions. According to one modification of the process, the liquid through which the air is blown is heated to about 50° C. The effluent may, when necessary, be neutralised by lime.—E. S.

United States Patents.

Burner gases [Sulphuric anhydride manufacture]; Process of purifying ——. R. Knietsch, Ludwigshafen on Rhine, Germany, Assignor to General Chemical Co., New York. U.S. Pat. 822,373, June 5, 1906.

See Eng. Pat. 15,948 of 1898; this J., 1899, 831.—T. F. B.

Sulphuric anhydride; Process of making ——. R. Knietsch, Ludwigshafen on Rhine, Germany, Assignor to General Chemical Co., New York. U.S. Pat. 823,472, June 12, 1906.

See Ger. Pat. 113,932 of 1898; this J., 1901, 360.—T. F. B.

French Patent.

Chromic acid; Electrolytic regeneration of ——, *in solutions of chromium salts.* M. Le Blanc. Fr. Pat. 362,195, Jan. 5, 1906. XII., page 643.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 590.)

Silicates [Glass]; Decomposition of ——, *[for analysis].* F. Hinden. XXIII., page 655.

Phosphorus; Qualitative test for —— Maurichéau-Beaupré. XXIII., page 655.

English Patents.

Rock quartz [Quartz glass]; Process for producing a molten mass of ——, *at a relatively low temperature.* J. Bredel, Höchst on the Maine, Germany. Eng. Pat. 15,630, July 31, 1905.

See Fr. Pat. 355,791 of 1905; this J., 1905, 1232.—T. F. B.

[*Pottery*] *Kilns; Impts. in construction of* ——. M. J. Adams, Stocksfield-on-Tyne, and J. Cannon, Scotswood-on-Tyne. Eng. Pat. 8440A, Oct. 12, 1905.

The claim is for improvements in the method of constructing kilns described in Eng. Pats. 6257 of 1891, 16,259 and 13,643 of 1902 (this J., 1903, 697). Two or more muffle-kilns are built side by side, with the fireplaces at the ends; the waste heat from one kiln passes through the flues of the adjacent kiln, and heats it. The temperature of the second kiln is finally raised to a finishing or glazing heat by feeding its own fireplace with fuel.—W. H. C.

United States Patent.

Silica [Quartz glass]; Process for fusing ——, *and for shaping the mass while plastic.* J. F. Bottomley, Wallsend-on-Tyne, and A. Paget, North Cray. U.S. Pat. 822,424, June 5, 1906.

See Eng. Pat. 18,437 of 1904; this J., 1905, 846.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 590.)

English Patent.

Wood and textile or fibrous substances; Chemically impregnating ——, *for preventing putrefaction, rot, and fungus.* F. Hasselmann, Munich, Germany. Eng. Pat. 11,294, May 30, 1905.

The wood or other substance to be impregnated is boiled with a lye containing in 30 parts 1 part of any waste salt of potassium or magnesium, 1 part of green vitriol (ferrous sulphate), and 1 part of aluminium sulphate. For the green vitriol, nickel sulphate may preferably be substituted, in the proportion of 1 part of the salt to 500 of lye.—A. G. L.

United States Patents.

Lime; Apparatus for burning ——. C. Ellis, White Plains, N.Y. U.S. Pat. 821,996, May 29, 1906.

The apparatus consists of a calcining chamber in the form of a vertical shaft, at the base of which is a gas producer with a deep bed of fuel. The gas enters the lower portion of the chamber, to which air is also supplied. The walls of the chamber are thick, and contain a flue through which products of combustion are withdrawn from the upper part, mixed with air, and returned to the producer by means of an injection apparatus.—W.C.H.

Fire-brick compound. T. P. Gourley, New York. U.S. Pat. 822,600, June 5, 1906.

About 80 parts of carborundum, 16½ parts of sodium silicate, 3½ parts of water, and ½ part of sulphuric acid are mixed together to form a plastic mass, which becomes hard when subjected to the action of heat.—A. S.

FRENCH PATENT.

Wood; Process of treating and colouring —— [by precipitation upon it of metallic oxides]. P. Merino. Fr. Pat. 360,703, March 7, 1905.

WOOD is coloured and prepared for use in the manufacture of works of art by the following series of operations:—(1) Treatment with an ammoniacal solution of a hydroxide of copper, cobalt, nickel, zinc, mercury, or other suitable metal. This has the effect of removing from the wood certain fermentable matters which, if left in it, would ultimately lead to its destruction. (2) Impregnation with a solution made by mixing together boiling solutions of sodium or potassium aluminate and barium chloride, allowing the mixture to cool, and removing the precipitated barium hydroxide. To this solution may be added a heavy coal-tar oil. The application of this solution is effected either by immersion in an open vessel, or in a closed vessel under pressure. The wood is afterwards treated with a solution of an alkali carbonate, which precipitates upon it "in the condition of oxide" the metal which has been applied. The process is completed by washing with a solution of an alkali sulphite. (3) The wood is next coloured, or its existing colour is modified, and its natural grain is at the same time rendered more prominent, by the application to it of suitable colouring agents, *e.g.*, cochineal carmine, litmus, orchil, coal-tar dyestuffs, metallic hydroxides, such as those of cobalt and nickel, in ammoniacal solution, or compounds such as ferric ferricyanide, ferric thiocyanate (sulphocyanide) &c.

The wood is thus "metallised," and rendered entirely unalterable by atmospheric influences. It is capable of taking an excellent polish. When prepared as described, but with the omission of the treatment with alkali carbonate and sulphite, it is, it is stated, in the form of thin sheets, flexible, and supple, like leather. In this condition it may readily be moulded into artistic shapes. To this end, the sheets are moistened on the back with starch paste, and sprinkled over with sawdust. They are then placed in heated moulds, and are strongly pressed. When dry they are removed, the hollow parts at their backs being filled with a paste composed of sawdust and glue size. They may, finally, be hardened by treatment with an alkali carbonate.—E. B.

X.—METALLURGY.

(*Continued from page* 593.)

Gold ores; Amalgamation of ——. T. T. Read. Bi-monthly Bull. Amer. Inst. Mining Eng., 1906, 467—495.

THE author discusses previous work on the amalgams, and describes experiments made with a view to determine the constitution of gold amalgams. The most satisfactory results were obtained by adding excess of finely-divided gold to mercury, heating at 100° C., filtering, treating with nitric acid of different strengths, and examining the residues by analysis, and under the microscope. The results obtained indicate that when the content of gold is high, a solid solution of mercury in gold (containing up to 13 atoms per cent. of mercury) is formed, which is isomorphous with gold. With lower proportions of gold, crystals belonging to the hexagonal system, and containing 17·44 atoms per cent. of mercury can be isolated; these represent either a compound of the two metals containing gold or mercury in solution, or a second solid solution. Ordinary amalgam consists of one or both of the foregoing, usually the former, mixed with an excess of mercury, which coats the particles, and causes them to cohere.

The amalgamation of gold ores appears to be a physical process; the grains of gold are wetted by the mercury, and are drawn beneath the surface of the film of mercury, and held against the plates, by the surface tension of the liquid mercury. Owing to diffusion into the metal of the plates, the amalgam often becomes strongly adherent. Silvered copper plates and Muntz metal plates are better than plain copper plates, the copper dissolved from the latter by the mercury having an injurious effect. Moreover the amalgam diffuses into Muntz metal plates only to a very slight extent. Plates coated with gold amalgam will retain a thicker film of mercury than any other kind of plates, and thus have the greatest "catching" power. Excessive scraping of the plates in actual working should be avoided, as the gain in daily yield of amalgam is more than counterbalanced by the loss of "catching" power. Changes of temperature have influence on the amalgamation process in various ways. Among the injurious effects are the increased solubility of salts and thus of precipitation of base metals in the mercury, and a diminution of the surface-tension and viscosity of the mercury, whereby the tendency of the mercury to "flour" is increased. On the other hand the wetting of the gold by the mercury, the "catching" power of the plates, and the capacity of the globules of mercury to coalesce are increased by rise of temperature. The author concludes that in the first place the working temperature should be kept constant, and when the influence of soluble salts in the ore can be neglected, as high a temperature as is possible economically should be maintained.—A. S.

Magnesium; Alloys of —— with silver. S. F. Zemczuznyj. Z. anorg. Chem., 1906, **49**, 400—414.

THE melting-point curve of magnesium-silver alloys shows four distinct points, *viz.*, a maximum at 820° C., corresponding to the compound, $MgAg$; two eutectic points at 756° C. (65·9 atoms per cent. of silver) and 469° C. (17·3 atoms per cent. of silver) respectively; and the transformation point (492° C., 22·57 atoms per cent. of silver) of the compound, Mg_3Ag. The latter compound is not indicated by a maximum on the melting-point curve, as it melts with decomposition at the transformation point. The compound, $MgAg$, forms solid solutions with both magnesium and silver, the limiting concentrations of the solutions being 34·57 atoms per cent. of silver on the one hand, and 62·6 atoms per cent. on the other. Micrographic examination confirmed the results obtained by the thermal investigation of the alloys. Magnesium-silver alloys are characterised by their hardness, which exceeds that of either of the components. The brittleness is greatest in those alloys approximating in composition to the definite compounds of the two metals. The alloys rich in magnesium are very brittle, easily oxidised, and decompose water more readily than pure magnesium; on exposure to the air, they disintegrate with production of a black powder.—A. S.

Aluminium-bismuth and aluminium-tin alloys. A. G. C. Gwyer. Z. anorg. Chem. 1906, **49**, 311—319.

ALUMINIUM and bismuth in the liquid state are mutually soluble only to a slight extent; the lowering of the melting-point of aluminium by addition of bismuth amounts to not more than about 5° C.

The gradual addition of tin to aluminium lowers the melting-point continuously, rapidly to 15 atoms per cent. of tin, more gradually to 55, then more rapidly again to 98 atoms per cent. of tin—a eutectic solidifying at 229° C.; beyond this the melting point rises to that of pure tin. No evidence of any compound of the two metals is furnished by the melting point curve.—J. T. D.

Aluminium bronze powders; Explosions of ——. Stockmeier. Chem.-Zeit., 1906, **30**, 580.

THE metal is pounded in stamp-mills, sorted according to size of grain, and is then polished in polishing mills. Very fine sorts are submitted to a rubbing treatment, after sifting, and before polishing, by grinding the metal dust with gum arabic solution. The explosions which occur in the sifting and polishing machines are dust explosions caused by accidental sparks in the machinery. Ordinary aluminium bronze powders do not flash when blown through a flame, but the finest sorts can be ignited in this manner, or even by a match. Another danger of explosions is that due to hydrogen evolved by the action of aluminium dust on water. A slight elevation of temperature in the process of washing out the gum may give rise to a sudden evolution of hydrogen. The author has established that the decomposition of water by

aluminium dust begins at 30° C., but does not take place at 20° C.; iced water is generally used for washing the metal. In cases of fire, when red-hot aluminium is quenched by water, large flames of burning hydrogen, or even explosions are produced. Since aluminium bronze in the form of fine dust normally contains about 2·3 per cent. of moisture, it has been suggested that explosions in the polishing machines may be due to the production of hydrogen by the decomposition of this moisture. The author has proved, however, that the production of hydrogen by the decomposition of the normal moisture of the metal never exceeds 4 per cent. of the theoretical quantity even under the most favourable conditions, and this quantity is not dangerous. Explosions have been greatly reduced of late years by the use of exhaustor fans, but two cases are on record where the breaking of a fan-blade has ignited the aluminium dust passing through the fan. Ignition by frictional electricity has been suggested as a possible cause of explosion, but no authenticated case is known. (See also this J., 1906, 430.)

—J. F. B.

Silicon chloride; Action of ——, on nickel. E. Vigouroux. Comptes rend., 1906, **142**, 1270—1271.

CONTINUING his researches, the author now describes the action of silicon chloride on nickel, the experiments being carried out on the plan employed previously in the case of iron and cobalt (see this J., 1905, 1308; 1906, 318), except that in the present instance the course of the reaction was more closely followed, and the successive products formed analysed separately. Two products were obtained, one containing 9·6 per cent. of silicon, corresponding with the formula Ni_4Si, and the other 19·3 per cent., corresponding with Ni_2Si. It is considered to be not at all improbable that at extremely high temperatures compounds still richer in silicon may be obtained.

—W. P. S.

Zinc-antimony alloys. S. F. Zemczuznyj. Z. anorg. Chem., 1906, **49**, 384—399.

THE author confirms, in general, the results obtained by Mönkemeyer (this J., 1905, 137). The compound, Zn_3Sb_2, does not form solid solutions either with zinc or with antimony. It crystallises in prisms, which can be easily obtained by piercing the skin which forms on the surface of the fused alloy, pouring off a portion of the molten material, and allowing it to cool slowly, when tolerably well-defined crystals are formed in the interior of the regulus. The compound is capable of existing in two modifications, the transformation from one to the other taking place, not at a constant temperature, but over the range 330°—358° C., according to the proportion of the compound present in the alloy in question, the higher temperature being the transformation point in the case of the pure compound. When free antimony and the compound, Zn_3Sb_2, are present together in an alloy, a condition of unstable equilibrium results; the crystals of the compound which first separate subsequently react with the antimony to form the compound, ZnSb, the reaction being accompanied by evolution of heat. The compound, ZnSb, decomposes on melting.—A. S.

Ferro-tungstens; Study of pure ——. E. Vigouroux. Comptes rend., 1906, **142**, 1197—1199.

THE alloys were prepared in crucibles of magnesia, by the alumino-thermal process, from pure oxide of iron and tungsten oxide, WO_3, obtained from pure ammonium tungstate by calcination, and reduction in hydrogen at a temperature below 400° C. Three perfectly homogeneous alloys were prepared, free from aluminium, and containing 2·30, 6·21, and 46·25 per cent. of tungsten respectively. The alloys were soft (they crushed easily under the hammer), slightly brittle, and granular or lamellar in structure, being less brittle and more granular as the percentage of iron became larger. They were attacked vigorously by hydrochloric acid, iron being dissolved, and also, eventually, a very small quantity of tungsten, which coloured the solution blue. *Aqua regia* attacked the alloys slowly, iron being dissolved, and tungstic acid precipitated, whereby the further action of the acid was hindered. By treating the alloys with dilute hydrochloric acid till nothing further was dissolved, the compound, Fe_3W_2, was left behind, in the form of brilliant plates having a metallic appearance. The compound has the sp. gr. 13·89 at 0° C., and is not appreciably magnetic. It is attacked vigorously by chlorine at 350° C., but is not acted upon by dry oxygen except at a bright red heat. It is not appreciably affected by solutions of hydrochloric and nitric acids, or by gaseous hydrochloric acid, and only slightly by *aqua regia* and sulphuric acid. For decomposing the compound, the best agent is potassium bisulphate, which attacks it rapidly at a dark red heat.—A. S.

Carbon-steel; Physico-chemical researches on ——. C. Benedicks. Jernkont. Ann., 1906, **60**, 107; Chem. Zeit., 1906, **30**, Rep. 184.

A NUMBER of the physical properties of steel are explained by the assumption that steel with over 0·5 per cent. of carbon consists of β-iron containing about 0·27 per cent. of hardening carbon, whereas iron and mild steel with less than that proportion consist of α-iron, the hardening carbon being regarded as concerned in the staining of ferrite by iodine tincture. The influence of silicon on the sp. gr., in conjunction with chemical tests, indicates the existence of a hitherto unknown light carbide, Fe_2C. It also appears that the transformation from the α- to the β- form is accompanied by a measurable contraction. The modulus of elasticity varies inversely with the carbon content; and the modulus is diminished to the same extent, or nearly so, by equivalent quantities of carbon, silicon, and nickel. With regard to the relation between the degree of hardness and the chemical composition, it is found that equivalent quantities of silicon and manganese have an equal effect, this being greater in the case of β-iron, but not so great as that of hardening carbon.

Electrical resistance.—Equiatomic solid solutions of the iron have the same resistance, and this applies approximately to the eleven different dissolved elements tried. The hardening carbon can be estimated from the resistance, which, in iron and mild steel, increases with the total carbon up to 0·15 per cent. of that element. Equivalent proportions of hardening carbon and manganese have the same effect in diminishing the intensity of magnetisation, and the diminution can be expressed by a formula.

Ferronite.—All the chemical, physical, and micrographical details tending to prove the existence of "ferronite" (a solid solution of β-iron with about 0·27 per cent. of carbon), are given, and this substance is considered to explain certain obscure phenomena.—C. S.

Copper-cadmium alloys. R. Sahmen. Z. anorg. Chem., 1906, **49**, 301—310.

COPPER and cadmium form two compounds, of formulæ Cu_2Cd and Cu_2Cd_3. From fused mixtures of the two metals containing 0—42 atoms per cent. of cadmium, copper crystallises out between 1084° and 552° C.; at the latter temperature long needles of the compound, Cu_2Cd, appear, and at 542° C. the rest of the mixture solidifies as a eutectic. Fused mixtures containing 42—45·4 atoms per cent. of cadmium deposit between 552° and 542° C. the same compound, Cu_2Cd; and the mixture containing 45·4 atoms per cent. solidifies eutectically at 542° C. Mixtures containing 45·4—60·0 atoms per cent. of cadmium deposit mixed crystals of the compounds, Cu_2Cd and Cu_2Cd_3, and those containing 60·0—97·97 atoms per cent., mixed crystals of the compound, Cu_2Cd_3 and cadmium. The mixture with 97·97 atoms per cent. of cadmium solidifies eutectically at 314° C., and mixtures richer in cadmium than this deposit cadmium from 314° to 321°·7 C.

—J. T. D.

Cæsium; Direct oxidation of ——. Properties of cæsium peroxide. E. Rengade. VII., page 637.

Mineral production of Southern Rhodesia. Bd. of Tr. J., June 28, 1906. [T.R.]

THE report for the year ended March 31st last, of the Rhodesia Chamber of Mines states that the output of gold from Southern Rhodesia and Tati for that year was declared at 438,893 oz. 3·49 dwts., valued at £1,599,195, being an increase of 129,376 oz. in weight and £478,667 in

value as compared with the year ended 31st March, 1905. The output of silver amounted to 83,996·27 oz., valued at £9,390; that of lead to 550·98 tons, valued at £6,232; and that of diamonds from the Somabula area to 1,161 carats, valued at £4,208. The yield of coal from the Wankie Colliery amounted to 111,105 tons; the sales during the year realised £62,285.

Metal and Mineral Production of New South Wales. Bd. of Tr. J., June 28, 1906. [T.R.]

From the Annual Report of the New South Wales Department of Mines for 1905, it appears that the metals and minerals produced in New South Wales during that year were valued at £7,017,940, as compared with a value of £6,391,764 in 1904. The quantities and values of the chief metals and minerals produced are shown in the following table:—

	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Coal ..... Tons	6,019,809	1,994,952	6,632,138	2,003,461
Coke ..... ,,	171,006	110,692	162,961	100,306
Copper (ingots, matte and ore)* ..... ,,	8,932	406,001	8,257	511,754
Gold ..... Fine oz.	269,817	1,146,109	274,267	1,165,013
Iron† ..... Tons	6,303	80,504	4,447	85,093
Portland cement	—	54,750	—	88,100
Silver-lead, ore, concentrates, &c. ..... Tons	397,220	1,942,284	441,447	2,441,856
Tin (ingots and ore)‡ ..... ,,	1,700	188,377	1,519	173,806
Zinc (spelter and concentrates) ..... ,,	57,603	117,978	103,533	221,155

*Exclusive of copper produced from ore from the other States of the Commonwealth.
†Made from scrap, no ore being used.
‡Exclusive of tin refined from imported ores.

Mineral production of Carthagena (Spain). For. Off. Ann. Series No. 3644. [T.R.]

446,035 tons of iron and manganiferous iron ores were shipped in 1905, of which the United Kingdom took 297,645 tons, being 131,010 tons more than in 1904.

Shipments of Cehegin (or Calasparra) magnetic ore have greatly increased. Although this ore meets with little acceptance in the United Kingdom, there appears to be no difficulty in disposing of all that is mined to other countries, chiefly Germany.

The shipments of silver and soft lead in 1905 amounted to 32,865 tons and 23,900 tons respectively. The export of silver-lead was 2,486 tons more than in 1904, and of soft lead 1,464 tons more. The increase in exports may be attributed chiefly to the higher prices of lead and zinc which permitted poorer lead mines to be worked, and caused the increased mining of blende, amongst which lead ore, to some extent, is usually found, and from which it is separated and sold to local smelters.

The quantity of silver exported during the year was 33,955 kilos., about 1,056,102 oz. troy, all to France. The quantity of zinc ore shipped was 88,430 tons, of which 56,125 tons went to Belgium. Of this quantity about 16,000 tons were calamine and the rest blende. These figures show a decrease of 4,206 tons as compared with 1904, and are about equal to those of 1903, but the above-named quantity exported in 1905 does not represent the quantity mined, and placed in deposit ready for shipment, as at the end of the year the stocks in this position were about 20,000 tons, and had not been shipped, principally because the different works which consume the ore were so blocked up that they postponed taking delivery. A notable feature is that Germany has taken about 11,000 tons more, while Belgium has taken nearly 15,000 tons less.

Shipments of iron pyrites were only 95 tons less than in 1904 (2455 tons).

The export of ochre for 1905 was better by 590 tons than in 1904, amounting to 1150 tons, of which the United Kingdom took 873 tons. Sulphur is again being shipped from mines in the interior, 895 tons having been sent off during the year to the United Kingdom. During the year only 80 tons of lead ore have been exported, 10 tons to the United Kingdom and 70 tons to France, thus going back to the small quantities bought for pottery purposes only. The experiment made in 1904 by an inland miner to export this ore instead of selling it to local smelters has not encouraged him to repeat shipments. 344 tons of copper ore were shipped to France, and 52 tons to the United Kingdom, total 396 tons, being about 200 tons less than in 1904, and 566 tons less than 1903. Only 74 tons of copper matte were exported, of which 16 tons went to the United Kingdom.

English Patents.

Steel; Treatment of ——. W. Taylor, Leicester, and F. J. Mudford, London. Eng. Pat. 15,809, August 2, 1905.

The change in the magnetic properties of the steel at the critical temperature is used to indicate that the proper quenching temperature has been reached. There are many ways in which the invention may be carried into effect, as, for example, by making the mass of steel part of a magnetic circuit in inductive relation with a circuit which includes a telephonic receiver; or the tractive or directive force of the steel may be utilised to displace a magnetic indicator, and this displacement may actuate a secondary indicator such as an electric bell, but the invention is not confined to the specific means herein referred to.—J. H. C.

Furnaces for roasting, &c.; Rabble-shafts and arms for ——. A. V. Leggo, Ballarat, Australia. Eng. Pat. 17,370A, Aug. 28th, 1905.

Various contrivances are provided to prevent leakage where water-cooled arms form junctions with the shafts, and also for attaching tines or teeth to the arms, whereby any tooth may be removed without disturbing the others.
—J. H. C.

United States Patents.

Ores; Method of melting primary baths for dissolving ——. R. Baggaley, Pittsburg, Pa., and C. M. Allen, Lo Lo, Mont. U.S. Pat. 822,712, June 5, 1906.

The "primary bath" is obtained by melting an ore of "high fuel value," with the aid of a large volume of blast, and producing from the ore a matte which "approximates as closely to the original combinations of sulphur, iron, copper, silver, gold, and the like in the original ore as is consistent with the removal of the gangue."—A.S.

Sulphide ores; Method of utilising as fuel the volatile portions of ——. R. Baggaley, Pittsburg, Pa., C. M. Allen, Lo Lo, Mont., and E. W. Lindquist, Chicago, Ill. U.S. Pat. 822,713, June 5, 1906.

The ore is introduced into a body of molten matte into which air is blown, and while the ore is floating in the matte, a supplementary blast of air is introduced above the molten matte, and at the place of contact of the floating ore therewith. The volume of air introduced is regulated so that all escaping sulphur is oxidised, but the resulting gases are not injuriously cooled.—A. S.

Ores and tailings; Apparatus for treatment of ——. A. Soderling, Bodie, Cal. U.S. Pat. 822,398, June 5, 1906.

The patent relates to the treatment of tailings or slimes preliminary to cyaniding. The ore or tailing is crushed between rollers, and fed by a jet of water into the upper end of an inclined trough with a riffle-bottom. A weak solution of solvent acids or acid salts is supplied from a tank, and at the lower end of the trough there are settling reservoirs for sands and for slimes, and a reservoir for base metal solutions.—A. S.

Copper; Process of hardening ——. C. R. Plumer, Assignor to Renstrom Tempered Copper Co., Seattle, Wash. U.S. Pat. 822,299, June 5, 1906.

Copper or a copper alloy is melted and treated with a hardening agent such as "copper sulphate," and a chilling agent such as "potassium bichromate." The mass is stirred until it becomes stiff, and is then reheated, and allowed to cool.—A. S.

[*Copper and nickel*] *Ores; Process of treating* ——. J. O. Handy, Pittsburg, Pa. U.S. Pat. 821,637, May 29, 1906.

Arseniferous cobalt and nickel ores containing silver are ground, sifted to 80-mesh size, and the fine ore is fused with sodium bisulphate to expel arsenic, which is recovered. The product is leached, and from the solution the silver is reduced and precipitated by means of a fresh portion of the arsenide ore, the iron and arsenic are removed, the cobalt and nickel are separated by fractional precipitation with hypochlorite, and sodium sulphate is recovered by evaporation and crystallisation. In the separation of the cobalt and nickel, the cobalt is first precipitated by adding slightly more than the necessary quantity of hypochlorite, and the nickel is dissolved out of the precipitate by a portion of the solution from which the iron and arsenic have been removed.—A. S.

Metallic flakes or scales; Process of making ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 821,627, May 29, 1906.

This invention relates to a process of making flakes or scales of cobalt, or of nickel and cobalt, and consists in subliming cobalt chloride, or mixed nickel and cobalt chlorides, in order to deposit the same in scales or crystalline flakes. The latter are then converted into hydroxides of the metals, and the hydroxides finally reduced to the metallic state.—B. N.

Conducting-films [*Cobalt*]; *Process for making* ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 821,628, May 29, 1906.

A sulphur compound of a metal, such as cobalt, is fused with an alkali sulphide, and the fused mass allowed to cool, so as to result in the crystallisation of the compound in thin scales or films. These are then screened in order to separate crystals not in the form of scales, and washed to eliminate alkali sulphides. The scales are roasted to oxidise the same, and the oxidised scales or films are reduced in an atmosphere of hydrogen to the metallic state.—B. N.

Steel; Manufacture of ——, *from phosphoritic iron.* J. Reese, Sharon Hill, Pa., Assignor to The Steel Patents Co., Pa. U.S. Pat. 821,744, May 29, 1906.

The molten metal is first de-siliconised and decarburised in a Bessemer convertor, and is then transferred to a basic-lined open-hearth furnace, wherein it is subjected to a bath of basic materials containing so much calcium phosphate that a slag is produced containing not less than 15 and not more than 22 per cent. of phosphoric acid.—A. S.

Nodulising ores, &c. C. Dellwik, London, Assignor to J. E. Goldschmid, Frankfort-on-Maine, Germany. U.S. Pat. 822,929, June 12, 1906.

See Fr. Pat. 360,576 of 1905; this J., 1906, 543.—T. F. B.

French Patents.

Furnaces; Impts. in metallurgical and other ——. Soc. anon. des Gazogènes sous Pression. Fr. Pat. 362,268, Jan. 9, 1906.

The mixture of air and gas to be used as fuel enters the furnace by way of a helical conduit or pipe constructed of a suitable metal, which is disposed in the masonry, and is heated by the products of combustion from the heating chamber of the furnace.—A. S.

Iron; Process for the desulphurisation of substances containing compounds of ——, *and for forming the same into lumps.* T. C. King. Fr. Pat. 362,145, Jan. 3, 1906.

The process is intended especially for converting burnt pyrites and flue dust into a form suitable for use in blast-furnaces or Siemens-Martin furnaces. The material, containing a certain percentage of moisture, is heated gradually in a long, cylindrical, rotating furnace, first to a temperature (646°—815° C.) high enough to expel the sulphur, and then to a temperature above 1090° C., to cause the material to agglomerate. It is stated that the material is thus obtained in the form of lumps of irregular size and shape, practically free from sulphur, and suitable for direct employment in blast-furnaces or Siemens-Martin furnaces.—A. S.

Steel for rails of railways and tramways; Manufacture of ——. G. P. Sandberg. Fr. Pat. 362,240, Jan. 8, 1906. Under Int. Conv., April 11, 1905.

See Eng. Pat. 7698 of 1905; this J., 1905, 1309.—T. F. B.

German Patent.

Iron and mild steel; Process for the cementation and hardening of articles of ——. G. Reminger. Ger. Pat. 167,034, June 23, 1904.

The process consists in heating the articles to redness, and then subjecting them to the action of a solution of a formate, *e.g.*, ammonium formate. It is claimed that by the use of formates, a uniform and strong carburisation is effected, that polished surfaces remain quite smooth, and that the use of alkali cyanides is avoided. The degree of carburisation can be controlled by varying the concentration of the formate solution.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 595.)

(*A.*)—ELECTRO-CHEMISTRY.

Alcoholates and alkyl-carbonic acid esters; Electrolytic preparation of ——. B. Szilard. Z. Elektrochem, 1906, **12**, 393-395.

By the electrolysis of alkali alcoholates with platinum electrodes, the corresponding alkyl-carbonic acid esters are formed; for example, sodium methylate yields sodium-methyl carbonate, and sodium ethylate sodium-ethyl carbonate. The best yields are obtained with a 4 per cent. solution of the alcoholate in the perfectly anhydrous alcohol, and with a current-density as high as is possible without causing evolution of gas at the anode. If a base metal anode be used, there is produced the alcoholate of that metal if the current-density be low, or the alkyl-carbonic acid ester of the metal if the current-density be high, whilst with medium strengths of current, mixtures of the two compounds are produced. The formation of the alkyl-carbonic acid esters is due to a secondary decomposition of the alcoholates produced first.—A. S.

English Patents.

Secondary or storage batteries. A. J. Boult, London. From E. V. Stebbins, Philadelphia, Pa. Eng. Pat. 26,876, Dec. 23, 1905.

The lead oxide for the negative plate of a storage battery

is mixed with about 5 per cent. of an insoluble, finely divided sulphate, *e.g.*, barium sulphate precipitated from a cold solution.—A. G. L.

White lead; [Electrolytic] Manufacture of ——, and mixtures of the same with oxides of lead. W. P. Thompson. From R. Goldschmidt and E. Polzininsz. Eng. Pat. 11,347, May 30, 1905. XIII*A*., page 644.

UNITED STATES PATENTS.

Storage batteries; Process of treating alkaline ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 821,625, May 29, 1906.

THIS invention relates to a process of eliminating soluble impurities from alkaline storage batteries, in which active masses of oxygen compounds of nickel and iron are used, and in which a conducting receptacle of an insoluble metal is employed. The receptacle is insulated to reduce the dissipation of heat, and the two electrodes are connected in circuit as cathodes with the conducting receptacle in alkaline solution. A reverse current is then passed through the battery, so as to heat the solution, and generate hydrogen gas in the active masses. The impurities are thus forced out into the solution, and this is finally poured off.—B. N.

Cell; Electrolytic ——. G. A. Gabriel, Assignor to Bleach and Caustic Process Co., New York. U.S. Pat. 822,109, May 29, 1906.

THIS invention relates to an electrolytic cell containing a porous diaphragm with a perforated vertical cathode in contact with one side of the diaphragm, and an anode having an active face adjacent to the opposite side of the diaphragm, together with a second diaphragm between the first diaphragm and the anode, with gauze embedded in it. Insulating material limits the inner exposed surface of the diaphragm to approximately the size of the active face, but the active area of the cathode is greater than the inner exposed surface of the diaphragm. The anode is continuous, with horizontal and vertical passages in it for the circulation of the electrolyte, and the cathodes are of substantially similar outline. The liquid which percolates through the diaphragm is conveyed away by downwardly-inclined projections, or liquid-conduits, extending from the face of the cathode which is out of contact with the diaphragm, thus draining the entire face by gravity. A plate engages with the liquid-conduits, and a means is provided for forcing the plate towards the cathode and diaphragm. A perforated draining plate connects the conduits at their lower ends. An exterior vertical transparent conduit communicates directly with the interior of the anode chamber at three points, one above the surface of the electrolyte, one slightly below the surface, and one near the bottom of the anode chamber, thus allowing of circulation of the electrolyte. An adjustable overflow pipe is located within the conduit, and a gas-discharging tube is connected with the top of the conduit.—B. N.

Organic substances; [Electrolytic] process of treating [oxidising and reducing] ——, in presence of vanadium compounds. E. Oppermann, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 823,435, June 12, 1906.

SEE Fr. Pat. 345,701 of 1904; this J., 1905, 33.—T. F. B.

Electric arcs; Production of stable ——, of large dimensions. Badische Anilin und Soda Fabrik. First Addition, dated Dec. 9, 1905 (under Int. Conv., Nov. 1 and 14, 1905) to Fr. Pat. 357,358 of Aug. 30, 1905 (this J., 1906, 79).

INSTEAD of passing the gas along the whole length of the electrode as in the main patent, it may be introduced into the tube only, beyond the end of the central electrode. Since the electrode is corroded somewhat by constant use, arrangements are made for its renewal without interruption of the process. The hot gases, leaving the reaction chamber, are employed for preheating the gases to be subjected to the action of the arc, or they may be used for evaporating solutions obtained in the course of the process. Forms of apparatus are described suitable for carrying these modifications into effect.—R. S. H.

FRENCH PATENT.

Battery; Electric ——, with aluminium chloride as exciting and depolarising liquid. H. Femerling and W. Pörscke. Fr. Pat. 362,280, Jan. 9, 1906.

A MIXTURE of carbon, manganese peroxide, aluminium chloride, and water is made, and compressed as usual around a carbon rod or into a hollow cylinder of carbon. The mass is surrounded by cloth, and placed in a receptacle of zinc or other suitable metal, containing a solution of aluminium chloride, or a pasty mass consisting of a double hydrous silicate of aluminium and magnesium. —B. N.

Chromic acid; Electrolytic regeneration of ——, in solutions of chromium salts. M. Le Blanc, Fr. Pat. 362,195, Jan. 5, 1906. Under Int. Conv., March 13, 1905

THE anode and cathode chambers are separated by partitions which do not reach quite to the bottom of the vat. The solution of chromic oxide is introduced in such a manner that the cathode liquid retains a suitable degree of acidity. It is advantageous to allow the solution of chromic oxide to first come in contact with those portions of the anode where the current density is highest, and subsequently with those where the current density is lower.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

Zinc; Electrolytic deposition of ——, using a rotating electrode. J. S. Price and G. H. B. Judge. Faraday Soc. Trans., June 12, 1906. [Advance proof.]

THE authors have studied the quantitative determination of zinc in zinc sulphate solutions, using the rotating electrodes recommended by Perkin (this J., 1903, 1065, Fig. 3). The solution is contained in a tap-funnel of about 100 c.c. capacity. Quantitative results are obtained if the solution be kept cool, even when the zinc sulphate solution is initially slightly acid. The addition of sodium acetate and sodium sulphate was tried, and in the latter case good results were obtained. A modified form of Kollock and Smith's apparatus (this J., 1905, 1127) is also described, in which a mercury cathode and rotating anode are employed. Here again a cylindrical vessel provided with a tap is used to contain the electrolyte, and after the completion of the experiment, the zinc amalgam can be run off through the tap, and subsequently weighed.—R. S. H.

UNITED STATES PATENTS.

Metallic films or flakes; Process of making —— [Electrolytically]. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 821 626, May 29, 1906.

A THIN film of a soluble metal, such as zinc, is deposited on a suitable cathode, and an insoluble metallic film of metallic cobalt or cobalt alloy is deposited over this. The plated cathode is subjected to the action of dilute acid, which dissolves the zinc, and the liberated hydrogen separates and detaches the insoluble film. The latter is finally annealed in an atmosphere of hydrogen.—B. N.

Steel containing titanium; Production of ——. A. J. Rossi, New York, Assignor to J. MacNaughton, Tahawus, N.Y., and P. C. Peck, New York. U.S. Pat. 822,305, June 5, 1906.

STEEL containing more than 1 and less than 5 per cent. of titanium is obtained by fusing molten cast-iron containing a definite percentage of carbon in an electric furnace, and treating it with a quantity of titanium oxide sufficient to decarburise the metal to the desired extent. By regulating the current, a high temperature is then maintained sufficient to effect the decarburisation, and to cause the reduced metallic titanium to be combined with the steel.—A. S.

Furnace; [Electric] Metallurgical ——. I. L. Roberts, Assignor to J. T. Morehead, New York. U.S. Pat. 821,830, May 29, 1906.

THE furnace consists of a receptacle or jacket, with a lining of heat-insulating material, and within this a chamber having refractory walls. Inside the chamber is a conducting vessel, with masses of resistance material on opposite sides, in contact with the walls of the chamber, but not in contact with each other. Electrodes are connected with the masses of resistance material.—B.N.

Furnace; Continuous magnetic ——. H. C. Shaw, Glenshaw, Pa. U.S. Pat. 821,752, May 29, 1906.

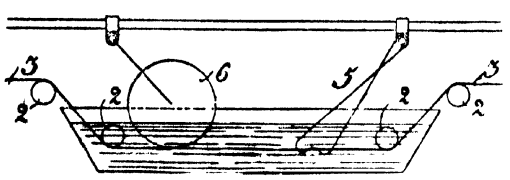
A HOLLOW screw conveyor is disposed within the heating chamber of the furnace, and is magnetised, and rotated, whereby magnetic material in the chamber is caused to travel along the screw. A cooling fluid is supplied to the interior of the screw. Within the screw, also, a grooved rod is caused to rotate, to prevent deposition of foreign matter.—A. S.

Metallic surfaces; [Electrolytic] Process of cleaning ——. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 821,622, May 29, 1906.

SEE Eng. Pat. 26,947 of 1904; this J., 1905, 201.—T. F. B.

FRENCH PATENT.

Deposition of metals; Arrangements suitable for the ——, *by electrolysis.* A. Schmutz. Fr. Pat. 362,182, Jan. 5, 1906.



IN order to facilitate the employment of high current-density in the electro-deposition of metals upon wires, &c., a displaceable arrangement is employed to lead the current to the material which is being plated. In the figure the method is illustrated in two ways; the wire, 3, passes over rollers. 2, which may be of insulating material. The current is conducted independently of these rollers by movable contacts which may either be of a rolling nature as at 6, or sliding, as at 5.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 596.)

Cod liver oil; Production of ——*at Finmarken.* Chem. and Druggist, June 30, 1906. [T.R.]

REPORTS from Bergen state that the Finmarken spring fishing is at an end, and the final report gives the following numbers:—

Finmarken Spring Fishing.

	1904.	1905.	1906.
Cod (thousands)	12,497	13,670	11,073
Cod-liver oil (brls.) ..	6,050	13,664	9,104
Liver for other oils (hl.) ..	2,250	6,757	10,560
Total of all Winter and Spring Fishings.			
Cod (thousands)	49,651	44,691	45,203
Cod-liver oil (brls.) ..	16,000	36,124	36,587
Liver for other oils (hl.) ..	7,728	12,896	17,158

The exports from Bergen up to June 25 amounted to 6994 barrels, against 5051 barrels at the same date last year.

ENGLISH PATENT.

Fats; Manufacture of iodine ——. H. A. Pryor. From Chem. Fabr. von Heyden Aktien.-Ges. Eng. Pat. 3132, Feb. 8, 1906. XX., page 653.

UNITED STATES PATENT.

Marine-animal oils [fish oils]; Method of treating ——. M. Potolowsky, Moscow, Russia. U.S. Pat. 823,361, June 12, 1906.

SEE Fr. Pat. 317,540 of 1902; this J., 1902, 1403.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page* 597.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

White lead; [Electrolytic] Manufacture of ——, *and of mixtures of the same with oxides of lead.* W. P. Thompson, London. From R. Goldschmidt and E. Polzniusz, Brussels. Eng. Pat. 11,347, May 30, 1905.

A SOLUTION containing about 1 part of sodium acetate to about 9 parts of sodium carbonate, is electrolysed in a suitable elevated vessel, in which the anodes consist of thick, and the cathodes, alternately with these, of relatively thin plates of lead. The bottom of the bath has a valved aperture, discharging into a vessel beneath, the latter being provided at the top with a filter or strainer. The filtered solution is forced by a pump into a closed vessel, heated from below, into which carbon dioxide is admitted under pressure. The electrolysis of the solution induces formation of lead acetate, which, in presence of the sodium carbonate, passes into lead carbonate. As the white lead formed is removed, and carbon dioxide is supplied to the filtrate under pressure, the sodium carbonate that has suffered decomposition is reformed. An upright tube, passing into the closed vessel, and continued so as to discharge, under pressure, into the electrolytic bath above, renders the process continuous, the proportion of acetate present remaining constant. By varying the temperature and the degree of the carbon dioxide impregnation, mixtures of white lead with lead oxides may be obtained. (Reference is directed to Eng. Pats. 14,801, of 1895, 19,179 of 1897, and 2382 of 1899; this J., 1895, 975; 1898, 163; and 1899, 502.)—E. S.

Lakes [from azo dyestuffs]; Manufacture of colouring matter ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,100, Sept. 21, 1905.

SEE Fr. Pat. 357,858 of 1905; this J., 1906, 129.—T.F.B.

FRENCH PATENT.

Lakes [from azo dyestuffs]; Production of red ——, *fast to light.* L. Cassella und Co. Fr. Pat. 361,313, March 31, 1905.

LAKES are prepared in the usual manner from the azo dyestuff from diazotised *p*-chloro-aniline and β-naphthol-disulphonic acid R. The red lakes thus obtained are said to be considerably faster to light than those derived from *o*- or *m*-chloro-aniline.—T. F. B.

(*B.*)—RESINS, VARNISHES

Pine resin (Pinus abies L.); Chemical investigation of the acids in ——. P. Klason and J. Koehler. J. prakt. Chem., 1906, **73**, 337—358.

THE authors review previous literature on the subject of resin acids, and state that in many cases the conclusions drawn by different workers are vitiated on account of neglect to take into account the fact that these acids are autoxidisable (compare Fahrion, this J., 1902, 127). The

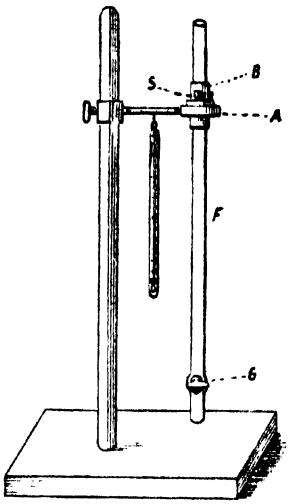
authors have observed that in the winter and spring (from January to April in the neighbourhood of Stockholm) a perfectly white and crystalline resin, bearing a striking resemblance to sugar, occurs sparingly under the bark of pine and fir trees. They name this product "winter resin" to distinguish it from ordinary pine resin, or "summer resin." It consists of a mixture of resin acids of the type, $C_{20}H_{30}O_2$, melting at about 140° C., and having a varying lævo-rotation, the highest value observed being $[\alpha]_D = -150{\cdot}46°$. On recrystallisation from alcohol, lamellar crystals of higher rotatory power and melting point are obtained. The mixture of acids is very sensitive to heat, the rotatory power being strongly diminished. "Summer resin" consists of a mixture of resin acids and oxidation products of the same, the latter usually amounting to at least 50 per cent. of the total. The oxidation products are insoluble in petroleum spirit, which dissolves the resin acids. On distilling *in vacuo* the resin acids obtained by extracting "summer resin" with petroleum spirit, acids isomeric with those present in "winter resin," but more stable, and having a lower rotatory power, are obtained. They are probably produced from the former by a stereometrical transformation brought about by the action of heat. The authors propose to name these acids, *colophonic acids*, and the more active acids present in the original resin and in "winter resin," *sapinic acids*. The name colophonic acids is proposed to distinguish the products from the abietic acids of Tschirch and Studer (this J., 1903, 1250) which the authors do not regard as chemical individuals. The acids previously obtained by different workers from pine and firs resins, and from American colophony, *e.g.*, abietic, sylvic, and pinic acids, and perhaps also colopholic acid, are all probably mixtures of sapinic and colophonic acids.

For the isolation of the colophonic acids, ordinary crude pine resin from which the turpentine oil had been removed by distillation with steam, was repeatedly extracted with petroleum spirit, the solvent was removed from the extract by distillation, and the residue was subjected to fractional distillation *in vacuo*. From the light yellow resin obtained as distillate, the resin acids were separated by crystallisation from petroleum spirit, followed by washing of the crystals with the solvent. From 2150 grms. of crude resin, there were obtained 150 grms. of crude oil of turpentine, 750 grms. of substances insoluble in petroleum spirit (700 grms. of oxidised resin acids and 50 grms. of impurities), and grms. of crude resin acids (sapinic acids). The la[illegible]on distillation yielded 400 grms. of residue and tions us[illegible] of distillate, from which 145 grms. of crystallised and caste[illegible] acids were isolated. The mixture of colo- to the acid[illegible]s, $C_{20}H_{30}O_2$, melted at 168°—172° C., and had for the cas[illegible] rotation $[\alpha]_D = +28{\cdot}14°$. It can be roughly [illegible] to its two components by fractional crystalli- [illegible] [illegible]cid being more readily soluble in petroleum spir[illegible] acetic acid, methyl and ethyl alcohols, ether, [illegible]cetaldehyde. The ammonium, calcium and barium salts were prepared, and it was found that the best separation of the two acids was obtained by fractional crystallisation of the ammonium salts from alcohol, but the acids were not obtained quite pure, owing to oxidation. The most reliable numbers for the melting point and optical rotation of the two acids are as follows:—α-colophonic acid, m.pt., 198°—199° C.; $[\alpha]_D = -59{\cdot}41°$; β-colophonic acid, m.pt., 168°—173° C.; $[\alpha]_D = +52{\cdot}2°$. The authors' β-colophonic acid is probably identical with the amorphous abietic acid of Easterfield and Bagley (this J., 1904, 989).

—A. S.

Varnishes; Viscosimeter for ——. E. Valenta. Chem. Zeit, 1906, **30**, 583—584.

THE measurement of the rate of flow through an orifice having proved unsatisfactory for determining the viscosity of linseed oil varnishes, the author has devised the simple "ball-fall" apparatus, illustrated in the figure. It consists of a glass tube, F, 63 cm. in length, and 13 m.m. inside diameter. The top of the tube is open, whilst a glass cock, G, 10—11 mm. in bore, is attached to the lower end. The collar, B, is clamped on the upper part of the tube, and carries two



steel knife-edges, S, which are supported on the ring, A, in such a manner that the tube always hangs in a vertical position. The tube is filled with the fluid, and a silver ball, 9 mm. in diameter, is allowed to fall from the top to the bottom, the time being accurately measured. When the ball reaches the bottom, the lower orifice is closed by the thumb, the cock is opened, and the ball passes through, being removed after closing the cock. The mean of ten determinations is taken, and the result is compared with that obtained with a standard castor oil.—J. F. B.

English Patent.

Linoleum mass and the like; Process for the manipulation of granular ——. E. C. R. Marks, London. From R. Holtkott, Bedburg-on-Rhine, Germany. Eng. Pat. 2436, Jan. 31, 1906.

THE difficulty of manipulating the linoleum mass due to its stickiness is overcome by powdering it with a fine vegetable or animal flour, such as rice starch, potato flour, or bone flour, prior to its introduction into the moulds. The flexibility of the linoleum is also increased by this addition.—C. A. M.

French Patent.

Resinous materials and their derivatives; Employment of superheated steam in the preparation and distillation of ——. Soc. Guignard et Lestandie. Fr. Pat. 362,264, Jan. 9, 1906.

SUPERHEATED steam is used in the distillation of resinous materials, instead of distilling with steam under pressure or distillation with a naked flame.—B. N.

(*C.*)—INDIA-RUBBER, Etc.

India-rubber containing notable amounts of resin; Vulcanisation of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 918.

EIGHTEEN varieties of raw india-rubber, containing from 1·4 to 12·2 per cent. of resin, were vulcanised with 10 per cent. of sulphur for one hour at 145° C., under a pressure of 3—4 atmospheres, and the products tested mechanically. None of the rubbers containing upward of 7 per cent. of resin were completely vulcanised by this treatment, whilst several of those containing less were decidedly under-vulcanised. Mozambique, Massai balls, Adeli balls, Soudan twists, and Lewa, all of which are highly resinous, showed remarkably high elasticity and strength, though only the last-named was fully vulcanised.

The experiments, so far from indicating any connection between resin-content and behaviour under vulcanisation, prove that the nature and origin of the rubber are the paramount factors in this respect.—W. A. C.

Balata; Vulcanisation of ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 893.

Washed and dried balata was vulcanised at 145° C., under a pressure of 4—5 atmospheres, with rising proportions of sulphur, and the products tested mechanically. With 50 minutes' vulcanisation the maximum of strength and extensibility was attained at 35—40 per cent. of sulphur; these specimens, however, were considered under-vulcanised. On vulcanising fully for 1½ hours, the extensibility reached a maximum at 40—45 per cent. of sulphur, whilst the breaking strains were throughout considerably less than those of the first series.—W. A. C.

Gutta-percha of Palaquium Treubi; Certain principles of the ——. E. Jungfleisch and H. Leroux. Comptes rend., 1906, **142**, 1218—1221.

When the gutta hydrocarbon is precipitated from the toluene extract of the leaves of *Palaquium Treubi* by means of boiling alcohol, a substance remains in solution to which the author gives the name of *paltreubin*. The liquors are evaporated to dryness, and waxy impurities are extracted by boiling alcohol; the paltreubin is then recrystallised from petroleum benzine until it has a constant melting point of 260° C. It crystallises in small, colourless, silky needles which sublime in the form of prisms; it dissolves best in benzine or toluene. Analysis indicates the formula $C_{30}H_{50}O$, isomeric with the amyrins obtained by Vesterberg from elemi. When heated in sealed tubes at 175° C. with acetic anhydride for 24 hours, paltreubin is completely converted into two acetates, *α* and *β*, melting respectively at 235° and 290° C. These acetates yield on saponification *α-paltreubyl alcohol* m.pt. 190° C., and *β-paltreubyl alcohol*, m.pt. 295° C. The *α*-alcohol and its acetate possess the same melting points as *β*-amyrin and its acetate, but are optically inactive. The *β*-alcohol is identical with a substance which has been isolated from the leaves of *P. gutta* and *P. borneense*. Paltreubin, which is not a mixture, is therefore regarded as an alcohol derived from a tri-terpene $(C_{10}H_{16})_3$; it undergoes isomeric change in two directions when acetylated.—J. F. B.

United States Patents.

Rubber; Machine for washing ——. F. C. Hood, Brookline, Mass. U.S. Pat. 821,716, May 29, 1906.

The machine comprises a tank in which is a pair of co-acting rollers mounted side by side in the same horizontal plane. The rubber to be washed is fed between the rollers from a tilting hopper, and washing liquid is introduced at the front of the tank, where the washed rubber is removed. The tank has two outlets, one at the bottom for the heavier impurities, and another at the top for floating matter; washing liquid is supplied in excess of that which can escape by the lower outlet. When the rubber emerges after its first passage between the rollers, it is automatically carried back, and passed through a second time. Means are provided for varying the temperature of the washing liquid in the tank.—A. S.

Rubber; Process of purifying ——. F. C. Hood, Brookline, Mass. U.S. Pat. 821,717, May 29, 1906.

The rubber is compressed or shredded between two rollers submerged in a washing liquid, and then passes through a further quantity of liquid before emerging from the containing tank. The current of liquid is utilised for returning the rubber issuing from the rollers for a second passage between them. The heavier impurities are removed through an outlet in the bottom of the tank, and the lighter impurities by means of an overflow outlet. (See preceding abstract.)—A. S.

Gum [Rubber manufacture]; Process of treating ——. A. P. Eves, Akron, Ohio. U.S. Pat. 821,934, May 29, 1906.

The patent relates to a method of refining gum, used in the manufacture of rubber. The gum is kept in a state of agitation, and exposed to the action of heated solvent (alcoholic) vapours, passed upwards, through and around it. The vapours are led into a condenser, and the condensed solvent is allowed to descend, through the rising vapour, on to the gum, thus utilising the heat of the vapour, and freeing the gum from deleterious substances. —C. S.

French Patent.

Caoutchouc; Process for the utilisation of waste —— Soc. Michelin et Cie. Fr. Pat 361,300, March 30, 1905.

The vulcanised caoutchouc in the form of fine powder is re-agglomerated by the influence of great pressure in moulds which are suitably heated, without treatment by the usual processes of manufacture. The internal section of the mould is such that the powder suffers the least possible lateral displacement during the compression. The final form of the piece may be obtained by a single stroke in the moulding, or by the reheating of a piece which has been first brought to a shape approaching as nearly as possible the final shape.—B. N.

German Patents.

Gutta-percha and balata; Process for obtaining —— from the leaves and wood of plants containing these substances. F. Frank and E. Markwald. Ger. Pat. 165,997, Dec. 10, 1903.

The leaves, &c., are heated under moderate pressure with dilute solutions of alkalis or alkali carbonates, until the melted gutta-percha or balata collects on the surface of the lye, from which it is recovered by extraction with a suitable solvent.—A. S.

Rubber, vulcanised, and ebonite; Process for the regeneration of ——. B. Roux. Ger. Pat. 166,639, March 16, 1904.

The rubber or ebonite, in small pieces, is mixed with sulphur, and subjected to a pressure of 100—500 atmospheres at a temperature of 150°—200° C.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page 598.*)

Tanning material analysis. H. R. Procter. Colle[illegible] 1906, 173—179.

The author deals generally with the analysis [illegible] materials, and raises some points which sh[illegible] opinion be discussed at the coming Conferenc[illegible] Chemists at Prague. Whilst in the present [illegible] sampling and preparing materials for analy[illegible]s but little need for changes, some better pr[illegible]tion appears to be required. The filtration and t[illegible]mina-tion of so-called "insolubles" as now perform[illegible] require reform. Certain extracts, especially quebracho extracts, give persistently turbid filtrates with the candle-filter method, and the analytical results naturally vary in a marked manner from those obtained by the filter-paper-kaolin method. The greater part of the "insolubles" seems to consist of difficultly soluble tannins, and as it nearly always happens that extracts are perfectly clear at 100° C. whatever amount of insoluble matter they may give at 15° C., it is obviously merely a matter of temperature and dilution as to what percentage of the extract will prove insoluble in the tannery. With respect to the detannisation of solutions, and the determination of non-tannins, improvement is urgently needed. At present, chromed, the hide-powder offers the best solution of the difficulty, but to be satisfactory the hide-powder must not contain soluble matter, should absorb all true tannins rapidly and completely, and must not absorb acids and other matters which are not tannins. To comply with the first requirement the powder must be thoroughly chromed, and the chromium salts present must be in a sufficiently basic condition to suffer no further hydrolysis by the action of water or organic acids. Any good chromed hide-powder will absorb tannins rapidly, whether

it be lightly or fully chromed. The absorption of non-tannin matter by the hide-powder is a subject presenting many difficulties. The author considers that improvements in methods of analysis in this direction will lie in the splitting up into its various constituents of the total matter absorbed by hide-powder from tanning solutions. —W. P. S.

ENGLISH PATENT.

Glue; Process for the manufacture of ——. W. Sadikoff, St. Petersburg. Eng. Pat. 4570, Feb. 24, 1906.

SEE Fr. Pat. 358,859 of 1905; this J., 1906, 327.—T. F. B.

UNITED STATES PATENT.

Casein solution, and method of producing same. H. V. Dunham, Bellows Falls, Vt., Assignor to Casein Co. of America, New Jersey. U.S. Pat. 821,620, May 29, 1906.

THE casein is dissolved in a mixture of alcohol and an alkali hydroxide soluble in alcohol, the solution being then neutralised, and treated with formaldehyde. C. S.

FRENCH PATENTS.

Tanning skins and mordanting tissues; Substance for use in ——. O. H. Nowak, E. N. Eaton, and J. M. McVean. Fr. Pat. 360,854, Dec. 22, 1905.

A "SUBSTANCE," suitable for use in the tannage of skins and mordanting of textile tissues, is prepared by separating the casein from skimmed milk or buttermilk, and allowing the residual liquid to ferment as long as any increase in its acidity takes place. The resulting solution may be evaporated in a vacuum, at a temperature not exceeding 74° C., to a syrupy consistency or even to the solid state. The syrup, it is stated, contains 18—24 per cent. of free acids, and 14—16 per cent. of acid anhydrides. Citric and lactic acids, lactose, and albuminoids are present in it, but no mineral acids or compounds capable of acting injuriously upon the cellular tissue of skins, or of attacking the gelatin in them.—E. B.

Leather; Process for the manufacture of artificial ——. Mme. J. Guillot, née M. Landivier. Fr. Pat. 362,170, Jan. 5, 1906.

FIBRES of any kind are impregnated with a solution of castor oil and nitrocellulose in acetone, &c., either before, during, or after having been formed into bands or sheets. The latter are then strongly compressed. The proportions used are: fibres, 80 parts; nitrocellulose, 15 parts, and castor oil, 5 parts. Gums and resins may be added to the acetone solution, and other fatty matters substituted for the castor oil.—W. P. S.

XV.—MANURES, Etc.

(*Continued from page* 599.)

Barley; Influence of manures on yield and quality of ——. J. A. Voelcker. J. Inst. Brewing, 1906, **12**, 408—435.

THE author gives an account of the principal results obtained in barley culture, chiefly at the Rothamsted and Woburn stations, and also, but in a minor degree, at other agricultural experimental stations in England and Ireland. In order to arrive at definite conclusions from the experimental treatments the barley is grown on the same land year after year, a course which is never followed in practical agriculture. The experiments showed that unmanured land continuously cropped with barley ultimately becomes exhausted. The same is true with land which receives top-dressings of nitrogenous salts only. The beneficial effects of nitrogenous salts only last for the year of their application; ammonia salts seem to be better adapted for wet seasons, and nitrates for dry seasons. Farmyard manure gives effects which last for a great number of years, and shows especially good results in dry seasons. The continuous application of ammonium salts, alone or with mineral salts, gradually causes failure through the development of an acid condition of the land, a defect which can be remedied by dressing with lime. Nitrogenous salts alone are inimical to good brewing qualities, but ammonia appears to be preferable to nitrates; phosphates are particularly favourable to quality, whilst potash improves the straw. Farmyard and organic manures show uneven results. The best all-round treatment for both yield and quality of barley, when artificial manures have to be used, would appear to be superphosphate, 3 cwt., kainite, 3 cwt., and ammonium sulphate, ¾ cwt., *i.e.*, a complete manure. As regards rotations, barley should not follow roots which have been fed to sheep on the same land; the crops are often too heavy, and the quality is bad. Barley should not be sown after grass, ploughed up, since the land is full of pests and weeds. Good results are obtained after roots which have received farmyard manure, provided the roots are taken off the ground. Perhaps the best results are got when barley follows a white straw crop, preferably wheat which has been manured.—J. F. B.

Calcium cyanamide; Decomposition of ——, [*when used as a manure*]. F. Löhnis. Biedermann's Centr., 1906, **35**, 375—377.

CALCIUM cyanamide is decomposed in ordinary soils by certain bacteria, ammonia, and possibly nitrates, being formed, and its action as a manure is similar to that of ammonium sulphate and sodium nitrate. In boggy soils it is not decomposed, owing to the absence of the necessary bacteria, or is converted by the acids present into compounds which are injurious to vegetation. Experiments show that several species of bacteria are capable of effecting its decomposition, the most powerful being *Bacterium Kirchneri* and *B. lipsiense*. The former is most active at temperatures between 20° and 22° C., and the latter between 10° and 12° C. Whilst mixed cultures of these bacteria effect the complete decomposition of calcium cyanamide, pure cultures of either do not seem to be so effective. The course of the decomposition is not affected by the admission or exclusion of air to the soil, and, consequently, is not helped by derangement of the surface of the soil. Of the above-mentioned bacteria, only *B. Kirchneri* has the power to decompose urea.—W. P. S.

Yeast; The disposal of waste ——. P. Schidrowitz and F. Kaye. XVII., page 650.

ENGLISH PATENT.

Fertilisers [*Phosphate rock and sulphur*] ——. W. B. Chisholm, Charlestown, S. Carolina, U.S.A. Eng. Pat. 6429, March 16, 1906.

PHOSPHATE rock and lump sulphur are reduced to the average size of a pea or bean by passing them together through a preliminary crusher, from 40 to 100 lb. of sulphur being added per ton of mixture. The latter is then ground to a fine powder, and mixed with other ingredients to form a fertiliser. It is claimed that the sulphur under the influence of the moisture of the soil reacts with the phosphate rock, and increases the amount of available phosphate. It also appears to act as a germicide. —W. P. S.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 601.)

Reducing sugars; Unification of methods for the determination of ——. L. S. Munson and P. H. Walker. XXIII., page 656.

Starch; The complete conversion into maltose of the dextrins resulting from the saccharification of ——. A. Fernbach and J. Wolff. XVII., page 648.

Sugar industry of Hawaii. For. Off. Ann. Series No. 3643. [T.R.]

THE export of sugar from the Hawaiian Islands during the year ended June 30, 1905, amounted to 371,751 tons, valued at 7,211,738*l.* Of this 362,324 tons, valued at 6,972,229*l.*, was raw sugar, and 9427 tons, valued at 239,509*l.*, was refined sugar; practically the whole export went to the United States.

The total tonnage of the sugar crop for 1904-05 was 426,248 short tons, which is the largest crop in the history of the Islands, with the exception of that for 1903, which exceeded it by 11,743 short tons. There are 53 sugar plantations in the Hawaiian Islands, all of which have their own factories except eight, the latter having their cane ground and manufactured at adjoining factories. Hawaiian sugar is all exported in the raw state with the exception of the output of one factory. In this factory granulated and powdered white sugars only are manufactured, and shipped to San Francisco, its output being about 20,000 short tons per annum.

It is estimated that the area from which the 1905 crop was taken was about 110,000 acres, and that the area now under cultivation, from which the 1906 and 1907 crops are to be harvested, is about double that in extent.

ENGLISH PATENT.

Massecuite, syrups, or impure sugar solutions. Process for purifying ——. J. Wetter, London. From M. Weinrich, Yonkers, N.Y., U.S.A. Eng. Pat. 11,838, June 6, 1905.

SEE Addition of June 9, 1905, to Fr. Pat. 325,882 of 1902; this J., 1905, 1182.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 604.)

Starch; The complete conversion into maltose of the dextrins resulting from the saccharification of ——. A. Fernbach and J. Wolff. Comptes rend., 1906, **142**, 1216—1218.

CONFIRMING the observation of Maquenne and Roux (this J., 1906, 601) that exceptionally high yields of maltose can be obtained in the conversion of starch paste by malt extract if the medium be nearly neutralised by acid, the authors point out that the addition of acid is by no means a necessary condition for obtaining these high yields. The production of maltose tends to proceed to just as high a limit if no addition be made, provided sufficient time be allowed. Nevertheless a partial neutralisation of the natural alkalinity has a stimulating influence on the activity of the diastase; this influence can be brought into play even when the saccharification of the starch has proceeded to a fairly advanced stage; it is therefore unnecessary to assume that the breakdown of the starch follows a different path in the case of the stimulated diastase. In a series of experiments on the conversion of the same starch by malt extract at 50° C. (*a*) partially neutralised and (*b*) without any addition of acid, the yields of maltose calculated on the original starch amounted, after 94 hours, in the case of (*a*) to 103·8 per cent., and in that of (*b*) to 100·7 per cent. The conversion of starch by diastase into maltose tends to attain the theoretical limit with sufficient time. The slackening observed in the later stages is not due to the failure of the diastase, but to the increasing dilution of the hydrolysable matter. If the residual dextrin be separated from the highly saccharified liquid by precipitation with alcohol, its aqueous solutions are still susceptible to saccharification by malt extract. If any dextrin which is not convertible into maltose exists, it must represent only an infinitesimal fraction of the original starch.—J. F. B.

Diastatic content; Difference in ——, *between malts from large-corned barleys and those from small-corned barleys.* G. Ellrodt. Z. Spiritusind., 1906, **29**, 209—210.

Two barleys having the following characters:—

	Large corn barley.	Small corn barley.
Water, per cent.	14·32	13·64
Nitrogen in dry substance, per cent.	2·058	1·962
Weight per hectolitre (kilos.)	67·6	61·7
,, ,, 1000 corns (grms.)	44·9	29·5
Germinative capacity	96	87

were investigated to ascertain which would give the most suitable malt for distillery purposes. It was found that, with the large-corned sample, the diastatic unit cost double as much as with the other. Barleys with low 1000-corn and hectolitre weights, and high albumin-contents are hence to be regarded as distillery barleys, whilst those with high 1000-corn and hectolitre weights, and low albumin-contents are most suitable for brewing malts.—T. H. P.

Acetic bacterium; Morphological-biological investigation of a new ——. F. Fuhrmann. Z. ges. Brauw., 1906, **29**, 376.

THE author describes a bacterium, named by him *Acetobacter plicatum*, which was isolated from wine in cask, and which converts ethyl alcohol into acetic acid. The infection of the wine with this organism takes place in the press, the grapes on the vine being quite free from it. *Acetobacter plicatum* forms rods 1·4—1·6 μ in length, and 0·4—0·6 μ in breadth. When the bacterium is grown on gelatin, no peptonisation of the medium occurs, even after a week's growth of the organism. On wine- or meat-extract-gelatin the bacterium forms an adhesive, whitish-yellow growth with folds running across the inoculation streak. A similar but more slimy growth is obtained on beer-gelatin, and, in this case, a reddish colour appears after some time. In presence of alcohol, no acid is formed in neutral gelatin media. The optimum temperature is 28°—30° C., but in wine or beer containing a large proportion of alcohol the bacterium grows best at about 25° C. The membrane formed gives with iodine neither a blue coloration nor the cellulose reaction. At temperatures lying between about 22° and 25° C., the organism can be grown in wine containing 11 per cent., or in beer containing 9·5 per cent. of alcohol by weight.—T. H. P.

Proteolytic enzymes; Detection of ——. C. Fermi. Centralbl. Bakt. Abth. II., **16**, 176—191; Z. Spiritusind., 1906, **29**, 221—222.

PROTEOLYTIC enzymes cannot always be detected by their action on fibrin, but the liquefaction of gelatin under antiseptic conditions affords a very reliable and sensitive test for their presence. The process can be applied in various ways, but the following method with solid gelatin is perhaps the best. The concentration of the gelatin solution may vary from 1 to 10 per cent. according to the temperature to be employed. To this solution 0·5 per cent. of phenol is added, and sufficient alkali or acid to create the condition of the medium which may be desired. One c.c. of gelatin solution is placed in each test-tube, these being preserved in a moist condition by storing them with their mouths downwards in a vessel of water. The liquid to be tested (0·5—1 c.c.) mixed with a little phenol or thymol is placed in the tube with the gelatin, and the extent of liquefaction is noted from time to time. The readiness with which the gelatin is liquefied varies inversely as its concentration. The differences in liquefactive capacity are greater with neutral gelatin than with alkaline gelatin; they are also greater at 14° C. than at 20° C. The sensitiveness of the test can be increased by increasing the surface of contact by the addition of some inert insoluble substance such as powdered charcoal. The rate of liquefaction is increased by providing for the draining away of the liquefied products. The detection of proteolytic enzymes in solid animal or vegetable tissues can be effected by placing fragments of the substance, previously sterilised by phenol solution, on the surface of gelatin plates kept in a moist chamber. Proteolytic enzymes can be absorbed from dilute solutions by pieces of fibrin, which can then be tested on the gelatin plates. Another method of detecting the enzymes consists in adding increasing quantities of the solution to a series of gelatin tubes, keeping these at a temperature of 30° C. for several days, cooling to a definite point, and noting the gelatinising power. In some cases, however, the high temperature is injurious to the enzyme. Or else, the quantity of the enzyme solution may be kept constant, and increasing quantities of gelatin may be added. The solid products obtained by the action of dilute alkalis on egg or blood albumin may be used instead of gelatin. They possess

the advantage of remaining solid at temperatures above 30° C., but these bodies are not so sensitive to the action of proteolytic enzymes as gelatin. (See also Schidrowitz, this J., 1903, 958; and 1904, 498.)—J. F. B.

Peroxydases as enzymes with specific activities. A. Bach. Ber., 1906, **39**, 2126—2129.

THE enzyme tyrosinase, discovered by Bertrand, has the specific property of converting tyrosine into a black-coloured oxidation product, whilst it possesses no oxidising action on phenols or aromatic amines. On the other hand, the ordinary oxydases are entirely without action on tyrosine. According to the author's view the oxydases are made up of two complementary enzymes—the peroxydases which "activify" peroxides, and the oxygenases which produce peroxides. The peroxydases are very stable enzymes, whilst the oxygenases are very rapidly destroyed by keeping; in the absence of oxygenases, however, the active system can be re-constituted by the addition of hydrogen peroxide to the peroxydases. The author has applied this rule in the case of tyrosinase in the following manner:—An extract containing tyrosinase was prepared from potatoes; on the addition of alcohol to the extract a precipitate was obtained the solution of which, although still slightly active towards tyrosine, possessed only a fraction of the activity of the original extract. This loss of activity, according to the author's views, should be due to the partial destruction of the oxygenase portion of the system. This was proved to be the case, since on the addition of hydrogen peroxide the solution of the alcoholic precipitate acquired all the activity of the original tyrosinase extract. Consequently, the specific action of tyrosinase is due to the specific nature of its peroxydase portion. The author quotes certain experiments by Palladin which tend to show that the enzymes which bring about respiratory oxidations are oxydases of the same order as the above, *i.e.*, mixed systems of peroxydases and complementary oxygenases. It was found that leaves which had ceased to respire in presence of air, owing presumably to the destruction of their store of oxygenase, could be made to resume their respiratory processes in a very intense degree when hydrogen peroxide was added.—J. F. B.

Acetone; A new microbe which produces ——. L. Bréaudat. Comptes rend., 1906, **142**, 1280—1282.

THE author has obtained from the water supplied to Saigon (Cochin China) an aërobic organism which grows at all temperatures between 30° and 37° C. On peptonised gelatin the cultures are violet, and on potatoes almost black, but no pigment is formed in the absence of peptone or air. The most important property of the organism is that it produces acetone in peptone solutions, the yield being increased by the presence of sugar, and if the medium be kept neutral by the addition of calcium carbonate. Besides liquefying gelatin, the organism reduces nitrates, and coagulates milk. From 10 litres of culture the author has obtained 7·8 grms. of acetone. He proposes to call the microbe *Bacillus violarius acetonicus*.—W. P. S.

Colour of wort and beer: Determination of the —— *, with N/10 and N/100 iodine solutions.* J. Brand and J. Jais. Z. ges. Brauw., 1906, **29**, 337—339.

THE N/10 iodine solution adopted at the Berlin Congress of 1903 as the colorimetric standard for malt worts is not suitable for dark beers of the Bavarian type, because iodine solutions, at the high concentrations necessary for matching the colour intensity of dark beers, have a considerably redder shade than the beer, which renders accurate comparison impossible. For this reason it has always been necessary to dilute such beers before their colour can be determined on the iodine scale. It is, however, possible to reproduce directly the colour of any dark beer by employing the mixture of coal-tar dyestuffs prescribed by Brand (this J., 1899, 935), whereby a standard equal in colour intensity to N/10 iodine, and equivalent in shade at all concentrations to the colouring matter of beer, can be prepared. This solution is more stable than N/10 iodine, and is proposed as a substitute for it in colorimetric work. When the N/100 iodine solution, adopted at the Vienna Congress of 1898, was in vogue, the deepest colour on the scale, *viz.*, 100° = 100 c.c. of water + 100 c.c. of N/100 iodine, was not dark enough for undiluted Bavarian beers. The authors were compelled to create an outside scale, representing from 100° to 200° on this standard, by calling the N/100 iodine solution, or its equivalent in dyestuff, 200°, so that a colour of 190°, for example, would be 190 c.c. of N/100 iodine + 10 c.c. of water.

Hanow (this J., 1903, 1205, and 1904, 380) has given tables for calculating the colour values of the obsolete N/100 scale to their equivalents on the N/10 scale now in use. His principal object was to allow for the fact that on the old colour scale the percentage of extract entered into the result, whereas on the present scale the colour is expressed regardless of the extract. The authors point out that Hanow's tables are founded on an incorrect basis, since he has disregarded the fact that a N/10 iodine solution contains less water than its equivalent of N/100 solution. For example, a colour of 3° on the new scale, which would correspond to 100 c.c. of water + 3 c.c. of N/10 iodine, would, according to Hanow, be equivalent to a colour of 30° on the old scale, which, however, would consist of 100 c.c. of water + 30 c.c. of N/100 iodine. The authors give tables of corrected equivalents.—J. F. B.

Yeast; Production of sulphuretted hydrogen by ——. R. Schander. Jahresber. Ver. angew. Bot., 1904, **2**; Woch. f. Brau., 1906, **23**, 285—286.

THE author conducted fermentations with pure cultures of wine yeasts in fruit and grape musts, in de-alcoholised wines with the addition of sugar, and in artificial nutrient media. Strips of filter paper steeped in a mixture of copper sulphate and lead acetate were placed in the necks of the flasks. All the races of yeast tested gave a greater or less browning of the test papers; as a rule the highly attenuating yeasts showed less than the weakly attenuating varieties, but a few exceptions were noted. The reaction was stronger in the case of cider musts than in that of wine musts. The production of sulphuretted hydrogen was stimulated by higher temperatures and strong aëration. The mycoderma yeasts gave a very strong reaction. The presence of free sulphur is not an essential condition for the production of sulphuretted hydrogen. The formation of sulphuretted hydrogen depends to some extent on the nature of the nitrogenous nutrients; *e.g.*, asparagine is favourable to the formation of the gas, leucine is the reverse, the presence of ultramarine in the sugar has to be taken into account, albumin increases the production, peptone has a slight influence, gelatin causes a strong evolution, isinglass yields no reaction. When the sulphates of potassium, sodium, ammonium, magnesium, and lime were added to the liquids, large quantities of sulphuretted hydrogen were evolved. The reduction of sulphates was very active in the case of mycoderma yeasts and *Oidium lactis*; mould fungi had not the power of reducing sulphates. The addition of powdered sulphur always increased the formation of sulphuretted hydrogen, but its influence was mitigated by the simultaneous addition of albumin or peptone, which, by providing excess of nutrition, diverted the activity of the yeast in another direction. The addition of dead yeast had a similar effect to that of free sulphur. When the sulphur-bearing constituents were added to the musts during fermentation, their effect was much more powerful than when they were present at the start. Dilution of the must with water increased the production of sulphuretted hydrogen. In many cases the browning of the test papers was doubtless caused by organic sulphur compounds such as mercaptans. The production of sulphuretted hydrogen by the yeast is not a simple result of the reducing power or decomposition of the yeast, but rather an essential factor in the vital metabolism, part of the sulphur compounds so produced being doubtless utilised in the synthesis of albumin in the new cells.—J. F. B.

Fruit and grape wines; Formation of sulphuretted hydrogen in ——. Osterwalder. Landw. Jahrb. Schweiz., 1902, 498—504; Woch. f. Brau., 1906, **23**, 285.

THE production of sulphuretted hydrogen in wines has

been attributed either to the presence of free sulphur, derived from the fumigation of the casks, or from the powder employed for the protection of the vines against mildew, or else to the putrefaction of the yeast sediment in the casks. The author made some experiments on the fermentation of pear juice in bottles, some of the samples being fermented by their own yeasts, whilst others were pitched with pure cultures of various Swiss fruit-must yeasts, with or without previous sterilisation. When the bottles were opened after three months, some of them gave a distinct smell of sulphuretted hydrogen, although no free sulphur could have been present, and no putrefaction of the yeast was observed. The varieties of yeast used in the samples which smelt were pure cultures of "Egnach" and "Hutzenwyl" yeasts, and a mixed culture of wild yeast with cultivated "Wadenswel" yeast.—J. F. B.

Spirits; Determination of higher alcohols in ——. P. Schidrowitz and F. Kaye. Analyst, 1906, **31**, 181—191 (See also this J., 1905, 753.)

After testing the degree of accuracy of the Allen-Marquardt process on solutions to which known quantities of amyl alcohol had been added, the authors conclude that the results of the oxidation are accurate with a boiling period of eight hours in the case of spirits containing up to 0·15 per cent. of higher alcohol, which is rarely exceeded in commercial samples. When the quantity of higher alcohol is between 0·15 and 0·2 per cent., fair results can be obtained by extending the time of boiling with the chromic mixture to 10 hours, and quantities up to 0·35 per cent. can be dealt with by boiling for 12 hours. But the authors do not recommend boiling for more than eight hours, and when the result so obtained is as high as 0·14 per cent., it is better to repeat the experiment after diluting the spirit. The authors show that the "mineral acid," presumably hydrochloric acid, which is reputed to be formed in the course of the oxidation is really the organic acid, which reacts to a slight extent as an acid towards Methyl Orange. This reaction of the organic acid can be prevented by adding some non-electrolyte, such as alcohol or acetone, to the liquid to be titrated. The result of the preliminary titration for "mineral acid" in the Allen-Marquardt process may be neglected when the figure obtained does not exceed one-tenth of the total.

Lastly, the authors have tested the colorimetric (sulphuric acid) process, but have come to the conclusion that it is useless. The results vary according to the particular higher alcohol selected as the colorimetric standard, and to the purity of that alcohol. Certain impurities also are present in the commercial spirits to a variable extent which intensify the colorations, and which are not removed in the operation of eliminating aldehydes. So far as this last operation is concerned the authors find that Hewitt's reagent, calcium phenylhydrazine-*p*-sulphonate, is the only agent which eliminates the aldehydes effectively.—J. F. B.

Yeast; The disposal of waste ——. P. Schidrowitz and F. Kaye. J. Inst. Brewing, 1906, **12**, 450—463.

The authors have experimented with two processes of dealing with the waste yeast from breweries (*a*) by destructive distillation; (*b*) by direct conversion into a dry manure.

By the destructive distillation of yeast four main products are obtained, *viz.*, an aqueous liquor containing chiefly ammonia, a fairly thick tar, a large volume of gas, and a species of coke. The yields of the different products vary according to the manner of heating; when the yield of liquor is low, that of the tar is high, and *vice versa*. The results from washed yeast are inferior to those from unwashed yeast. On the large scale a gas retort is better than a still. A sample batch of roughly dried yeast, distilled on the large scale, yielded: liquor, 25 per cent.; tar, 7·6 per cent.; and coke, 48·8 per cent., calculated on the yeast dry-substance. The liquor contained 6 per cent. of ammonia. The tar resembles bone-tar, but is probably superior; the sample obtained above yielded 4·8 per cent. of ammonia when distilled again, and a residue resembling stearin-pitch. The gases are combustible, and can be used for heating the retorts; they contain a large proportion of ammonia, 16 lb. per ton of dry yeast in the above case, which can be removed by washing. The total quantity of ammonia in the above products amounted to 58 lb. per ton of dry yeast. The coke contains important quantities of nitrogen, phosphates, and potash.

The experiments in connection with the direct conversion of waste yeast into manure were carried out with J. L. Baker's process (Eng. Pat. 7921, 1903; this J., 1904, 333), according to which the drying, which is the most difficult problem in dealing with waste yeast, is facilitated by treating the yeast with a small quantity of sulphuric acid, and partially neutralising the acid by the addition of chalk. The mass becomes porous and bulky, after which it is easily dried in open pans, and ground. One hundred tons of pressed yeast yield about 30 tons of product, containing 8 to 9 per cent. of ammonia.

The authors give estimates of manufacturing costs and profits, and of the available supplies of waste yeast in various districts. They point out that, without the co-operation of brewers, no process of dealing with yeast is possible.—J. F. B.

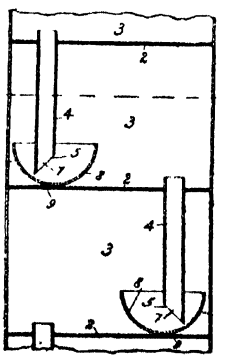
English Patent.

Brewing; Process of ——, *and appliances therefor* [*Boiling and aerating wort*]. C. F. Hyde, Manchester. Eng. Pat. 10,783, May 23, 1905.

A dome-shaped division is placed in the copper boiler at such distance from the bottom as will allow sufficient space below it to accommodate the quantity of wort to be treated. In the centre of the dome is a stuffing-box and gland through which a vertical pipe passes. This pipe may be raised or lowered, and has a number of holes near its lower end. When it is desired to boil the wort under pressure, the pipe is lowered until the holes are under the surface of the wort. As soon as the wort boils, the pressure generated forces a quantity of the liquid up the pipe, at the top of which is a cowl or shield so placed that the liquid is deflected downwards on to the top of the dome. When a certain volume has collected there, a valve is automatically opened, and the liquid returned to the boiler. If it be desired to boil the wort at the ordinary pressure, the pipe is raised until the holes are above the gland, and the wort simply boils over on to the top of the dome, and returns through the valve. A manhole is provided in the dome for cleaning the boiler, &c.—W. P. S.

United States Patents.

Still. J. J. Brennan, Assignor to T. J. Hines, Louisville, Ky. U.S. Pat. 822,573, June 5, 1906.



The fractionating column of the still consists of a tube divided into separate chambers, 3, by perforated plates, 2. The chambers, 3, communicate with one another by the overflow-pipes, 4, having their lower ends, 5, cut away obliquely as shown at, 7, to facilitate the discharge of any

solid matter that may accumulate in the pipes. The overflow-pipes, 4, are sealed at their lower ends by the hemispherical cups, 9, each of which has an inclined side, 8, opposite the oblique opening, 7, so that the rush of liquid from the pipe, 4, may easily wash any solids over the side of the cup.—W. H. C.

FRENCH PATENT.

Ethereal oils contained in flowers and especially in hops; Process of obtaining the ——. L. Nathan. Fr. Pat. 362,252, Jan. 8, 1906. Under Int. Conv., Jan. 19, 1905.

SEE Eng. Pat. 519 of 1906; this J., 1906, 603.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 605.)

(*A.*)—FOODS.

Flour; Method for examining bleached ——. R. H. Shaw. J. Amer. Chem. Soc., 1906, **28**, 687—688.

THE natural or "ageing" process for bleaching flour is rapidly being superseded in American mills by artificial methods, amongst which may be mentioned the electric flaming-discharge process, the electro-chemical process, the purely chemical process, and the "exothermic" process. In all the processes on the market the higher oxides of nitrogen play a part, and the proposed method of examination depends on the detection of derivatives of these bodies. About 1 kilo. of flour is boiled for four hours with 95 per cent. alcohol under a reflux condenser. The mixture is cooled and filtered, and the flour is washed once with alcohol. The extract and washings are evaporated nearly to dryness, and the residue is extracted with a mixture of equal parts of alcohol and ether. This extract is filtered, and evaporated to a syrup in a 4-inch porcelain dish. The syrupy mass is then caused to spread itself in a film over the inside of the dish, and a drop of a solution of diphenylamine in sulphuric acid is allowed to trail over the film. In each authentic case of artificial bleaching the drop of reagent used in the above manner left a blue path, whereas no coloration was perceptible in cases of unbleached flour.—J. F. B.

Milk; Absorption of odorous matters by ——. F. Bordas and Toutplain. Comptes rend., 1906, **142**, 1204—1205.

IT is a well-known fact that milk absorbs traces of odorous matters present in the air with extreme facility. In studying this phenomenon the authors selected formaldehyde as the volatile body. They found that when milk was exposed for only one minute to an atmosphere containing formaldehyde, appreciable quantities of that body were absorbed. Further, the presence of formaldehyde could be detected in the milk after a few minutes' exposure, when the atmosphere contained only 1 part of formaldehyde per 100,000. The rapidity of absorption appears to be greater the fresher the milk; it is so great that milk might be used as an absorbent for the detection of traces of formaldehyde in the air. If milk be placed in glass vessels which have contained solutions of formaldehyde, but which have subsequently been thoroughly rinsed, the aldehyde can afterwards be detected in the milk.—J. F. B.

Flours; Detection of rice in wheat ——. G. Gastine. XXIII., page 655.

Flavouring-extracts; Standards for ——. Chem. and Drug., June 23, 1906. [T.R.]

A COMMITTEE of the Association of Official Agricultural Chemists of the United States and the Inter-state Food Commission which was entrusted with the duty of reporting on standards for various foods, has issued a report in which the following are recommended as the strengths of flavouring-extracts. The definition of flavouring-extract is given as "a solution in ethyl alcohol of proper strength of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its colouring-matter, and conforming in name to the plant used in its preparation." The strengths given are percentages by volume.

Almond Extract.—1 per cent. of oil of bitter almonds derived from the seeds of the bitter almond, apricot, or peach.

Anise Extract.—3 per cent. of oil of anise from aniseed.

Celery-seed Extract.—0·3 per cent. of oil of celery-seed.

Cassia Extract.—2 per cent. of oil of cassia, free from lead, and containing not less than 75 per cent. of cinnamic aldehyde.

Cinnamon extract.—2 per cent. of oil of cinnamon, obtained from the bark of Ceylon cinnamon, and containing not less than 65 per cent. of cinnamic aldehyde and 10 per cent. of eugenol.

Clove Extract.—2 per cent. of oil of cloves.

Ginger Extract.—Containing in 100 c.c. the alcohol-soluble matter from 20 grms. of ginger.

Lemon Extract.—Prepared from oil of lemon, lemon-peel, or both; contains 5 per cent. of oil of lemon.

Terpeneless Extract of Lemon.—Prepared by shaking oil of lemon with dilute alcohol; contains 0·2 per cent. by weight of citral derived from the oil of lemon.

Nutmeg Extract.—2 per cent. of oil of nutmeg.

Orange Extract.—Prepared from oil of orange, orange-peel, or both; contains 5 per cent. of oil of orange.

Peppermint Extract.—3 per cent. of oil of peppermint.

Rose Extract.—Prepared from otto of roses with or without red-rose petals; contains 0·4 per cent. of otto of roses.

Savory Extract.—0·35 per cent. of oil of savory.

Spearmint Extract.—3 per cent. of oil of spearmint.

Star-anise Extract.—3 per cent. of oil of star-anise.

Sweet Basil Extract.—0·1 per cent. of oil of sweet basil.

Sweet Marjoram Extract.—1 per cent. of oil of marjoram.

Thyme Extract.—0·2 per cent. of oil of thyme.

Tonka Extract.—From tonka-bean, with or without sugar or glycerin; contains 0·1 per cent. by weight of coumarin with a corresponding proportion of the other soluble matters.

Vanilla Extract.—From vanilla-bean, with or without sugar or glycerin; contains in 100 c.c. the soluble matters from 10 grms. of vanilla-bean.

Wintergreen Extract.—Contains 3 per cent. of oil of wintergreen.

ENGLISH PATENT.

Baking powder; Manufacture of a ——. L. Weil, Strasburg, Germany. Eng. Pat. 15,667, July 31, 1905.

TARTARIC acid is mixed with about one-tenth of its weight of paraffin or other solid hydrocarbon, and warmed in order that the paraffin shall form a coating over the tartaric acid crystals. The mixture is then stirred until cold, and mixed with suitable quantities of sodium hydrogen carbonate and starch to produce the baking powder claimed. The purpose of the paraffin is to retard the action of the acid.—W. P. S.

FRENCH PATENTS.

Cocoa substitutes; Process of manufacturing ——. J. Meinl. First Addition, dated Dec. 9, 1905, to Fr. Pat. 316,861, Dec. 13, 1901 (this J., 1902, 1344).

SUGAR and other ingredients are added to the cocoa and malt preparation described in the original specification, in order to form a chocolate. The product is not deprived of its excess of fat.—W. P. S.

Milk; Process and apparatus for the concentration and preservation of ——. C. Joanne and E. Borde. Fr. Pat. 362,248, Jan. 8, 1906.

THE milk is heated to a temperature not exceeding 70° C., and is concentrated by the passage of a current of hot dry air over its surface, the temperature of the air being not more than 50° C. The concentrated milk is placed in bottles, and sealed under vacuum at a temperature of 40° C. The bottled milk is sterilised by heating it repeat-

edly on alternate days to 76° C., being kept at 36° C. on the other days. The apparatus for concentration consists of a closed cylinder in which the milk is placed and heated; a series of discs mounted on a rotary shaft is placed in the cylinder, so that when the shaft is revolved, the milk is carried round on the discs in a thin layer which is exposed to the current of hot dry air which enters at one end of the cylinder, whilst the saturated air escapes at the other end.—J. F. B.

Fruit; Process of preparing concentrated juices and extracts of ——. O. Volz. Fr. Pat. 362,247, Jan. 8, 1906. Under Int. Conv., Jan. 10, 1905.

See Eng. Pat. 612 of 1905; this J., 1906, 332. T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Towns' refuse; Apparatus for forcing and promoting the combustion of ——, *in destructor furnaces.* F. Aslatt, Southampton. Eng. Pat. 16,204, Aug. 9, 1905.

The invention deals with the application of compressed air highly charged with water to a closed space or ash-pit below the furnace grates. For this purpose the injector described in Eng. Pat. 16,203 of 1905 is mounted on the front wall or plate of the ash-pit. It consists of a perforated conical nozzle, through which air is forced by an air-compressing engine; within this nozzle there is a water pipe having a perforated nozzle coincident with the exit end of the air nozzle. The water is drawn up this pipe, and broken up into a very fine spray by the air-blast. Over the combined air and water nozzles is fitted a screw-cap device to regulate the air and water blast, and around the whole is placed an air induction funnel. The water supply may also be regulated by a tap fitted on the water pipe. The air and water blast passes from the ash-pit upwards through the grate and burning refuse, and accelerates the combustion of the latter.—W. P. S.

Distilling water by the multiple-effect system, and apparatus therefor. W. Clark, London. From American Water Purifying Co., Philadelphia, U.S.A. Eng. Pat. 16,177, Aug. 8, 1905.

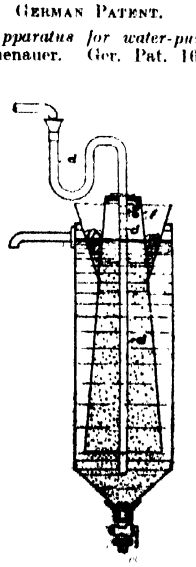
See Fr. Pat. 356,762 of 1905; this J., 1905, 1319.- T. F. B.

French Patent.

Carbon dioxide in the atmosphere of rooms, &c.; Apparatus for the determination of ——, *and for other purposes.* A. A. Lévy and A. Pecoul. Fr. Pat. 362,199, Jan. 6, 1906. XXIII., page 655.

German Patent.

Lime-saturation apparatus for water-purifying installations. F. Eichenauer. Ger. Pat. 164,713, May 25, 1904.



The air evolved from the incoming water collects in the upper part, *f*, of the saturator, and is then sucked in through perforations, *g*, by the water flowing down the inlet pipe, *d*, and is utilised for agitating the mixture of lime and water in the lower part of the saturator.—A. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 606.)

Cellulose; Note on the constitution of ——. A. G. Green and A. G. Perkin. Chem. Soc. Trans., 1906, **89**, 811—813.

The chief objection to the constitutional formula for cellulose proposed by Green (this J., 1904, 382).

$$\begin{matrix} CH(OH).CH & -CH(OH) \\ \cdot & >O \quad >O \\ CH(OH).CH & -CH_2 \end{matrix}$$

lies in the fact it contains only three hydroxyl groups, and should therefore only yield a triacetyl derivative on complete acetylation, whereas it has been generally accepted hitherto that the highest product of the acetylation of cellulose (without concomitant hydration) is a tetra-acetyl derivative. The authors have now determined by three different methods the number of acetyl groups in this supposed tetra-acetyl compound, prepared in the usual manner from cellulose regenerated from the xanthate (see Cross, Bevan, and Beadle, Chem. Soc. Trans., 1895, **67**, 447). The results show clearly that the product contains only three acetyl groups. It is pointed out that the formula given above is only intended to represent cellulose in its simplest or unpolymerised form, as, for instance, in an ammoniacal cupric solution. The cellulose of fibres may consist of a number of these C_6 complexes united together by means of their oxygen atoms, or, as is more probable, of a physical aggregate of molecules of cellulose of the constitution given.—A. S.

Copper-alkali-cellulose. W. Normann. Chem.-Zeit., 1906, **30**, 584-585.

Linkmeyer's process for the manufacture of artificial silk depends on the coagulation of a cuprammonium solution of cellulose by a solution of caustic soda. The coagulated thread, instead of becoming milky white as is the case when an acid coagulating bath is used, remains blue and perfectly transparent. This is due to the formation of a copper alkalicellulose, by the displacement of ammonia by soda in the cellulose compound. Cupric hydroxide dissolves to a slight extent in concentrated soda lye giving a blue solution. If cotton be immersed in this solution the ordinary phenomena of mercerisation are observed, but at the same time the fibre is coloured deep blue, and the liquid is decolorised. By repeatedly renewing the copper solution a saturation point is reached at which the cellulose ceases to absorb more copper. The compound can then be washed without dissociation by means of soda lye of a certain strength, and analysis shows a ratio of cellulose to copper in the saturated compound corresponding to the formula $C_{12}H_{20}O_{10}.CuO$, or 23·15 per cent. of copper oxide. The copper-alkali-cellulose compound is dissociated by water, pale blue copper hydroxide being precipitated in the thread. The precipitation of a cuprammonium solution of cellulose by substitution of the alkali requires a certain concentration of the soda lye; conversely the soda in the coagulum can be displaced if a large excess of concentrated ammonia be employed, and the soluble ammonium compound is regenerated. Consequently copper-alkalicellulose can be produced in solutions rich in copper by adding sufficient caustic soda lye to a solution of cuprammonium. The threads of artificial silk coagulated in a caustic soda bath, and washed in soda lye are deep blue in colour; the copper is immediately removed by dilute acids, and the decolorised threads retain their perfect transparency.

—J. F. B.

English Patents.

Paper; Manufacture of ——, *by the web machine.* C. E. Armengaud, sen., Paris. Eng. Pat. 1377, Jan. 18, 1906. Under Int. Conv., Jan. 21, 1905.

See Fr. Pat. 359,419 of 1905; this J., 1906, 389.—T. F. B.

Waste-water of a paper machine; Procedure for the direct utilisation of the ——. M. Erfurt, Straupitz, Germany, Eng. Pat. 5851, March 10, 1906. Under Int. Conv., March 20, 1905.

See Fr. Pat. 352,524 of 1905; this J., 1905, 984.—T. F. B.

United States Patent.

Cellulose [Cotton seed hulls]. J. S. Cochran, Philadelphia, Pa., Assignor to F. Taylor, Wilmington, Del. U.S. Pat. 822,430, June 5, 1906.

A mechanical process is specified for recovering the fuzz of the hull of the cotton seed in a pure and unchanged condition after all the staple fibre and lint have been removed from the hull, and bleached.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 608.)

Autocatalysis and decomposition of a photochemical system [Iodoform]. B. Szilard. Comptes rend., 1906, **142**, 1212—1214.

A solution of iodoform in chloroform, when exposed to the action of light in presence of oxygen, gradually decomposes, with liberation of iodine. When this decomposition has once started, it continues spontaneously even in the dark. The spontaneous decomposition of the solution is not complete even after 100 days, but if mercury be added, and if the liquid be shaken occasionally to absorb the iodine produced, the decomposition proceeds to the end. If a solution which has been decomposed by light, be mixed with a solution which has been prepared in the dark, it brings about the decomposition of the latter. The decomposition partakes of the nature of a purely catalytic reaction, the catalytic agent being produced by the reaction itself. Nevertheless, the catalytic substance is not definitely liberated, since the rate of decomposition does not show an increase up to a certain limit. The phenomenon is not limited to solutions of iodoform in chloroform, but proceeds also in other solvents. A small quantity of oxygen is quite as effective as a large quantity. The authors have worked out an expression representing the course of the reaction. In order to study the influence of light apart from that of the autocatalysis pure and simple which goes on in the dark after a short exposure to light, this exposure must in the latter case be as short as possible, and in the former case as complete as possible; the difference between the two curves represents the influence of the light factor.—J.F.B.

Mercuric iodide and methylamine; Compounds of ——. M. François. Comptes rend., 1906, **142**, 1199—1202.

On passing gaseous methylamine over mercuric iodide, a turbid liquid is finally obtained, from which, after standing, the clear liquid may be decanted. This latter, when again saturated with methylamine, yields the compound, $HgI_2,5CH_3NH_2$, in the form of a colourless liquid, which solidifies at —46° C. The compound can be preserved indefinitely in sealed tubes, but when exposed to the air, it loses methylamine, and yields crystals of the compound. $HgI_2,2CH_3NH_2$. This compound forms colourless prisms having an ammoniacal odour; it loses methylamine very slowly when exposed to the air, but can be kept unaltered in closed bottles. It can also be prepared by introducing a solution of potassium iodide saturated with mercuric iodide into excess of a solution of methylamine. A third compound of mercuric iodide and methylamine, HgI_2,CH_3NH_2, can be obtained by leaving for five days a small crucible containing the compound, $HgI_2,2CH_3NH_2$, in a large closed flask containing some mercuric iodide, or by introducing methylamine into excess of a solution of potassium iodide saturated with mercuric iodide.

—A. S.

Mercury oxychlorides; Production of ——. M. Dukelski. Z. anorg. Chem., 1906, **49**, 336—337.

On mixing boiling concentrated aqueous solutions of borax and mercuric chloride, a precipitate of small deep-brown needle-shaped crystals is obtained, while the mixing of more dilute solutions at 40° C. causes a precipitate of shining golden-yellow plates. These two precipitates are identical in composition, and have the formula $4HgO.HgCl_2$.—J. T. D.

Bismuth; Contribution to the study of ——. J. Aloy and P. Frébault. Bull. Soc. Chim., 1906, **35**, 396—406.

Bismuth potassium chloride, $BiCl_3.2KCl$.—Dry chlorine is passed over bismuth heated to 250° C., and the resulting vapour of bismuth chloride allowed to pass over potassium chloride heated to dull redness in small boats. The alkali chloride is first coloured brown, then the mass melts, and when the action is complete in the first boat it spreads to the second, and so on. Bismuth-potassium chloride is a light amber-coloured crystalline compound, somewhat deliquescent, but not so much so as bismuth chloride. Excess of water converts it into bismuth oxychloride.

Bismuth potassium bromide, $BiBr_3.2KBr$, is prepared in a similar manner to the chloride, but after the reaction is ended, it is cooled in an atmosphere of carbon dioxide. It is a well-defined crystalline substance, more highly coloured than the chloride. On heating, it gradually changes from yellow to brownish-red, and melts at about 600° C. without volatilising.

Bismuth hydrogen bromide, $BiBr_3.2HBr.4H_2O$, is obtained as bright yellow needles by dissolving bismuth bromide in concentrated aqueous hydrobromic acid till saturated, and cooling the solution to —10° C. It is deliquescent, and readily decomposes in the air with evolution of hydrobromic acid.

In attempting to make alkali bismuthates by allowing a solution of bismuth nitrate in nitric acid to fall drop by drop into boiling caustic alkali, large needles of indefinite composition were obtained, varying in colour according to the strength of the alkali. These crystals contained bismuth and oxygen in the proportion Bi_4O_7; they were anhydrous, insoluble in water, soluble in alkalis, and decomposed on treating with hydrochloric acid with evolution of chlorine.—B. J. S.

Alcoholates and alkyl-carbonic acid esters; Electrolytic preparation of ——. B. Szilard. XIA., page 642.

English Patents.

Dialkylbarbituric acids; Manufacture of ——. G. B. Ellis, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 11,219, May 29, 1905.

See Fr. Pat. 357,968 of 1905; this J., 1906, 197.—T. F. B.

Pharmaceutical compounds [Alkyloxyacetylcatechol ethers]; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,571, Dec. 8, 1905.

See U.S. Pat. 822,339 of 1906; following these.—T. F. B.

Fats; Manufacture of iodine [iodised] ——. H. A. Pryor, London. From Chem. Fabr. von. Heyden, Akt.-Ges. Radebeul, Germany. Eng. Pat. 3132, Feb. 8, 1906.

A fat with a low iodine value, *e.g.*, cocoanut oil or cacao butter, is treated with an iodising agent other than hydriodic acid or a chloriodide. Thus, cocoanut oil is mixed, at about 50° C., with alcohol and a solution of iodine in alcohol, and the mixture stirred with a solution of iodic acid in alcohol for about an hour, after which the oil is separated, washed with alcohol, and dried at a low temperature. The product, which contains about 5 per cent. of iodine, is crystalline when cold, has an agreeable taste, and is very stable if protected from light.—C. A. M.

United States Patents.

Pyrocatechinmonoethyl ether; Alkyloxyacetyl compound of ——. R. Berendes, Assignor to Farbenfabr. vorm F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 822,339, June 5, 1906.

Alkyloxyacetylcatechol alkyl ethers are obtained by the action of alkyloxyacetyl chlorides on catechol mono-

alkyl ethers. They possess valuable therapeutic properties, and are decomposed by dilute caustic alkalis. The compound obtained by the action of ethoxyacetyl chloride on guaiacol is a colourless oil, b.pt. 150° C. (10 mm. pressure), soluble in alcohol and ether, and decomposed by alkali hydroxides into guaiacol and ethoxyacetic acid. T. F. B.

Pharmaceutical compound. F. Hofmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 822,370, June 5, 1906.

See Fr. Pat. 355,367 of 1905; this J., 1905, 1189.—T. F. B.

Dialkylmalonyl ureas; Process of making ——. G. Keil, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 822,672, June 5, 1906.

See Eng. Pat. 26,275 of 1905; this J., 1906, 233.—T. F. B.

Beryllium hydroxide; Process of making ——. F. Haber and G. van Oordt, Karlsruhe, and F. Bran, Mannheim, Germany. U.S. Pat. 822,444, June 5, 1906.

See Fr. Pat. 340,027 of 1904; this J., 1904, 799.—T. F. B.

French Patent.

Esters of fatty acids; Process for the decomposition of ——. Ver. Chem. Werke Akt.-Ges. First Addition, dated Dec. 11, 1905, to Fr. Pat. 328,101, Oct. 9, 1902. Under Int. Conv., Jan. 25, 1905.

The esters are subjected to the action of vegetable ferments in the presence of water and manganese sulphate or other metallic salt. Acetic acid may be added at the beginning of the operation, or that formed during the fermentation may be utilised; in the latter case the decomposition is somewhat slower.—W. P. S.

German Patents.

Alkylapomorphinium salts; Process for preparing easily soluble, stable ——. J. D. Riedel, A.-G. Ger. Pat. 167,879, July 30, 1903. Addition to Ger. Pat. 158,020, July 30, 1903 (see this J., 1905, 750).

Stable, soluble alkylapomorphinium salts are obtained by the action of metallic salts (*e.g.*, potassium bromide) on concentrated solutions of the salts of alkylapomorphinium bases with an alkyl hydrogen sulphate.—T. F. B.

C.C-Dialkyl-2.4-diimino-6-oxypyrimidines; Process for preparing ——. E. Merck. Ger. Pat. 168,405, Dec. 20, 1903. Addition to Ger. Pat. 162,657, Nov. 10, 1903 (this J., 1905, 1255).

Dialkylcyanoacetic esters and guanidine can be condensed without the aid of a condensing agent, to form dialkyl-2.4-diimino-6-oxypyrimidines. The products are stated to be particularly pure.—T. F. B.

Dialkylbarbituric acids; Process of preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 168,406, July 7, 1904. Addition to Ger. Pat. 163,136, March 30, 1904.

Alkali metals or their amides may be used in place of alkali alcoholates in the condensation of dialkylmalonic acid diamides and normal carbonic acid esters to form dialkylbarbituric acids.—T. F. B.

p-Dialkylaminobenzhydralamines; Process for preparing ——. E. Merck. Ger. Pat. 167,462, Jan. 9, 1904.

p-Dialkylaminobenzhydralamines are obtained by the action of ammonia on dialkylaminodiphenylcarbinols or their ethers or halogen acid esters. (See also Ger. Pat. 167,462 of 1904; this J., 1906, 608).—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 609.)

Fixation; Theory of ——, *and the action of thiosulphate on development.* S. E. Sheppard and C. E. K. Mees. Phot. J., 1906, **46**, 235—254.

The velocity of fixation of photographic emulsions (*i.e.*, solution of silver halide in the thiosulphate) is directly proportional to the concentration of the thiosulphate solution. It increases rapidly at first, and afterwards becomes constant. The presence of an alkali bromide has no effect on the velocity; neither has "tanning" of the gelatin (by means of formaldehyde), or prolonged exposure of the emulsion to light. Hydrogen and hydroxyl ions slightly increase the velocity of solution. The course of the fixation may be divided into three main reactions which take time (1) "macro-diffusion" through the film, *i.e.*, diffusion combined with absorption; *invasion or penetration*; (2) "micro-diffusion" through the membrane of the grain, very possibly this membrane is only semi-permeable with respect to certain ions; *permeation*, (3) the chemical action itself. With solvents of sufficient concentration, fixation depends mainly on (1) and (2). When thiosulphate is present in acid developers, the rapidity of development is increased; in alkaline developers it is retarded; it is considered probable that, in the former case, silver sulphide is formed and deposited on the image, more especially on the exposed portions, thus causing more rapid development, and, at the same time, fog. In alkaline development, formation of sulphide would be prevented by the presence of hydroxyl ions and SO_3 ions.—T. F. B.

Silver bromide emulsion for the printing-out process. E. Valenta. Brit. J. Phot., 1906, **53**, 466.

Silver bromide emulsified in collodion is found to be suitable for preparing printing-out papers. Bromides of lithium, calcium, and strontium are best suited to the process, the amounts used being so chosen that about one-half of the silver is combined with bromine. The emulsions may contain 18 grms. of silver per litre of 2·5 per cent. collodion. The prints have a purple-violet tone, which changes to yellowish-brown on fixing: they may be toned with gold or platinum, and give reddish or purple-brown tones.—T. F. B.

Asphaltum; Action of light on . V. Vojtech. Phot. Corr., **63**, 284. Phot. J., 1906, **46**, 259.

Glass strips were coated on both sides with a 4 per cent. solution of asphaltum in benzene, and exposed to the action of light in presence of hydrogen, nitrogen, oxygen, carbon dioxide, and air. In presence of air and oxygen, considerable absorption of the gas was noted, and the asphaltum became insoluble in oil of turpentine; the absorption occurred rapidly at first, and the velocity decreased gradually until maximum absorption was attained; the amount of absorption depends on the intensity of the light. In presence of nitrogen, hydrogen, and carbon dioxide, no absorption was observed, and the asphaltum remained soluble as if unexposed. The results were similar whether dry or damp gases were employed, and whatever the variety of asphaltum used. Heat has an action similar to that of light upon asphaltum, which is rendered insoluble by heating to 100° C.—T. F. B.

English Patents.

Photographic film. L. Smith, Croydon. Eng. Pat. 16,999, Aug. 22, 1905.

A celluloid or similar base is coated on each side with one or more layers of gelatin silver emulsion, the layer on the top of the base being faster than that beneath it, or, if more than one layer of emulsion is applied to each side of the base, the speeds of the layers are graduated from top to bottom. The resulting film is stated to be capable of receiving long exposure without exhibiting

the effects of over-exposure, the slower emulsion absorbing the rays of light which have passed through the more rapid layer.—T. F. B.

Photographic printing; Impts. in ——. T. Manly, London. Eng. Pat. 17,007, Aug. 22, 1905.

A PAPER coated with pigmented gelatin is immersed for a short time in a solution containing an alkali bromide, ferrocyanide, and bichromate, and is then laid, face upwards, on a glass plate; a silver bromide or other image consisting of silver is moistened, and placed, face downwards, in contact with the gelatin paper, and the whole allowed to remain for 20 to 30 minutes; the silver is stated to react with the bromide and ferrocyanide, with evolution of hydrogen, which reduces the bichromate, the reduction products of which render the gelatin insoluble. The two papers may now be separated by soaking in hot water, in which case the silver print is converted into a pigment print, or they are soaked in cold water, and separated, and the gelatin layer transferred from its support to a permanent support in the usual way; in this latter case, the bromide print may be redeveloped, and again utilised.—T. F. B.

UNITED STATES PATENT.

Photographic plate for colour photography. A. and L. Lumière, Lyon-Monplaisir, France. U.S. Pat. 822,532, June 5, 1906.

SEE Eng. Pat. 25,718 of 1904; this J., 1905, 152.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 609.)

Gelatin-dynamite; Chemical analysis of ——. T. B. Stillman and P. F. Austin. XXIII., page 656.

ENGLISH PATENT.

Explosives; Manufacture of ——. W. Macnab and Ammonal Explosives, Ltd., London. Eng. Pat. 16,514, Aug. 14, 1905.

THE addition of potassium bichromate to explosives of the "ammonal" type enables a larger proportion of aluminium to be used, so that the explosive force is increased without adding to the danger of igniting fire-damp. A satisfactory composition is as follows:—Ammonium nitrate, 85·5; aluminium, 8; charcoal, 2·5; and potassium bichromate, 4 per cent. An equivalent proportion of a hydrocarbon, such as paraffin or naphthalene, or of a nitrohydrocarbon, such as dinitrobenzene, may be used in place of the charcoal.—C. A. M.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 611.)

APPARATUS, ETC.

FRENCH PATENT.

Carbon dioxide in the atmosphere of rooms, &c.; Apparatus for the determination of ——, *and for other purposes.* A. A. Lévy and A. Pecoul. Fr. Pat. 362,199, Jan. 6, 1906.

THE apparatus employed, consists of a reservoir filled with water, and by means of which, suitable tubes being provided, a known volume of the air can be aspirated through the absorbing part of the apparatus. This consists of a U-tube having a bulb on each limb and three small bulbs at its bend or lower part. Before commencing the operation, a measured volume of alkali is placed in the U-tube, and after the air has been aspirated through it, an acid solution is added. If the indicator present is not decolorised, the quantity of carbon dioxide present is less than 10 parts per 10,000. Additional supplies of alkali and acid are provided, by means of which, with the aid of pipettes, the excess of carbon dioxide above this quantity may be determined.—W. P. S.

INORGANIC—QUALITATIVE.

Phosphorus; Qualitative test for ——. Mauricheau-Beaupré. Comptes rend., 1906, 142, 1206—1207.

THE vapours of phosphoric acid possess the property of etching glass when the latter is heated at a temperature near its fusing point. A short, hot flame should be used, *e.g.*, that of acetylene or hydrogen burning in a Bunsen burner. Whichever gas be employed it is necessary to purify it by absorbing any phosphoretted hydrogen in a tower containing sulphuric and chromic acids. A small piece of glass tubing, 5—10 mm. in diameter, is supported on a platinum wire at the top of the flame in the exterior zone of oxidation, the glass is heated to the fusing point, and the vapours of the substance to be tested are mixed with the gas in the burner. After 10 minutes, etching of the glass is observed if phosphorus be present; this etching action takes place with a slight gain in weight, and with the fixation of phosphorus in the glass. The phosphorus in iron can be liberated by acids, and the gas can be conducted into the air-holes of the burner. In the case of organic compounds, the substance is placed on a platinum wire, and is burnt in the upper part of the blue cone of the flame, the piece of glass being at the top of the flame.—J. F. B.

Gold and platinum; Detection of ——. J. Petersen Z. anal. Chem., 1906, 25, 342—344.

To the faintly acid solution containing gold and platinum, an excess of zinc turnings is added. Mercury, silver, lead, bismuth, copper, cadmium, platinum, gold, arsenic, antimony, tin, and some cobalt and nickel are precipitated on the zinc. After warming for 15 minutes, the precipitate is filtered off, washed, and warmed with dilute hydrochloric acid, which dissolves the cadmium, tin, and excess of zinc, together with some cobalt. The solution is filtered, and the undissolved metal well washed, and then boiled with dilute nitric acid. Mercury, lead, copper, bismuth, and nickel are dissolved, and the residue, now consisting only of gold, platinum, and antimony, is dried and mixed with 1–2 parts of ammonium nitrate and 5 parts of ammonium chloride, and is then ignited in a porcelain crucible. Antimony is volatilised as chloride, and the residue may now be dissolved in a few drops of *aqua regia*, and tested for platinum and gold.—F. SODN.

INORGANIC—QUANTITATIVE.

Cadmium; Determination of ——. C. Goldschmidt. Z. anal. Chem., 1906, 25, 344.

CADMIUM is precipitated completely from solutions of its salts on boiling these in aluminium vessels in presence of a trace of chromium nitrate and cobalt nitrate. The aluminium acts as the catalytic agent. The precipitation is as complete as that of gold by nickel, or that of silver by cobalt, on boiling the solutions.—F. SODN.

Silicates [Glass]; Decomposition of —— *[for analysis].* F. Hinden. Z. anal. Chem., 1906, 25, 332—342.

FOR success in the method described, it is essential that the substance should be reduced to an impalpable powder. After drying, 1 grm. is weighed into a platinum dish, moistened with water, and 10—15 c.c. of concentrated hydrofluoric acid added. After evaporating to dryness on the water-bath, and taking up in 5—10 c.c. of hydrochloric acid (1:1), another 10 c.c. of hydrofluoric acid are added, and the solution is again evaporated to dryness. The silicon will now have been volatilised; the solution is next evaporated six times on the water-bath with 10—20 c.c. of hydrochloric acid (1:1) to completely convert all the bases into chlorides. These are then dealt with in the usual way. The method has been found to give good results with many natural silicates, and also with artificial silicates such as glass.—F. SODN.

ORGANIC—QUALITATIVE.

Flours; Detection of rice in wheat ——. G. Gastine. Comptes rend., 1906, 142, 1207—1209.

THE detection of rice flour in wheat flours is greatly

solitated by treating a trace of the sample on an object lass with a solution of a suitable dyestuff, drying the reparation at about 30° C., and then completing the esiccation by heating for a few minutes at 110°—130° C. The preparation should be mounted in cedar-wood oil or anada balsam and examined under the microscope. For taining, a solution of Aniline Blue or Green may be em-loyed at a strength of 0·05 grm. in 100 c.c. of 33 per cent. lcohol. This treatment has the effect of showing up the ilum of the minute rice-starch granule, whilst wheat starch arely exhibits a visible hilum. In rice flour isolated tarch granules are rare, the granules generally occurring n clusters in starch-bearing cells, several of which may be een together in fragments of the grain. These clusters, ccording to the above method, have a very characteristic ppearance, since the hilum of each starch granule shows p as a reddish-coloured point, these red points being rouped quite uniformly in a symmetrical arrangement esembling a mulberry under a high magnification. Wheat and rice starches do not take up the dyestuff, nly the nitrogenous matters are dyed. The fragments f rice flour therefore appear coloured; the medium sized nd large granules of wheat starch are practically un-oloured, but the small granules of the wheat, in which he interstitial nitrogenous matter is more abundant, are listinctly coloured. The granules of maize and buck wheat starches behave like rice. Potato, arrowroot, and weet-potato starches, unlike the cereal and leguminous tarches, absorb the dyestuff directly.—J. F. B.

ORGANIC—QUANTITATIVE.

Reducing sugars; Unification of methods for the determination of ——. L. S. Munson and P. H. Walker. J. Amer. Chem. Soc., 1906, **28**, 663—686.

The authors recommend the following as a standard method for the determination of reducing sugars. The copper sulphate solution contains 34·639 grms. per 500 c.c.; the alkaline tartrate solution contains 173 grms. of Rochelle salt and 50 grms. of sodium hydroxide per 500 c.c. Twenty-five c.c. of each solution are placed in a Jena beaker of 400 c.c. capacity, and 50 c.c. of the sugar solution are added; if a smaller quantity of sugar solution be desirable, the balance must be made up by water. The beaker, covered by a watch-glass, is heated upon an asbestos-gauze with a flame so regulated that boiling begins in four minutes, and ebullition is continued for exactly two minutes. The cuprous oxide is then filtered off immediately, without diluting, on to an asbestos felt in a Gooch crucible. It is washed with hot water, and finished off with 10 c.c of alcohol, followed by 10 c.c. of ether; the crucible is then dried for 30 minutes in a water-oven, and weighed. The preparation of the asbestos consists of a prolonged digestion with hydrochloric acid, followed by a digestion with "soda" solution, an extraction with boiling diluted alkaline tartrate solution, and digestion with nitric acid. The Fehling's solution deposits a little cuprous oxide when boiled alone without sugar; a blank experiment made each day will correct this error and that due to the solubility of the asbestos in the alkaline liquid. "The presence of sucrose materially increases the reduction of the copper, the amount of increase being influenced primarily by the amount of sucrose present, and secondarily by the amount of invert sugar present." "The amount of sucrose remaining the same, its influence will be less when a large amount of reducing sugar is present than when only a small amount is present." The authors have drawn up tables for use with this method, the values of which are summarised in the following formulæ where y = mgrms. of cuprous oxide and x = mgrms. of reducing sugar:—

For dextrose, $y = 0{\cdot}5614 + 2{\cdot}3484x - 0{\cdot}001209x^2$.
For invert sugar alone, $y = -0{\cdot}2460 + 2{\cdot}2747x - 0{\cdot}001077x^2$.
For invert sugar and sucrose, total sugars = 0·4 grm., $y = 6{\cdot}9886 + 2{\cdot}2279x - 0{\cdot}000703x^2$.
For invert sugar and sucrose, total sugars = 2·0 grms., $y = 20{\cdot}6690 + 2{\cdot}0921x - 0{\cdot}000930x^2$.—J. F. B.

Gelatin-dynamites; Chemical analysis of ——. T. B. Stillman and P. T. Austin. Bull. Soc. Chim., 1906, **35**, 373—376.

The dynamite is cut into small pieces, and the moisture determined by allowing 10 grms. to dry over calcium chloride to constant weight. The residue is digested in the cold, with frequent shaking, for two hours in an Erlenmeyer flask with 200 c.c. of a mixture of 1 part of alcohol and 2 parts of ether, and decanted through a weighed filter, extraction being repeated with fresh solvent until a drop of the extract shows no residue on evaporation. A solution (1) and a residue (2) are thereby obtained.

Solution (1) is evaporated to 100 c.c. without heating, and on adding 100 c.c. of chloroform, and agitating, the soluble nitrocellulose is precipitated, and is dried at 60° C., and weighed. The filtrate is slowly evaporated in a current of air to constant weight. The residue, which consists of a mixture of nitroglycerin, resin, sulphur, paraffin, and nitrates, is extracted with small quantities of cold water to dissolve nitrates of potassium, sodium, and ammonium. Resin may be estimated in the portion which remains by titration with N/1 alcoholic potash. Excess of potash is then added, the mixture is evaporated nearly to dryness so as to completely hydrolyse the nitroglycerin, and the residue is dissolved in water, and extracted with ether. The extract contains resin and paraffin. The aqueous solution is treated with bromine to oxidise sulphur, acidified with hydrochloric acid, warmed, and cooled to 15° C. Resin separates, and is filtered off, dried, and weighed. The solution is precipitated with barium chloride, and the sulphur weighed as barium sulphate, whilst the nitroglycerin is obtained by difference.

Residue (2) is dried at 60° C., cooled, and weighed. Nitrates are extracted with hot water, and estimated in the filtrate. The undissolved residue which contains sulphur and wood pulp is dried at 70° C., and weighed. The sulphur is then separated by digesting with carbon bisulphide, and the residual wood pulp dried at 60° C., and weighed.—B. J. S.

Trade Report.

JAPANESE TARIFF; NEW ——.

Bd. of Trade J., June 14 *and* 28, 1906.

The complete customs tariff of Japan was published on June 14th last as a supplement to the issue of the Board of Trade Journal of that date.

The issue of the Board of Trade Journal for June 28th contains the following notes of errata:—

(i.) *Tariff No.* 129.—*Carbonate of magnesia.*—The new rate is 2·730 yen per 100 kin, not per km.

(ii.) *Tariff No.* 172 (i.). *Light mineral oils* (specific gravity below 0·730).—The reference ‖ to foot-note beginning "Conventional duty on paraffin oil" should be inserted against the words "10 per cent. *ad valorem*" in the third and fifth columns.

New Books.

ANNUAL STATEMENT OF TRADE OF THE UNITED KINGDOM WITH FOREIGN COUNTRIES AND BRITISH POSSESSIONS, 1905. Volume II. [Cd. 3022.] Wyman and Sons, Fetter Lane, E.C. Price 4s. 2d.

This blue book has been compiled at the Custom House from official documents, and contains abstract detailed tables of the trade of the United Kingdom with each country and at each port, together with some miscellaneous tables. The information covers the years 1901 to 1905.

JOURNAL OF THE

Society of Chemical Industry.

No. 14.—Vol. XXV. **SUPPLEMENT.** **JULY 31, 1906.**

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
English.—8*d.* each to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
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Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

CORRECTIONS FOR DECENNIAL INDEX.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

Browne, Dr. Chas. A., jun., l/o New Orleans; Bureau of Chemistry, Washington, D.C., U.S.A.

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Chemical Society; Editor's copy to Dr. J. C. Cain, 28, Pembury Road, Clapton, N.E.

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Horton, Edw., l/o Orford Street; 10, Smith Street, Chelsea, S.W.

Institute of Commercial Research in the Tropics, l/o University; The Municipal Museums, Liverpool.

Lévy, Réné, J., l/o 62; L'Air Liquide, 43, Rue St. Lazare, Paris.

Purves, Geo., l/o Y.M.C.A.; The Refinery, Canal Bank, St. Ambroise Street, St. Henri de Montreal, Canada.

Royle, C. L.; Journals to c/o Parry and Co., Samalkot, Godaveri District, Madras, India.

White, Arthur F., l/o Manningham; 2, Melbourne Grove Thornbury, Bradford.

Change of Address Required.

Scholes, Geo. R., l/o 21, Longue Rue des Claires, Antwerp.

Change of Style.

His Majesty has been pleased to confer the honour of knighthood on Dr. William Henry Perkin, F.R.S.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 24,840A (1905). Clarke, Chapman and Co., and Robson. *See under* VII.

,, 15,047. Shaw. Apparatus for separating solids or liquids from gases or vapours. July 2.

,, 15,048. Shaw. Condensers. July 2.

,, 15,085. Lennox. Drying chambers. July 3.

,, 15,285. Draper (Christ.). Apparatus for separating substances of different specific gravities. July 5.

,, 15,297. Töbelmann. Furnaces. [Ger. Appl., Jan. 11, 1906.]* July 5.

,, 15,645. Allen and Simmonds. Furnaces.* July 10.

,, 15,677. Thwaite. *See under* IX.

,, 15,744. Sutton. Hydro-extractors. July 12.

,, 15,831. Lavington (Brown). Apparatus for filtering solutions containing solid matter. July 12.

,, 15,913. Dunn. Furnaces.

,, 15,947. Whiteley, Whiteley and Peace. Drying machines. July 14.

,, 15,974. Shaw. Apparatus for distilling water, evaporating syrups, &c. July 14.

,, 16,001. Haddan (Aktiebolaget Separator). Centrifugal machines for drying and other purposes.* July 14.

[A.] 16,002. Haddan (Aktiebolaget Separator). Centrifugal separators.* July 14.

,, 16,003. Haddan (Aktiebolaget Separator). Centrifugal machines for drying purposes.* July 14.

,, 16,009. Hoffmann. Hydro-extractors for the recovery of waste products.* July 14.

[C.S.] 7573 (1905). Lake (Sterzing). Furnaces. July 18.

,, 13,602 (1905). Soc. Jules, Jean et Cie., and Raverat. *See under* XVII.

,, 19,670 (1905). Hart. Furnaces for re-heating and like purposes. July 11.

,, 83 (1906). Gobbi. Apparatus for filtering liquids. July 11.

,, 1280 (1906). Barnes. Extraction of liquids from solids. July 18.

,, 3432 (1906). Passburg. Apparatus for drying pulverised, granular and like material *in vacuo*. July 18.

,, 9799 (1906). Grönwall. *See under* X.

,, 10,278 (1906). Schüler. *See under* XVI.

II.—FUEL, GAS, AND LIGHT.

[A.] 14,972A (1905). British Thomson-Houston Co., Ltd. (General Electric Co.). Manufacture of incandescent electric lamp filaments from thorium and like metals. July 6.

,, 14,972. Krogmann. Process for producing air gas, or for carburetting low grade combustible gases. July 2.

,, 15,013. Tervet. Methods of and apparatus for testing gas. July 2.

,, 15,021. Consortium f. Elektrochemische Ind. Incandescence bodies of tungsten for lamps. [Ger. Appl., July 5, 1905.]* July 2.

,, 15,234. Sabatier. Manufacture of gaseous mixtures containing hydrogen and methane. [Fr. Appl., July 5, 1905.]* July 4.

,, 15,295. Albrecht. Method of producing incandescent mantles.* July 5.

,, 15,326. Sabatier. Manufacture of a gaseous mixture containing hydrogen and methane. [Fr. Appl., July 7, 1905.]* July 5.

,, 15,753. Radcliffe. Treatment of "spent liquor." July 12.

,, 15,776. Meyersberg. Production of a gas. July 12.

,, 15,915. Nernst and Stockem. Electric incandescence lamps.* July 13.

[C.S.] 14,098 (1905). Anderson, and Kynoch, Ltd. Suction gas producers. July 18.

,, 15,226 (1905). Parry and Pillinger. Manufacture of coal gas and producer gas. July 18.

,, 16,386 (1905). Koppers. Treatment of gases obtained from the dry distillation of fuel. July 18.

,, 17,038 (1905). Furse. *See under* XV.

,, 19,264 (1905). British Thomson-Houston Co., Ltd. (General Electric Co.). Filaments for electric incandescent lamps. July 18.

,, 3417 (1906). Schatz. *See under* XXIII.

,, 3870 (1906). Pistorius. Manufacture of lighting gas and dense coke from coal dust. July 18.

,, 4077 (1906). Müller. Power gas producers. July 11.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[C.S.] 14,294 (1905). Fell (Korndörfer). Manufacture of emulsifying mineral oils and mineral oil soaps. July 18.

,, 17,267 (1905). Langlands and O'Connor. *See under* VII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 7287A. Johnson (Badische Anilin und Soda Fabrik). Manufacture of naphthalene derivatives.* July 6.

[C.S.] 22,736 (1905). Johnson (Kalle und Co.). Manufacture of organic compounds containing sulphur and of red colouring matter therefrom. July 11.

„ 3107 (1906). Lerman, Schwartz and Pikos. Manufacture of a black dye with by-products including a tanning agent or a second black dye. July 11.

„ 12,518 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. July 18.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 15,133. Thiele, and Soc. Gén. de la Soie Artificielle Linkmeyer. Method of producing cellulose threads. July 3.

„ 15,160. Ribbert. Preparation of discharging resists under vat dyestuffs upon colours capable of discharge by hydrosulphites.* July 3.

„ 15,206. Newton (Bayer und Co.). Dyeing with sulphur dyestuffs. July 4.

„ 15,300. Paechtner. Dressing or sizing for yarns or other textiles.* July 5.

„ 15,618. Bonny and Pritchard. Method of preparing vegetable fibres.* July 10.

„ 15,629. Ellis (Merck). Impregnation of cotton fibres or cotton fabrics. July 10.

[C.S.] 13,580 (1905). Fell (Korndörfer). Process for oiling cotton and other vegetable fibres. July 11.

„ 13,714 (1905). Henry. Processes of cold dyeing. July 11.

„ 22,331 (1905). Johnson (Badische Anilin und Soda Fabrik). Production of stable dyeings. July 11.

„ 23,787 (1905). Brandt. Treating or impregnating textiles, paper, &c., with resins, fatty acids, and the like. July 18.

„ 25,602 (1905). Ellis (Chem. Fabr. von Heyden A.-G.). Manufacture of aldehyde hydrosulphite salts. July 11.

„ 2330 (1906). Summers. Preparation of vegetable fibre for spinning and other purposes. July 18.

„ 4533 (1906). Leishman. Waterproofing composition applicable also as a vehicle for pigments. July 18.

„ 8045 (1906). Soc. Franç. de la Viscose. Manufacture of artificial silk from viscose. July 11.

„ 12,517 (1906). Johnson (Badische Anilin und Soda Fabrik). Removal of colouring matter from dyed or coloured material. July 11.

„ 14,261 (1906). Kalle und Co. Dyeing and printing red on textile fibres. July 18.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 24,840A (1905). Clarke, Chapman and Co., and Robson. Absorbers for ammonia and other gases.* July 3.

„ 15,002. Miebach. Process of producing high-pressed ammonia vapours.* July 2.

„ 15,445. Carlson. Production of nitrogen compositions. [Swed. Appl., Feb. 28, 1906.]* July 6.

„ 15,590. Rinman. Manufacture of alumina compounds.* July 10.

„ 15,591. Jaeger. Manufacture of metal oxides.* July 10.

„ 15,753. Radcliffe. *See under* II.

„ 15,973. Bran and Van Oordt. Separation of beryllia from alumina and iron. [Ger. Appl., July 15, 1905.]* July 14.

[C.S.] 17,267 (1905). Langlands and O'Connor. Apparatus for making sulphate of ammonia. July 11.

„ 5901 (1906). Brünler. Oxidation of the nitrogen of the air, and conversion of the product into nitric acid or its salts. July 11.

„ 9419 (1906). Edwardes. Table salt. July 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 15,292. Chambers. Combined glass tank and pot furnace.* July 5.

„ 15,293. Chambers. Manufacture of glass.* July 5.

„ 15,539. Engelhorn. Treatment of corundum. July 9.

[C.S.] 5302 (1906). Pauls. Composition for making grinding tools. July 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 14,992. Wilson and Wilson. Process for making hydraulic cement. July 2.

„ 15,306. Latham. Utilisation of old plaster casts and other hydrated sulphate of lime, and apparatus therefor. July 5.

„ 15,553. Schougaard. Manufacture of artificial marble.* July 9.

„ 15,631. Altena. Apparatus for treating wood with preservative compositions. July 10.

„ 15,677. Thwaite. Burning or calcining calcareous and argillaceous and mineral substances in rotary furnaces or kilns. July 11.

„ 15,734. Collins. Manufacture of a refractory material. July 11.

„ 15,735. Collins. Manufacture of refractory materials. July 11.

„ 15,808. Simonsen. Cement mixture. July 12.

[C.S.] 6946 (1906). Morgan. Cement kilns. July 18.

„ 9006 (1906). Stowell. Bricks for fireproof and refractory purposes. July 18.

X.—METALLURGY.

[A.] 15,015. Bosshardt and Garda. Smelting furnaces.* July 2.

„ 15,384. MacIvor, Fradd, and The Metals Extraction Corporation, Ltd. Treatment of ores or ore products containing zinc. July 6.

„ 15,535. Plathner and Dorn. Tinning, leading, and soldering metals. [Ger. Appl., March 20, 1906.]* July 9.

„ 15,612. Callow. Compound flux for smelting metal. July 10.

„ 15,626. Colburn. Manufacture or treatment of iron or steel.* July 10.

„ 15,677. Thwaite. *See under* IX.

„ 15,722. Lake (Soc. L'Oxyhydrique Internat.). Soldering and brazing metals. July 11.

„ 15,818. Kaiser. *See under* XI.

[C.S.] 14,532 (1905). Kemper, Damhorst and Utke. Powder for application to patterns for sand moulding. July 18.

„ 20,961 (1905). Kemp. Smelting ores in blast furnaces. July 18.

„ 24,003 (1905). Lake (Parker). Art of producing metallic iridium. July 11.

„ 7451 (1906). Howatt. Mineral washing and separating apparatus. July 11.

„ 9799 (1906). Grönwall. Process for heating, smelting, or reducing materials. July 18.

„ 10,513 (1906). Siemens und Halske A.-G. Alloy for bearings or the like. July 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 14,971. Dickson. Insulating materials. July 2.
„ 15,727. Jungner. Primary galvanic elements. [Swed. Appl., July 12, 1905.]* July 11.
„ 15,759. Butterfield. Insulators and non-conducting material for electrical work. July 12.
„ 15,818. Kaiser. Process for obtaining metals from ores or furnace products in the electric furnace. [Ger. Appl., July 19, 1905.]* July 12.
[C.S.] 24,724 (1905). Clark (Darmstädter). Electrolytic manufacture of metal tubes and other bodies. July 18.
„ 11,498 (1906). Trunkhahn. Process for obtaining electrolytic metal deposits. July 18.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[C.S.] 14,294 (1905). Fell (Korndörfer). *See under* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 15,649. Boult (Schlegel). Oil-paints.* July 10.
[C.S.] 4533 (1906). Leishman. *See under* V.

(*B.*)—RESINS, VARNISHES.

[A.] 15,338. Justice (McKenzie). Method and apparatus for extracting turpentine and other products from wood.* July 5.
„ 15,341. Pickles. Composition of driers for paint, and drying materials for linseed and other drying oils and for varnish. July 6.
„ 15,838. Guittet. Manufacture of driers for paints, varnishes, and oils. July 12.
[C.S.] 8884 (1906). Sommer. Manufacture of mono-coloured linoleum. July 18.

(*C.*)—INDIA-RUBBER.

[A.] 15,638. Price. Refining or purifying india-rubber, gutta-percha, balata, and the like. July 10.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 15,209. Boult (Stange). Manufacture of plastic and elastic substances and artificial leather therefrom. July 4.
„ 15,418. Sebastiano Bocciardo & Co. The tanning of hides. [Ger. Appl., July 6, 1905.]* July 6.
„ 15,648. Dufour. Treatment of tannic extracts.* July 10.
[C.S.] 26,517 (1905). Karle. Process for producing artificial leather. July 11.
„ 3107 (1906). Lerman, Schwartz and Pikos. *See under* IV.

XV.—MANURES, ETC.

[A.] 15,922. Brightmore. Production of fertilisers and the like. July 13.
„ 15,949. Earp-Thomas. Preparing and growing and distributing organisms which fix or gather atmospheric nitrogen. [U.S. Appl., Sept. 29, 1905.]* July 14.
[C.S.] 17,038 (1905). Furse. Method of obtaining manure and fuel from refuse. July 18.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 15,974. Shaw. *See under* I.
[C.S.] 16,589 (1905). Boidin. *See under* XVII.
[C.S.] 22,425 (1905). König. Mechanical blueing apparatus for use in the treatment of sugar. July 11.
„ 10,278 (1906). Schüler. Centrifugal machines for clarifying and washing sugar and similar materials. July 11.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 15,179. Foll. Apparatus for drying yeast. July 4.
„ 15,254. Bailey. Production of sterilised or pasteurised non-deposit beer. July 5.
„ 15,966. Kubessa. Brewing process. [Ger. Appl., July 15, 1905.]* July 14.
[C.S.] 13,602 (1905). Soc. Jules, Jean, et Cie., and Raverat. Recovery of vapours of alcohol, pure or mixed with air, gases, moisture, or other volatile solvents. July 11.
„ 16,589 (1905). Boidin. Process for rendering the carbohydrates in general soluble, principally for grain distillation. July 18.
„ 26,274 (1905). Lee. Process of brewing. July 11.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

[A.] 15,173. Wurm. Method of treating milk.* July 4.

(*B.*)—SANITATION; WATER PURIFICATION.

[C.S.] 25,016 (1905). Stephenson. Apparatus for purifying water or other liquids. July 18.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 10,228A. Johnson (Badische Anilin* und Soda Fabrik). Manufacture of substances resembling celluloid.* July 6.
„ 15,001. Schmidt. Method of making partly transparent papers, and apparatus therefor.* July 2.
„ 15,068. Stock. Paper making machines. July 2.
„ 15,241. Mitchell. Treatment of paper and other surfaces. July 4.
„ 15,527. Eichmann. Production of sulphite cellulose from wood. July 9.
[C.S.] 23,787 (1905). Brandt. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 15,064. Wilhelm Anhalt Ges.m.b.H. Method of producing permanently clear tinctures. [Ger. Appl, Aug. 3, 1905.]* July 2.
„ 15,519 Newton (Bayer und Co.). Manufacture of dialkylbarbituric acids. July 9.
[C.S.] 15,515 (1905). Imray (Meister, Lucius, und Brüning). Manufacture of Δ_4-cyclogeranic acid and derivatives thereof. July 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 8911 (1905). Kelly and Bentham. Preparation and development of photographic plates, films, and the like. July 18.
„ 91 (1906). Deeks. Photographic printing. July 11.

XXII.—EXPLOSIVES, MATCHES, ETC.

[C.S.] 23,920. (1905) Wolfshohl. Apparatus for nitrating cotton or the like. July 18.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 3417 (1906). Schatz. Apparatus for analysing gas. July 18.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 7287A. Johnson (Badische Anilin und Soda Fabrik). Manufacture of naphthalene derivatives.* July 6.

[C.S.] 22,736 (1905). Johnson (Kalle und Co.). Manufacture of organic compounds containing sulphur and of red colouring matter therefrom. July 11.

„ 3107 (1906). Lerman, Schwartz and Pikos. Manufacture of a black dye with by-products including a tanning agent or a second black dye. July 11.

„ 12,518 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. July 18.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 15,133. Thiele, and Soc. Gén. de la Soie Artificielle Linkmeyer. Method of producing cellulose threads. July 3.

„ 15,160. Ribbert. Preparation of discharging resists under vat dyestuffs upon colours capable of discharge by hydrosulphites.* July 3.

„ 15,206. Newton (Bayer und Co.). Dyeing with sulphur dyestuffs. July 4.

„ 15,300. Paechtner. Dressing or sizing for yarns or other textiles.* July 5.

„ 15,618. Bonny and Pritchard. Method of preparing vegetable fibres.* July 10.

„ 15,629. Ellis (Merck). Impregnation of cotton fibres or cotton fabrics. July 10.

[C.S.] 13,580 (1905). Fell (Korndörfer). Process for oiling cotton and other vegetable fibres. July 11.

„ 13,714 (1905). Henry. Processes of cold dyeing. July 11.

„ 22,331 (1905). Johnson (Badische Anilin und Soda Fabrik). Production of stable dyeings. July 11.

„ 23,787 (1905). Brandt. Treating or impregnating textiles, paper, &c., with resins, fatty acids, and the like. July 18.

„ 25,602 (1905). Ellis (Chem. Fabr. von Heyden A.-G.). Manufacture of aldehyde hydrosulphite salts. July 11.

„ 2330 (1906). Summers. Preparation of vegetable fibre for spinning and other purposes. July 18.

„ 4533 (1906). Leishman. Waterproofing composition applicable also as a vehicle for pigments. July 18.

„ 8045 (1906). Soc. Franç. de la Viscose. Manufacture of artificial silk from viscose. July 11.

„ 12,517 (1906). Johnson (Badische Anilin und Soda Fabrik). Removal of colouring matter from dyed or coloured material. July 11.

„ 14,261 (1906). Kalle und Co. Dyeing and printing red on textile fibres. July 18.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 24,840A (1905). Clarke, Chapman and Co., and Robson. Absorbers for ammonia and other gases.* July 3.

„ 15,002. Miebach. Process of producing high-pressed ammonia vapours.* July 2.

„ 15,445. Carlson. Production of nitrogen compositions. [Swed. Appl., Feb. 28, 1906.]* July 6.

„ 15,590. Rinman. Manufacture of alumina compounds.* July 10.

„ 15,591. Jaeger. Manufacture of metal oxides.* July 10.

„ 15,753. Radcliffe. *See under* II.

„ 15,973. Bran and Van Oordt. Separation of beryllia from alumina and iron. [Ger. Appl., July 15, 1905.]* July 14.

[C.S.] 17,267 (1905). Langlands and O'Connor. Apparatus for making sulphate of ammonia. July 11.

„ 5901 (1906). Brünler. Oxidation of the nitrogen of the air, and conversion of the product into nitric acid or its salts. July 11.

„ 9419 (1906). Edwardes. Table salt. July 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 15,292. Chambers. Combined glass tank and pot furnace.* July 5.

„ 15,293. Chambers. Manufacture of glass.* July 5.

„ 15,539. Engelhorn. Treatment of corundum. July 9.

[C.S.] 5302 (1906). Pauls. Composition for making grinding tools. July 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 14,992. Wilson and Wilson. Process for making hydraulic cement. July 2.

„ 15,306. Latham. Utilisation of old plaster casts and other hydrated sulphate of lime, and apparatus therefor. July 5.

„ 15,553. Schougaard. Manufacture of artificial marble.* July 9.

„ 15,631. Altena. Apparatus for treating wood with preservative compositions. July 10.

„ 15,677. Thwaite. Burning or calcining calcareous and argillaceous and mineral substances in rotary furnaces or kilns. July 11.

„ 15,734. Collins. Manufacture of a refractory material. July 11.

„ 15,735. Collins. Manufacture of refractory materials. July 11.

„ 15,808. Simonsen. Cement mixture. July 12.

[C.S.] 6946 (1906). Morgan. Cement kilns. July 18.

„ 9006 (1906). Stowell. Bricks for fireproof and refractory purposes. July 18.

X.—METALLURGY.

[A.] 15,015. Bosshardt and Garda. Smelting furnaces.* July 2.

„ 15,384. MacIvor, Fradd, and The Metals Extraction Corporation, Ltd. Treatment of ores or ore products containing zinc. July 6.

„ 15,535. Plathner and Dorn. Tinning, leading, and soldering metals. [Ger. Appl., March 20, 1906.]* July 9.

„ 15,612. Callow. Compound flux for smelting metal. July 10.

„ 15,626. Colburn. Manufacture or treatment of iron or steel.* July 10.

„ 15,677. Thwaite. *See under* IX.

„ 15,722. Lake (Soc. L'Oxyhydrique Internat.). Soldering and brazing metals. July 11.

„ 15,818. Kaiser. *See under* XI.

[C.S.] 14,532 (1905). Kemper, Damhorst and Utke. Powder for application to patterns for sand moulding. July 18.

„ 20,961 (1905). Kemp. Smelting ores in blast furnaces. July 18.

„ 24,003 (1905). Lake (Parker). Art of producing metallic iridium. July 11.

„ 7451 (1906). Howatt. Mineral washing and separating apparatus. July 11.

„ 9799 (1906). Grönwall. Process for heating, smelting, or reducing materials. July 18.

„ 10,513 (1906). Siemens und Halske A.-G. Alloy for bearings or the like. July 11.

Liverpool Section.

Chairman: J. T. Conroy.

Vice-Chairman: Eustace Carey.

Committee:

J. Campbell Brown.	G. Watson Gray.	Alex. Watt.
Arthur Carey.	C. Longuet Higgins.	W. Collingwood Williams.
H. E. Davies.	Max Muspratt.	
F. G. Donnan.	H. J. L. Rawlins.	

Hon. Treasurer: W. P. Thompson.

Hon. Local Secretary:
W. R. Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

London Section.

Chairman: R. J. Friswell.

Vice-Chairman:

Committee:

E. J. Bevan.	J. Lewkowitsch.	Walter F. Reid.
H. G. Colman.	A. R. Ling.	A. Gordon Salamon.
M. O. Forster.	G. T. Morgan.	P. Schidrowitz.
G. C. Jones.	B. E. R. Newlands.	F. Napier Sutton.
C. A. Keane.	Wm. Pearce.	Thos. Tyrer.

Hon. Local Secretary.
Julian L. Baker, Stainesbury Holt, Kingston Road, Staines.

Manchester Section.

Chairman: G. H. Bailey.

Vice-Chairman: K. E. Markel.

Committee:

H. Benfey.	R. S. Hutton.	W. J. Pope.
W. H. Coleman.	W. E. Kay.	H. Porter.
J. Grossmann.	H. Levinstein.	T. Stenhouse.
W. B. Hart.	H. Morris.	

Hon. Local Secretary:
Julius Hübner, Ash Villa, Cheadle Hulme, Cheshire.

Newcastle Section.

Chairman: H. Louis.

Vice-Chairman: J. T. Dunn.

Committee:

P. P. Bedson.	John Pattinson.	J. A. Smythe.
Ellwood Holmes.	C. J. Potter.	W. H. Sodeau.
W. M. H. Hutchings.	Geo. Sisson.	A. Spiller.
N. H. Martin.	Harry Smith.	C. E. Stuart.

Hon. Local Secretary and Treasurer:
F. C. Garrett, Armstrong College, Newcastle-on-Tyne.

New England Section.

Chairman: Henry Howard.

Vice-Chairman: F. E. Atteaux.

Committee:

C. R. Borland.	J. W. Loveland.	Charles R. Sanger.
Goddard L. Cabot.	L. A. Olney.	F. H. Thorp.
W. A. Gallup.	Edw. D. Pearce.	W. H. Walker.
A. F. Hobbs.	F. C. Robinson.	W. J. Webber.
Lawrence S. Jones.		

Hon. Local Treasurer: Robert W. Neff, 32, India Square, Boston, Mass., U.S.A.

Hon. Local Secretary:
A. A. Claflin, Box 1286, Mass., U.S.A.

New York Section.

Chairman: Geo. C. Stone.

Vice-Chairman:

Committee:

C. Baskerville.	Geo. F. Kunz.	A. Plaut.
Howard B. Bishop.	E. G. Love.	G. A. Prochazka.
V. Coblentz.	E. H. Miller.	W. E. Rowley.
J. B. F. Herreshoff.	R. W. Moore.	Maximilian Toch.
A. C. Humphreys.	T. J. Parker.	

Hon. Local Secretary:
H. Schweitzer, 128, Duane Street, New York, U.S.A.

Nottingham Section.

Chairman: J. M. C. Paton.

Vice-Chairman: J. T. Wood.

Committee:

L. Archbutt.	H. S. Garry.	J. O'Sullivan.
S. F. Burford.	J. Goldings.	G. J. Ward.
F. J. R. Carulla.	F. Stanley Kipping.	J. White.
R. M. Caven.	O. Quibell.	

Hon Treasurer: S. J. Pentecost, Sherwood Rise, Nottingham.

Hon. Local Secretary:
S. R. Trotman, King's Walk Chambers, Parliament Street, Nottingham.

Scottish Section.

Chairman: J. S. Macarthur.

Vice-Chairman: Thos. Gray.

Committee:

R. M. Clark.	Jno. S. Ford.	T. L. Patterson.
W. S. Curphey.	R. Hamilton.	David Perry.
L. Dobbin.	G. G. Henderson.	D. J. Playfair.
Jas. Faill.	J. Falconer King.	R. T. Thomson.
J. Arnold Fleming.	Jas. McLeod.	Chas. W. Townsend

Hon. Secretary and Treasurer:
Chas. E. Fawsitt, 9, Foremount Terrace, Glasgow.

Sydney, N.S.W., Section.

Chairman: R. Greig Smith.

Vice-Chairman: A. Liversidge.

Committee:

W. A. Dixon.	L. Meggitt.	J. A. Schofield.
V. Elliott.	Jas. M. Petrie.	H. G. Smith.
G. Harker.	A. A. Ramsay.	T. Steel.
G. C. Joplin.		

Hon. Local Secretary and Treasurer:
T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.W.

Yorkshire Section.

Chairman: F. W. Branson.

Vice-Chairman: Thorp Whitaker.

Committee:

J. E. Bedford.	J. Garfield.	H. R. Procter.
B. A. Burrell.	H. R. Hirst.	G. E. Scott-Smith.
E. M. Chaplin.	W. McD. Mackey.	G. W. Slatter.
S. M. Davies.	B. North.	A. Smithells.

Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

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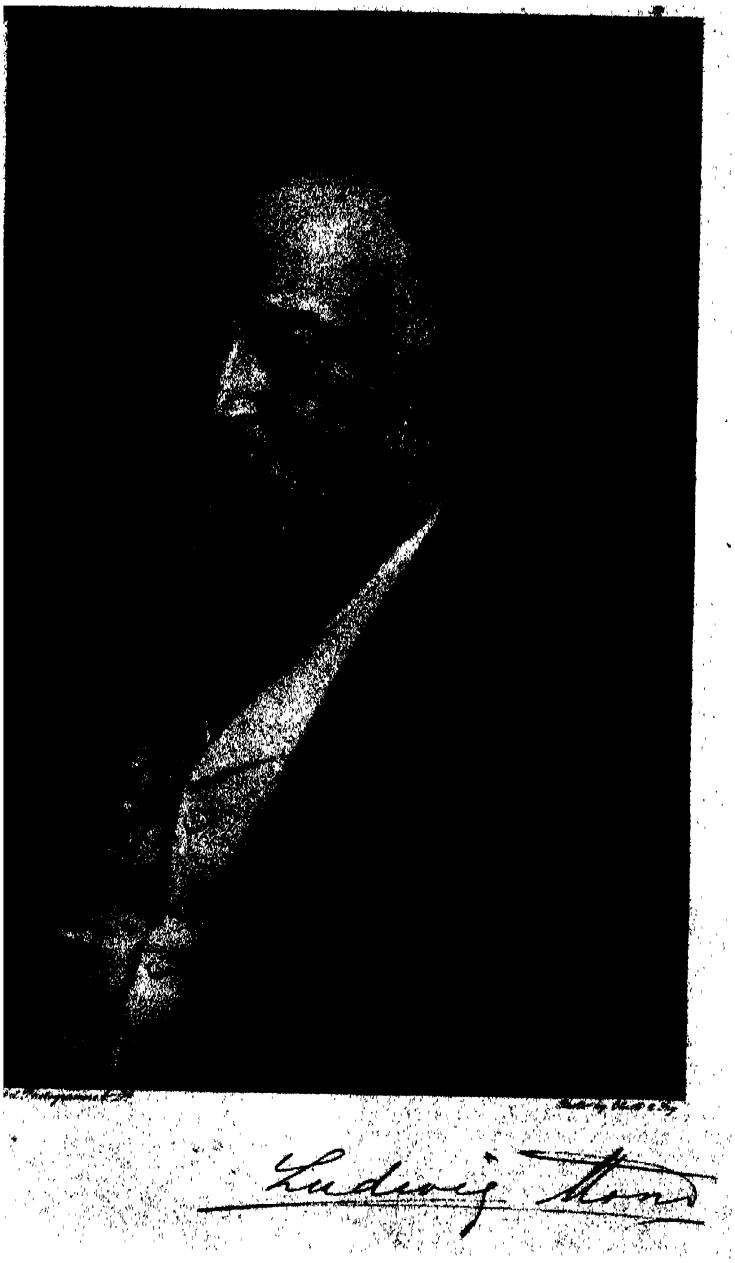
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Ludwig Mond

Change of Style.

His Majesty has been pleased to confer the honour of knighthood on Dr. William Henry Perkin, F.R.S.

PROCEEDINGS
OF THE
TWENTY-FIFTH ANNUAL MEETING.

MANCHESTER;

WEDNESDAY, JULY 11TH, 1906.

The Twenty-fifth Annual General Meeting of the Society was held at the Municipal School of Technology, Manchester, on Wednesday, July 11th, the President, Dr. Edw. Divers, F.R.S., being in the chair.

Among those present were Mr. Eustace Carey (President-Elect), Dr. L. Baekeland, Sir W. H. Bailey, Mr. John Brock, Mr. W. W. Butler, Dr. J. T. Conroy, Mr. G. M. Davidson, Dr. C. Dreyfus, Mr. Thos. Fairley, Dr. C. E. Fawsitt, Prof. P. F. Frankland, F.R.S., Prof. A. G. Green, Prof. C. E. Groves, F.R.S., Mr. Oscar Guttmann, Mr. Samuel Hall, Mr. D. H. Hacking, Mr. D. Roscoe Hardwick, Mr. H. Hemingway, Mr. Julius Hübner, Dr. D. B. Hewitt, Mr. J. M. Irving, Prof. W. R. Lang, Mr. Ivan Levinstein, Dr. J. Lewkowitsch, Dr. K. E. Markel, Mr. T. D. Morson, Mr. J. Worthing, Mr. F. R. O'Shaughnessy, Mr. David Perry, Prof. W. J. Pope, F.R.S., Sir Boverton Redwood, Mr. J. H. Reynolds (Principal Clerk of Manchester), Sir H. E. Roscoe, F.R.S., Mr. F. Scudder, Mr. Watson Smith, Mr. E. R. Taylor, Mr. H. L. Terry, and Mr. Thos. Tyrer.

There was a large attendance of members.

The PRESIDENT read a letter received from the Chairman of the Manchester Section (Dr. G. H. Bailey), expressing regret at his inability to be present, and communicating the hearty welcome which Manchester desired to express to the Society on visiting that city for its twenty-fifth annual meeting.

Dr. HEWITT stated that he had been asked by the Manchester Section to express their hearty welcome to the members on that, the twenty-fifth meeting of the Society. The Society was initiated in Manchester, and he saw on the platform two of those who were present when the Society was inaugurated, Sir Henry Roscoe and Mr. Eustace Carey. He well remembered the long discussion which they had, as to what would be a suitable name for the Society. He was very glad to welcome to Manchester that large national Society, which had now branches not only on this side but abroad. He was much interested in the formation of the American Sections, and was glad to welcome their American friends. He had great pleasure in welcoming the Society on that, the twenty-fifth anniversary of the Society, to Manchester.

The PRESIDENT, addressing Dr. Hewitt, said that, on behalf of the Society, he returned very hearty thanks for the cordial way in which they (of Manchester) had provided the members hospitality. It was a very great pleasure to him to note the active part which Manchester had taken in inaugurating that Society. He proposed a vote of condolence with the Chairman of the section, Dr. Bailey, expressing at the same time their gratification at knowing that he was making rapid recovery to full health again. He suggested that a message be sent saying how much they missed him, and that they were very glad to know he was through with his illness.

The suggestion was approved, and the Secretary was instructed to send such a message to Dr. Bailey.

The PRESIDENT then called upon the Secretary to read the Minutes of the last meeting.

The General Secretary, Mr. CHARLES G. CRESSWELL, read the Minutes of the previous meeting, and of the extraordinary general meeting held on March 27th, with the object of considering and adopting, if approved, a resolution :—

"That it is desirable that the Society of Chemical "Industry, as now existing, should be incorporated "under and subject to the grant of a Royal Charter, "and that the Council be, and hereby is authorised "to take all necessary steps to procure the grant of a "Royal Charter of Incorporation."

The Minutes were confirmed.

The PRESIDENT read letters, expressing regret at their inability to be present at the meeting, from Mr. Forbes Carpenter, Mr. N. H. Martin, Mr. A. Gordon Salamon, and Mr. Chas. Wightman.

NOMINATIONS TO THE COUNCIL.

The PRESIDENT read the list of the new Council, as follows :—

LIST OF COUNCIL, 1906–1907.

President : Eustace Carey.

Vice-Presidents :

Dr. L. Baekeland.	Dr. E. G. Love.
J. Carter Bell.	N. H. Martin.
Dr. Virgil Coblents.	Dr. Wm. H. Nichols.
Dr. Edw. Divers, F.R.S.	Sir Wm. Ramsay, K.C.B., F.R.S.
David Howard.	A. Gordon Salamon.
Dr. J. Lewkowitsch.	Chas. Wightman.

Ordinary Members of Council.

Dr. J. T. Dunn.	Sir Boverton Redwood.
Oscar Guttmann.	Walter F. Reid.
E. Grant Hooper.	Dr. F. J. Smale.
Prof. W. R. Lang.	Thos. Tyrer.
A. R. Ling.	Sir Thomas Wardle.
Dr. K. E. Markel.	R. C. Woodcock.

Sectional Chairmen and Secretaries :

BIRMINGHAM.
Prof. Percy F. Frankland, F.R.S. | F. B. O'Shaughnessy.

CANADIAN.
Prof. W. Hodgson Ellis. | Alfred Burton.

LIVERPOOL.
Dr. Jas. T. Conroy. | W. Roscoe Hardwick.

LONDON.
R. J. Friswell. | Julian L. Baker.

MANCHESTER.
Dr. G. H. Bailey. | Julius Hübner.

NEWCASTLE.
Prof. H. Louis. | Dr. F. C. Garrett.

NEW ENGLAND.
Henry Howard. | Alan A. Claflin.

NEW YORK.
Geo. C. Stone. | Dr. H. Schweitzer.

NOTTINGHAM.
J. M. C. Paton. | R. R. Tatlock.

SCOTTISH.
J. S. McArthur. | Dr. Chas. E. Fawsitt.

SYDNEY, N.S.W.
Dr. R. Greig Smith. | E. V. Walton.

YORKSHIRE.
F. W. Branson. | Thomas Fairley.

Honorary Treasurer.
Samuel Hall, East London Soap Works, Bow, E.

Honorary Foreign Secretary :
Dr. Ludwig Mond, F.R.S.

General Secretary : Charles G. Cresswell, 50, Palace Chambers, 9, Bridge Street, Westminster, S.W.

Telegraphic Address : 50, Palatable, London.

Telephone Number : 7316, Victoria.

The SECRETARY read the Report of the Council of the Society for the past year, as follows :—

REPORT OF COUNCIL.

The number of members on the register is 4,442, as compared with 4,326 at the last Annual Meeting. During the year 371 members have been elected as compared with 452 last year; the losses have been 255 as against 260, and there have been 35 deaths as compared with 41 last year.

The names of those who have died are : Robt. Bardsley, C. A. Bartsch, Percy Bateson, Thos. Christy, Aug. Clark, F. G. Claudet, A. N. Crosskey, Jas. Donald, Jas. Duncan, H. S. Elworthy, R. W. S. Griffith, Dr. W. Hanuaford, G. H. Hurst, Dr. Karl Kellner, Jos. Leese, Dr. J. R. Littlewood, F. Maxwell Lyte, A. R. Meyer, Jas. P. Muir, S. Newgass, W. J. Orsman, J. H. Osmond, L. W. Redpath,

Thos. Royle, D. Russell, Howard P. Ryland, Charles Sevin, Prof. H. Sprengel, F.R.S., Dr. Wm. S. Squire, Robt. Taubman, Jas. Davis Taylor, Sir Charles Tennant, Bart., M. A. Whichelo, W. Watson Will, and Harvey L. Williams.

The Hon. Treasurer's financial report was issued in the Journal for June 30th, and will be laid before the meeting.

The Journal for 1905 numbered 1,334 pages, equal to 55·6 pages for each issue, as compared with 52·2 in 1904. During the past session 85 original papers, with discussions, have appeared in the Journal as compared with 92 in the previous session. Of 24 papers returned to authors by the Publication Committee for recasting, amendment, or condensation, 18 have been published and three have been withdrawn. Thirteen papers and communications have been refused. Mr. T. F. Burton has been appointed Indexer of the Journal in place of Mr. Renaut who has resigned.

Mr. David Howard and Mr. Thomas Tyrer have been nominated by the Council to succeed Mr. Walter F. Reid and Mr. R. Forbes Carpenter as the Society's representatives on the Governing Body of the National Physical Laboratory. Mr. David Howard has since been placed upon the Executive Committee of the Laboratory.

Some discussion took place between the Council and the Governing Body of the National Physical Laboratory with regard to work invited by the Laboratory which came within the scope of the practising chemist; and certain words in a letter from Lord Rayleigh to the President of the Society of Public Analysts, as well as in the Test Pamphlet published by authority, appeared to indicate that this competition with private enterprise might continue. After some correspondence, the Executive Committee promised to modify the wording of the Test Pamphlet, and gave satisfactory assurances in regard to the work of the National Physical Laboratory. Copies of the correspondence were sent to the Institute of Chemistry and the Society of Public Analysts.

It has been decided to petition H.M. the King to grant to the Society a Royal Charter of Incorporation. A requisition, in accordance with By-Law 40, asking the Council to convene an Extraordinary General Meeting of the Society to consider the matter, was presented in December last, and on March 27th the meeting was held at the House of the Society of Arts, at which it was unanimously resolved:—"That it is desirable that the Society of Chemical Industry, as now existing, should be incorporated under and subject to the grant of a Royal Charter, and that the Council be and hereby is authorised to take all necessary steps to procure the grant of a Royal Charter of Incorporation."

On the recommendation of the British Joint Organising Committee, the Council concurred in the opinion that the International Congress of Applied Chemistry should be invited to hold its seventh meeting in London in 1909, and undertook the preliminary arrangements connected with the giving of the invitation in Rome. At the closing meeting of the Congress Dr. Ludwig Mond gave the invitation, and was supported by Prof. W. A. Tilden on behalf of the British Government, Dr. Edw. Divers on behalf of this Society, and Prof. R. Meldola on behalf of the Chemical Society. The invitation was unanimously accepted, Sir William Ramsay was elected President, Sir Henry Roscoe, Hon. President, and the Joint Organising Committee already formed was made the Organising Committee for the next Congress.

A committee has been formed to celebrate the Jubilee of Dr. W. H. Perkin's discovery of the first aniline dye-stuff, and all the members of this Society have been invited to take part in the movement. It is proposed to present Dr. Perkin with his portrait, to be retained by him during his lifetime and afterwards to become the property of the nation, and to place his bust in the rooms of the Chemical Society.

The Council has been able to render some assistance to the Board of Trade in the negotiations in regard to the new Spanish and Portuguese tariffs.

There is every probability that the pledges on the subject of Industrial Alcohol given by the late Chancellor of the Exchequer will be carried out by his successor.

A committee of the Society is at present engaged in collecting evidence to be laid before the Royal Commission on Canals and Waterways.

Representatives of the Society were appointed to join a deputation which waited on the President of the Board of Trade on April 9th to urge upon his attention the subject of Patent Law Amendment, and, in particular, the necessity of putting an end to protection for inventions which are only worked abroad.

In order better to enable members abroad to take part in the elections of the Council, a few simple amendments in the By-Laws are proposed, whereby members will have a little more time to return their Ballot papers.

The medal has on this occasion been awarded to Dr. Ludwig Mond, F.R.S., for his conspicuous services to Applied Chemistry in all the three departments for which the medal was established, *viz.*, his researches, discoveries, and improvements in processes.

Mr. John Brock formally moved the adoption of the Report.

Mr. C. E. Groves said he had great pleasure in seconding the Report, and must, at the same time, congratulate the Council and their fellow members on trying to effect their incorporation as a Royal Society, which would no doubt be carried out.

The Report was adopted.

The Hon. Treasurer (Mr. Samuel Hall) said that in the Journal of June 30th, on page 565, there appeared a statement of last year's working, as nearly correct as it was possible to make it. In the income there had been an increase of £220 from members' subscriptions; entrance fees gave an increase of £35, the total of entrance fees and life composition fees being £486. This was not reckoned as available income. £500 of such money had been invested, and £485 had been received on account of income from investments, being £42 more than in 1904. £237 had been received from advertisements, and £491 from sales, making the working income £6254. As regards expenditure, £1160 extra had been spent in publishing and postage. This, with the Editorial work, which was as before, made the total for publishing the Journal £3679. Two new Sections had been added during the year. Birmingham, an old Section which had fallen out, had been revived, and a vigorous New England Section had been formed. The Sectional expenses had, therefore, a tendency to increase. They, and the Annual Meeting expenses, amounted to £860, being only £24 less than in 1904, which was an exceptionally heavy year. The remaining working expenditure was a little over £1000, £30 in excess of 1904. Towards the Decennial Index £91 had been paid; it was hoped this would be ready early in 1907; it involved a very considerable cost for compilation, and an equally large cost for printing. It would be a very valuable work, and, when within measurable distance of completion, notice would be sent out asking those who wished for copies to send their names and subscriptions, that an estimate might be formed of the number of copies required. Fresh arrangements had been made for indexing the yearly volume, at a less cost, while making the index ready earlier in the year. Mr. Burton had been appointed indexer of the Journal in place of Mr. Renaut, who had resigned.

At this point the Right Honourable James Herbert Thewlis, Lord Mayor of Manchester, arrived, and took his seat on the platform.

Mr. Hall, proceeding, said the final position, the excess of income over expenditure, was a balance of £423 to the good. This was not much, and was £60 less than the dividends from their investments. Careful economy would be necessary, and the Council were considering if they could not increase the income by advertisements. Arrangements had been made for cheques on American banks to be sent direct to the Treasurer. This should be a decided convenience to members on the other side, instead of their having to obtain paper payable in England, and it was hoped it might lead to an increased number of members. The balance sheet to the 31st December, 1905, would be found on page 566 of the Journal, and the receipts and expenditure during the year. That was

the real balance sheet. They had been able to invest £1,000 during the year, and to carry forward £1,100 in cash for the work of the Society this year. All accumulations were invested in first-class securities, and in the name of three trustees.

Mr. THOMAS TYRER moved that a vote of thanks be given to the Hon. Treasurer. He called attention to the narrowness of the margin between the revenue and the expenditure. Mr. Hall had, he said, referred to the responsibility of the Council with regard to economy, but he did not hear that he had referred to the duties of members who valued their privileges in the shape of the JOURNAL. Never mind, Mr. Tyrer said, what was called in business "touting," let them "tout" in a good cause. He ventured to say their duty was to support the Society, and increase the membership and revenue. He proposed a vote of thanks to the Hon. Treasurer. for the work which he had done for them.

Dr. L. BAEKELAND seconded, and the vote was passed with enthusiasm.

The PRESIDENT said that they were now honoured by the presence of the Lord Mayor, who had kindly come to address them on the subject of their visit.

The LORD MAYOR said that he knew they had a programme before them which would be, at any rate, an exhausting tax, not only on their physical endurance, but on some other aspects of their physical capacities, and therefore he would only detain them a moment. He did so with much pleasure that morning, because during the year of his tenure of office as Lord Mayor there had been visits paid to the city by members of societies and members of congresses of various classes of the community, and it had been his pleasure to receive a good number, but of none could he say that his pleasure had been greater than in receiving that morning, on behalf of the city, the members of the Society of Chemical Industry. To begin with, he rather liked the description of their Society as one of industry, and as one of chemical industry. They, probably, above and beyond all others, combined a double capacity. In the first place, the development and industrial application of their researches would make for themselves, he was going to say, large fortunes; many of them did, and were heartily welcome to them and deserved them. In the second place, it was scarcely possible for them to benefit themselves without at the same time benefiting the community. That was the strongest feature of their Society—they benefited society by the tangible means which contributed to the development of their own fortunes. If he might be so rude as to illustrate what he meant, by the case of a gentleman who seconded the last resolution, he had been identified with "Velox," and benefited himself to an enormous extent, but he could not do that without benefiting others at the same time. He (the Lord Mayor) was very glad that it fell to him in his year of office to welcome their splendid Society of Chemical Industry. He trusted their stay in the city might be pleasant, and that the weather might be all that they could wish.

The PRESIDENT, addressing the Lord Mayor, said it fell to him, on behalf of that Society, to express to him their most cordial thanks for the reception which the city of Manchester had given them on that occasion, and to assure him that all were interested in the city of Manchester in respect of its chemical industries. In the old days, the Society owed very much to Manchester. The meeting for forming it took place in Manchester. They thanked the Lord Mayor very heartily for coming there that day to offer that welcome on behalf of the city.

The Lord Mayor now retired.

The PRESIDENT, before proceeding to deliver his presidential Address, expressed the pleasure which it was to him to welcome many of those who were before them. They had to welcome that day Sir Henry Roscoe; Mr. Brock, another founder of the Society, and another of those men on whom so much of the success of the Society had depended; Dr. Hewitt he had already referred to; and there were others, of whom he might name Mr. Tyrer, but there was one among them all that he was particularly desirous of referring to, and that was their President-elect, Mr. Eustace Carey. He now took the opportunity of expressing to him the very great satisfaction they had in the prospect before them of sitting under him for the next year to come, as their President. He called upon Mr. Carey to respond, on behalf of the founders and on his own behalf, in connection with the office they had conferred on him. (Applause.)

Mr. EUSTACE CAREY, who was cordially greeted, said he knew they were as anxious as himself that the President should deliver his Address at the earliest possible moment; he must, however, obey that command by rising and saying how greatly he appreciated the honour they had conferred on him that day, an honour he never had the slightest idea was coming along his way until he had a word from his kind friend Mr. Tyrer. Whatever was coming during the next year, he could only promise one thing, and that was, that as far as his small ability went, anything that he could do to promote the interests of the Society should be done. With regard to the founders of the Society, they were all delighted to see their beloved first President there, to whom he (Mr. Carey) thought they might say that that Society owed more than to any other man. The President had mentioned others: Dr. Mond, Mr. E. K. Muspratt, and Mr. Brunner were invited to attend the first meeting; Dr. Mond invited Manchester men like Dr. Schunck and others, and then Sir Henry Roscoe invited men in London, and the result they saw that day in one of the largest societies that existed. He again thanked the members for the honour they had conferred upon him, and concluded by expressing the hope that at the end of the year they would not be disappointed.

PRESIDENT'S ADDRESS.

The PRESIDENT then read his Address, the full text of which was as follows:—

THE SOCIETY OF CHEMICAL INDUSTRY.

The time and place of this meeting offer a fitting opportunity to take a retrospect of the life of the Society of Chemical Industry. In accordance with the approved custom of reviewing events, when some self-imposed task of public utility has been going on uninterruptedly for a quarter-century, this should be the day on which progress is to be reported, for this assemblage of members constitutes the twenty-fifth Annual General Meeting of the Society. No place more appropriate than Manchester could have been chosen in which to issue that report of progress. It was in Manchester that much of the work was carried out which led up to the formation of the Society of Chemical Industry, and it was here, for six years, that the Journal of the Society was printed and published. Not only is Mr. Watson Smith, who has edited our Journal throughout its existence, a former member of the teaching staff of what was then the Owens' College of Manchester, but Sir Henry Roscoe, the distinguished man who took so large a part in bringing the Society into existence, who was the first President of the Society, and the first chairman of its Manchester Section, was for nearly forty years associated with Manchester, first, as Professor of Chemistry in the Owens' College, and afterwards as one of its Members of Parliament. Only a few years ago, for two years in succession, another President of the Society, Mr. Ivan Levinstein, was chosen from Manchester, and the meeting to-day is the fourth Annual Meeting of the Society that has been held in Manchester.

The Chemical Society, founded in 1841, was 36 years old when the Institute of Chemistry was incorporated (1877), and 40 years old when the Society of Chemical Industry was founded, and the younger bodies have become very successful, without in the least affecting unfavourably the increasing rate of growth of the parent Chemical Society. This fact makes it certain that there is no rivalry in the purposes of these Societies. But that does not lessen the interest of an enquiry into the distinctness

of their provinces from each other, not perhaps so well appreciated as it should be. Manifestly, the titles of these Societies only imperfectly indicate what differences there may be, and not altogether satisfactory is the information as to the nature of these differences which is to be obtained by reference to their articles of Association.

First, let us consider the titles. To everyone, such a title as Law Society or Natural History Society conveys correctly the notion of a society formed for doing something in connection with law or natural history—promoting knowledge of it, as a matter of fact. To call a Law Society a Legal Society would be felt to be the substitution of a puzzling title for the correct one. So much objection is not, however, felt to the use of the title, Historical Society, although History Society would be preferable, because free from the ambiguity, if not oddity, of calling a society, historical. The titles, Chemical Society, Physical Society, Electrical Society, have, however, been accepted without misgiving, and are now not to be changed, even though they cannot be defended. But, at least, we see that the meaning is not the impossible one, that a society is chemical, but that it is a Chemistry Society, a Society which is concerned in some way with chemistry, presumably with its advancement. Between the titles, Chemical Society and Institute of Chemistry, no sufficient distinction can be drawn, since, as here used, "institute" can scarcely be differentiated from "society" to any useful extent.

The titles, "Institute of Chemistry" and "Society of Chemical Industry," are alike to be condemned, with that of "Society of Arts," on the ground that a society is of persons, and not of arts or sciences or anything else, as is seen illustrated in the titles, "Institution of Civil Engineers," of "Naval Architects," &c., "Society of Public Analysts," &c. The founders of the Institute of Chemistry would indeed have correctly named it, "The Institute of Professional Chemists," had it not been for the fact that anyone who is not registered as a "pharmaceutical chemist" or a "chemist and druggist" is punishable with fine should he style himself a "chemist." In the case, too, of the Society of Chemical Industry, such titles as "Society of Chemical Engineers" and "Society of Technical Chemists" had been suggested for it. That neither was adopted was due mainly to the recognition, that it was not sufficiently comprehensive. The excuse for giving it the title, "Society of Chemical Industry," is that this title came into existence as an abbreviation of "Society for the Advancement of Chemical Industry," an earlier title only to be objected to on account of its length, and for a defect common to it and the term, "chemistry," similarly used. It is not for the promotion, except indirectly, of chemical or any other industry that the one society has been formed, or for the promotion of chemistry that the other has been formed. It is for the promotion of knowledge of the ways in which the science of chemistry can be utilised in the industrial arts, that is, in the arts which minister to the needs and desires of mankind, that the one Society exists, and for the advancement of the science of chemistry that the other Society exists. This view of the matter is justified by the fact, that the extended title of the Royal Society is that of being for improving natural knowledge, and that the title of the British Association is that of being for the advancement of science. We are apt to forget that there is chemistry itself, and that there is the science of chemistry: chemistry being the change of substances into other substances, whilst its science is the knowledge of chemical phenomena and their relations of interdependence.

Having seen that the titles, when liberally interpreted, indicate a sharp delimitation of the provinces of the Society of Chemical Industry and the Chemical Society, we may look into the Charters or Articles of Association of the three Societies for fuller information. According to the Charter of the Institute of Chemistry, the object of that Society is to attest by the certificate given to each of its Fellows and Associates that he was admitted into the Society only after he had proved himself qualified to advise concerning the applications of chemistry to the industrial arts. Its object, therefore, marks it off very distinctly from either the Chemical Society (so nearly the same in title) or the Society of Chemical Industry. There must not, in justice, be overlooked, however, the beneficial influence which the Institute of Chemistry exerts upon the advancement of the science of chemistry, and of the knowledge of the applicability of that science to the service of man, by making the attainment of efficiency in applying the science of chemistry to the development of the arts a condition for receiving its fellowship.

In the preamble to the Charter of the Chemical Society, confirmation is to be found of the correctness of the reading of its title which was just now set forth. It is stated in its charter that the Chemical Society was established for the general advancement of chemical science, and that it had till then pursued that object by having discoveries brought under discussion and the results made known to the public. But matters become rather complicated by the circumstance that in the amplification of this statement it is said that the object of the Society is the "advancement of chemical science, as intimately connected with the prosperity of the manufactures of the United Kingdom, many of which mainly depend on the application of chemical principles and discoveries for their beneficial development, and for a more extended and economical application of the industrial resources and sanatory conditions of the community." This may look very like a definition of the object of a society of chemical industry. But it is not really so, and these words, giving a reason why the real object of the Chemical Society should be promoted by the grant of a Royal Charter, only express now the need which was then felt, if the application for the Charter was to be successful, of pleading the commercial utility of that object to an audience little alive to the value of the cultivation of science for its own sake. It has always been fully recognised that the motive of its utility is not the motive for doing most of the work brought before the Chemical Society, but a still higher one, little understood by the world at large, and therefore hardly to be serviceably expressed in the petition for a charter. Very few papers on chemistry in relation to chemical industry have appeared in the Journal of the Chemical Society, and on the occasion when Henry Deacon, describing himself, with a purpose, as "Alkali Manufacturer, Widnes," lectured to the Society, in 1872, on the application of physics and chemistry to explain the catalytic conversion of hydrochloric acid and atmospheric oxygen into chlorine and water, he availed himself of the occasion at the end of the lecture to appeal to the Society to try to attract manufacturers and technological chemists to its meetings by giving them opportunities to read papers on chemistry applied to the arts. Nothing came of the appeal, the Council of the Society apparently recognising the impracticability of admitting such papers into its transactions.

But the objection may be made that the Chemical Society publishes abstracts of papers on chemistry in connection with mineralogy, agriculture, and physiology, and that it did, until April, 1886, publish abstracts on chemistry as used in the arts, and still does so on chemistry used in identifying substances ("analytical chemistry"), thus showing its activity in connection with the applications of chemistry. The answer to this objection is simple. The Chemical Society helps to spread knowledge of the applications of chemistry only as a means to advance the science of chemistry, just as knowledge of the progress of the science of chemistry is seen to be all-important to him who would successfully apply chemical science to the industrial arts.

The Society of Chemical Industry has not yet got a Charter of Incorporation, but in its by-laws the specific object of its establishment is stated to be "to advance applied chemistry in all its branches." In connection with this definition of the object of the Society, it is to be mentioned that "Society of Applied Chemistry" was a title suggested for it before its present one was decided upon, just as recently there was the meeting in Rome, which called itself the Sixth International Congress of Applied Chemistry. The terms "applied chemistry," "applied physics," "applied mathematics," "applied mechanics," and the like, are too firmly planted in the language of technology to leave anyone much hope.

that they will, within a reasonable time, fall into disuse. Nevertheless, the propriety of using such terms must be seriously called in question. In the first place, we have to remember that there is only one science of chemistry, one science of mathematics, and so forth, and certainly in the term, "applied chemistry," by chemistry is meant the science of chemistry. Whether "applied" or not, whether called "analytical," "practical," or anything else, chemistry remains one and the same science still. It follows, almost obviously, at least it does so on reflection, that by "applied" chemistry is not meant chemistry at all, and that it is not an object, at least not a direct object, of the Society of Chemical Industry to advance the science of chemistry. "Applied chemistry" signifies, not chemistry itself, but its applications—it might be to anything; but, by convention, applications to the useful arts and manufactures. The Society of Chemical Industry concerns itself with the applicability, conceived only or verified, as the case may be, of the science of chemistry to the arts, and its object is to advance the knowledge of how and when or where to apply the science of chemistry in manufactures and other undertakings. In brief, its object is to advance the scientific knowledge of chemical technology.

In its by-laws other objects of the establishment of the Society are given, but on examination these so-called objects prove to be nothing but ways and means to be employed in the furtherance of the true object of the Society. As there stated, the second of these objects is said to be to afford its "members opportunities for the interchange of ideas with respect to improvements in the various chemical industries, and for the discussion of all matters bearing upon the practice of applied chemistry." To the first part of this statement, the suspicion of hollowness seems to cling. There are those, indeed, numerous enough, who will give to the world their ideas how particular industries might be improved, and we can receive these ideas for what they are worth. But few ideas which can be acted upon with good promise of success are ever given thus generously to the world, instead of being worked out under the direction of those who have conceived them. Whether or not that be the case, it is not to be supposed that the Society of Chemical Industry endeavours to cultivate this publication of ideas. Then, too, the words quoted, "practice of applied chemistry," will also be felt to have been not well chosen, especially if the comments just now made upon the term, "applied chemistry," meet with approval. Even the substitution of "practice of applying chemistry to the arts," or of "practice of chemical technology," either of which would be an improvement, would not make things right, for part of the difficulty lies in the use of the term "practice." It is not wanted to express what is intended, and it may convey what is not meant. It has elsewhere an accepted professional meaning and may therefore here suggest that the province of the Society of Chemical Industry trenches upon that of the Institute of Chemistry. The third object is said to be "to publish information upon" improvements, and so forth.

It is now suggested that the object of the Society, as understood by the founders, is fully and more definitely expressed as being "To promote in every way the use of the knowledge of how the science of chemistry may be successfully applied to manufactures and other industries." To attain that object, the Society, through its Council and Committees, endeavours to increase and diffuse that knowledge, and to lessen difficulties in the making full use of it, firstly, by organising meetings of its members to receive and discuss communications made to it concerning what purports to be an enlargement of that knowledge; secondly, by publishing a journal of the proceedings of the Society, together with abstracts of letters patent, and other publications concerning such advances in chemistry as seem likely to react upon industry, and concerning proposed or actual changes in the applications of chemistry to the arts; thirdly, by influencing legislation when it affects the development of chemical industries; and, fourthly, by doing such other things, as acquiring and disposing of property, which may be conducive to the attainment of its object.

Some possible misconception of the sense of this phrasing of the object of the Society may be here anticipated and provided for. Men interested and engaged in the pursuit of a chemical industry too often attach a meaning to the word science, which makes them ready to exclaim, when they meet it, that what is wanted is a "practical" knowledge, compared with which "scientific" knowledge is of small account. They attach a contemptuous common meaning to scientific knowledge, associating and even confounding it with what is known as "book" knowledge, a verbal "so-it-is-said" knowledge, included along with other things in the equipment of the well-read and well-informed man. Such knowledge need not be, and usually is not real knowledge at all. It is possible for a man to be textually familiar with the contents of a large treatise on chemistry, and yet be wanting in the qualification of a chemist. Only the practical chemist, to use the current term, can indeed be a chemist, can possess a scientific knowledge of chemistry. But not a few "practical chemists" have been, in the past and perhaps are still to-day, almost without scientific knowledge, and without, therefore, any true claim to be a chemist. Their practical knowledge is mere experience unenlightened by science. There may be a pile of it, but all of it will be without cohesion, unproductive and unprogressive. Apart from his craftsmanship, which may be an invaluable acquisition, his so-called practical knowledge is not worth consideration. To convert the experience of the practical man, to convert in fact any experience, into that real, trustworthy knowledge which is the true scientific knowledge, the matter of that experience must be analysed and resolved into phenomena or events standing or occurring in definite interdependent relations with each other, relations ascertained quantitatively to be such by trained observation and experiment. Only those who handle facts in that way have knowledge of them available for development and progress, and only among practical men, those who do handle facts, can those who have scientific knowledge be found. There is no science not resting on art, practice, experience. The concern of the Society of Chemical Industry is that chemical industries shall be carried out with scientific knowledge, instead of being dependent solely, as they have been and often are, upon that knowledge which is mere experience.

When "science" and "theory" are given their true sense, the contrasts, "science and practice," "theory and practice" lose all the point they are supposed to have. Theory is the quintessence of science, but, unfortunately, much base coin passes for theory. The utterers of these base coin are nearly always the unscientific practical men.

To repeat, all science is practical; the making and extending of science is art, and, obviously, so are its applications, which, when the science applied is chemistry, are the concern of the Society of Chemical Industry. In that familiar collocation, "science and art," we have, according to the dictionary, "art" used as being opposed to "science." This, then, is but another form of the disjunction of "practice" from "science" or "theory"—pseudo-science, pseudo-theory, that is—to which reference has just been made. But the phrase, "science and art," merits more consideration. If "art" is taken here to signify the fine arts, then indeed a striking contrast is offered by the collocation, "art" being the outcome of the emotions, of the æsthetic analysis and estimate of natural phenomena, and "science" being the outcome of the reason, of the intellectual analysis and measure of natural phenomena. But if "art" is taken in its simple sense of being ability to apply the faculties of mind and body to the achievement of a desired end, then any coordination of the terms "science" and "art" ceases to be evident, and their collocation loses significance.

That all science is practical and comes through art is a proposition least evident, probably, when it relates to mathematics, because the science of mathematics deals with such pure abstractions. But on consideration it will be seen how great must be the mental activity when some advance is being made in this science, activity so elaborate as to be only effectively exercised through the external medium of a calculus of operations. The man who merely "reads" mathematics, without acquiring the

mental aptitude or skill to extend either the science or a knowledge of its applicability in aid of other sciences, is no mathematician, though there are many such vain manipulators of symbols who pass as such. Coming to our own science of chemistry, we know that progress in that science can only occur either through incidental or chance discovery, or by mental activity in imagining, from what is known of chemistry, the possible existence of what is as yet no part of the science, and then putting this imagining or conception to the test of experiment. As to incidental or unpremeditated discovery, which is far more frequent as well as far more valued than predicted or anticipated discovery, it is not only necessarily the result of working in the laboratory, but it is also dependent upon the working knowledge, "practical" knowledge, scientific knowledge, of the discoverer, through which alone he is enabled to recognise the discovery for what it is. All advancement in the science of chemistry is therefore the result of and dependent upon the mental and physical practice of an art. There can be a treatise on the art of chemical discovery, just as there can be one on the art of wood-carving, and in either case, the success of the treatise, in making a man into a discoverer or into a wood-carver, will depend upon his previous possession of the requisite ability of mind and sense.

That progress in the knowledge of how to use the science of chemistry for industrial purposes is dependent upon the practice of an art, will be at once admitted —too readily admitted, in fact; for it should not be forgotten how largely the activity in that practice needs to be mental activity. In extending the science of chemistry by laboratory research, the chemist, for the most part, does his own manual work, whereas the chemist in the works still more frequently leaves all manual operations, in the carrying out of his ideas as to applying chemistry to a manufacturing process, to the artisans he has about him, men of experience and skill, but with very little scientific knowledge. There is no such difference as is implied by "scientific" and "practical" between the chemist in the research laboratory and the chemist in the works, except as to object and what that entails. The one is no more and no less a practical man than the other: the one works at the chemical art of extending the science of chemistry, the other at the chemical art of applying the science to effect useful ends; and in both cases the art depends upon the scientific knowledge of the worker. The object does indeed make a great difference in the art in the one case from that practised in the other. The need for inventiveness, for ingenuity, seems often to be much greater in the case of the works chemist than in that of the laboratory chemist. Hence, the satisfaction felt by many "practical" men in thinking of the works chemist as a chemical engineer, and hence also the assertion he makes that the object of the Society of Chemical Industry is essentially chemical engineering. But this greater call for ingenuity is surely more imaginary than real. What difference in kind is there, it may be asked, between the inventiveness, the ingenuity, the engineering skill of a Moissan in preparing fluorine or in distilling the most refractory metals, and that shown by a Solvay and a Mond in applying the knowledge, that common salt and sal volatile can change together into soda and sal ammoniac, to the successful manufacture of these products? And who will maintain that the chemist needs in one pursuit much more knowledge of physics and of the useful arts than he does in the other?

The undoubted difference, which does exist between the two pursuits, lies in this: the chemist engaged in technological pursuits must be economical, putting the consideration of profit and loss before all else, and must, therefore, work upon a large scale and consider the relative cost of materials, apparatus, power and its supply, skilled labour and attendance, handling and carrying of materials, disposal of noxious and other by-products, and several matters besides. The chemist occupied with the extension of the boundaries of science, in making scientific discoveries, need pay very little attention to economy of cost in relation to quantity, having other more pressing interests in view, and the knowledge that the outlay is made almost always once for all. There is only one economy that presses on him, as it does also upon the chemist in the factory; the economy of his own tim To gain this economy, he works on a very small scal because quantity of the product is of little moment, i perfect isolation and the scientific testing of its natu alone being important.

This difference between the two pursuits is inde great, and therein is to be found the reason for the comi into being of the Society of Chemical Industry. Bu before dealing with that, it is to be pointed out that t matter of profit and loss is one which falls fully within t definition already given of the object of the Socie of Chemical Industry. The question of profit and lo in an industry with an essentially chemical basis, fin its solution in the choice of the chemical processes, a in the choice of the plant best fitted to carry out the processes. That choice, at its best, will vary from tin to time with the advancing knowledge of the possib and actual applicability of chemistry to the indust concerned, and with the facilitation of the use of th knowledge.

Before the subject of the character of technologic pursuits is left, it may be of interest to say somethi about the significance of the terms, "chemical enginee and "chemical engineering." That of "engineering" one and the same in origin with "ingenuity," and impli fundamentally, the art or faculty of discovering or inven ing means to accomplish an end, not obviously attainab in known ways, engineering standing towards ingenui in much the same relation as science stands to knowledg That being so, to regard the term, "chemical enginee as signifying nothing more than one skilled in the co struction of chemical plant, is to take an altogether t limited view of it, and therefore an erroneous one. The may be sufficient objection to the use of this term, becau of its being often misunderstood, like the terms, "chemist and "engineer," themselves, but otherwise the titl "chemical engineer," would be much to be commende as being a full and comprehensive, logical and distinctr one, which cannot be said of the term, "applied chemist

After what has now been said in explanation and order to remove misunderstandings due to loose conce tions of the meanings of terms, it is hoped that t definition of the object of the Society which has be here offered as a desirable revision of that contained the by-laws, will be unanimously accepted and adopte in the wording of the new Charter of Incorporatio It reads thus: "The object of the Society of Chemic Industry is to promote in every way the use of the kno ledge of how the science of chemistry may be succes fully applied to manufactures and other industries It is surely a matter of supreme importance that the obje of a movement, which has resulted in the establishme of a great institution like the Society of Chemical Industr should be clearly laid down and apprehended.

Coming now to the history of the making of the Socie of Chemical Industry, we learn that, in 1879, Mr. Jol Hargreaves, of Widnes, was inspired with the thoug of starting in Widnes a chemical society on lines simil to those of the Tyne Chemical Society, which was a association of managers and chemists, not to be co founded with the Newcastle Chemical Society. T first recorded meeting to discuss this scheme took pla on November 21st, 1879, in Widnes. Other meetin followed, and the adhesion of such men as James Muspratt, Ferdinand Hurter, Douglas Herman, a George E. Davis was obtained. The scheme was quick enlarged to be that of a society for South Lancashi and a meeting was called in Liverpool, in January, 188 to consider rules and organisation, with Dr. Ludw Mond in the chair. The Committee appointed by th meeting met in Manchester, on the invitation of Pr H. E. Roscoe (Sir Henry, as he was to be), on April 19t 1880, and became a memorable one. Even before t actual meeting, the movement was set going by whi the formation of a Lancashire Chemical Society was be superseded by that of the Society of Chemical Industr This was done by Mr. Eustace Carey's proposing to S Henry Roscoe the formation of a Society of Chemic Engineers, and obtaining from him his approval of t project. After the already existing Committee h reported to the meeting what it had been doing a

had expressed its inability to make further progress with the scheme for establishing the Lancashire Chemical Society, and the Committee's report had been adopted by the meeting, Mr. Carey initiated the new order of things, at the suggestion, he said, of Mr. H. L. Pattinson, sen., of Newcastle-on-Tyne, by proposing, Dr. D. B. Hewitt, of Manchester, seconding, "that a committee be appointed to consider the question of the formation of a society for the promotion of the application of chemical science to manufactures." The proposal was unanimously adopted, after Dr. Mond had urged the desirability of making it clear by the name to be given to the Society that its basis was not local but co-extensive with the whole of the United Kingdom, and that its object related strictly to applied chemistry. It was also suggested by Dr. Angus Smith that its object should be concerned with the whole field of manufacturing chemistry, and by Mr. J. F. Allen, of Manchester, that it should also take in calico printing, metallurgy, and other industries in which chemistry played a part. Here, then, we see the scope of the new Society fully drafted, for we may take it for certain that in extending its reference beyond the limits of Lancashire and its industries to those of the whole of the United Kingdom, the intention of Dr. Mond and the others was to prevent the future Society being restricted to any one locality or limited to some only of the industries to which the science of chemistry is applicable. Mr. Hargreaves, who had worked so well in setting the stone rolling within this county of Lancaster, handed over at this meeting his secretarial office to Mr. G. E. Davis, then of Manchester, who for two sessions was to act with such advantage to the young Society as the Society's honorary General Secretary.

During the year intervening between this meeting and the meeting in London which inaugurated the Society, Sir Henry Roscoe brought his wisdom and power as an organiser and his knowledge of matters and men to bear upon making the birth of the Society the brilliant event which it turned out to be. It would be ungrateful to overlook the services of the Committee, composed of Messrs. J. Fenwick Allen, J. Brock, J. Campbell Brown, J. H. Crossley, Alfred E. Fletcher, J. C. Gamble, H. Gaskell, jun., Jno. Hargreaves, W. D. Herman, D. B. Hewitt, F. Hurter, L. Mond, J. L. Muspratt, Edward Schunck, Angus Smith, Frank Spence, Peter Spence, and T. E. Thorpe (three of whom and the son of a fourth were to become Presidents of the Society). The Society must for ever feel gratitude to that Committee, but the fact is on record that they, at a very early date and repeatedly afterwards, placed matters largely in the hands of their chairman, Sir Henry Roscoe, and thus imposed upon him, and upon Mr. George E. Davis, a considerable amount of work and responsibility. The minutes of the meetings of the Committee held between that date (April 19th, 1880) and that of the inauguration of the Society (April 4th, 1881) testify to the thoroughness with which Sir Henry Roscoe discharged the obligations he had accepted. No one, again, was more regular in attendance at these numerous meetings than Mr. Carey, whose definition of the object of the proposed Society, as adopted at the Manchester meeting, soon again came under consideration, namely, at the meeting in Liverpool, a week after the Manchester meeting, when it was considered along with several other suggested definitions, from among which it was selected and again unanimously approved and adopted. Later on, the attempt was made to express within the title to be given to the Society the purpose of its formation, but the words, "advancement of chemical industry," thus used, are wanting in the clearness and exactness of the words of Mr. Carey's original motion, namely, "promotion of the application of chemical science to manufactures," which can only be improved upon by substituting "industries" for "manufactures," and making one or two additions.

The Society was inaugurated in London on April 4th, 1881, at the rooms of the Chemical Society, Burlington House; a full report of the proceedings is given in an appendix. Sir Henry Roscoe was elected President; the late Sir Frederick Abel, the late Sir Lowthian Bell, Mr. F. H. Gossage, the late Dr. G. D. Longstaff, Mr. E. K. Muspratt, the late Mr. Hugh Lee Pattinson, Dr. W. H. Perkin, the late Sir Wm. Siemens, the late Dr. Angus Smith, the late Mr. Walter Weldon, the late Prof. A. W. Williamson, and the late Dr. James Young, Vice-Presidents; and a "Committee," consisting of Sir Wm. Abney, Mr. Alexander Chance, Sir Wm. Crookes, Prof. Chas. Graham, the late Mr. Peter Griess, Dr. D. B. Hewitt, Mr. David Howard, the late Mr. James Mactear, Mr. John Spiller, the late Prof. Sprengel, the late Mr. Henry Tate, jun., and Mr. Philip Worsley. The late Mr. E. Rider Cook was hon. treasurer; Mr. Thos. Tyrer was hon. Metropolitan secretary; Mr. Eustace Carey, hon. Northern secretary; Dr. Ludwig Mond, hon. Foreign secretary; and Mr. George E. Davis, hon. general secretary.

The present occasion does not give time for recounting the services rendered to the Society by many of the bearers of these names, and the important influence which they have exerted over the progress of chemistry and of its applications to the arts.

The Society has made a most gratifying progress in the number of its members. Beginning with 297 when founded, it is now about four and a half thousand. At the date of the first Annual Meeting, the number had risen to 1140. In the early life of the Society after that date, the annual increase was more than 200; in 1884 it was even 400, but this rate slowly subsided to such an extent that the total increase for the five years, 1893-7, was only 245. The number then rose again more rapidly with each year, though not uniformly, but since that year the average annual increase has been 146—a remarkable number, it will be admitted, particularly when consideration is given to the fact of the large annual loss by death and defection in so numerous a body which has to be made good before any increase can be shown. The greater rate of growth within the last decade or so expresses the accession of strength consequent upon the opening of Sections of the Society in the United States and, though as yet to a much less degree, in Canada and Australia. It must not be overlooked, however, that the Society had already a considerable number of members in America before the New York Section was formed.

Another interesting comparison of the rate of growth in the numbers of the Society may be made. In 1886 there were 2270 members; in 1900, fourteen years later, there were half as many again, namely, 3460; now, there are nearly double as many as in 1886, namely, 4450, through the addition of nearly 1000 within the last six years. Apart from the great expansion in America and elsewhere abroad, the Society has hardly grown in numbers in the British Isles since, say, 1886. In these islands the membership was distinctly higher in the year 1900 than it is now. Only the London Section and the Yorkshire Section show a noticeable enlargement since 1886, and no falling off from the numbers of the year, 1900. It would be well if we could know exactly why this is, and were able to assure ourselves that, collectively and individually, we none of us are to blame for this stagnation in local growth. A table, showing both the change in the number of the members in every year and in different localities, prepared with the kind assistance of the General Secretary, is appended to this Address.

Throughout its life the Society has been dependent wholly upon the modest subscriptions of its members and the sale of its Journal. In thus receiving the total neglect of benefactors, it has been unlike most of the institutions which are subserving great general interests, even the Chemical Society having received donations and legacies which, apart from its endowment for research purposes, amount to some £4750, with no yearly item of rent to meet out of its income. Notwithstanding the fact of having been left to its own resources, the Society, under the healthy administration of its affairs which it has experienced, neither parsimonious nor too liberal, can show to-day invested funds little inferior in amount to those of the Chemical Society when research and other endowments are not included. It must, however, not be forgotten that, but for the interest on its investments in the past, the Society would have had a balance sheet for 1905 showing expenditure a little in excess of income, not including in this, of course, life com-

position and entrance fees. In 1884, before the Society had funds to invest, this event actually did occur. At present, there are 121 members of the Society who have paid the composition fee, which until 1894 was £15, and since then has been £20.

One characteristic of the Society is that by its constitution it is divided into local Sections. Another hardly less significant character is the diversity of the several pursuits in which its members are interested. Let us consider this character first. It is a tradition, that among the earlier notions of what such a Society as ours should accomplish was that it was to serve to bring together men engaged in the conduct of the applications of chemical science with those who devote their powers to developing the science itself. Desirable, however, as that service undoubtedly is, and effective as it may prove to be in benefiting these two orders of members, it is surely one quite subordinate to that of drawing men together who are occupied with *different applications* of chemistry. Inventiveness is the foremost qualification for success in any progressive industry. Keenness of observation, receptivity for novel ideas, imaginative power, the possession of all these being assumed—for that assumption is indispensable—where shall a man so qualified best turn when he would develop by his inventiveness an industry in which he has interest and training? Indisputably, he must turn to the experience reported in the conversation and writings of others engaged upon problems like his in principle, but unlike them in the field of the operations to which they relate. It is true that the association of men concerned with the same or almost the same industry must be conducive to much good, and have great attractions, and the Society serves excellently for the purpose of thus associating those having the same or closely kindred pursuits and interests. It is evident also that the existence of several specific societies indicates what a great desire there is for opportunities for closer intercourse and fuller consideration of particular interests than a society more comprehensive is supposed to be in a position to afford. But to whatever extent the Society of Chemical Industry may be thought to serve this end sufficiently or to fall short of doing so when compared with the working of a specific association, this purpose, like that just referred to, is of quite minor importance when compared with the possibilities for effecting great things which membership of the Society offers by affording opportunities for interchange of knowledge and ideas between chemical engineers more or less widely separated in the nature of the chemical industries which they are severally advancing. The subject cannot receive further notice on the present occasion, but recognition of this aspect of the unique character of the Society, as promising more than anything else to favour invention and in that way to advance chemical engineering, calls for the utmost attention, when considering the value of the Society to its members and to the cause of chemical technology. It will be seen that, from this point of view, the highest value of membership of the Society is only obtainable by those members who seek to find something of interest in all parts of the work of the Society. He who confines himself to the discussion which his own subject receives in the proceedings of the Society is throwing away the best part of the advantages which membership offers him.

The advantage to the whole Society and to each of its members of having as much as possible of its business conducted at different centres by dividing off the Society into Sections is sufficiently obvious to call for little comment. Meeting together with a frequency impossible for those widely separated by distance, the members of a Section have the opportunity of chancing upon suggestions for invention in their own industry to which procedure in other industries now and again gives rise. Rarely as it must happen that any fruitful suggestion is thus obtained, the chance of it may be of unexpected value. Another and much more obvious advantage is the extension given by the meetings of Sections to the opportunity for the discussion of papers. These discussions at meetings may be not only of value in bringing out more clearly the points of a communication made to the meeting, but help to make the meeting more attractive and serve to show sympathy with the author of the communication in the trouble he has taken to make it. Those, however, who take part in the discussion can seldom be other than those specially informed on the subject, and yet it is the suggestiveness of the paper and its discussion to the members present who are *not* engaged in that branch of chemical industry which promises to be of more consequence than anything it can be to those who are themselves engaged in that branch.

Thirteen Sections of the Society have been formed, the names of which, taken in the order of the dates of their formation, are London, Liverpool, Manchester, Newcastle, Birmingham, Scottish, Nottingham, Bristol, Yorkshire, New York, Canadian, Sydney (N.S.W.), and New England. The limits of this Address preclude the attempt to give some account of each of these Sections. They have shown widely differing degrees of vitality. This Section of Manchester has all along been a very vigorous one. Its first meeting occurred on February 6th, 1883. London, from the density of the distribution of members within the Section, and because of its many chemical industries, could not fail to prove to be the largest of the Sections in the United Kingdom, but its output of papers is not quite so great as it seems, because of the fact of its receiving more papers from beyond its limits than do any of the other Sections. Through no fault of its own or of the Society, this Section is not infrequently taken to be the Society itself, owing to the fact that the headquarters of the Society are also in London, and that the constitution of the Society is imperfectly apprehended by the public, but also due to the prominence it acquires through its great activity.

The value of being members of the Society of Chemical Industry, within a local Section, over that of being members of an independent, self-contained local society, is that a Section of the larger Society has assurance of a longer and much fuller life, in that it is not wholly dependent upon its own efforts, as is a local society, and is not confined within the limits of its own powers. It finds, in the Society of which it is a part, the means of making known to a very much larger body than itself, what it is doing, and in return receives and is influenced largely by what is being done in the other Sections of the Society. "Local centre" is not a good and logical expression, but it is nevertheless one which is peculiarly well-fitted to indicate at once what a local Section of the Society is, as compared with a self-contained local society, since each Section becomes, in a very real sense, the centre for itself of the whole Society, shining its light upon all parts of it, and in return being itself illumined by them. It is indeed hard to imagine the case of a local Section which would not find far more loss than advantage in cutting itself adrift, in order to form itself into an independent association, even though, as is the fact, oceans may separate it from some of the other Sections. Too important to be passed over without comment, notwithstanding the need for brevity, is the spread of the Society into the United States of America to such an extent as to have led to the formation of two Sections there, which include 1350 members. A corresponding growth, rapidly increasing, in Canada and Australia has led to the formation of a Section in each of those countries. Not to dwell upon the evidence of international amity which the existence of these Sections affords, the evidence it also affords of the estimation in which the Society is held abroad is such as ought to induce many in this country to recognise the probable advantage to themselves of joining the Society.

The government of the Society is at present regulated by by-laws, which can be amended, after due notice has been given, at any general meeting of the Society, but it is hoped that the Society may soon have a Royal Charter to work under, and to secure for its recommendations even greater consideration in legislation and other public matters than they have already received.

Only two of the offices of trust and responsibility in the Society can ordinarily be filled for any long period by the same persons, namely, those of the Hon. Treasurer and Hon. Foreign Secretary, although there are means provided by which the services of those who have filled them may be recovered, should a year's interval have shown that the

recall of such persons to office is to be desired in the interests of the Society. In this connection, one of the noteworthy points in the constitution of the Council is that the fact of having been President of the Society confers no qualification to have a permanent place on the Council. Why should it? Since the Council is appointed to administer the affairs of the Society to the best advantage, every member of it should have been elected on the sole ground of the superior fitness for office which he is believed to possess.

Another noticeable point in the constitution of the Council is that the Chairmen and the Honorary Secretaries of all the Sections are, *ex-officio*, members of the Council, and that, as far as practicable, special facilities are afforded for securing their presence at its meetings, and for getting their opinions and advice, when they are obliged to be absent.

The work done by the Council and by its various Committees is and always has been very considerable. Some evidence of this may be obtained by reference to its annual Reports as they have appeared in the Journal of the Society.

Meetings of the whole Society, as distinguished from the many which are held by its various Sections, that is, the Society's General Meetings, are, almost of necessity, rare events, there being usually in one year only the Annual Meeting itself; this year there happens to have been another to consider the application for a Royal Charter. The General Meeting held in London in June, 1881, was not only remarkable as being the first one, but also for the importance of the papers read before it. The next General Meeting was not only the First Annual Meeting, and occupied with important papers, but it has just now the interest attaching to it of having been the first General Meeting held in Manchester. The nineteenth Annual Meeting is memorable for having been the first to be held under an American President, Professor Chandler; the twenty-third for having been held in New York; and the twenty-fourth for having had as its President another American member, Dr. Nichols, of New York. It may be of interest to mention that the reading of papers was excluded from the business of the second Annual Meeting and, with the exception of the fourth Annual Meeting, papers have not since been read at General Meetings. This seems to be the only suitable plan, so long as the Society has its Sectional Meetings for the reading of papers.

The Society started with four Honorary Secretaries, of whom, one of the founders, Dr. Mond, the Foreign Secretary, still fills that office, to the great benefit of the Society. At the second Annual Meeting (1883) Mr. George E. Davis, another of the founders, who, as General Secretary, had been of the greatest service in putting the Society into shape and working order, retired from that office, and was made a Vice-President. At about the same time, the honorary offices of Northern and Metropolitan Secretaries, having become superfluous by the formation of Sections in London, Liverpool, and Manchester, were abolished. A salaried General Secretary was appointed, in the person of Mr. C. G. Cresswell, who still serves the Society with the same zeal which he displayed from the beginning, and now, also, with the skill and judgment which he has acquired during his twenty-four years of office. Mr. Eustace Carey, another founder, the Northern Secretary, was put on the Council, and has always, to the present day, when he is being elected to the office of President, taken great interest in the progress of the Society. Mr. Thomas Tyrer, the Metropolitan Secretary, became Honorary Secretary of the London Section, and has, through the whole life of the Society, served it in the most efficient and self-sacrificing way, and in almost every office, including the highest, for he was President in 1895-96.

Far and away the most important visible work of the Society through its Council, and under the latter through the Editor, Sub-Editor, Abstractors, and Publication Committee of the Council itself, has been the production of the Journal of the Society, which will soon have completed its twenty-fifth annual volume. All who know the Journal seem to agree in recognising its great value and merit. Some go so far as to hold that the Society of Chemical Industry is little else than the producer and publisher of its Journal. If that were so, its existence would be more than justified, and the subscription of each member be more than repaid him in supplying him with the Journal. To what extent it approaches being little else than that, is matter for serious consideration. It has been the chief object of this Address to bring out, to those who may not have recognised it, what great possibilities the Society should possess in helping on invention in the minds of its members. That is something quite above the work of issuing a Journal, even so excellent a one as ours. If, in a sense, it is allowable to look upon that Journal as everything to the members of the Society, that can only be because in so big a Society it affords the only universally available way of letting every member know what is going on in all branches of chemical industries, and not merely in one branch, in the hope that the object of the Society may in this way best be served. But whatever view may be taken of the function of the Journal, its very great value in many ways is evident to everyone familiar with it. From the first, it has been edited by Mr. Watson Smith, acting in accordance with the advice of the Publication Committee, and we cannot wonder at the pride he takes in his fame as Editor of so great a work. For many years Mr. Cresswell has performed an important part of the very great labour of editing, and taken very much interest in successful endeavours to improve the Journal. How well Mr. Burton has done his part in assisting the Editor and Sub-Editor may be learned from the fact of his having been asked to undertake the indexing of the volumes in succession to Mr. Renaut, who, for so long, and until failing health obliged him to lessen his work, has prepared both the Annual and the Collective Indexes. Concerning the arduous services voluntarily given by the Publication Committee, nothing in the way of praise would be excessive. The Society has no benefactions, it is true, but the work of the Publication Committee must be counted as a continuous gift of the greatest value.

There is one serious matter in connection with the publication of the Journal, and that is its cost, even after everything has been done to reduce it without affecting the value of the Journal. In particular, there has to be considered the increasing cost of the collective indexes. They are offered to members at prices far below what they cost, and even at that rate have but a limited sale. Were the Society a business firm, it would naturally withdraw from the further production of collective indexes. But it feels it to be its duty to strive to supply these indexes to its members, for it is difficult to understand how any member who is in earnest in prosecuting work in any part of chemical industry should not want such an index, and should fail to recognise what assistance he might derive from having it at hand and frequently consulting it. It would be a valuable benefaction to the Society and to the cause of progress in chemical industry if some one were to endow the Society with a fund to defray part of the expense of producing the collective indexes, already making too great a demand upon the Society's income.

One other matter about the Society's Journal, of too great importance to be passed over in silence, is the change made a few years ago from a monthly issue to a half-monthly one. This change has made the cost of production of the Journal greater than it was. It is disheartening to know that the change is by no means so much valued as it should be. Everywhere around us we see steps being taken to quicken the rate of transmitting news and information. In sympathy with this, it is the effort of the Council to have all the steps in the progress of applying chemistry to the arts made known as quickly as possible to its members, one means adopted being a fortnightly issue of the Journal. It ought to be, and must be, that every earnest member should welcome the change. The Journal is, however, interesting in a way to many members who are satisfied to take matters easily, and it is some of these who almost resent having to turn over the pages of a new number more than once a month. But, as in the case of the collective indexes, it is the duty of the Council to facilitate reference to the past volumes of the

Journal, so is it its duty to keep its members informed of what is going on with as little loss of time as possible. With the expression of the wish that the importance of keeping our knowledge well up to date, than which, perhaps, no other wish would have in its fulfilment greater effect upon the advance of chemical industry, this Address is brought to an end.

APPENDIX A.

[*Reprinted from the "Chemist and Druggist," April* 15, 1881.]

THE SOCIETY OF CHEMICAL INDUSTRY.

On Monday, April 4, 1881, a meeting was held in the rooms of the Chemical Society, Burlington House, which was notified as the inaugural meeting of a proposed society with the above as the suggested title. About 60 gentlemen were present, including many of the best known chemists of the day. The following statement, which had been previously circulated, will sufficiently explain the proceedings antecedent to this meeting.

At the last general meeting of the Sub-Committee, held at the Owens College, Manchester, on December 14, 1880, it was resolved that a Society of Chemical Engineers be established, and a Sub-Committee was appointed to make preparations for this meeting, and for considering the details of the scheme to be laid before you.

It is not necessary to go into all the particulars which have led up to this meeting; suffice it to say that for some time the want of a Society has been felt, the object of which is the advancement of manufacturing chemistry in the United Kingdom.

In order to accomplish this it is desirable to establish a Society which may be the means of bringing together, at stated intervals, all those who possess chemical, physical, and engineering knowledge, and who use this knowledge in the utilisation of chemical action on a manufacturing scale, and who have the charge of, or an interest in, chemical industries. It may, indeed, prove afterwards desirable to found a distinct branch of the engineering profession, to be composed of persons who possess the aforesaid knowledge, and who may be designated as chemical engineers.

It is unnecessary to state the advantages which would doubtless accrue to the various branches of chemical industry by the training in all chemical, physical, and engineering matters connected with the business, of all those who have charge of processes; but independently of this, such a Society as is proposed to be established would have certain objects in view, which may be briefly stated as follows:—

To enable persons interested in chemical industries to meet, to correspond, and to interchange ideas respecting improvements in the various processes.

To publish information relating to the aforesaid, by means of a journal or otherwise.

To acquire and dispose of property for such purposes, and to do all other things incidental or conducive to the above-named objects, or any of them.

It is proposed that the Society shall consist of members, associates, students, and honorary members.

Members may consist of persons who by their attainments may be considered by the Council to be eligible.

Associates may consist of persons practically engaged in such matters, and considered by the Council and Local Committees to be eligible.

Students may be those who are disqualified by age or otherwise from election as members or associates.

Honorary members must be selected by reason of their distinction in matters relating to chemical industry.

It is proposed that all who subscribe their names to the memorandum shall be admitted as the first members of the Society, and afterwards that all persons be elected in accordance with the bye-laws which your first Council will be instructed to prepare.

There are two features in the scheme which demand attention; the first is to hold meetings at which papers relating to questions of chemical industry may be read and discussed, and the other is to publish a journal whenever the Council deem it advisable and the funds enable it to be done.

It is proposed to hold annual general meetings at such times and places as may be decided upon at each annual meeting, and further, it is proposed to organise district or local sections, branches of the parent Society, at which members and associates may meet oftener and more conveniently than would be possible if only annual meetings were held.

The foregoing statement having been read by Mr. George E. Davis, of Manchester, the honorary secretary *pro tem.*,

Professor Roscoe, who presided, explained briefly the objects of the proposed Society. Having spoken of the work accomplished by other societies, the Chemical, the Institute of Chemistry, and the Society of Public Analysts, he said the new Society would not, in his opinion, interfere with the work of any of these. The idea of those gentlemen who had already worked in connection with it was to found a Society which should stand in relation to chemical industries in much the same position as the Iron and Steel Institute stood in relation to the great iron industries of this country. That Institute had proved most valuable and useful, and he believed this suggested Society would bring results of similar value. After commenting on some of the passages in the statement already quoted, and suggesting that perhaps it might be found desirable to hold two general meetings in the course of each year, one in London and the other in some provincial centre, besides establishing local branches, he proposed—

> That a society for the advancement of chemical industry be and hereby is established.

Mr. W. H. Perkin seconded the motion, which was put to the meeting and declared by the Chairman to be carried unanimously.

The Chairman then called for the next resolution to be proposed, when

Mr. Kingzett rose and said he should like to be allowed to make a few remarks before they proceeded further. As a member of Council of the Institute of Chemistry, and out of loyalty to that institution, he would like it to be considered whether this new Society was really necessary. One of the objects of the Institute was to promote the interests of manufacturing chemistry and of all branches of the science allied thereto. It had, therefore, seemed to many and to himself that there was no reason why the Institute, if properly developed, should not achieve the end proposed to be attained by this Society, and that the latter would but afford a means of drawing another two guineas a year from the pockets of manufacturing chemists. He only offered these remarks for the consideration of members of the Institute.

The Chairman remarked that the resolution to form the new Society had been already carried.

Dr. Longstaff thought they had been taken somewhat by surprise. For his part he could not conceive what this new Society was going to do which the other societies did not, or could not, accomplish. Was it supposed that manufacturers who had studied hard and spent large sums in learning how to improve their processes were going to communicate the result of all their researches at meetings of this Society? If not, what other object was proposed that the other societies could not accomplish? He was an old member of the Chemical Society, and was also a Fellow of the Institute of Chemistry, and should be happy to meet in any other society, but he thought they ought to be told what were the special objects of this proposed association.

Mr. Lowthian Bell said no doubt the Chairman was right in saying that the resolution had been carried by a show of hands, but now that they had before them these *quasi* amendments it might be desirable to point out the anticipated advantages of such a Society. He could corroborate fully what the Chairman had said as to the advantages and utility of the Iron and Steel Institute. He did not know that gentlemen joining that had done so altogether from philanthropic motives, but there were

other good objects which might fall somewhat short of this. They might meet together to discuss subjects of common interest without considerations of abstract benevolence. Perhaps, as one of the parents of the Iron and Steel Institute, he might be supposed to look upon it with especial indulgence, but he had experienced much benefit and pleasure from attending its meetings, and still did so, though not now very actively engaged in manufacture. He considered that the Institute had given to the manufacturing iron interests a degree of dignity which they would not have otherwise attained, and he believed that a similar association would confer equal benefits on the great trades of chemical manufactures. He had no doubt that his old friend, Dr. Longstaff, who was always noted for his candour, would soon come to appreciate the value of such a Society, and would do his best to promote its interests.

A MEMBER pointed out as one object of the new Society, that though among manufacturing chemists there were many fully competent to take a high place among scientific chemists, there were also many engaged in some particular branches of the manufacture who were perhaps too modest to associate themselves with either of the other societies, but who could both give and derive great advantage from practical discussion.

The SECRETARY OF THE CHEMICAL SOCIETY OF NEWCASTLE spoke of the kind of practical discussions which were carried on there, and said that they were of great service to the manufacturers and managers of works who took part in them.

Professor ABEL (President of the Institute of Chemistry) said an objection had been raised to this proposed Society on the ground that it might interfere with the functions of the Institute of Chemistry, and on the other hand it had been suggested that the Institute could fulfil the work which was now desired to be accomplished. Having a little acquaintance with the working of the Institute, he had concluded that the objects proposed by this Society were entirely distinct. He could also add his testimony to the great services which had been rendered by the Iron and Steel Institute, and he saw no reason why an institute of chemical industry should not attain an equally important position. There were subjects of vast importance which persons actually employed in processes would be very happy to discuss together. There had been found no reluctance in the Iron and Steel Institute to discuss subjects in detail, and he did not think such a difficulty was likely to occur.

Dr. HEWITT said that the object of starting this Society was the fact that while good analysts and good manufacturing chemists were to be had abundantly, there was not a sufficient supply of men of engineering skill also versed in the arts of manufacturing chemistry. They could obtain plenty of men capable of carrying through processes in a laboratory, but not competent to apply these on a large scale. There were many processes now awaiting development. His experience was that the difficulties manufacturing chemists had to overcome were rather mechanical than scientific.

Mr. KINGZETT wished it to be understood that his only object in raising the question was to ascertain the views of Fellows of the Institute. The expressions of the President of the Institute quite disposed of any possible objection.

Mr. LOWTHIAN BELL proposed the next resolution: That those who entered their names at this meeting should be the first members of the Society, and should be admitted without entrance fee, and that the same rule should apply to others who joined within the next six months after being approved by the Council. In reference to some remarks that had been made, he hoped that the modesty of those who did not claim to be scientific men would not prevent them from joining the Society. It was practical workers that they wanted. He was glad to see that his friend, Dr. Longstaff, had given in his name, and he hoped that some others who had perhaps come to scoff would remain to help on the Society.

Mr. GOSSAGE seconded this resolution, which was supported by a few words from Dr. Longstaff, and carried unanimously.

The CHAIRMAN said that the next business was to agree upon a name for the Society.

Mr. CAREY proposed that it be called the "Society of Chemical Engineers." His experience, he said, showed that chemistry had far outrun construction, and that the main requirement of manufacturing chemists at the present time was more skill in the construction of apparatus He thought the title suggested would indicate with definiteness that the chief purpose of the Society was to encourage development and engineering ability as applied to chemical action.

This proposal having been seconded, Mr. WELDON moved as an amendment: That the title "Society of Chemical Industry" be adopted. He thought that the suggested title of "Society of Chemical Engineers" would unwisely restrict the objects and membership of the Society, and that if adopted there would be still an opening for one more society. The term "Chemical Industry" included all that could be included by "Chemical Engineering" and something more. Referring to the objections which it had been said existed on the part of manufacturers to give information concerning their processes, Mr. Weldon said that he had often conducted representatives of foreign works over chemical works here, and his experience was that information was always very willingly given. He was confident that, so far as alkali manufacturers were concerned they would very willingly and gladly embrace opportunities to meet together and discuss subjects of common interest.

Professor ARMSTRONG believed that if they entitled the Society a "Society of Chemical Engineers" it would have a very deterrent effect on professional chemists joining. He considered that there existed a great want of a means for bringing together scientific and manufacturing chemists, and a "Society of Chemical Industry" would meet that want. There were many processes awaiting development, and the Society, by offering opportunities for the discussion of these by practical men, would be of great service.

Mr. TYRER said there was an advantage of definiteness about the title proposed by the resolution, while that proposed in the amendment was more comprehensive. Could they not have a composite title which should cover all, and at the same time express the special objects desired, as, for instance, the term "Society of Chemical Industry and Chemical Engineering"?

Dr. MOND said the title "Chemical Industry" undoubtedly included Chemical Engineering, and the latter subject would necessarily be prominent in the work of the Society. At present the term "chemical engineer" was only used by a very small number of persons, and he had found that, as a rule, these knew very little of chemistry. There was great need to educate a class of men who should be engineers and should understand chemistry.

Mr. MUSPRATT said that chemical science was often at fault, as well as engineering skill. There was, for example, still wanted in alkali manufacture a satisfactory process for the recovery of sulphur from the waste. They must take care, in selecting their title, not to frighten off chemists. The term "Chemical Industry" included all.

Mr. FORSTER preferred the term "Chemical Engineers." His experience was to the effect that without engineering skill chemical manufactures could not be carried on with profit, and he was convinced that it was this department of knowledge which it was especially necessary to develop.

Mr. LOWTHIAN BELL would like to ask how the adoption of the term "Chemical Industry" could prevent any chemical engineer from joining the Society? On the other hand, he could easily understand the converse case.

Mr. DAVID HOWARD advocated the adoption of the title "Society of Chemical Engineers" on the ground that he did not know what was meant by "Chemical

Industry." He understood what was an industrious chemist, but the term "Chemical Industry" was so vague as to include too much. The way to fail was to try to include everything. Those who advocated the term "Chemical Engineers" had definite objects, and knew what they wanted to accomplish, and for that reason and on account of the rather uncommon character of the title, he thought the Society more likely to be successful than if entitled vaguely the "Society of Chemical Industry."

Mr. SPILLER pointed out that the title used by members of the Institution of Civil Engineers was M.Inst.C.E., and there might result confusion from Chemical Engineers having the same initials.

Mr. CAREY said that difficulty could be obviated by using the letters Chem. instead of the C. merely. He considered the term "Society of Chemical Engineers" was more likely to attain honoured recognition than "Society of Chemical Industry."

On a show of hands being taken the Chairman declared the amendment carried in favour of the term "Society of Chemical Industry."

The election of office-bearers was then proceeded with and scrutators were appointed to examine the voting-papers, who subsequently reported the result as follows:—

PRESIDENT.
Prof. H. E. Roscoe, F.R.S.

VICE-PRESIDENTS.

Prof. F. A. Abel, F.R.S.	Jas. Young, F.R.S.
Prof. A.W.Williamson,F.R.S.	F. H. Gossage.
I. Lowthian Bell, F.R.S.	E. K. Muspratt.
W. H. Perkin, F.R.S.	H. Lee Pattinson.
Dr. C. W. Siemens, F.R.S.	Walter Weldon.
Dr. Angus Smith, F.R.S.	Dr. G. D. Longstaff.

COMMITTEE.

Capt.W. de W.Abney, F.R.S.	Jas. Mactear.
Prof. Chas. Graham.	H. Sprengel.
W. Crookes, F.R.S.	Henry Tate.
Peter Griess, F.R.S.	Philip Worsley.
Dr. D. B. Hewitt.	J. Spiller.
David Howard.	Alex. Chance.

TREASURER.
E. Rider Cook.

SECRETARIES.

Eustace Carey.	Ludwig Mond.
Thomas Tyrer.	George E. Davis.

In reply to a question as to where would be the head-quarters of the Society, the CHAIRMAN said he supposed that would be settled by Council, but, as the inaugural meeting had been held in London, he should presume that subsequent meetings were also likely to be held there.

A discussion next took place as to the amount of subscription, and both one guinea and two guineas were suggested. It was ultimately decided to fix the first subscription at one guinea, understanding that this arrangement was tentative, and leaving the Council to fix the amount when the requirements of the Society were known.

In regard to meetings, Mr. GEORGE E. DAVIS explained that the idea of the sub-committee who had proceeded in the matter hitherto was that local sections would be formed and would hold meetings in their several localities, and that a general meeting of all sections would be held annually.

It was then agreed to hold a general meeting to receive the report of the Council when the bye-laws and general arrangements had been agreed upon.

Mr. TYRER suggested that the sense of the meeting should be taken, as a recommendation to the Council, as to whether such a meeting should be held in London or in the country. On a show of hands being taken a general preference for London as the place of meeting was indicated.

Votes of thanks to the Chemical Society for the use of their rooms, and to Professor Roscoe for presiding, were passed and acknowledged, and the meeting terminated.

APPENDIX B.

Comparison of Membership in 1886, 1900, *and* 1906.

Year.	1886.	1886.	1900.	1900.	1906.	1906.
Total membership ..	2270	2270	3460	3460	4320	4320
		per cent.		per cent.		per cent.
London	642	28	865	25	888	20·5
Liverpool	184	8	260	7·5	218	5
Manchester	312	13·7	450	13	333	7·5
Newcastle	120	5	105	3	72	1·5
Birmingham	112	5	†	—	96	2
Scotland	251	11	293	8·5	266	6
Bristol	73	3	—	—	74	1·5
Nottingham	75	3	170	5	78	2
Yorkshire	121	5	201	6	232	5·5
Ireland	30	1	—	—	36	1
Other English	115	5	—	—	46	1
United States (other)	96	4	741	21·4	539	12·5
New England	*	—	*	—	220	5
New York (and N.J.)	*	—	*	—	593	14
Canada	*	—	—	—	113	2·5
Other countries	140	6	—	—	484	11

* Included under United States in 1886 and 1900.
† Included with Nottingham in 1900.

The PRESIDENT supplemented the printed matter on page 666, by stating that a chemist had said to him, that he had benefited very considerably by seeing processes carried on in works very different from his own. They could not go to learn into works of the kind they themselves were engaged in. To do that would be monstrous and unfair, but they were able to go and see operations carried out at other works, and it was quite open for them to make use of what they had there seen in the industries they were engaged in themselves.

Sir HENRY ROSCOE proposed a vote of thanks to the President for his Address. He had given an Address about their Society, which from its formation up to its manhood, had become one of the most important scientific societies in the world. He had spoken well and clearly with respect to the objects of the Society.

Sir Henry proceeded to read extracts from the printed Address, to show the value of the opportunities which the Society afforded its members for the interchange of ideas. That, he said, seemed to him a very wise definition of the work of the Society. They, who met in that room in Owens' College five and twenty years ago, might, he thought, be proud of their bantling. He thought the progress of the Society had been unequalled by that of any other society with which he was acquainted. Not only had it received recognition from men of science, for if they looked through the names of their Presidents and Vice-Presidents during the last five and twenty years, they would find that some of the most eminent chemists and scientists had adorned their presidential chair, and had rendered important services in the domain of applied science. He would not mention their names, for they were household words, but he thought that would serve to show that their Society, in the short period of its life, had placed itself on the same plane as the older societies in the country. But they were not only a British Society, they had spread their wings and gone over the field, not only to British Colonies, but to their cousins in the United States; they had ceased to be national and had become international. As one of the founders of the Society, he would like to congratulate them on the great results from the efforts of the President and the members of the Council. He had been struck when he attended the meetings to see the immense interest taken by the members of the Council in the work of the Society. With regard to the desirability of obtaining a Charter, and to the application which had been made for a Charter, he felt that that was a very

important point, and that the obtaining of a Charter would assist them much, and that the efforts made by the Council would meet with success, and that before long, probably before the next meeting of the Society, they would be able to congratulate themselves on having a Charter and on placing the Society in a truly satisfactory position. They were all glad to come to Manchester again; Manchester had always received them well. He had great pleasure in moving that the best thanks of the meeting be accorded to the President for his Address.

Mr. EUSTACE CAREY seconded. He quite indorsed everything which Sir Henry Roscoe had said about the usefulness and the character of the Address. There were two points to which he would like to draw attention; one was, that the President had thought well to record the name of Hugh Lee Pattinson, of Newcastle. It was in 1876 that he made the suggestion, and that suggestion slumbered in their minds until they brought it out on the lines which he intended. There was another point to which the President had alluded: the usefulness of seeing and learning about processes other than their own. That certainly was so, and in their Sectional work it had occurred to him that enough use was not made of the advantages to which the President had alluded. They did not make enough use of them because they were afraid of exposing their ignorance. They were too reticent. A little obscurantism was growing upon them. He remembered speaking about that to Dr. Markel: that they were getting a little too careful about showing to others what they themselves were doing. It arose from the feeling that they were at the top of the tree and that the other fellow might get there himself. Dr. Markel had said: "Well, if the other fellow considers he is at the top of the tree, I am quite certain he won't stop there long."

The vote was passed very cordially.

The PRESIDENT expressed his thanks to the members for the vote which they had just passed to him, and then announced that the next business was the presentation of the Society's medal.

THE MEDAL.

The PRESIDENT said that the Society gave its medal in order to show its high appreciation of, its satisfaction in, and its gratitude for—in a word, to signalise its great pleasure in, the success of the recipient of the medal in advancing chemical industry in one or another of its branches. The Society's aim was to advance or develop the knowledge of the applicability of chemical science to arts and manufactures, and it knew no better way of furthering its object than by pointing out for the benefit of the would-be technologist, someone eminent for the work that he had accomplished in the field of chemical technology. In Dr. Ludwig Mond they met with the man who had been eminently successful in that way. The history of his important inventions, improvements, and discoveries came to them almost like a realised, marvellous dream. Having, in connection with the great British Leblanc soda industry, invented a method by which the sulphur which was used in the manufacture could be profitably recovered, he turned his attention to the Belgian Solvay process, and commenced that wonderful series of discoveries they now owed to his genius. This process had been really discovered, or invented, in this country, but had not been successfully worked, and much later on, it was virtually re-invented by Solvay and made a process which could be carried on in successful competition with the older method of making soda. But in this country, the ammonia soda process became a great success—a brilliant success—by the beautifully simple arrangement adopted by Brunner and Mond, of placing works in Northwich over the salt beds, letting down water into the salt, and pumping it up again as brine into the apparatus. By the addition of various improvements which Mond made in the working, it had become a thoroughly established and signally successful process. In that process, the ammonia soda process, ammonia was the most important agent required. Mond, therefore, turned his attention to the economic production of ammonia, and he ascertained that when coal was burned in an atmosphere of steam, it yielded up practically all its nitrogen in the form of ammonia, and at the same time yielded a form of producer gas, used for fuel, of very considerable value, so that the coal was in no way wasted in giving out the ammonia wanted for the process. Then Mond was struck with the wastefulness of burning this valuable gas in the common way, under steam boilers. He, therefore, proceeded to utilise the discovery made by Groves, of utilising the hydrogen and oxygen in galvanic batteries. He made batteries in which producer gas on one side and air on the other were made to yield up their energy as electromotor force. One difficulty was carbon monoxide, which destroyed the batteries. Mond therefore turned his attention to removing this substance and overcame all the difficulties, and, in conjunction with Langer and Quincke, made one of the most remarkable discoveries, that of nickel carbonyl. He adapted this discovery to another industry, and invented a new metallurgical process to make pure nickel. By Mond's work they were now able, with common salt, common air, and the gaseous product of the lime-kiln, to make soda with the expenditure of comparatively little labour and fuel. That was the magical dream, to the realisation of which he had alluded. Most unfortunately Dr. Mond was not able to be present; but he had written the following letter:—

"Wyfold Court, near Reading,
"July 6th, 1906.

"Dear Dr. Divers,—Up to this date I had hoped and wished fervently that I might be able to take part in the celebration of the Jubilee Meeting of the Society of Chemical Industry in Manchester in the company of many old friends, and to receive from your hands on this occasion the medal of the Society, a distinction which I value very highly, and am particularly proud of having conferred upon me by the Council of the Society at its Twenty-fifth Anniversary Meeting. To my great disappointment, however, my medical adviser decrees that I have not yet sufficiently recovered my energies to enable me to undertake next week a journey to Manchester, and so I must perforce submit.

"As I have been so intimately connected with the Society ever since its foundation, and for some time previously, and have been, during the whole time of its existence, a member of the Council in one capacity or another, I need not assure you that it is a real grief to me not to be present at the celebration of its Twenty-fifth Anniversary—an occasion of rejoicing to all who have, like myself, been connected with the foundation and with the development of the Society, and who have been witnesses of its wonderful growth and of the great services the Society has rendered to its members and the industrial world at large.

"While I cannot be with you at this Meeting, I hope that I may yet have the satisfaction of remaining a useful and active member of the Council of the Society during the second jubilee term of its existence.

"Believe me,
"Yours very sincerely.
"LUDWIG MOND."

The PRESIDENT asked Mr. Eustace Carey to take charge of the medal for Dr. Mond, and to tell him that at that public meeting he (Dr. Divers) had expressed the very great honour which he felt in having, as President, to present that medal to the most perfect example that he knew of the chemical technologist.

Mr. CAREY received the medal from the President's hands, remarking that he need not say how deeply he regretted, and he was sure they all shared in that regret, that Dr. Mond was not there that day. He had very great pleasure in receiving the medal on his behalf, and would endeavour to transmit to him the words to which the President had given expression respecting him.

Dr. D. B. HEWITT moved that Messrs. Miall, Wilkins, Randall, and Co. be re-elected as auditors, at a fee of £10 10s. This was formally seconded by Mr. F. SCUDDER, and carried unanimously.

AMENDMENT OF BY-LAWS.

Sir BOVERTON REDWOOD, alluding to certain proposed amendments of the By-laws, of which printed copies were before the meeting, said that the object of

the amendments was to extend the time in which members residing beyond the seas might send in their ballot lists. He moved the adoption of the alteration of the By-laws, of which notice had been given.

The motion was seconded by Mr. IVAN LEVINSTEIN, and the amendments were adopted.

PLACE OF NEXT ANNUAL MEETING.

Prof. P. F. FRANKLAND, F.R.S., said he had the honour to represent the Birmingham Section of the Society, and on their behalf to extend to the Society a cordial invitation that the Annual Meeting of the Society take place next year in Birmingham. It had met in many provincial towns, including Manchester, Bradford, and Nottingham, and they thought it was now time it should meet in Birmingham, the capital of the Midlands. It was quite unnecessary for him to enlarge on Birmingham; it was a city which need not hide its light under a bushel. It had been used by many societies, and he could assure the meeting that the Society would meet with a reception both warm and welcome. He had very great pleasure in putting it to the Society, that the Annual Meeting be held next year in Birmingham.

Mr. W. W. BUTLER seconded, and on the motion being put to the meeting, it was carried unanimously.

The PRESIDENT said that the next business was the very pleasant one of expressing their thanks to the authorities of Manchester for the use of the Municipal School of Technology for the purposes of their meeting. It was a great thing to find such a splendid palace devoted to the purposes of technology. They ought, therefore, to have very great pleasure in expressing to its representative their great satisfaction, and their hearty thanks for the hospitality of its halls. (Applause.)

Dr. J. LEWKOWITSCH said that he had very great pleasure in seconding the resolution which the President had put before them. He also referred to the magnificent laboratories which bade fair to fill the want of this country in technical education. He himself, as an old Manchester citizen, felt some pride as he saw the growth of that establishment with its splendid site and its glorious laboratories, and thus Manchester had set an example to London, which was now contemplating the establishment of a similar institution. They had there an example of the old saying that what Lancashire did to-day, London and England would do to-morrow.

The vote was unanimously carried with acclamation, and the members then adjourned.

VISITS TO WORKS AND PLACES OF LOCAL INTEREST.

FIRST DAY.—WEDNESDAY, JULY 11TH.

MANCHESTER MUNICIPAL SCHOOL OF TECHNOLOGY.

This institution, with its bleaching, dyeing, printing, and finishing school for textile goods, and for paper-making, is a product of the enterprise of the Manchester Corporation, and of the development in the city, under its auspices, of technical instruction. The school is designed to accommodate the mechanical, electrical and sanitary engineering industries, the chemical and textile industries, architecture and the building trades, printing, and other less important trades and industries. The value of the sites, structures, and equipment of the two buildings exceeds £300,000. The Corporation owe the admirable site on which the school is placed to the liberality of the legatees of Sir Joseph Whitworth, Bart., who also added a gift of £5,000 towards the equipment. In addition, a sum of nearly £14,000 was received from the profits of the Royal Jubilee Exhibition of 1887.

On the left of the main entrance are the administrative offices, comprising the general office, the principal's rooms, and the council chamber, the remainder of the ground floor being allotted to the various classrooms and laboratories connected with the physics and textile departments. On the first floor is the large central hall for examinations or public lectures, and adjoining it are the library and reading rooms, a room for scientific societies' meetings, laboratories, class and lecture rooms for mathematics, and for electrical, mechanical and sanitary engineering. The second floor contains lecture rooms, drawing offices, and laboratories in connection with engineering, architecture and the building trades, the photographic and printing crafts, and electrical engineering. An experimental bakery is also placed on this floor. The organic and inorganic chemical laboratories, the principal chemical lecture theatre, laboratories for metallurgy and brewing, and the woodworking, plumbing and sanitary engineering workshops are placed upon the third floor. On the fourth floor are arranged the dyeing laboratories, an experimental brew-house, a gymnasium, a house painting and decorating workshop, and rooms for bookbinding and lithographic drawing. The astronomical observatory, situated above the fourth floor at the north-east corner of the building, is equipped with an equatorial telescope. The basement is covered by the workshops and laboratories for spinning and weaving, and for mechanical and electrical engineering, including laboratories for experimental motors and dynamos, steam and gas engines, hydraulic appliances, and the testing of materials.

The building in which is installed the department for the bleaching, dyeing, printing, and finishing of textile goods, and for the manufacture, dyeing and finishing of paper, is erected on a plot of land contiguous to the main building. In addition to containing technical laboratories, it is equipped with an extensive experimental plant.

The day departments of the school now form the Faculty of Technology of the University of Manchester, and students may prepare for the degrees of Bachelor and Master of Technical Science (B.Sc.Tech. and M.Sc.Tech.). The school is attended by upwards of 5,500 day and evening students. The principal of the school and Dean of the Faculty is Mr. J. H. Reynolds, M.Sc.

PILKINGTON'S TILE AND POTTERY CO., LTD., CLIFTON JUNCTION.

Leader: Mr. WILLIAM BURTON.

Here the manufacture of tiles of every description, from plain floor tiles of red, buff, or drab clay, to artistic hand-painted tiles for walls, fireplaces, or furniture, is carried out. Ceramic, mosaic, and architectural faïence are also largely manufactured, and during the last three years the Lancastrian pottery, representing the latest achievements of scientific glaze-making, has also been produced. During the last six months an entirely novel style of decoration has been introduced in the form of Lancastrian "Lustre Ware," which rivals the finest lustre wares of the ancient Persian, Spanish-Moorish, and Italian potters.

The following processes were shown and explained:—(1) The preparation and mixing of the primary materials, clays, flint, pegmatite, felspar, &c., used in the various bodies or pastes. (2) The preparation and mixing of the glazing and colouring materials. (3) The shaping of tiles, faïence, and vases: (*a*) tiles by compression of clay-dust; (*b*) faïence by pressing plastic clay in moulds; (*c*) vases, by throwing on the potter's wheel. (4) The firing of the clay into pottery. Various types of potters' ovens were shown, as well as the different pyrometers and pyroscopes used in controlling the firing. (5) The application of glaze to the fired pottery: (*a*) Dipping; (*b*) painting; (*c*) blowing by compressed air. (6) The firing of the glaze, together with the various precautions for obtaining the different colours. (7) The artists' departments, including modelling, designing, and painting.

Afternoon tea was provided for the visitors, and ere leaving a vote of thanks was proposed by Mr. Thos. Tyrer, to the firm, and especially to its director and manager, Mr. W. Burton, for his specially lucid explanatory remarks and demonstrations.

CALICO PRINTING WORKS OF MESSRS. SALIS SCHWABE AND CO., RHODES, NEAR MIDDLETON.

Leader: Dr. J. BÜRGER.

The operations carried on at these works include the bleaching, mercerising, printing, dyeing, and finishing of

cotton piece goods. The cloth to be printed arrives at the works in the grey state, just as it leaves the weaving shop. It contains the natural impurity of the cotton and the "size" added for weaving purposes. The first operation, that of bleaching, is to remove these natural and added impurities. The cloth, in the roll form, is subjected to the action, first, of lime, and afterwards of alkalis and resin, under steam pressure in closed keirs. It is afterwards treated with acid and bleaching liquor. The cloth, after washing, opening out, and drying, is ready for printing. The colours printed may either contain both the colouring matter and the mordant, which is used along with it to effect its fixation; or the mordant alone may in some cases be printed first, the colour being fixed upon the mordant by a subsequent dyeing operation. In the former case the cloth containing colour and mordant is submitted to the operation of steaming, by which the colour is fixed upon the fibre. In the latter case the mordant itself is fixed by a process of "ageing"—that is, by exposure to warm moist air or steam; the cloth is subsequently dyed in a solution of the colouring matter, the combination of mordant and colour being completed by a final steaming, as in the case of direct-printed goods.

The cloth is then subjected to cleansing or soaping operations to remove the excess of colour not fixed in the fibre, and so render the colour bright, and also fast against subsequent washing operations. After this the goods are finished and made up for delivery. The operations at the works also include that of mercerising. The engraving department of the works for the preparation of the copper rollers includes a plant for the electro deposition of copper on iron shells for the purpose of making engraving rollers less costly than those made entirely of copper. A plant for the manufacture of caustic soda, and its concentration by means of multiple-effect evaporators, is included in the works' equipment.

Reception at the Town Hall.

In the evening, the Lord Mayor (the Right Hon. James Herbert Thewlis) and the Lady Mayoress held a reception and conversazione at the Town Hall, at which nearly 600 people were present. The band of the 2nd V.B. Manchester Regiment was in attendance. Around the large hall are the remarkable frescoes illustrative of the city's history, painted by Ford Madox Brown. One represents John Dalton collecting marsh gas.

Second Day.—Thursday, July 12th.

Works of Messrs. Joseph Crosfield and Sons, Ltd., Warrington.

Leaders:—Messrs. J. J. Crosfield, Captain Crosfield, and Dr. K. Markel.

About 300 members of the Society paid a visit to the extensive works of this firm, which was founded by Mr. Joseph Crosfield in 1815.

This party, which contained many ladies, was conveyed, in omnibuses provided by Messrs. Crosfield, to their works at Bank Quay. The following are the chief products manufactured, and the demonstration of the various branches involved was most carefully and elaborately given by the leaders of the several parties.

Soaps.—"Perfection," "Pink Carbolic," and household, laundry, textile and other manufacturing soaps.

Carbosil.—A detergent and water softener, consisting of a double salt of sodium carbonate and silicate, said to combine the advantages of these two detergents without the disadvantages of either.

Erasmic toilet specialities and toilet soaps, &c.

Glycerine.—Crude, 80 per cent.; dynamite, and chemically pure 1·260 S.G.

Caustic soda.—Solid 77—78 per cent.; also powdered, stick, detached, and flaked caustic of the highest purity, and pure caustic liquor of 90° Tw.

Silicate of soda.—Alkaline and neutral lump, and solution in concentration varying from 75° Tw. to 175° Tw.

Speciality.—Water-glass for egg preserving.

Boiler fluid, disinfectant powder, protective paint and black enamel for ironwork, joint box composition for electrical insulation, "Veberine," a pure neutral sterilised vegetable butter.

Tin box making department.—The autogenous soldering of iron was illustrated, and excited considerable interest.

Caustic Soda.

There are two processes in use for the manufacture of caustic soda, the ordinary or lime process, and the Loewig or ferrite process. The former involves the production of a large amount of waste calcium carbonate, for the utilisation of which cement works are in process of construction on the other bank of the Mersey. In the ferrite process, iron oxide or "blue billy" and soda ash are mixed, and heated in a gas-fired revolving furnace for several hours; carbon dioxide is given off and sodium ferrite is produced, which is treated with water in lixiviating tanks, producing a solution of caustic soda of high strength. The ferric oxide thus recovered is used again with fresh soda ash.

A scheme was distributed amongst the visitors, illustrating the manufacture in the various stages, of soap, caustic soda and glycerine.

The firm provided a sumptuous dinner at mid-day, Dr. Markel presiding, and the works orchestra, conducted by Mr. F. H. Crossley, performed a selection of music during its progress.

The President proposed a hearty vote of thanks to Messrs. Crosfield for their exceeding hospitality, and for the kind manner in which the members had been conducted through these marvellous works. The vote was acknowledged by Dr. K. Markel, for the firm.

Not the least attractive demonstration was that following the dinner, *viz.*, the fire brigade and ambulance performances. The large engine sends out 750 galls. of water per minute, and is said to be the highest jet in Lancashire. The drill by a squad of the works volunteer company, and the gymnastic display by the girls, stimulated much interest. Performances were also given by the works brass band, and also by the male voice and mixed voice choirs. Later on in the afternoon, and before leaving, the visitors were entertained to tea in the fine roof-garden.

East Lancashire Paper Mill Co., Ltd., Radcliffe.

Leader: Mr. J. H. Lester.

In the esparto store and cleaning department, room is provided for the storing of over 2000 tons of esparto grass; it also contains the machinery for the mechanical cleaning, and for the opening out of the grass preparatory to boiling.

Rag stores and sorting rooms.—The rags are sorted into grades and passed through the revolving chopper and duster for the purpose of removing mechanical impurities. They are afterwards conveyed to the rag boilers.

Boiling and washing.—The department contains one large spherical boiler for the boiling of rags, eight stationary boilers for the boiling of esparto grass, and the washing pans. After the boiling and the preliminary washing, the esparto is conveyed to special washing engines for the final washing. After this it is bleached in the poachers.

Water purification.—Battery of filters, with pumps, &c., for treating 40,000 gallons of water per hour.

Chemical wood pulp breaking and bleaching department.—Mixing of the different kinds of "chemical wood" (wood cellulose), and opening out of the pulp in two breaking engines. Four large bleaching engines, each capable of holding three tons of cellulose at one time, are provided for the bleaching of the chemical wood pulp. To ensure cleanliness these engines are lined with white tiles. The bleached pulp is passed to the draining house, where the excess of water is removed. The rags are also bleached in this department in a separate engine.

Draining of bleached material.—This building contains nine large drainers, lined with white and cream coloured tiles. After draining, the material is filled into wagons and conveyed to the beating engines. The waste water from the paper machines is passed through filter presses for the purpose of removing the fine fibres and solid matter which it contains. In this manner considerable economy is effected, and these substances are prevented from contaminating the mill effluent. *Press pate or half stuff machines.*—The bleached esparto fibres are passed over a series of settling traps and through mechanical strainers

so as to remove sand, particles of roots, and other foreign matter; they are then passed over the "press pate," and formed into sheets, which are afterwards conveyed to the beaters, in which the fibres are drawn out and disintegrated, so as to make them suitable for the manufacture of the various classes of paper.

Waste paper breaker.—In this department waste paper is reduced to the state of pulp, and is then added to the ordinary paper pulp in the beating engines.

The pulp coming from the beaters is passed to the pulp chests, in which it is mixed with the necessary quantity of water. From here it is conducted over the sand tables and through the revolving strainers on to the endless wire band of the paper machine. The water is gradually removed, and the web of paper formed. The moist web after leaving the endless wire band, now passes between a series of press rollers, by means of which a further quantity of water is pressed out, and it is ultimately conducted over the drying cylinders. A passage through calenders gives the paper the required finish. A still higher finish is obtained by passing the paper through the super calenders.

Soda recovery plant. Multiple effect evaporation.—The waste lye from the esparto boiling is concentrated to about 50° Tw., and afterwards incinerated in a revolving furnace. The "black ash" obtained is finally converted into caustic soda by causticising.

THE MANCHESTER SHIP CANAL DOCKS AND THE CORPORATION SEWAGE WORKS, DAVYHULME.

Leader: Dr. G. J. FOWLER.

The Rivers Department of the Manchester Corporation have charge of all the arrangements for treatment and disposal of sewage, a task of enormous difficulty. A vast sum has been spent in the endeavour to deal with the sewage problem, and the Committee believe they have found a satisfactory solution. Including storm water, the average daily flow of sewage for the year 1901, which may be taken as indicative of other years, was 34,071,019 galls., whilst the average daily dry-weather flow was 25,700,000 galls. Until the last few years the treatment was by chemical precipitation, but this is now rapidly giving place to the bacterial system.

SIR W. G. ARMSTRONG, WHITWORTH AND CO.'S WORKS, OPENSHAW.

Leader: Mr. W. H. COLEMAN.

These works were founded by the late Sir Joseph Whitworth, who began business in Manchester in 1833. They were built in 1880, and have been greatly extended since that time. The total area covered is 40 acres, and an additional 12 acres have recently been acquired for the purpose of further extension. In 1897 Whitworth's firm amalgamated with the great Tyneside shipbuilding firm founded by the late Lord Armstrong. Many of the famous tools and machines invented by Whitworth are still manufactured here. These include surface plates, screw threads, measuring machines, and sundry machine tools. Great ingenuity was displayed in his inventions in connection with the manufacture of rifles, large guns, steel guns, and armour plate. The present establishment at Openshaw comprises departments for engineering, machine tools, gauges, guns, gun mountings, and armour plate, steel works, crucible steel department, iron and brass foundries, tinsmiths' shops, pattern makers' department, metal testing department, laboratories, producer gas plants, two complete ammonia recovery plants, general offices and drawing offices. The number of hands employed is 4,163.

THE CORPORATION ELECTRICITY WORKS, STUART STREET.

Leader: Mr. W. H. COLEMAN.

The area of the works is about eight acres. Three-phase alternating currents, with a frequency of 50 cycles per second, are generated at the main power house at an extra high pressure of 6,500 volts, and are transmitted at this pressure to the sub-stations. The supply from the sub-stations is at 500 to 550 volts pressure for supplying to the tramways, and at 410 and 205 volts pressure for lighting and power purposes.

The plant in the engine room consists of six main 1500 kilowatt three-phase alternator sets. Each of the main engine sets consists of a 2500 i.h.p. vertical cross-compound engine running at 94 revolutions per minute, and a 1500 kilowatt three-phase alternator, generating current at a pressure of 6500 volts with a periodicity of 50 cycles per second. The high pressure and low pressure cylinders of the engine are 36 in. diameter and 71 in. diameter respectively, by 3 ft. 6 in. stroke. They are steam jacketted, and are fitted with Dobson's "Corliss" valve gear. Over one hundred miles of cable are required for connecting the sub-stations with the generating station.

The extension plant at Stuart Street Works consists of two 6500 h.p. triple expansion engines, and twelve Babcock and Wilson boilers. The engines are run condensing, and the cooling towers are by Messrs. Klein's, Messrs. Koppel, and the Wheeler Condenser Company. The total horse-power at Stuart Street is 28,000 h.p.

Opportunities were also given to members for visiting the following institutions: The University, Municipal School of Technology, Art Gallery, The John Rylands Library, Chetham Hospital and Library, and the Whitworth Institute.

THE ANNUAL DINNER.

The annual dinner was held at the Grand Hotel, Aytoun Street. Dr. E. Divers, the President, presided, and he was supported by Mr. Eustace Carey (President-elect), Alderman I. Frankenburg (Mayor of Salford), Alderman Sir James Hoy, Alderman Sir Bosdin T. Leech, Sir W. H. Bailey, Mr. Ivan Levinstein, Mr. J. H. Reynolds, Professor Schuster, Dr. D. B. Hewitt, Professor W. R. Lang, Mr. Thomas Tyrer, Alderman Joseph Thompson, Mr. O. Guttmann, Dr. Julius Lewkowitsch, Dr. L. Baekeland, Dr. K. E. Markel, Mr. C. E. Groves, Professor W. J. Pope, Mr. J. Crosfield, and the Hon. Secretary, Mr. Julius Hübner.

The CHAIRMAN said, before proceeding with the toasts set down on the programme, he desired, on behalf of the Society, to express their thanks to Messrs. Joseph Crosfield and Sons, for the privilege of inspecting their works, for the admirable arrangements made for the inspection, and for the hospitality extended throughout the day.

Dr. K. E. MARKEL acknowledged the expression of thanks on behalf of himself, his co-directors, and the staff employed by the firm.

The CHAIRMAN proposed "The Health of the King."

The CHAIRMAN expressed regret at the absence of the Lord Mayor of Manchester, owing to a long-standing engagement, but he was glad to see they had with them His Worship the Mayor of Salford (Alderman Frankenburg), and they had also Sir James Hoy, who had come there partly in consequence of the absence of the Lord Mayor, in order that he might show attention to them on behalf of the City of Manchester. They had also Sir Bosdin T. Leech, an ex-Mayor of Manchester, and they had also that well-known citizen and ex-Mayor of Salford, Sir William Henry Bailey.

After a telegram which had been received from Dr. Ludwig Mond, acknowledging receipt of the Society's medal, had been read,

Dr. DAVID B. HEWITT, in proposing "The City of Manchester and the Borough of Salford," paid a high compliment to the admirable manner in which their affairs were managed. There had been a succession of most able Mayors and Lord Mayors of the two towns that ought, in his opinion, to be one. Both places had exhibited a vast amount of enterprise in various directions, and the only fault he could find with them was that they had not paid sufficient attention to sewage purification. In that respect neither of the towns was what it ought to be, but he hoped there would be a change within the next few years.

Alderman Sir JAMES HOY, in responding, said that in the various phases of municipal life Manchester had done fairly well, and was not behind other places. In the last two or three years much wider demands had been

made on municipalities than had been the case in the past. Alongside these demands was the growing necessity for economy. To his mind the question of making life worth living to a community was one of the greatest problems that any body of men could have entrusted to them.

Alderman FRANKENBURG (Mayor of Salford) admitted that Manchester was a glorious city, and if to that they would add "ancient and royal," they could imagine what Salford was like.

Sir WILLIAM BAILEY also responded.

Sir BOSDIN T. LEECH gave "The Society of Chemical Industry." Alluding to the sewage purification problem, he remarked that if Manchester had not been restricted by the Local Government Board, and had been allowed to fully adopt the advice of its chemical advisers, the city would by now have had a perfect sewage scheme. He coupled the toast with the name of the President, and complimented him on the success of his efforts to impart chemistry to the Japanese.

The CHAIRMAN, in replying, said that Japan, with which Sir Bosdin Leech had associated him in too complimentary terms, largely owed its success to the fact that it had applied science to the business of life—to the army, navy, and education.

Mr. EUSTACE CAREY, President-elect, said it was a great pleasure to him to think the Society had "come of age," but it would be some years before they arrived at maturity, as they had a great future before them, and a great deal of work to do. Their first interest was in applied science and technology; at the same time they were not only chemists so far as their ability would permit them to be so, but they were also business men. In order to manufacture products they must needs come in contact with railways and canals, and they had to consider the question of rates, and he hoped the time was not far distant when they would be in a similar position with regard to carriage as they were in France and Belgium, where the canals were like our high roads, absolutely free from toll. They also came into contact with the Government on the Alkali and other Acts, and, while he did not complain of anything which the Government had done, he wished to point out that their business as chemists had to deal with something more than technology. He thought they must in future give more attention to subjects of general interest, and be alive to what was contemplated by the Government of the day, and do their best to promote the interests of the manufacturer in the United Kingdom and other countries where their Society was so well-known. He was pleased with the efforts which had been made to bring the members together by visiting the various works, which not only gave opportunities for members becoming known to each other, but also removed that feeling of secrecy which had unfortunately too long prevailed in this country. By inspecting various operations, and by the interchange of opinions, they would eventually make their beloved Society of Chemical Industry more important even than it had been in the past.

Dr. K. E. MARKEL, in proposing "The University of Manchester," said he approached this toast with a certain amount of diffidence, but he claimed to have one qualification for the task in his unbounded admiration for the University. Well did he remember, as a boy in Germany at school, purchasing with his first pocket money two English scientific books—Roscoe's "Elementary Chemistry" and Tyndall's "Heat." On the title page of one of the books he read that the writer was Prof. Roscoe, of Owens' College, and boylike, he wondered what sort of a place Owens' College was. Coming to England, he very soon became intimately acquainted with it, and ever since he had taken a very great interest in the institution, and particularly the far-reaching effect of the science taught there on chemical industries. The little book he referred to had created a thirst in him for science which had never been quenched, and which he hoped never would be, as long as he lived. If the University could have such an effect on the humble foreigner far away, what must be the influence on its immediate *alumni*. He need only mention Frankland, Perkin, Schorlemmer, Roscoe, and Dixon, to show the influence which the University had had in the chemical world. It would be futile for him, in the presence of so many who were far more intimately acquainted with the University than he was, to speak further of its influence, but he could say this, that Manchester was the first city that had really recognised the necessity of co-ordinating all the higher educational institutions and grouping them round the University, and, what was more, it had forced other towns to follow its example. He coupled with this toast "The Municipal School of Technology," that splendid Institution with its magnificent laboratories, and its excellent staff, of whom they had the privilege of having two on their Council, Messrs. Hübner and Pope.

Prof. ARTHUR SCHUSTER, responding to the toast of "The University of Manchester," said, from the information they had already received that day, they might have gathered that the University and the Society of Chemical Industry were really sisters, for one of the fathers of the Society was also one of the fathers indirectly of the University. They began their birth from the time that they really became identified with the City and became the University of Manchester, and this enabled them to become more closely associated with the various interests of the City. He had read in the newspaper that morning that the Minister of Education hoped to establish an educational ladder, by means of which every boy or girl might ultimately pass from the elementary school to one of the ancient Universities. He quite agreed that, if education is to end at the University, it must be an ancient one. They claimed that their University was a modern one, and therefore education only began there, and it was carried on after the boy or girl left the University and commenced practical life. We are taught, however, that the education of a man of science practically begins when he enters upon a trade. He thought Manchester could claim that it always kept its eyes open, and one of the conditions of a modern University was, that there was a certain danger of students of any particular profession being kept too much in contact with their own subject. In their own University, they were trying to overcome that difficulty, and bring their students into close contact with each other.

Mr. IVAN LEVINSTEIN, speaking to the toast of "The University," said he was sure there was no Society which took a deeper interest in science and its application than the Society of Chemical Industry. They had seen their great School of Technology built by the ratepayers of Manchester, and, while Prof. Schuster had referred principally to pure science as taught in the University, he might say that the establishment of a Faculty of Technology was largely due to Prof. Schuster. The purely scientific chemist, seeking to solve problems, was quite regardless of time and expense and regardless of the demands of the public, whilst the technologist, who did not care so much for seeking the truth and nothing but the truth, had to consider the requirements of the market, and the saving of time and cost of production. Such investigations could not be successfully carried out in an ordinary laboratory, especially in the textile and allied industries, and for this reason the Municipal School of Technology had been erected and equipped with laboratories and workshops containing complete plant and machinery such as the student would meet on entering bleach-, dye-, print- and paper-works, spinning and weaving mills, &c. Proof of the advantage of such a system was afforded by the success achieved by students of the School of Technology, who had entered for the degree in technical science at the University.

Dr. JULIUS LEWKOWITSCH, in proposing "The Manchester Section," said he was associated with this particular Section some four years ago, and he was proud to say the only friends he had in Manchester at that time were members of the Section, a Section which, in those days, devoted much attention to smoke and sewage. He coupled with the toast the name of the Hon. Secretary, Mr. Hübner, and expressed sympathy with the Chairman (Dr. Bailey) in his absence through illness, and expressed thanks to both of these gentlemen for their efforts, which had resulted in such a successful meeting.

Mr. JULIUS HÜBNER, in responding to the toast, expressed his indebtedness to Dr. Lewkowitsch for the

very complimentary references which he had made as to his association with the Manchester Section, and the satisfactory arrangements which had been made for the entertainment of the visiting members and their friends. He also wished to acknowledge his indebtedness to the Lord Mayor and the Manchester Corporation, and to the various firms who had so freely extended their hospitality, and which had in such a large measure added to the success of the meeting.

Mr. THOMAS TYRER, in submitting "Our Guests," said the toast needed no elaboration by him. He might make a supplementary remark of regret that Dr. Ludwig Mond, the recipient of the Society's medal this year, was not with them, and they could only hope that the causes which led to the recommendation of his medical adviser not to undertake the journey had passed away. He asked their acceptance of the toast committed to his care, *viz.*, "Our Guests." They had heard some of them that night, and while they honoured them, they nevertheless must have felt honoured in being associated with the Society. The guests were many, including Sir James Hoy, the Mayor of Salford, Sir Bosdin T. Leech, and many others, and it was his pleasure, on behalf of the Society, to heartily welcome them. He coupled with the toast the name of Alderman Joseph Thompson, LL.D.

Alderman Thompson having left, the CHAIRMAN called upon Sir William Henry Bailey to reply.

THIRD DAY. FRIDAY, JULY 13TH.

The party travelled by special train to Hope, whence brakes took them to Castleton. Here the Great Peak Cavern was inspected, after which luncheon was served at the Peak Hotel. It had been intended to drive to Hathersage and the Surprise View, but the weather became unfavourable, and rain fell for the rest of the day. A large room belonging to the hotel, nevertheless, enabled a pleasant afternoon to be spent, to which the excellent singing of the Misses Johnston, daughters of the proprietor of the hotel, contributed. A small number, braving the weather, contrived to visit the Blue John and Speedwell mines. After tea the party returned to Manchester.

In the evening a conversazione was held in the Whitworth Hall of the Victoria University, where Vice-Chancellor Hopkinson received the guests. In the Chemical Lecture Theatre Professor Harold B. Dixon gave a lecture on South Africa, illustrated by lantern slides, and in the chemical laboratories were shown exhibits of scientific and industrial interest by the professors, demonstrators, and students of the University, and others.

New England Section.

Meeting held at Boston, Mass., on Friday, April 6th, 1906.

A paper was read on the "De-arsenication of Sulphuric Acid" by Mr. Hervey J. Skinner.

New York Section.

Meeting held at Chemists' Club on Friday, May 25th, 1906.

MR. RUSSELL W. MOORE IN THE CHAIR.

PINACHROMY AND PINATYPE: NEW PROCESSES OF COLOUR PHOTOGRAPHY.

BY M. A. METZ.

Dr. E. Koenig, of the Farbwerke, vorm. Meister, Lucius and Brüning, has developed two new processes in colour photography which are known, respectively, as "pinachromy" and "pinatype." They are not only of interest to the student of chemistry and physics, but are a distinct and important advance towards the reproduction of objects in their natural colours.

In pinachromy, three collodion films are successively superimposed and coloured by the action of light on certain sensitive chemical preparations with which the films are coated, thus making a true coloured photograph. The process has met with considerable success abroad, and is based on the light sensitiveness of the leuco-bases of the organic dyestuffs. While many of these leuco-bases, for instance those of the safranines, are so oxidisable that they cannot be isolated in a free state, there are others, like the leucomalachite green, which can be easily produced, and are comparatively stable. These more permanent leuco-bases, when exposed for some time to light, become strongly coloured.

Dr. Koenig examined all the leuco-bases at his command, but found that when exposed to light, either by themselves, or in gelatin coatings, none of them gave results of the desired strength or brilliancy. Subsequently he selected collodion as the support, and thus obtained the desired increase in sensitiveness, the leuco-bases, in the presence of collodion, becoming strongly oxidised after a comparatively short exposure. This increased reaction he attributed to the presence of the nitric acid groups in the nitrocellulose, and upon further experiment found that, like nitrocellulose, all nitric acid esters would react. The nitrous acid esters, on the contrary, and the isomeric nitro derivatives of the aliphatic and aromatic hydrocarbons proved ineffective. The nitrosamines showed reactions similar to, but weaker than, those of the nitric acid esters. It is of interest that the light sensitiveness of the mixture of nitrocellulose with the leuco-bases is considerably reduced by the presence of urea or of antipyrine. This would seem to point to the fact that the leuco bodies are oxidised by nitrogen oxides, which separate from the collodion. While nitrocellulose is by no means the most effective of such compounds, still greater sensitiveness resulting from the admixture of leuco-bases with the nitric acid esters of glycerol, glucose or mannitol, it is the most suitable compound, as it acts at the same time as the film and as the support for the picture. The light sensitiveness of the mixture of nitrocellulose and the leuco bodies can be considerably increased by the addition of nitromannitol.

Blue pictures are produced with leucosetocyanine, which is *o*-chlorotetraethyldiaminotriphenylmethane; green with leucomalachite green, or with *m*-nitro- or *m*-aminotetraethyldiaminotriphenylmethane; red with *p*-leucoaniline, or leuco-rhodamine; violet with hexamethyl-*p*-leucaniline (the leuco-base of Violet 6 B crystals), and yellow with leucofluorescein or leucoflavaniline. The fixing of the picture is effected with dilute organic acids, of which monochloracetic acid is the best; acetic acid or di- or tri-chloracetic acids cannot be used.

The practical application of this process is as follows:—A sheet of paper is coated with the blue collodion mixture and exposed under its corresponding negative. When the blue picture appears sufficiently strong, it is fixed in a 10 per cent. solution of chloracetic acid, washed, coated with a thin gelatin film, and dried. This gelatin film serves to protect the first collodion coating from dissolving when the second coating is put on. The dry blue picture is then covered with the yellow collodion mixture and exposed under its corresponding negative, care being taken that the pictures register accurately. After exposure, it is fixed, washed and dried, and the yellow picture produced. The final red picture is obtained in a corresponding manner. On account of the complete transparency of these very thin films, and the brilliancy of the colours produced, the prints appear very uniform. The fastness to light of pinachromy pictures is naturally not absolute, but the dyestuffs used are relatively fast. The poorest is the blue, but even this surpasses the "blue prints" (cyanotypes) in fastness. The quantity of the leuco bodies necessary is extremely small; hence pictures composed of the three-colour films cost but a trifle more to produce than ordinary gum or pigment prints.

In pinatype, the second process, on the other hand, a single gelatin film is so treated that a succession of paper prints may be obtained from the coloured plate as often as desired. This makes pinatype especially adapted to three-colour work, and it is now being carefully tested for this purpose. A bichromated gelatin plate is exposed to light under a photographic negative, and the undecomposed bichromate is removed by washing. Pinatype dyes have the property of dyeing the unhardened gelatin very strongly, whereas the hardened portions are either not coloured at all or very slightly. If moist paper, coated with specially prepared gelatin, is now brought into intimate contact with the gelatin layer, coloured by means of a pintapye dye, in a short time a coloured paper picture with all the half tones is obtained, which appears strongly coloured on those parts not affected by light, while the most exposed parts remain white. From this it is evident that in order to obtain a positive picture the bichromated gelatin layer must be exposed under a diapositive. The facility with which enlarged copies can be made is especially important for three-colour photography, as the direct production of large-sized plates in three colours offers many technical difficulties. By this process the negatives can be enlarged directly, whereby all the details are much better preserved than when an enlarged negative has to be prepared from the original negative. The print plates for pinatype, which are not sensitive to light, are steeped with the film side uppermost, for three or four minutes, in a sensitising solution (2 grms. of chromic acid dissolved in 110 c.c. of water) in shaded daylight or lamplight. The solution must not be warmer than 20° C. Any bubbles of air should be removed with the finger or a brush. A great number of plates may be sensitised, one after the other, in the same bath. After the plates have been sensitised, they are well drained and dried in a dark and not too warm place, free from dust. The sensitised plates keep much longer than sensitised pigment paper, and preserve their qualities completely for two or three weeks. The diapositives to be copied are laid in a frame with the film side in contact with the film side of a sensitised print plate. The exposure time for a print plate is about the same as that for collodion paper. Electric arc light is just as good as direct sunlight for copying. After copying, the pictures should be distinctly seen in brown colour on a yellow background. The print plate is now washed in running water until all undecomposed chromic acid has been removed. Usually washing is complete in ten minutes. The plates may now be dried or placed directly in the dye solution. The well-washed print plate, either dry or moist, which corresponds to the red filter negative, is steeped in the blue dye solution composed of 5 grms. of "pinatype blue" dissolved in 250 c.c. of water, and the dish rocked from time to time. The first dyeing takes about 15 minutes. The plate is then washed and rinsed until the water running off from it is no longer coloured. It should have the appearance of the diapositive full of detail, with almost transparent whites and intense shades. When the dyed plate is finished, a piece of transfer paper of the size of the plate is softened in cold water, all air bubbles being removed, until the paper has become completely pliable and fully stretched. The paper is now attached to the plate, preferably under water, with the film side against the film side of the printed plate, and both removed from the bath, at the same time draining off the excess of water by a gentle motion of the hand. The plate is then laid upon a table, paper uppermost, and protected with a piece of oiled silk or the like, and the paper firmly smoothed over with a rubber squeegee, from the middle outward, using moderate pressure. The operation is similar to that in the pigment process. When the paper adheres satisfactorily it is covered with a damp sheet and a glass plate, in order to prevent evaporation, and the whole allowed to stand 10 to 15 minutes, if desired, under a light weight. At the end of this time the picture will be found transferred to the paper with sufficient strength. The paper is now removed and hung up to dry. The print plate is now again placed for about five minutes in the dyebath, rinsed, and the picture again transferred to paper as above directed. These operations may be repeated as often as desired. By repeated immersion in the dyebath the print plate becomes darker. Nevertheless, the prints from the plate are quite uniform, as only the exterior surface of the dyed plate has action on the paper. The dyed plates may be kept for any length of time after use, and can be again employed after a fresh immersion in the dyebath. The dyeing of the print plate corresponding with the green filter negative is done in the same manner. For the dyebath 5 grms. of "pinatype red" are stirred with a little water to a paste, and then 3 to 5 c.c. of concentrated ammonia solution added. Sufficient ammonia must be used to completely dissolve the dye to a clear deep red solution. After about five minutes the solution is diluted with cold water to 250 c.c. After the red plate has been washed free from the excess of dyestuff, the blue picture is softened in water and laid under water upon the red print plate. The operation is carried out in the same way as before described, the blue picture being easily shifted under water, so as to exactly correspond to the red print plate. When the adjustment is complete, the paper is held firmly against the plate with suitable clamps, leaving the film free. The film is then withdrawn, water again run over the plate, and the paper pressed firmly down with the squeegee. It is allowed to stand for 10 to 15 minutes, and the paper then removed from the plate. About 30 minutes should be allowed for the first immersion of the print plate, corresponding to the blue filter negative, in a dyebath composed of 5 grms. of "pinatype yellow" dissolved in 200 c.c. of hot water; for subsequent immersions, five to ten minutes. The yellow transfer upon the blue and red picture takes about 30 minutes. It is advisable to moisten the superimposed damp sheet well in order to prevent the films adhering to each other. To increase the picture's fastness to light, and to harden the gelatin layer, the paper is now immersed for about one to two minutes in a fixing bath of 2 grms. of fixative chromium salt and 100 c.c. of water. After fixing, the picture is washed for about five minutes in clean water and hung up to dry.

The principal advantage of pinatype lies in the use of print plates, which are prepared in a simple manner with the aid of light, allowing the preparation of a large number of paper copies therefrom by a purely mechanical process, without further resource to light. The print plates can be kept and used again at any time, without the aid of light, for the preparation of paper copies. In consequence of the intensity of the pinatype dyestuffs and the immunity from spoiled pictures, pinatypes are very cheap. Pinatypes are extremely fast to light. A three-coloured pinatype is not composed of different films. A single thin film carries all of the colours, which therefore blend harmoniously.

Papers were also read by Maximilian Toch on "Modern Three-colour Processes," and by Hoyt Miller on "Three colour Photography."

Nottingham Section.

Meeting held at Nottingham, on Monday, May 28th, 1906.

MR. J. M. C. PATON IN THE CHAIR.

A NEW BOTTLE FOR CULTURES.

BY J. GOLDING.

At a recent meeting of this section, Mr. Droop Richmond showed me a flat-sided bottle which he was using for cultures instead of Petri dishes. The bottle was very portable and convenient, and had the additional advantage of being much cheaper than the Petri dish. By placing the gelatin uppermost it can be used for anaërobic cultures if alkaline pyrogallic acid is put on the under side. It

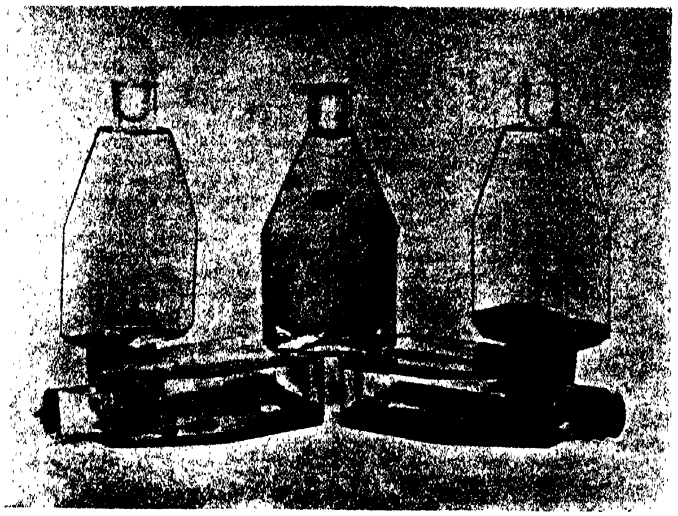


FIG. 1.

was, however, rather too thin to allow of stopping the liquefying growths with silver nitrate, a very convenient practice which I owe to Prof. Hiltner, of Munich. I therefore designed the bottle shown in Fig. 1, which was made for me by Messrs. A. Gallenkamp, of London.

The sides of these bottles are as flat as they could be made. The shoulders taper off so that a straight platinum needle, or a specially-designed silver quill holding a stick of silver nitrate, can reach any colony growing on the gelatin.

Method of using.—The bottle is first cleansed, plugged with cotton wool, and sterilised, 20 c.c. of nutrient gelatin or other medium are then added, and the bottle sterilised again. When required for use the bottles are placed in warm water to melt the gelatin, and kept just warm enough to keep it liquid.

The water, soil, or other substance to be analysed, is so attenuated in sterile distilled water that 1 c.c. contains not more than 100 organisms.

One c.c. of this attenuated liquid is then run into the melted gelatin, well shaken, and the bottle laid on its side to set.

When liquefying colonies grow, sub-cultures may be made from them, and from colonies in their immediate neighbourhood, or if a count only is desired, these colonies are noted and then stopped with silver nitrate. The remaining colonies can then go on growing till large enough to count.

If it is desired to make an anaërobic culture, the bottle is turned over when the gelatin has set, and a solution of pyrogallic acid introduced; the bottle is then slightly raised, and a small stick of potash introduced; the mouth is then tightly corked with a rubber stopper, and the acid allowed to come in contact with the soda.

A NEW FRACTIONAL CONDENSER FOR STEAM.

BY J. GOLDING.

I have for some time been in want of a good supply of pure distilled water for pot and water cultures, and for use in the chemical and bacteriological laboratories at the Midland Agricultural and Dairy College. It was necessary that this water should be quite free from traces of metals which are well known to affect the growth of plants and bacteria, and also that it should be as free as possible from traces of ammonia.

The laboratories at Kingston are supplied with gas (made from gasolene), which for the purpose of making distilled water is too expensive.

Steam from a large boiler some thirty yards from the laboratory, used for heating a drying oven and condensed in a copper condenser, gave impure condensed water. This condensed steam contained much ammonia, not easily driven off by boiling, organic substances which gave it a strong taste and smell, also traces of copper from the condenser.

As the water in the well at Kingston which supplies the laboratory and the boiler contains much gypsum in solution (some 220 parts total hardness per 100,000), the pressure steam could not well be used as a source of heat for boiling water to feed a condenser.

I therefore designed the following modification of Bousfield's apparatus (Journal Chem. Soc., 1905, 740).

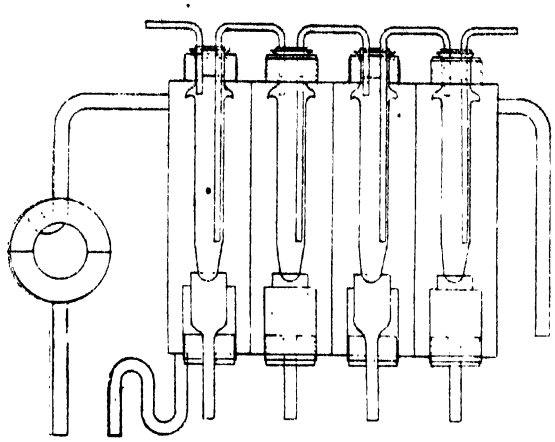
The condenser consists of a copper box 12 ins. long by 5½ ins. wide by 9½ ins. high. It is divided into four compartments, which communicate with each other by narrow slits on alternate sides of the box. Through the top of each of these compartments passes a tube of Jena glass, which can be cooled by tap water. Under each tube is a cup of Jena glass. The tubes are so designed that condensed water from the top of the box should fall clear of the cups.

The box is tin lined throughout, and the steam enters through a splash trap, also tin lined.

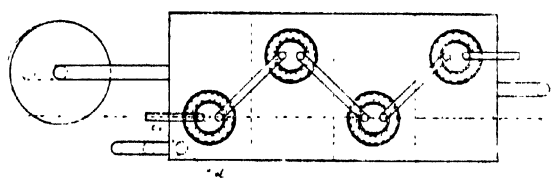
This condenser did not at first give good results, as the steam came out through the cups and brought with it the more volatile impurities. This was got over by jointing them to a longer piece of Jena glass tube bent to form a trap.

The condensed steam, though much more pure, still contained some ammonia and was not quite free from smell and taste. I therefore removed the tube nearest to the steam inlet and substituted for it a dropping funnel containing dilute sulphuric acid (about 10 per cent.) and pure potassium permanganate (about 3 per cent.). This liquid was allowed to stand in the funnel, and was run through and through the separating funnel till nearly decolorised.

This produced the desired effect, and the water from the tubes gave hardly any colour with Nessler solution; the purest in this respect being from the tube nearest the



ELEVATION.



PLAN.

steam inlet; but even the third tube contained less than 0·01 part ammonia per 100,000.

Through the kindness of Dr. Sand, I was enabled to determine the conductivities of the water at the University College, Nottingham, but great difficulty was experienced in bringing the samples into Nottingham. Good results were at last obtained by drawing out the necks of small Jena flasks, filling them with water from the condensers, boiling and emptying this water away, then again filling them and quickly sealing up the necks.

Ordinary good distilled water, according to Bousfield, has a conductivity of some 5 to 10 reciprocal megohms per cubic centimetre. While water prepared by Stas' process of re-distillation only falls just below 1 reciprocal megohm.

A series of conductivities for water brought in in these flasks worked out at—

Tube	1.	2.	3.	Box.
K 18	1·3	2·3	2·3	4·3 reciprocal megohms.

The quantity of water yielded was also satisfactory, and amounted to 4¼ to 4½ litres per hour from the three tubes.

The yield from the different tubes per hour was as follows:—

Tube 1.	2.	3.	Box.
1520 c.c.	1510 c.c.	1210 c.c.	650 c.c.

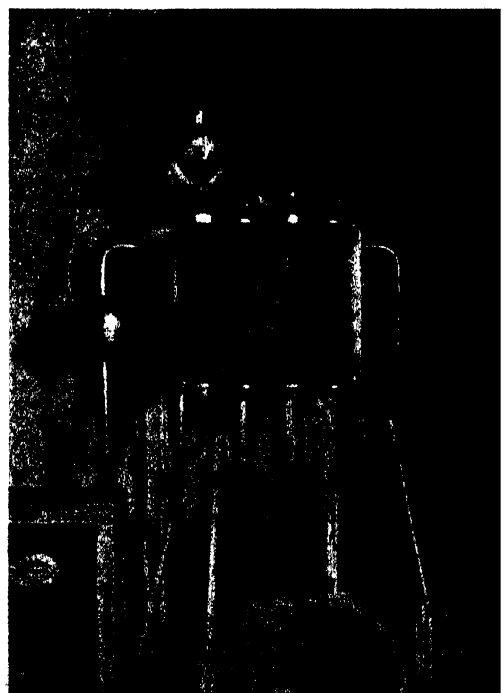
In the earlier experiments with the four tubes, 5 litres per hour were obtained.

The condenser was made by Bender and Holbein, Munich.

In conclusion, I wish to express my thanks to the Government Grant Committee of the Royal Society, as this condenser was purchased with a grant made by them for researches on nitrogen assimilation.

Mr. GOLDING, in reply to various questions, said he had not made out the cost of making distilled water by the apparatus. The apparatus cost £5, which was very much under the cost of many other forms of condenser which would not condense the same amount of water. It simply condensed the waste steam, so that the cost was very little beyond the original outlay. Where the supply was short, the water used to condense the steam could be cooled and used over and over again. As to Dr. Caven's question in regard to the use of permanganate, he thought that the idea of using permanganate might be developed so that all organic matter might be got rid of. He must own that he often got in the boiler steam a slight taste, most from the third of the tubes, as the permanganate as now used did not destroy all the taste. There was some volatile organic substance left; but he did not exactly know what it was. The taste, however, did not interfere with the conductivity.

At first, he tried sulphuric acid for absorbing the organic matter and ammonia, but it did not seem to answer so well. Instead of blowing steam through the solution, he thought it would be better to let the acid trickle over a series of funnels placed in the first chamber.



Scottish Section.

Meeting held at Glasgow, on Tuesday, March 6th, 1906.

MR. DAVID PERRY IN THE CHAIR.

METHODS OF FIRING A POTTER'S KILN: EFFECTS OF HIGH TEMPERATURES ON CLAY.

BY J. ARNOLD FLEMING.

The increased demand which has arisen in recent years for more decorative articles has necessitated the employment of higher temperatures and greater precautions in firing; at the present time, large numbers of articles are worked upon at the same time, using the same clays, which are subjected to the same treatment, and these must be fired so as to obtain the desired results as regards colour, size, and durability.

The general construction of a potter's kiln has remained very much the same for now over 100 years. The fires—of which there may be 10—are situated in the circumference of the base of the oven. The heat enters by "bags" built up inside, and by flues, running more or less horizontally in the bottom or floor of the kiln, entering a well hole in the centre of the bottom; it then enters the firing chamber and ascends through bungs of "seggars" full of the clay articles to be fired to the crown of the kiln, where it is liberated into the air, or controlled by dampers as occasion requires. The air regulator controls the amount of air to be introduced, and by careful manipulation by the fireman, forces the heat through the flues, thus heating the centre of the firing chambers as well as the "ring," or portion immediately above the fires.

The potter's oven, or kiln, is, therefore, really a large reverberatory furnace, in which the volume of the articles to be fired is out of all proportion to the grate area of the fires.

The clay articles absorb a vast amount of heat at the beginning with very little apparent result, but the fuel consumption and the temperature increase as firing progresses.

The fuel required must contain small ash residue, and must be free from sulphur, giving a good flame. As was the case in all historical industries, wood was the fuel in early times. This explains many beautiful results of fire in bygone days. But although free from sulphur and other impurities, and most suitable, it had to be given up owing to its scarcity. Suitable coal has, so far, accomplished the firing process economically and satisfactorily, if only by the virtue of the fact that the stoking is intermittent. Sulphur is often found as sulphide of iron, accompanied by siliceous ash; it runs on the bars, gradually filling up the fire mouths, which, as already pointed out, have a limited grate area. The combustion of fuel is variable, and imperfect at the beginning, having mixtures of oxygen, nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons, contaminated with the sulphur from the coal.

The construction and form of the fire of the kiln is such that it acts practically as a gas producer. Fresh fuel is carefully put on the front and top of the fire, allowing a mass of incandescent fuel to remain at the back to ignite the gases that may enter from the fuel in smoke or unconsumed gases. The fires are long, deep, and narrow. The average dimension is approximately 3 ft. 8 in. long, 1 ft. 8 in. wide, and 2 ft. 8 in. deep. Some of the early types had large and wide hobs, and the fuel was piled on these, so that nothing but the products of combustion could enter the firing chamber of the kiln.

Gas firing was tried in our works very many years ago. It worked very satisfactorily and economically in a confined furnace for glass making, but the firing of clay was not so successfully nor economically attained. In firing clay at certain stages, it is important that the heat, after being brought to a certain degree, should be maintained, neither allowing it to increase or decrease, so that the denser articles shall have absorbed the heat shown in the firing chamber throughout their cubical area. Only very large potteries could adopt gas economically, as often the case may occur that another oven or kiln may not be ready for the firing process, or that several kilns may require firing at the same time. In Staffordshire this is having considerable attention. Mond and other gases are being experimented with, and the results are awaited with deep interest. So far, the gas producer has been attached to each individual kiln, and no doubt as experience is gained in controlling the gas as we do with the coal fuel, similar results should be obtained with economy and cleanliness in working. So far the drawback has been in controlling the consumption of the gas in the firing chamber—a fierce heat obtains in one section, and none in another, so much so, that sometimes one end of a brick could be very hard, and the other not burnt through at all satisfactorily.

To get the full benefit of the gas produced, the producer requires to be in close proximity to the furnace using the gas, as the cooling of the gas from the producer to the furnace involves a loss of heat from the products of combustion. In order to make gas cheaply, production must not be intermittent. Storage would be required for a pipe system, and that would be a serious drawback. Difficulties would arise when the gas is stored through separation of tar, and consequent loss of a valuable heating constituent of the fuel. Leakage of pipes also would arise, and after all volatile sulphur compounds would remain. Nitrogen has no heating power, and in the most modern plants is extracted as sulphate of ammonia and sold as a fertilizer and as a valuable bye-product. In coal the hydrocarbons are at first driven off slowly, and as the temperature rises to redness, the carbonaceous matter begins to ignite, and to be effective in reducing the ferric oxides present in the clay to ferrous oxides; further, as the temperature increases, the oxygen entering with the burning of the fuel gives an oxidising reaction on the ferrous oxide. Iron is the chief colouring factor in clays, existing in several states of combination, and exercises, under certain circumstances, an injurious pyrometrical influence. It is not a mere question of the presence of one of these, but often two or more influence the colour. To demonstrate the effect of iron as a colouring agent, and the complex reactions of materials during firing, we may mention the thin, red Roman bricks, burnt right through, and completely oxidised. We have also the thicker bricks of to-day, varying from brown to orange, according to the firing of the kiln, and the dryness of the clay in the kiln. Then there are the plum-coloured Tudor bricks, fired with wood. The sickly yellow bricks, blanched by added chalk, made from London clay, are a good example of the curious effect of lime upon ferric oxide. But iron often combines with silica and small quantities of lime and alkalies, forming silicates and a vitreous mass apart from any colouring effects.

Therefore, the fired ware will be clean if the kiln atmosphere is light, and the draught so manipulated that it is sufficiently mixed with air—the firing will be of an oxidising nature. On the other hand, let the kiln atmosphere be slow and heavy, with little air, it is in a reducing condition of heat, and the clay, if it contains much iron, will be dark.

The regulation of the heat, and its distribution throughout the kiln from the circumference to the centre, and the bottom to the top, is the duty of the fireman. As already pointed out, the heat would naturally all ascend the "bags," as the fires are practically gas-producers, the fireman controls their action by the air-inlets and the dampers in the crown of the kiln.

Contraction, as a pyrometer, is the method generally adopted of testing the amount of work the heat is doing during the firing process. Contraction in firing is entirely a different matter to contraction in drying; it depends on the rate of heating. When the substances are brought to a given temperature slowly, the cubical contraction is always less than when they are rapidly heated, and the difference increases up to 1000° F.; at higher temperatures the difference generally decreases. Rapid firing has to be carefully guarded against, as the pressure is very great from outside the kiln, owing to the low pressure of

the atmosphere inside the kiln. The strength of the article is increased owing to contraction, as the fire proceeds; on the other hand, there is a marked diminution in measurement, or volume, without any essential alteration in weight, hence contraction can only be explained by the fact that the body possesses hollow spaces which, under the influence of heat, contract; this is fully determined by the actual porosity. Hence, the amount of porosity depends on the contraction of the clay, and is thus used as a test by the potter, who applies his tongue to the fired piece of ware to feel the quality and quantity of suction. Clay contains combined water, and shrinkage only begins after a temperature of 600° C. has been attained; to drive off the combined water, it may be treated as an amorphous body. Therefore, capillary forces must be at work as the temperature rises. This is the force which, in the case of rapid firing, shrinks the surface almost to vitrification, while the interior of the section is porous.

The smaller amount of water in the clay, the smaller is the resulting cubical contraction. Now, many articles are made of dry clay, in the form of dust, to obtain more exactitude.

In practice it has been found that clay with a large percentage of silica shrinks more during drying than firing, whilst with small proportions of silica, the contraction is greater during firing than drying. It has been found that vertical contraction is greater than horizontal contraction. Contraction formed the basis of Wedgwood's pyrometer. This consists of a number of half-baked pieces of clay, put into the kiln with the pottery, and taken out one by one, till the necessary contraction of the clay is produced. This method is still relied on by many potters to control the firing.

This system denotes not so much that the correct temperature has been attained, but rather that the firing had been sufficiently high for a long enough period. These pieces of clay, when fired, are put into a graduated slot, and the further they travel to the smaller end, the greater is the contraction and, consequently, the heat.

These test objects serve to show the potter how the firing is progressing, and enable him to draw his conclusions regarding the condition of the ware in the kiln, which is of greater importance than a knowledge of the temperature prevailing at any particular time.

The chemical composition of clay is represented by the formula $Al_2O_3.2SiO_2.2H_2O$, but little is known regarding the cause of plasticity, notwithstanding the large amount of attention which has been given to the subject.

To-day, the potter, in producing white clay articles with some degree of certainty and regularity, makes a mixture of various substances.

Blue ball clay forms one of the chief constituents. It varies in composition and colour from yellowish-white to black. It is soft and plastic, and infusible when free from alkalis, iron, and other fluxes. It is very refractory, retaining its form at a high temperature of fully 3000° F., and is capable of containing a large percentage of free silica. This not only increases the whiteness of the ware, but also counteracts the tendency, shown by clays with an excess of alumina in their composition, to shrink too much and crack.

Black ball clay is of a similar quality; it owes its distinctive colour to the quantity of carbonaceous matter it contains, sometimes as much as 9 per cent. It burns whiter than blue ball clay, on account of the reduction of its sesquioxide of iron in the kiln by the reaction with its carbonaceous matter.

Cornish stone is another ingredient. It is a potash felspar, or orthoclase, which contains 3 per cent. to 8 per cent. potash. It is mainly from the decomposition of this that china clay is obtained. Stone is rich in potash, but china clay does not retain this, otherwise it would be useless, on account of its non-refractory nature. China clay is fat and plastic in various degrees, according to its richness in alumina; it is dry and chalky when rich in silica. This latter variety does not shrink so much. Alumina is a most valuable constituent of clay, and plays a decisive part in influencing its properties. It is not only in itself difficult to fuse, but it also increases the refractory nature of the silicates.

The free silica employed is flint, a heavy and somewhat impure quartz. It is a crystalline silica, containing minute percentages of Al_2O_3, CaO, and Fe_2O_3. It is calcined to change it into amorphous silica, becoming then easier to grind. Le Chatelier and Cramer investigated this calcining of flint, showing how at about 600° C. it expanded 10 per cent. This gives some reasons for "duntage" and expansion, especially in silica bricks. It is an indispensable ingredient, and endures the highest temperatures without alteration. The co-efficient of expansion of a "body" may be increased by adding flint, as clay has a very low co-efficient, whilst flint has a high one.

The plasticity of a clay is not a measure of its tensile strength. Too much clay is often as bad as too much flint or silica.

We therefore find physical structure and chemical composition for the potter are inseparable, and are not only in themselves important. Such refractory substances as SiO_2, Al_2O_3, Fe_2O_3, and CaO, when mixed intimately, are found to flux under the influence of comparatively very moderate heat. A furnace built with fire-brick and lime mortar will flux into a black glass mass with very moderate heat in a very short time.

To a potter a flux may not necessarily be a fusible body, but one which, when added to the other materials comprising the "body," increases their fusibility.

On account of these complex reactions which take place in firing, practical firing tests must be made, if only to add to the value of the chemical analysis. Seger felt that some systematic range of trials should be adopted, and made cones varying from 600° C. to very high temperatures.

But, after all, the best test has been found is to heat a portion of the clay that is being fired to a certain degree of vitrification. In practical working the form of the articles affects result as the clay may have a different volume in each case.

No law as to firing and quantities can thus be laid down. If two or more kilns be built, so far as one can see alike in every respect, no two of them will fire in the same way. For the potter the pyrometer must be possessed not only of reliability and to give constant records, but the personal factor in manipulating should have no effect on its accuracy.

Sydney Section.

Meeting held at Sydney, on Wednesday, May 9th, 1906.

PROFESSOR A. LIVERSIDGE, F.R.S., IN THE CHAIR.

THE ESTIMATION OF TANTALUM BY MARIGNAC'S METHOD.

BY ARTHUR TIGHE.

In an attempt to estimate tantalum as the pentoxide by Marignac's method, considerable difficulty was experienced in obtaining the crystals of the double fluoride (K_2TaF_7). In all the text books consulted, it is directed, after dissolving the mixed oxides of tantalum and niobium, to add a quantity of acid potassium fluoride equal to one-quarter of the weight of the mixed oxides. But on concentrating to about 7 c.c., and cooling, I found that the crystals of the double fluoride did not appear, or only sparingly so, until a further quantity of acid potassium fluoride had been added, the best results being obtained with an amount equal to twice the weight of the ore taken for the assay. The proportions specified in the text books are evidently erroneous.

I also found that when the mixed oxides were dried in an air-oven, they became almost insoluble in aqueous hydrofluoric acid, although if transferred at once, without drying, they were readily soluble. It is, therefore, necessary to determine their weight by a separate experiment.

Obituary.

THOMAS ROYLE.

Thomas Royle was born in Salford in 1837, and was brought up at Crayford, in Kent. When thirteen years of age, he entered the works of the Swaisland Printing Co., and there worked his way up to the position of manager. He subsequently studied at the Royal School of Mines under Prof. A. W. Hofmann, and took first-class certificates. After a year or two as a calico printer at Foot's Cray, Kent, he entered the colour works at Greenford Green, founded by Dr. W. H. Perkin, and, later on, became manager of Burt, Boulton, and Haywood's colour works at Silvertown, where he remained some thirteen years. He then went to America, and built the works of the Mead Phosphate Co. at Charleston, S.C., but soon returned to this country, and became manager of Hardman and Holden's tar distillery, near Manchester. He also erected cyanide works in Germany, and works at Riga for Agthe, Fey, and Co. He was a chemical engineer of exceptional capacity, ability, and experience. Thos. Royle was an original member of this Society, and served on the Council; he was also a Fellow of the Chemical Society and of the Institute of Chemistry. He died on June 2nd, leaving a widow, four sons, and two daughters.

Journal and Patent Literature.

I.—PLANT, APPARATUS & MACHINERY.

(*Continued from page* 631.)

ENGLISH PATENTS.

Kilns; Impts. in tunnel ——. A. A. Gery, Reading, Pa., U.S.A. Eng. Pat. 12,874, June 21, 1905.

SEE Fr. Pat. 356,838 of 1905; this J., 1906, 21.—T. F. B.

Vacua; New method of producing ——. F. Soddy, Glasgow. Eng. Pat. 17,933, Sept. 5, 1905.

A RECEPTACLE containing metallic calcium is placed in communication with the vessel to be exhausted, and is provided with means for placing it in communication also with a supply of a gas (oxygen, hydrogen, carbon dioxide, &c.) capable of being completely absorbed by heated metallic calcium. The air is first pumped out by a mechanical or other exhauster, and a current of oxygen or other gas passed through to expel the residual air. The pump is then started again, and afterwards the metallic calcium is heated, when it absorbs all remaining gas.—A. S.

Vacua; Impts. in the production of ——. F. Soddy, Glasgow. Eng. Pat. 5349, March 5, 1906. (See preceding abstract.)

METALLIC barium or strontium may be used in place of calcium for absorbing the residual gases.—C. S.

Filters; Centrifugal ——. L. C. Trent, Van Trent, Cal., U.S.A. Eng. Pat. 20,866, Oct. 14, 1905.

SEE U.S. Pat. 806,213 of 1905; this J., 1906, 7.—T. F. B.

Filters; Impts. in ——. A. J. Boult, London. From E. Goldman & Co., Chicago. Eng. Pat. 2991, Feb. 7, 1906.

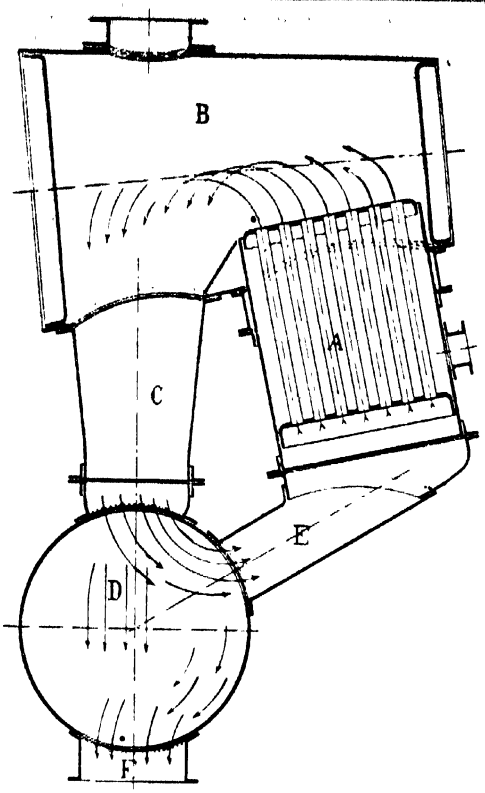
THE filter is composed of two or more superposed vertical cylindrical casings, each containing a number of superposed filter cells. The casings rest upon a base between two pillars, connected at the top above the filters by a movable cross-piece, which carries a screw. The latter serves to apply pressure to a cover or top piece, which rests on the upper filter casing; the whole series of filters is consequently pressed between the top piece and the base. The liquid to be filtered enters the casing at the bottom, and passes through the cells to a central pipe, which has an outlet at the bottom of each casing. By an arrangement of flexible connections the filters may be worked in series or in parallel.—W. H. C.

Filters; Impts. in ——. A. J. Boult, London. From E. Goldman & Co., Chicago. Eng. Pat. 2992, Feb. 7, 1906.

THE invention relates to filters, which consist of a number of superposed cells enclosed in a vertical casing, and held together by pressure applied by a screw from a cross-bar above (see preceding abstract). The cross-bar and the upper half of the casing are made to swing out sideways in order to facilitate the removal of the cells. The gasket joint between the upper and lower halves of the casing can be broken by means of a cam worked by a lever.—W. H. C.

Boiling apparatus for liquids containing or depositing solid substances. O. Faller, Basel, Switzerland. Eng. Pat. 24,737, Nov. 29, 1905.

THE claim is for improvements in apparatus described in Eng. Pats. 463 of 1872, 9499 of 1892 (this J., 1893, 510), 8763 of 1900 (this J., 1901, 460), and 20,147 of 1902 (this J., 1903, 202). The improved apparatus consists of a tubular heater, A, a vapour-separating chamber, B, and a solids-depositing chamber, D, connected as shown by the tubes, C and E. The tubes of the heater, A, are slightly inclined, to prevent solid matter from accumulating on the sides, and the heating jacket projects into the chamber, B, so that the liquid in the upper ends of the tubes is not cooled by contact with the body of liquid in B, which would tend to cause the choking up of the tubes by the deposition of solid matter. In consequence of the circulation of the liquid in the direction indicated by the arrows, the separated solids are carried forward, and settle in that part of the vessel, B, which is over the tube, C, and instead of falling back upon the tubes of the heater, A, and choking them, they are carried down the tube, C, into the vessel, D, where they accumulate. From time to time they are removed through the door, F, and the liquid returns to



the heater through the tube, E. Claim is also made for a double construction in which there are two heaters. —W. H. C.

Evaporating liquids; Apparatus for ——. D. Grove, Charlottenburg, Germany. Eng. Pat. 25,552, Dec. 8, 1905.

See Fr. Pat. 360,618 of 1905; this J., 1906, 462.—T. F. B.

United States Patents.

Dryer. A. T. Collins, Swarthmore, Pa. U.S. Pat. 823,262, June 12, 1906.

The material to be treated is made to travel along a jacketed trough by a conveyor formed of disconnected blades mounted on a shaft, which passes axially through the trough. Each of the blades has a scraper attached to it by a bolt at one end, so that the scraper falls by gravity, follows the contour of the trough, and removes and pushes forward any material which escapes the action of the blades themselves.—W. H. C.

Centrifugal machine. F. Kaehl, Berlin. U.S. Pat. 823,948, June 19, 1906.

See Ger. Pat. 155,562 of 1903; this J., 1905, 629.—T. F. B.

French Patents.

Separation of vapours of volatile liquids diffused or contained in air; Dynamo-thermal process of ——. A. Barbezat. Fr. Pat. 361,389, April 17, 1905.

The principle of the process consists in compressing the air containing the vapour to be separated, in a rotary compressor, and then, after passing it through a pressure-equalising vessel, allowing it to expand in a turbine, where it performs work. The air is cooled by the expansion, and the vapour is condensed, and collects in a peripheral chamber surrounding the turbine, the collection being assisted by the centrifugal force developed.—W. H. C.

Drying pulverulent and other materials; Process and apparatus for ——. J. Savary. Fr. Pat. 362,315, Jan. 10, 1906.

The material is first passed through a jacketed preheater and then through the dryer proper, the inlet and outlet openings of which are provided with double slides or doors to prevent the entrance of air. The dryer has hollow heating shelves provided on the inside with gills or blades, and over which the material is moved by rakes; the shelves are heated by injecting into them the steam or vapour given off from the material on them, after it has been superheated. For this purpose the steam is withdrawn from the dryer, and passed through a compressor to increase its temperature before returning it to the hollow shelves. The condensed liquid from the hollow shelves is passed through the jacket of the preheater in order to utilise the heat in raising the temperature of the material before it reaches the dryer proper.—W. H. C.

Dryer for animal or vegetable materials. E. Stauber. Fr. Pat. 362,477, Jan. 17, 1906.

The invention relates to a drying drum, which is rotated between a furnace and a chimney, the material to be dried being fed in at the chimney end, and carried forward to the outlet, near the furnace end, by an Archimedian screw. The furnace gases travel in the opposite direction, and dry the material, which leaves the drum by a number of holes pierced in the side of the drum just before it enters the furnace casing. The invention claimed consists in turning inwards the edges of the outlet end of the drum, and carrying them backwards into the interior in the shape of an open-ended funnel, which extends so far that it covers the outlets, and protects the dried material from the fire. It further serves the purpose of imparting a whirling motion to the furnace gases.—W. H. C.

German Patents.

Evaporation of liquids in a vacuum; Apparatus for the ——. E. Passburg. Ger. Pat. 166,045, Dec. 10, 1903. Addition to Ger. Pat. 162,237, Aug. 28, 1903.

The patent relates to apparatus of the type in which a heating drum rotates in the chamber containing the liquid to be evaporated, whereby a thin film of the liquid is produced on the surface of the drum. In order to prevent the liquid coming in contact with the ends of the drum, these are furnished with protective outer walls; and to prevent oil from the stuffing-boxes on the central shaft being drawn into the evaporating chamber, special oil-collectors are provided.—A. S.

Filtering drum with endless filter cloth. W. Guenther. Ger. Pat. 166,354, Sept. 13, 1904.

In ordinary drum-filters with endless filtering cloths, either the drum must be removed from the containing box, or the end of the box must be removed, in order to put the filter-cloth in place. According to the present invention, the filter-cloth is introduced through an annular slit in the end of the containing-box, and a "closing-ring" is provided for closing the slit.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 634.)

Suction gas producers for bituminous and small-sized fuel. C. Diegel. Stahl u. Eisen, 1906, **26**, 796—799.

The body of the producer for bituminous fuels consists of a circular brickwork casing, which at the top and at a point about one-fifth of the way down is built inwards so as to form circular ledges to support iron tubes. The upper and narrower of these tubes forms the feed, and can be closed at the top by a lid; its open lower end projects

a little way into the top of the wider tube, which is open at both ends, and the bottom of which reaches about half-way down the producer. It will thus be seen that when the producer is filled, the fuel in the bottom portion reaches the walls, but is surrounded, in the middle and upper portions, by two annular spaces which do not communicate with one another. The hot gases from the bottom bed of fuel rise into the lower annular space, and are thence taken off by a pipe to the engine. Their heat carbonises the fuel in the iron tube, and the gases and tarry vapours produced, rise into the upper annular space, whence they are taken off by a pipe to the bottom of the producer, and by means of a steam jet are driven with the air into the bed of fuel at the bottom. The fuel in the bottom section of the producer is thus always coke, and the gases taken to the engine are quite free from tarry and other condensable products. The gases pass, on their way to the engine, through a cooler, a scrubber, and a purifier, and the steam for the steam-jet is derived from the evaporation of water in the pipes of the cooler.

The producer for small fuel is rectangular, and has "stair-grates" along the bottom of two opposite sides, with hoppers for fuel above each. An inverted V of brickwork, parallel with the hearths, and a little above the middle height of the producer, shelters the exit pipe, which starts from the angle of the V, and ensures an open space free from fuel below it. The air passes from the grates (which from their form cannot be choked by the fuel) through the fuel to this central space, and the gases are thence drawn off as usual.—J. T. D.

Gas analysis; Sodium hyposulphite [hydrosulphite] in ——. H. Franzen. XXIII., page 715.

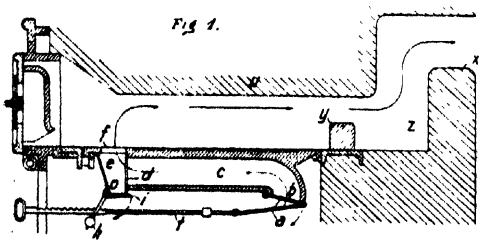
ENGLISH PATENTS.

Power and heat from highly explosive substances; Impts. in developing ——, *and in apparatus therefor.* J. de Dios, Tejada, New York. Eng. Pat. 22,125, Oct. 30, 1905.

THE explosive is exploded in a series of small charges in a detonating chamber. A portion of the resulting gases is used to operate the charging and detonating mechanism, and the remainder is either utilised directly for producing power and heat in separate apparatus, or it may be stored in reservoirs for future use.—W. H. C.

Smoke-consuming furnaces; Impts. in ——. J. O Schmidt, Mönchswalde, Saxony. Eng. Pat. 25,454 Dec. 7, 1905.

Fig 1.



THE air enters the hollow bars, *c*, through the opening, *b*, provided with the regulating door, *a*, common to all the bars, and operated by the rod, *t*. The air, warmed by its passage through the hollow bar, *c*, passes through the opening, *d*, into the ash-pit, *e*, which has an opening, *o*, closed by the door, *i*, kept in position by the counter-weight, *h*, and through which the ashes are removed. From the ash-pit, *e*, the air passes through the opening, *f*, into the furnace, where it is caused to pass close to the bed of fuel by the low furnace crown, *u*. A further thorough mixing and combustion of the gases takes place in the combustion chamber, *z*, formed by the two bridges, *x* and *y*, at the rear of the furnace.—W. H. C.

Gas producers; Apparatus for feeding and smoothing the fuel in ——. L. Weaselsky, Dresden, Saxony. Eng. Pat. 20,445, Oct. 10, 1905.

SEE Addition of July 11, 1905, to Fr. Pat. 335,291 of 1903; this J., 1906, 116.—T. F. B.

Gaseous mixture; Method of and apparatus for producing a combustible ——. C. K. Harding, Chicago. Eng. Pat. 21,369, Oct. 20, 1905.

SEE U.S. Pat. 803,534 of 1905; this J., 1906, 170.—T. F. B.

Acetylene gas; Purification of ——. G. F. Jaubert, Paris. Eng. Pat. 24,418, Nov. 25, 1905. Under Int. Conv., Nov. 28, 1904.

SEE Fr. Pat. 350,356 of 1904; this J., 1906, 116.—T. F. B.

Gases; Impts. in the cleansing of ——. H. N. Potter, New York. Eng. Pat. 12,210, May 25, 1906. Under Int. Conv., June 10, 1905.

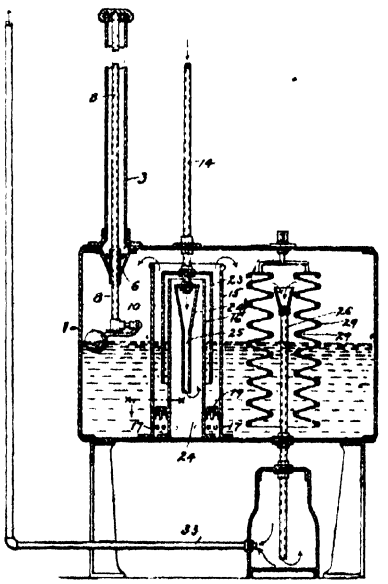
THE gases are freed from dust and suspended particles by passing them through a porous screen coated with silicon monoxide powder. (See Eng. Pat. 26,788 of 1905; this J., 1906, 434.)—C. S.

UNITED STATES PATENTS.

Coke briquettes; Process for the manufacture of ——. L. L. D. Zuiderhoek, Amsterdam. U.S. Pat. 824,680, June 26, 1906.

SEE Eng. Pat. 17,906 of 1904; this J., 1905, 836.—T. F. B.

Carburetter. A. Akeson, Assignor to Standard Gas and Heating Co., Worcester, Mass. U.S. Pat. 823,382, June 12, 1906.



THE apparatus consists of a containing vessel, 1, supplied with the carburetting liquid through the pipe, 8, which passes through the vent pipe, 3, and is provided with a float-valve, 10, to maintain a constant level of liquid in the container, 1. The air to be carburetted enters by the pipe, 14, and travels in the direction indicated by the arrows through the carburetter, which is formed of a number of concentric cylinders, 15, 16, 23, and a conical pipe, 24, 25. The liquid enters the carburetter from the container through the perforations, 17, and the valves, 19, and the carburetted air leaves the vessel, 1, by the pipe, 26, surrounded by the collapsible bag, 29, and by way of the pipe, 33.—W. H. C.

Gas-generating furnace. C. A. Buzzell, Newburyport, Mass. U.S. Pat. 824,337, June 26, 1906.

THE gas-generating furnace comprises a furnace body provided with a steam-generating chamber, and enclosed in a gas-jacket. The fire-chamber is interior, and provided with a bottom fuel-grate, below which is a combined ash-pit and gas mixing-chamber with gas-tight closures. Between the fire-chamber and the enveloping gas-jacket is a space forming a water-jacket, which opens at the top into the steam-chamber. Steam is delivered, under pressure, into the fire-chamber above the fire-line, and passes through the fuel-bed and grate into the gas mixing-chamber. An oil-feed pipe extends through the fire-chamber, and is provided with a delivery port beneath the grate, where oil in gaseous form is delivered. The gas mixing-chamber is provided with gas-ports in communication with the gas-circulating jacket.—W. C. H.

Gas-producer. H. Gerdes, Berlin, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 824,353, June 26, 1906.

THE fuel-chamber is formed by a casing, and a hearth extends beneath the chamber. Standards are arranged on the hearth on opposite sides of the casing, and guide-flanges on the standards. The ends of series of horizontal plates, arranged in different planes above the hearth, and on opposite sides of the centre of it, rest upon the guide-flanges. These plates form a stepped support for the fuel within the chamber, from the centre to the walls of the casing, with laterally-extending air-passages between the steps.—W. C. H.

Gas-producer; Suction ——. E. Higgins, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 824,358, June 26, 1906.

THE producer described consists of a casing having a "fire-lining" enclosing a combustion chamber, a grate of basket form in the lower portion of the chamber, and an ash-pit chamber beneath the grate, extending diametrically across the producer, through the lining to the walls of the casing. There is a horizontal air inlet passage into the casing, which opens into a horizontal semi-annular air passage, this passage being formed by a segmental baffle-plate, forming a portion of the supporting wall for the lining. The air enters by the central horizontal inlet, and passes both ways, through the semi-annular passage into the opposite ends of the ash-pit.—W. C. H.

Gas-producer. R. Hilprecht, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 824,359, June 26, 1906.

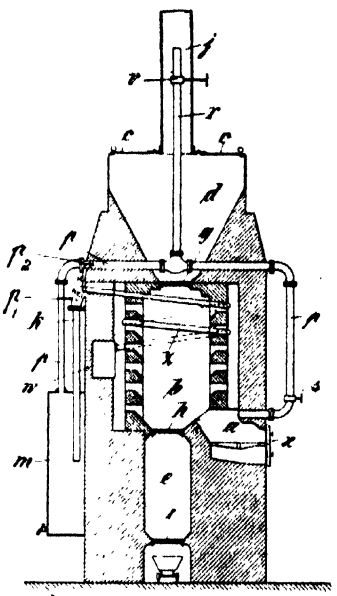
THE suction gas-producer described consists of an outer casing, and an inner casing tapered downwards, and open at its lower end, the space between the two forming an annular fuel chamber. The grate is arranged below the opening of the inner casing. The gas generated is withdrawn from the gas chamber within the inner casing through a suitable outlet pipe. A vaporiser is arranged in the upper portion of the inner casing, the conical or tapered hood of which forms a shoot down which fuel passes to the fuel chamber, from a hopper above the hood. Gases from the vaporiser and from the fuel chamber can be mixed, and conducted by a pipe to the ash-pit chamber below the grate.—W. C. H.

Gas-producer. E. Sandner, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 824,384, June 26, 1906.

A HOLLOW member passes transversely across the fuel chamber of the producer, the outer walls of this member being of inverted V-shaped cross-section, and the inner wall of cylindrical cross-section, and opening centrally downwards into the mass of fuel, thus forming an eduction conduit through which the generated gases are drawn. The space between the walls of this hollow member forms a water chamber, in which vapour is generated and commingled with the air drawn through the casing. The top of the vaporiser is provided with a detachable cap.—W. C. H.

FRENCH PATENTS.

Retort-oven for the carbonisation of peat, wood, &c., with return of the gas given off into the furnace. E. Stauber. Fr. Pat. 362,497, Jan. 18, 1906.



THE apparatus consists of a furnace, *a*, with a door, *x*, by which the supply of air is regulated, a carbonising chamber, *b*, above which is a chamber, *d*, where the peat undergoes a preliminary drying, and a cooling chamber, *c*, for the carbonised residue. The peat is charged into the drier, *d*, through the hinged doors, *c*, and its passage into the chambers, *b*, and *c*, is regulated by the slides, *g*, and *h*. From the cooler, *c*, the residue falls into trucks through the opening closed by the slide, *i*. The products of distillation pass by the pipe, *k*, to the condenser, *m*, and the uncondensed vapours and gases pass on by the pipe, *p*, into the furnace, any excess going directly to the chimney, *j*, by the branch, *r*. The quantity passing in either direction is regulated by the valves, *s*, and *v*. A tank, *w*, fed with water from without, is built into the brickwork, and communicates with the coil, *z*, in which steam is generated and superheated by the heat of the carbonising chamber, and then delivered by the valved pipes, p_1, and p_2, into the gas-pipes, *k*, and *p*, to cause an increased circulation of the gases.—W. H. C.

Gas-producer. P. M. V. Guignard, Fr. Pat. 361,331, April 6, 1905.

THE claim is for a producer with an open, easily detachable, water-jacketed bottom piece, from which the clinker can be easily removed. The water-jacket serves to cool the bottom piece, and to produce steam for use in the producer. The bottom piece has an inner ring, on which the fuel rests, screwed into it by a square-threaded screw, which presents a large contact surface between the ring and the bottom piece so that the heat is readily conducted away from the ring. The gas leaves the producer near the top, and passes first through a dust-separating chamber, and then through a water seal into a coke scrubber down which water is caused to flow. The producer proper is supported on one side by the washer, and on the other by a leg bolted on to it, leaving the space below free, so that access can be easily had to the bottom for clinkering. —W. H. C.

Gas generator. Kynoch, Ltd. Fr. Pat. 362,436, Jan. 16, 1906.

SEE Eng. Pat. 13,517 of 1904; this J., 1905, 666.—T. F. B.

Oxygen; Production of ——, for use in combustion motors. P. Winand. Fr. Pat. 362,524, Jan. 19, 1906. Under Int. Conv., Feb. 9 and 16, 1905.

See Eng. Pat. 3121 of 1906; this J., 1906, 632.—T. F. B.

Incandescence by gas, obtained by the application of artificial threads in the form of hydrated refractory oxides to moist atmospheres; New process of ——. A. M. Plaissetty. Second Addition, dated Jan. 9, 1906, to Fr. Pat. 321,803, May 2, 1902. (See this J., 1903, 291 and 547.)

This addition to the original patent covers the use for incandescence mantles of threads of cellulose or its direct derivatives in the form of homogeneous filaments that have lost their natural cellular structure, obtained by solution of cellulose or of its substituted derivatives in an appropriate solvent.—W. C. H.

German Patent.

Gases; Process of and apparatus for filtering ——. H. Apel. Ger. Pat. 166,614, May 4, 1905. Addition to Ger. Pat. 166,613, Nov. 22, 1904.

The gas before being passed through the series of filtering layers described in Ger. Pat. 166,613 (this J., 1906, 633), is conducted through a water-separator of the ordinary kind, provided with baffle-plates to form a zig-zag path for the gas. The spaces between the baffle-plates may be filled with "wood-wool."—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 634.)

Ammonia as a by-product in coke-making; Use of gypsum for the recovery of ——. H. Warth. Chem. News, 1906, **93**, 259—260.

In places where large quantities of sulphuric acid are not available, the author recommends the use of calcium sulphate for the recovery of ammonia from gas-liquor. A sample of gas-liquor containing 2·6 grms. of ammonia per 100 c.c. was well shaken with plaster of Paris, allowed to settle, and the clear liquid drawn off. From the clear solution it was found possible to recover 97 per cent. of the ammonia present in the original gas-liquor, *viz.*, 17 per cent. by boiling the solution, and absorbing the evolved ammonia in sulphuric acid, and 80 per cent. by concentrating the residual solution to obtain crystallised ammonium sulphate. If it were desired to dispense altogether with the use of sulphuric acid, the gas-liquor might be first treated with calcium sulphate, the solution drawn off and treated with ferrous sulphate, the precipitated ferrous sulphide removed, and the clear solution evaporated to obtain crystallised ammonium sulphate. It was found possible in this way to recover 95·4 per cent. of the total ammonia.—A. S.

Wood distillation in the United States; Census of ——. Oil, Paint, and Drug Rep., July 2, 1906. [T.R.]

The Director of the Census has announced the result of the tabulation of the statistics for wood distillation for the calendar year 1904, forming a part of the census of manufactures of 1905. Following is a summary of the report:—

The statistics for the 141 establishments engaged in this industry are summarised in the following statement:—

Capital	$10,506,979
Materials used—	
Total cost	$4,847,770
Wood—	
Cords	586,144
Cost	$1,783,004
Lime—	
Bushels	523,334
Cost	$101,068
Soda—	
Pounds	371,780
Cost	$5,484
Crude wood alcohol—	
Gallons	5,723,001
Cost	$1,976,156
Smoke, cost	$22,998
All other materials, cost	$959,070
*Products, total value	$7,813,483
Wood alcohol, crude—	
Gallons	6,684,871
Value	$2,161,813
Refined—	
Gallons	4,316,346
Value	$2,618,886
Acetate of lime—	
Pounds	105,141,361
Value	$1,474,982
Charcoal—	
Bushels	25,869,055
Value	$1,197,973
All other products, value	$364,829

*Exclusive of wood distillation products valued at $1,208,335, made in establishments engaged primarily in the manufacture of other products. The principal items included in this amount are:—Crude alcohol, 129,387 galls., valued at $40,148; refined alcohol, 1,585,807 galls., valued at $824,239, and charcoal, 6,045,157 bushels, valued at $290,192.

Petroleum of good quality; Attempts to obtain ——, without chemical refining. K. Charitschkow. Westnik shirow. promysl., 1906, **7**, 61. Chem.-Zeit., 1906, **30**, Rep., 205.

On repeating the treatment recommended by Deichler (Ger. Pat. 160,717 of 1904; this J., 1905, 1295), namely, warming the crude oil for some time in presence of 1 per cent. of metallic sodium, and then distilling under a reflux condenser, the author collected two fractions, one coming over below 150° C., the other (lamp oil) between 150° and 270° C. In colour they were equal to the ordinary refined products, but the light fraction had a more pungent smell. In point of acidity, the use of sodium made little difference to the light fraction, but considerably reduced that of the lamp oil. It is concluded that, though the method is capable of economising caustic soda in refining, the acid process is still necessary, and the advantages are diminished by the higher consumption of fuel required in the preliminary heating process.—C. S.

English Patents.

Mining "deads"; Treatment [distillation] of ——. H. Koppers, Essen-Ruhr., Germany. Eng. Pat. 15,513, July 28, 1905.

See Fr. Pat. 356,578 of 1905; this J., 1906, 12.—T. F. B.

Tar, naphtha, and like hydrocarbons, Oxidation and distillation of ——. Soc. Anon. des Combustibles Industriels, Hame-St. Paul, Belgium. Eng. Pat. 16,182, Aug. 8, 1905. Under Int. Conv., Dec. 19, 1904.

See Fr. Pat. 349,214 of 1904; this J., 1905, 668.—T. F. B.

French Patents.

Decomposition of the products of distillation during carbonisation, Process for avoiding ——. H. Koppers. Fr. Pat. 362,505, Jan. 18, 1906.

A current of inert gas, that is, a gas which has no chemical influence on the reactions taking place in the coking chamber, is introduced above the charge for the purpose of hastening the removal from the chamber of those products which may become modified by prolonged contact with the heated interior. It is preferred to use for this purpose a portion of the coke-oven gases themselves after they have been cooled and purified. In addition to the above action, the introduction of cool gases into the oven keeps down the temperature of the space above the charge. If desired, a gas or vapour which acts chemically on the charge may be introduced along with the inert gas.—W. H. C.

Coal and other substances; Distillation of ——, and apparatus therefor. J. Bowing. Fr. Pat. 362,506, Jan. 18, 1906.

See Eng. Pat. 580 of 1905; this J., 1906, 171.—T. F. B.

Acetone; Industrial manufacture of ——. Soc. Pagès, Camus, et Cie. Fr. Pat. 361,379, April 14, 1905.

See Eng. Pat. 8757 of 1906; this J., 1906, 634.—T. F. B.

Mineral oils and similar substances; Process for preparing emulsions of heavy ——. J. P. Van der Ploeg. Fr. Pat. 361,395, April 19, 1905.

See Eng. Pat. 7699 of 1905; this J., 1906, 423.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 635.)

Nitrophenolsulphonic acids; Study of the ——. R. Gnehm and O. Knecht. J. prakt. Chem., 1906, **73**, 519—537.

Experiments were made to prepare sulphonic acids from *o*-, *m*-, and *p*-nitrophenols with the following results:—*o*-Nitrophenol with concentrated sulphuric acid or chlorosulphonic acid gives one sulphonic acid, $C_6H_3OH(NO_2).SO_3H$,1:2:4. If mercury be added to the reacting mixture, several sulphonic acids are produced, but only one of these, an *o*-nitrophenoltrisulphonic acid, was isolated in the form of its barium salt. *m*-Nitrophenol gives a sulphonic acid when acted on by sulphuric acid, but not by chlorosulphonic acid, and mercury accelerates the reaction. The position of the groups in this acid is not known. *p*-Nitrophenol gives with sulphuric acid, but not with chlorosulphonic acid, one sulphonic acid, $OH:SO_3H:NO_2$,1:2:4. The reaction is accelerated but not otherwise changed by addition of mercury or boric acid.

The greater readiness of *o*-nitrophenol to react with chlorosulphonic acid than *m*- and *p*-nitrophenol is explained by the directive influence of the two groups already attached to the benzene nucleus.—C. E. F.

Dyestuffs; New ——, *fixed by metallic oxide mordants.* Poirrier and Ehrmann. Bull. Soc. Ind. Mulhouse, 1906, **76**, 69—71.

On heating for an hour on the water-bath, dinitrosoresorcinol (8 parts) with resorcinol (30 parts) and hydrochloric acid (6 parts), a dyestuff is formed which dyes tissues mordanted with iron oxide, alumina, and chromic oxide, in yellowish-brown shades. Mononitrosoresorcinol (7 parts), similarly heated with aniline (10 parts) and hydrochloric acid (100 parts), yields a compound which dyes iron-mordanted tissues in greyish-blue, and alumina-mordanted tissues in blue shades. Mono- and dinitrosoresorcinol, when heated alone with hydrochloric acid, also give dyestuffs, of the same class, but deficient in dyeing power.

C. Vaucher, who has examined the above dyestuffs, along with one prepared by heating together nitroso-2.7-dihydroxynaphthalene, pyrogallol, and hydrochloric acid, finds that they possess a general similarity in character. They are insoluble in water, and easily soluble in alkalis. They all give yellowish-brown shades upon iron oxide, chromic oxide, and aluminium hydroxide mordants. When printed in ammoniacal solution, and steamed, they give brown colours which are inferior in intensity to that yielded by an ammoniacal solution of dinitroresorcinol (this J., 1899, 270).—E. B.

Colouring matters from molasses, vinasse, &c. Wichardt. Z. Ver. deutsch. Zuckerind., 1906, 595—596.

The author describes the manufacture of a dyestuff from ammonium molybdate and molasses, vinasse, &c. Ground ammonium molybdate, $(NH_4)_2MoO_4$, is dissolved in hot water, and molasses or vinasse is added to the solution in the proportion of 1 part of molasses to 10 parts of molybdate. After warming for a considerable time the solution becomes green. Addition of some dilute sulphuric acid causes the solution to become bluish-green, and with more acid, deep blue. The dyestuff may be precipitated by addition of spirit, and if excess of molybdate has not been used, the supernatant liquor may be poured off, and the residual dyestuff freed from sugar by washing with water. The purified substance is slowly dried on the filter, ground, and sifted. The product thus obtained is exactly similar to "mineral indigo," Mo_8O_7, and behaves towards acids and alkalis just like the latter. If the filtrate is treated with milk of lime, and again neutralised, the sugar may be recovered. The dyestuff may be used for dyeing linen, cotton, wool, and silk, as well as for the preparation of pigments, since it possesses great covering power, and is very stable.—L. E.

Ferro-cyanogen compounds; Reduction of blue ——. M. Kohn. VII., page 695.

Ultramicroscope; The ——, *and its application in chemistry.* L. Michaelis. XXIII., page 715.

United States Patent.

Dye and process of making same; Disazo ——. T. Kroeber, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 823,793, June 19, 1906.

See Fr. Pat. 358,444 of 1905; this J., 1906, 368.—T. F. B.

French Patents.

Indigo pastes; Process of obtaining highly concentrated preparations of ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 361,357, April 12, 1905.

See Eng. Pat. 7390 of 1905; this J., 1906, 259.—T. F. B.

Indigo white; Process for obtaining preparations of ——, *suitable for vats and particularly for the fermentation vat.* Farbwerke vorm. Meister, Lucius und Brüning Second Addition, dated April 17, 1905, to Fr. Pat. 360,608, March 6, 1905.

See Eng. Pat. 4647 of 1905; this J., 1906, 174.—T. F. B.

Hydroxynaphthobenzaldehydinsulphonic acids and their derivatives; Process of making ——. L. Cassella und Co. Fr. Pat. 361,393, April 18, 1905.

See U.S. Pat. 807,117 of 1905; this J., 1906, 65.—T. F. B.

Dyestuffs for cotton; Process for preparing diazotisable [*Azo*] ——. L. Cassella und Co. Fr. Pat. 361,397, April 19, 1905.

See U.S. Pat. 813,155 of 1906; this J., 1906, 260.—T. F. B.

5-Nitro-2-aminophenol and [*Azo*] *dyestuffs derived therefrom; Process for making* ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,405, April 22, 1905.

See Eng. Pats. 7910 and 7910A of 1905; this J., 1905, 1298.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 636.)

"*Ecru*" *silk; Chemical characteristics of* ——. G. Gianoli. Report of the Milan Commission on Silk. Rev. Gén. des Mat. Col. 1906, **10**, 199—201.

Until recently, practical men attributed great importance to the colour, smell, and "handle," in order to judge if silk were pure, and in case of doubt they boiled off the silk in order to determine the percentage of fibroin present. However, the differences which are always met with in silks of the *Bombyx mori* of the same race or of the same cross even when cultivated in the same district, and the inequalities which depend on the culture, food, &c., do not permit an accurate judgment of the silk on the determination of the fibroïn alone, as this has been shown to vary from 73 to 84 per cent. Since the proportion of matter soluble in a soap solution may vary from 16 to 27 per cent., it is possible to increase artificially the proportion of "impurities" which is usually found

in the fibre, and this makes it necessary to establish limits between which this proportion can vary owing to natural causes. To show whether silks of known purity had chemical properties sufficiently characteristic, ten well-known samples were examined, with the following result:—

	Minimum.	Maximum	Mean.
Matter soluble in:	per cent.	per cent.	per cent.
3 per cent. soap solution ..	21·449	25·913	22·865
Distilled water at 50 —55° C.	0·447	1·053	0·617
Ether.....	0·104	0·451	0·275
Ash	0·726	1·903	0·853

The silks examined being from different Provinces, these limits were taken as standards of purity, and similar determinations with more than a hundred samples have confirmed the results. In order to show the effect of the extractive matter in the water used for unwinding the cocoons, experiments were made in winding Chinese cocoons in water which contained from 16—27·9 grms. of extractive matter (from the chrysalides, &c.), the variation being due to the condensation of steam.

The silk obtained, gave the following results, compared with the same silk wound with ordinary water:—

	Water containing extractives.	Ordinary water.
Loss on boiling off	22·63	18·85
Loss with water 50°—55° C	3·83	0·18
Ether extract	0·56	0·29
Ash	1·14	0·82

These figures show remarkable differences, due to the presence of extractive matter in the water used for unwinding. The following figures show the results obtained with various species of silk:—

Species.	Loss on washing.	Boiling off	Ether.	Ash.
White Kutais	0·57	22·16	0·55	0·83
White Turkestan	0·32	21·44	0·31	0·91
Yellow Adrianople	0·54	24·88	0·35	0·88
Yellow Greek	0·69	24·64	0·26	0·91
White Chinese crossed with yellow Italian	0 59	22·48	0·39	0·81

The slight variation in the figures, even with silks from very different places, is explained by the fact that the cocoons, during winding, &c., are treated with a relatively large quantity of warm water, which causes the differences due to the nature of the cocoons to disappear. The determination of the matter soluble in water at 50°—55° C. has become of great importance, indicating indirectly whether extractive matter, soap, glycerin, dextrin, glucose, borax, or other matters soluble in water have been added to the silk to increase its weight. In order to allow for differences in the water employed for winding, it has been decided by the International Congress that the amount soluble in water must not exceed 1·5 per cent. Owing to the difficulty in drying silk at 110°—120° C., the temperature employed in conditioning has been raised to 140° C. If the silk contain substances such as glycerin, some of these are vaporised with the water, and thus cause too high results to be obtained for the amount of water.

Another difficulty in the testing of silk is the "sampling." Cocoons from the same lot have given differences of 9 per cent. in the amount of fibroin present, and portions of the same silk have shown differences of 2·63 per cent.

In the Milan Laboratory the samples are placed in tubes of nickeled copper or aluminium, and heated air under pressure is passed through them. The tubes are closed, and allowed to cool in a desiccator before weighing. The silk is then plunged into ten times its weight of distilled water, heated to 50°—55° C. on a water-bath, and left for half an hour; the water is then changed, and the silk left for another half-hour at the same temperature. The fact that the loss may not exceed 1·5 does not show that the silk is pure, as the water only removes soluble substances. The silk should also be treated with ether, as the proportion of natural silk soluble in this solvent varies between well-defined limits.

The presence of inorganic adulterants can usually be found by an ash estimation, as the amount in a pure silk very seldom exceeds 1·0 per cent.—A. B. S.

Silk weighted with tin, and of good resistance to light Sealed Note No. 1377, Feb. 3, 1903. O. Meister. Also Report on same by E. Grandmougin. Bull. Soc. Ind. Mulhouse, 1906, 128—133.

SILK heavily weighted with phosphate and silicate of tin is liable to become tender on storing, especially if exposed to sunlight. The spontaneous formation of red spots, where both dyestuff and silk are destroyed, has also been frequently observed, and has occasioned very heavy losses to silk dyers. It has been established, in particular by the work of Sisley and of Gnehm respectively, that the spots are caused by the presence of sodium chloride, perhaps also by the presence of traces of copper (see O. Meister, Chem.-Zeit., 1905, 39). Precautions have consequently been taken, which have considerably diminished the frequency of this complaint. In his communication, O. Meister states that silk heavily weighted by the tin-silicate-phosphate process may be rendered completely immune from the formation of spots, and also from the liability to become tender on exposure to light, by treatment with a preparation of ammonium thiocyanate, glycerin, boric acid, and tannin. Thus, silk weft yarn weighted 100 per cent., and then after-treated was, it is stated, unaffected by exposure to bright sunlight for several months. The same silk not after-treated had considerably diminished in strength and elasticity after an exposure of only a few days. The process has been successfully employed since 1902 in a large silk dyehouse. Grandmougin points out the great importance of this work to the silk trade, especially in view of the approaching expiration of the agreement between the Zürich and Crefeld manufacturers. This agreement, by which the weighting of silk warp was limited to 20—30 per cent., and that of silk weft to 60—80 per cent., was not renewed at the Turin International Conference in 1905, the settlement of the question being referred to a special committee.—H. L.

Wool; Effect of chlorine on ——. L. Vignon and J. Mollard. Comptes rend., 1906, **142**, 1343—1345.

THE authors have examined the effect of chlorine, as gas, as chlorine water, and as bleaching powder, on wool when used to bleach it. They find that it modifies the wool, and may under certain conditions entirely destroy it. The wool loses up to 10 per cent. of its weight; the treated wool dyes more readily than the untreated, giving deeper and more brilliant shades. The elasticity and tenacity of the wool are usually diminished by the treatment, but the fibres still readily felt together, and the tendency to shrinkage is greatly lessened.—J. T. D.

"*Lappings*," *composed of woollen and cotton tissues, employed in tissue printing; Note on the manufacture of* ——. C. Rollin. Bull. Soc. Ind. Mulhouse, 1906, **76**, 59—62.

CERTAIN tissues employed in lapping the impression cylinders of printing machines for the purpose of giving the necessary elastic pressure to the tissues to be printed, as these pass between the cylinders and the printing rollers in the operation of printing, and made by fastening together by means of a solution of india-rubber a web of woollen tissue and one or more, usually two, webs of cotton ("cretonne") tissue, frequently, after being in use for a short time only, become unfit for further use owing to the cotton tissue on one or both sides of the woollen tissue becoming in parts detached from the latter. This occurrence is sometimes caused by the chemical action on the india-rubber of compounds present in the printing

mixtures employed. Sometimes it is due to mechanical causes. Of these, it is commonly assumed that bubbles of air left between the several layers of tissues in the process of preparing the "lapping," constitute a frequent source of the damage. The author, however, attributes it primarily to the different elasticities of wool and cotton, the tissues stretching to different extents under the pressure to which they are subjected in the printing operation. To prevent it from taking place, it is recommended that the woollen tissue should be stretched to some extent before attaching it to the cotton tissue or tissues, and that the "lapping" thus made should not be stretched more than is necessary when the impression cylinder is being wrapped with it.—E. B.

Nitrosamine Red [Paranitraniline Red]; Method of printing ——, in association with sulphur dyestuffs and indigo. C. Favre. Bull. Soc. Ind. Mulhouse, 1906, **76**, 67—68.

Sulphur dyestuffs and indigo may be printed in conjunction with Paranitraniline Red on tissues prepared in sodium β-naphtholate, but the latter cannot be kept long before printing. The necessity for preparing in β-naphthol is avoided by using for the red a mixture composed of "Nitrosamine Red" (this J., 1894, 2189), "β-Naphthol R," dissolved in the requisite quantity of caustic soda-lye, and sodium sulphoricinoleate (Turkey-red oil) with the addition of a small quantity of an easily decomposable salt, such as ammonium oxalate, the whole being thickened with gum tragacanth. The following are suitable proportions:—1·2 litres of a paste made from 360 grms. of "β-Naphthol R," 360 grms. of "caustic soda-lye," 0·4 litre of sodium sulphoricinoleate, and 2·4 litres of gum tragacanth paste (75 grms. per litre), are mixed with 2·4 litres of gum tragacanth paste, 60 grms. of ammonium oxalate, and 2·4 litres of a paste prepared by mixing 1 kilo. of "Nitrosamine Red" paste with 2 litres of gum tragacanth thickening. The ammonium oxalate may be omitted from the printing mixture, and applied to the tissue in the form of a preparation-solution (10 grms. per litre), double the proportion of caustic soda employed in the above mixture being in this case taken. After printing, the tissues are steamed for two minutes, soured, washed, and soaped.—E. B.

Wool; Printing —— with printing-mixtures containing phenol. E. Justin-Mueller. Bull. Soc. Ind. Mulhouse, 1906, **76**, 72—74.

Based on the observation that wool prepared for printing by treatment with chlorine, is more readily moistened by water than wool not so treated, endeavours were made to find a compound possessing the property of instantaneously moistening this fibre, with the object of enabling it to be printed in the unchlorinated condition, and thus to dispense with the operation of chlorinating. Phenol, ethyl alcohol, and Turkey-red oil were found to have, in different degrees, the desired property, the first acting the best. An addition of 30 grms. of phenol per litre of the printing-mixture suffices in most cases to give, upon unprepared woollen tissues, colours almost as intense as those produced upon prepared tissues with similar mixtures from which the phenol is absent. The effect is greater when the tissues, before printing, are treated with acid, *e.g.*, by boiling for half an hour in a bath containing 10 per cent. of their weight of sulphuric acid. In the printing of chlorinated tissues, the addition of phenol to the black and dark blue printing-mixtures serves to give well defined and regular impressions. The use of phenol is, moreover, very advantageous in the printing, by the Vigoureux method, of woollen slubbing, which it is impracticable to prepare with chlorine.

H. Grosheintz, who has been asked by the Mulhouse Industrial Society to report on the above paper, states that the printing-mixtures containing phenol, give on unchlorinated wool, shades only slightly deeper than those obtained with the mixtures in ordinary use, and much paler than those produced with the latter mixtures on chlorinated wool. Still there is no doubt that the moistening of the wool is greatly aided by the presence of the phenol. In regard to the treatment with sulphuric acid, Grosheintz's results do not entirely accord with the author's, but this matter is considered of little importance. Grosheintz adds that, without detracting in any way from the merit of the author's note (dated Aug. 13, 1903), which appears to be the first to be published relating to the subject, the firm of Scheurer, Lauth, and Co. in 1897 and for some time afterwards made use of phenol in some of their printing-mixtures for wool. The addition was not made to all the mixtures, as it was found that the phenol had a harmful influence on certain shades. The use of the compound was ultimately abandoned, as, owing to the presence of impurities in the product at first employed, an objectionable smell, which it was impossible to remove, was left in the tissues. The use of pure phenol, it is stated, is unattended by this drawback.—E. B.

α-Naphthylamine Claret; Discharging of ——, by means of [hydrosulphite-][sulphoxylate-]formaldehyde in the absence of iron salts. L. Baumann and G. Thesmar. Z. Farben-Ind., 1906, **5**, 221—223.

In a sealed communication to the Soc. Ind. de Mulhouse, No. 1559, dated August 25, 1905, the authors, together with Hug, described a method of producing coloured discharges on α-Napthylamine Claret with hydrosulphite-[sulphoxylate-]formaldehyde without the addition of iron salts. The principle consists in increasing the acidity of the sulphoxylate-formaldehyde preparation at the moment of reaction, viz., during steaming. Acids cannot be directly added to the printing-mixture, as they decompose sulphoxylate-formaldehyde, and the object is attained by adding a volatile organic base in conjunction with an organic acid or organic acid ester. Of all the organic bases tried, o-anisidine yields the best results. Mono-methylaniline and o-toluidine are also good; aniline and ordinary toluidine have a weaker action. Xylidine and cumidine being less volatile, are also unsatisfactory, unless the goods are subjected to repeated steaming. The best organic acids or derivatives thereof are, in the order of efficiency, levulinic acid, methyl and ethyl tartrate, oxalic, citric, benzoic, salicylic, lactic, succinic, phthalic, and gallic acids. Examples of printing-mixtures which yield a good white discharge are given in the following table:—

400	400	400	400	350	400	Starch-tragacanth thickening solution.
400	400	400	400	350	400	Rongalite C.
30	30	30	30	30	30	Sodium ricinoleate.
–	160	–	–	–	–	o-Anisidine.
80	–	–	–	–	–	Mono-methylaniline.
–	–	160	125	150	125	o-Toluidine.
–	–	–	30	–	30	Dimethylaniline.
120	–	–	–	–	–	Levulinic acid, 25 per cent.
–	10	10	15	–	–	Methyl tartrate, 22° B.
–	–	–	–	120	–	Benzoic acid.
–	–	–	–	–	15	Citric acid.
1000						

After printing, the goods are thoroughly dried, steamed—if necessary repeatedly—for four minutes in the small Mather-Platt, rinsed, soaped, and dried. Most ingrain dyeings can be discharged white in this way.

Printing-mixtures for coloured discharges are readily prepared by dissolving basic dyestuffs in the aromatic base, and tannin in the thickening solution. Gallocyanine dyestuffs may also be used with or without the addition of a mordant. The goods are passed through a weak bichromate solution, rinsed, soaped in the presence of tartar emetic, again rinsed, and dried.

With regard to the comparative advantages of the old ferric-citrate-nitrite process (see this J., 1906, 371) and the above, the authors state that the former is still exclusively employed by them in practice, although the iron salt affects the shade of certain basic, particularly yellow basic, dyestuffs. The new process is free from this disadvantage, and yields satisfactory results for coloured discharges. On the other hand, the printing-mixtures are liable to run, owing to the large quantity of aromatic base that is required; and consequently the white produced on light printing cloths is liable to be

blurred and indistinct. Thus, a satisfactory white can only be produced by the new process on heavier cloths, such as sateens. This difficulty in obtaining a good white in conjunction with coloured discharges renders the new process practically inferior to the older one.

—H. L.

α-Naphthylamine Claret; Improved methods of producing white and coloured discharges upon —— [*with the aid of Setopaline and Alizarin Orange*]. P. Wilhelm. Bull. Soc. Ind. Mulhouse, **76**, 1906, 84—93.

With "dry hydrosulphite" (*hyposulphite*).—"Dry hydrosulphite" (B.A.S.F.), employed in a neutral medium, *e.g.*, in the presence of dextrin and glycerin, gives an imperfect discharge on tissues dyed in α-Naphthylamine Claret. Discharges are, however, readily obtained when certain basic dyestuffs are added to the mixture. Thus, a *blue discharge* is produced with a mixture of "dry hydrosulphite" (300 parts), ground to a smooth paste with glycerin (150 parts), the paste being poured into a solution of dextrin (125 parts) in glycerin (125 parts) and water (50 parts), to which, are added, first, a solution of Thionine Blue (30 parts) or Discharge Navy Blue S (M.L.B.) in phenol (75 parts), and then a solution of tannic acid (75 parts) in glycerin (75 parts). *Yellow, pink, and green discharges* are produced by substituting for the blue dyestuff in this mixture, Auramine, Rhodamine 6G, and a mixture of Auramine and Thionine Blue, respectively. For *a white discharge*, "dry hydrosulphite" made into a paste with glycerin (550 parts of a 66 per cent. paste) and thickened with dextrin (200 parts) and caustic soda-lye (250 parts at 40° B.) may be used. The tissues printed with these mixtures are steamed for four minutes, passed through a bath of tartar emetic, and soaped at full width. This method of discharging does not, however, give regular results. The coloured discharges lose their purity of shade as the printing proceeds. Further, the undissolved hydrosulphite present in the printing-mixtures scratches and damages the printing rollers.

Discharges with sodium hydrosulphite-(sulphoxylate-) formaldehyde.—When this is printed upon tissues dyed in α-Naphthylamine Claret, which are afterwards treated in the same manner as tissues dyed in Paranitraniline Red, a half discharge is produced upon the Claret with a mixture which is sufficiently concentrated to yield a complete discharge upon the Red. In the presence, however, of certain dyestuffs which appear to have a "catalytic" action, a perfect discharge of the Claret results. The dyestuffs which have been found to act most powerfully in this connection are Setopaline (Geigy and Co.) and nitro-alizarin. With each of these white discharges are readily obtained. While, however, to give good results, the nitro-alizarin requires an addition of caustic soda or caustic potash to be made to the printing-mixture, and the steam employed in the steaming operation to be as dry as possible, the Setopaline acts best in a slightly acid mixture and in the presence of glycerin, *i.e.*, a hygroscopic agent. Again, the best thickening for the nitro-alizarin mixture is gum, whilst that for the Setopaline mixture is gum tragacanth. The printing-mixtures are composed as follows:—("White A") Gum tragacanth paste (300 parts), Setopaline (10 parts) dissolved in phenol (40 parts), and glycerin (150 parts), which are mixed together, and heated to 56° C., at which temperature the "Hydrosulphite NF" (450 parts) is added, and dissolved. The function of the phenol in this mixture, it is explained, is probably that of a weak acid. "White B" consists of "Hydrosulphite NF" (500 parts) dissolved at 50° C. in gum solution (200 parts of a 33 per cent. solution) and water (60 parts). The solution is cooled to 31° C. before nitro-alizarin (70 parts of a 20 per cent. paste) is added, and completely cooled before a final addition of caustic potash-lye (200 parts at 50° B.) is made to it. "White B" is not adapted for printing in association with Aniline Black, the acid vapours disengaged from the printing-mixtures employed in producing the latter, neutralising the alkali in it, and preventing it from acting properly. For printing in conjunction with this colour, "White A," which is free from this defect, is used. "White B" may be prepared with "Hydrosulphite NF concentrated," half as much of this as of ordinary "Hydrosulphite NF" being taken. On the other hand, "White A" does not discharge so well with the "concentrated" as it does with the ordinary "Hydrosulphite NF." This is probably owing to the Setopaline becoming transformed by the former product into a compound devoid of "catalytic" action. The addition of an excess of tannic acid, however, keeps the dyestuff in an active condition. Advantage is taken of this in the preparation of coloured discharges. The "concentrated" preparation, moreover, gives better results than the ordinary preparation with certain dyestuffs; thus, with nitro-alizarin, in a neutral mixture, it gives a much better discharge than does the latter. Although the action is too incomplete for a white discharge to be produced in this manner, it may be utilised in effecting a yellow discharge by means of a mixture containing nitro-alizarin, Auramine, tannic acid, and glycerin, in addition to the "Hydrosulphite NF concentrated." Again, Rhodamine 6G, with the latter preparation, in the proportion of 4 grms. per litre of the printing-mixture, completely discharges the Claret. With proper proportions of this dyestuff, dark and pale pink discharges are readily produced. Acridine Yellow also exhibits a similar action, but in lesser degree. By extending the duration of steaming to six minutes, this dyestuff gives a yellow discharge with a greenish tone, which may be "corrected" by the addition to the printing-mixture of a minute proportion of Rhodamine 6G. With these two dyestuffs, the presence of glycerin in the mixtures is necessary. *Dark blue discharges* are obtained with Discharge Navy Blue S along with Setopaline, tannic acid, glycerin, and "Hydrosulphite NF concentrated." *Pale blue discharges* are effected with Thionine Blue and the same reagents. *Olives* and *greens* are produced from mixtures of these dyestuffs and Auramine. The tissues, after printing, are steamed for four to five minutes, then passed through a bath of tartar emetic, rinsed, and soaped for two minutes at 56° C. The pinks, after steaming, have a slightly purplish tint, which disappears on clearing with bleaching powder solution. All the discharge-mixtures keep well and print easily. It is essential for success that sodium ricinoleate ("soluble oil") should be added to the sodium β-naphtholate solution with which the tissues are prepared in the production of the Claret. If this be omitted, the discharge-mixtures, with the exception of "White B," yield unsatisfactory results. The printing-mixtures described, may also be employed in discharging the Puce from benzidine and β-naphthol.

F. Binder and C. Eckert, at the request of the Mulhouse Society, have repeated Wilhelm's experiments, and confirm his results. They state that a printing-mixture containing per kilo., 400 grms. of "Hydrosulphite NF" discharges Paranitraniline Red perfectly, but scarcely attacks Naphthylamine Claret and Benzidine Puce. The same mixture, with the addition of Setopaline, glycerin, and phenol, discharges both of the latter colours. Nitro-alizarin acts similarly to Setopaline, but the printing-mixtures containing it keep badly. They gradually disengage formaldehyde, and become useless for printing. Setopaline gives its full effect only in the presence of glycerin. Rhodamine 6G and Acridine Yellow act like Setopaline, but less powerfully, Acridine Yellow being the weakest in this respect. Binder and Eckert consider that Wilhelm's discovery possesses technical interest of the highest importance, and opens up a new method of producing discharges in tissue-printing by means of hydrosulphite compounds.—E. B.

Modern Violet and Blue 1900; New method of fixing ——. C. Favre. Sealed communication 1406, dated July 27, 1903. Bull. Soc. Ind. Mulhouse, 1906, 133—134.

BLUE 1900 yields an Alizarin Blue shade, whilst Modern Violet gives a much more violet tone of blue, of great fastness to light and soaping, when printed on cotton with the addition of tannin if the goods, after steaming, be passed through a bath containing sodium bichromate, *e.g.*, 2½ grms. per litre at 25° R. The depth and brightness of the shades obtained can be varied considerably by altering the temperature and concentration of the chroming bath. The following are the printing-mixtures

commended:—(1) 40 grms. of Blue 1900 in powder,, litre of acetic acid, ¼ litre of water, ¾ litre of starch, id tragacanth thickening, $\frac{2}{10}$ litre of tannin solution (1:1).) 120 grms. of Modern Violet, 40 per cent. paste, $\frac{1}{10}$—$\frac{1}{10}$ tre of acetic acid, $\frac{1}{10}$—$\frac{1}{10}$ litre of water, $\frac{1}{10}$—$\frac{3}{10}$ litre of starch id tragacanth thickening, $\frac{2}{10}$ litre of tannin solution. hese printing-mixtures, if printed with the addition of tric acid on cloth prepared with aluminium acetate, can rve to produce a fast blue on a Turkey-red ground. —H. L.

eport on the sealed communications 1406, *dated July* 27, 1903, *and* 1442, *dated January* 15, 1904, *of C. Favre, referring to a new method of fixing Modern Violet, Blue* 1900, *and derivatives of Gallocyanine.* O. Alliston. Bull. Soc. Ind. Mulhouse, 1906, 134—135.

HE author in general confirms the results obtained by . Favre in his communication 1406 (see preceding ostract), and states that the latter now adds 3—4 grms. oxalic acid per litre of printing colour, thereby in- reasing the solubility of the dyestuffs, and improving ie shades obtained.—H. L.

English Patents.

hreads, films, and laminæ from viscose; Preparation of ——. S. Peessarer, St. Petersburg. Eng. Pat. 16,583, Aug. 15, 1905.

HE method consists in treating viscose in aqueous olution with salts of aniline, naphthylamine, pyridine, and ther organic bases, whereby an insoluble preparation of ellulose is obtained, the dyeing of which may be effected t the same time by the addition of reagents capable of orming colour effects.—D. B.

olychromatic printing; Process of ——. J. J. Hart, Sydenham. Eng. Pat. 12,128, June 10, 1905.

EE Fr. Pat. 356,153 of 1905; this J., 1906, 17.—T. F. B.

alicoes and other woven fabrics; Apparatus for printing ——. I. V. Hulme, Didsbury. Eng. Pat. 18,168, Sept. 8, 1905.

OR printing scarfs and also continuous patterns on woven abrics, the articles are made to pass under a cylinder, eneath which a roller is mounted, receiving its motion om the cylinder. An endless perforated metal sheet stencil band passes between the cylinder and roller, id under the latter a wooden trough is fixed, containing ie colour or other solution, in which the roller revolves, ereby imparting the coloured design to the fabric. —D. B.

aper, textile fabrics, or the like; Apparatus for spraying fluid upon the surface of ——. C. A. Hanitzsch, Manchester. Eng. Pat. 20,220, Oct. 6, 1905.

PRAYING nozzles, communicating with the colour or other uid container, are mounted at any suitable part in the ngth of the fabric to be decorated. They are worked by eans of compressed air, and are fitted with a screwed ead, which enables the distance between the fluid and air utlets to be adjusted, so as to regulate the fineness of the pray. The container may be divided into compart- ents for the simultaneous employment of various colours. is provided with means for stirring and agitating the uid during the spraying operation, or it may be caused oscillate or otherwise move so as to bring about suf- icient agitation.—D. B.

rinting fabrics and wall papers; Machines for ——. H. H. Lake, London. From Companhia Manufactora Flumineuse, Rio de Janeiro, Brazil. Eng. Pat. 25,054, Dec. 2, 1905.

EE Fr. Pat. 359,677 of 1905; this J., 1906, 426.—T. F. B.

oating goods or material [textile fabrics] with liquid or semi-liquid substances; Method of and apparatus for ——. A. Brown, Londonderry, and R. Young, London. Eng. Pat. 14,193, July 10, 1905.

HE invention is specially applicable for starching fabrics, id consists in placing the goods in a vessel, creating a vacuum therein, passing the exhausted air, under pressure, to a second vessel containing the coating material, and allowing the latter to be forced into the first vessel, so that with the combined vacuum and pressure every particle of the material to be impregnated is efficiently acted on.—D. B.

United States Patents.

Cork fabric, and process of making the same. P. Sechiari, Paris, Assignor to Soc. Anon. du Grimson, Charenton, France. U.S. Pat. 824,675, June 26, 1906.

SEE Eng. Pat. 14,839 of 1904; this J., 1905, 887.—T. F. B.

Mercerising; Process of ——. W. Mather, J. Hübner, and W. J. Pope, Manchester. U.S. Pat. 824,255, June 26, 1906.

SEE Eng. Pat. 2993 of 1905; this J., 1905, 1225.—T. F. B.

French Patents.

Collodion for artificial silk; Compression of ——, *by special solvents.* Soc. Anon. des Plaques et Papiers Phot. A. Lumière et ses Fils. Fr. Pat. 361,323, April 4, 1905.

THE use of water for operating the hydraulic piston in apparatus in which the collodion is supplied to the spinning device under a pressure produced on the hydraulic principle, suffers from the disadvantage that the collodion becomes clotted when traces of the water leak between the piston and the cylinder wall. According to the present invention the hydraulic medium employed is a solvent of nitrocellulose, preferably amyl acetate, which is pumped into the cylinder and pressure accumulator in the same way as water in an ordinary press. —J. F. B.

Collodion for artificial silk; Preparation of a concentrated ——. Soc. Anon. des Plaques et Papiers Phot. A. Lumière et ses Fils. Fr. Pat. 361,324, April 4, 1905.

A FLUID collodion is prepared by dissolving 300 parts of nitrocellulose in 200 parts of methyl alcohol, 200 parts of ethyl alcohol, and 1600 parts of ether. Owing to the excess of ether this collodion is very fluid, and can be easily filtered under a slight pressure. The collodion is then distilled in a vessel provided with stirrers, until 1000 parts of ether have been driven off and condensed for future use. The concentrated collodion is cooled, and, having already been filtered and freed from air whilst in the dilute condition, it can be directly stored in closed vessels ready for spinning.—J. F. B.

Collodion [for artificial silk]; Filter-press for ——. Soc. Anon. des Plaques et Papiers Phot. A. Lumière et ses Fils. Fr. Pat. 361,329, April 5, 1905.

FOR the filtration of collodion for the preparation of artificial silk, a continuous roll of filtering medium is provided outside the press. A portion of the fabric is clamped tightly over the perforated support by means of a screw-head, and the collodion is admitted under pressure from below through a pipe provided with a stop-cock. When the filtering surface has become clogged, the stop-cock is closed, the conduit for filtered collodion is also closed, the screw-head is raised slightly, and a new filtering surface is pulled through from the roll, and is clamped down ready for use.—J. F. B.

Silk; Process for the manufacture of artificial ——. E. Crumière. Fr. Pat. 361,048, Nov. 27, 1905.

OZONE or ozonised air is employed in treating cellulose in the manufacture of artificial silk. To this end the cellulose, in the form of cotton, ramie, &c., is exposed, "in contact with a solution of caustic soda or potash," for about half an hour to the action of the gas. The cellulose thus treated, it is stated, rapidly dissolves when it is immersed in a cupro-ammoniacal solution, giving a solution of a consistency suitable for the manufacture of threads. It is recommended to add metallic copper to the ammoniacal solvent, for the purpose of reacting

with the ammonia liberated, and of replacing in it the "copper" absorbed by the cellulose during the first stages of its action upon the cellulose.—E. B.

Silk; Process for the manufacture of brilliant threads of artificial ——, by precipitating cellulose in alkaline solutions. Soc. Gén. de la Soie Artificielle Linkmeyer. Fr. Pat. 361,061, Dec. 4, 1905.

In manufacturing artificial silk from cupro-ammoniacal solutions of cellulose, the threads produced, after passing into fixing or forming baths of "salts," or caustic soda or potash, are, according to this invention, freed from most of the ammonia present in them, before the rest of this is removed by treatment with dilute acid. This may be effected, as described in Fr. Pat. 347,960 (this J., 1905, 438), by simple evaporation in the air, but it is preferably accomplished by forcing or aspirating air or other suitable gases through the threads, wound, for example, in the moist state upon a perforated cylinder, or, still better, by using solutions of salts, such as sodium carbonate, potassium carbonate, "chromates, phosphates, oxalates, borates, iodides, &c.," which have the property of "absorbing" the ammonia, and of yielding with the cupric hydroxide in the threads, compounds which are insoluble in water, but easily soluble in acids. The solutions may, conveniently, be applied to the threads wound upon perforated reels.—E. B.

Scouring, &c., of wool and other textile fibres; Machine for ——. R. Kleinjung. Fr. Pat. 362,448, Jan. 11, 1906.

The material to be treated is fed in between two endless bands which pass in a zigzag direction through a series of compartments containing the various liquids employed. The liquid passes from one compartment to the next in the opposite direction to the movement of the material. The travelling bands can move relatively to one another, and can exercise a pressure on the material, and also a rubbing effect.—A. B. S.

Dyeing preparations containing, as fixing agents, proteids, especially maizine, of vegetable origin, and dyestuffs; New ——. E. Donard and H. Labbé. Fr. Pat. 361, 121, Dec. 27, 1905.

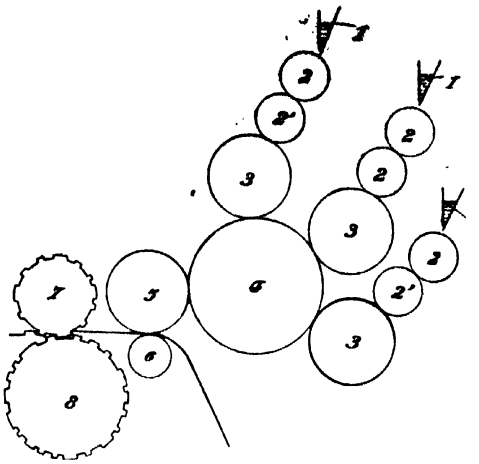
Maizine, the proteid substance derived from maize (this J., 1902, 1464 and 1548; 1905, 853), and the glutens of wheat and other cereals, are introduced in a powdered condition into hot aqueous solutions of basic and acid dyestuffs. The "zéo-" and "glutino-colorines" thus produced are collected and dried. Textile tissues and other materials are coloured with them either by fixing them upon the latter as pigments by means of suitable "agglutinants," or by dissolving them in volatile solvents, such as alcohol, acetic acid, "formaldehyde," aniline, &c., and thus applying them, the colour-lakes becoming fixed upon the tissues, &c., when the solvents are volatilised. They resist, it is stated, washing and soaping. Maizine may be chemically modified by dissolving it in a dilute solution of caustic soda, and precipitating it from this solution with a mineral acid. The product, "maizine S," is employed in the same manner as ordinary maizine, but it gives colour-lakes which are soluble in alkalis and alkaline salts, such as borax.—E. B.

Dyeing threads or fabrics containing acetylated cellulose; Process for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 362,721, Jan. 26, 1906.

Although acetylcelluloses can only be dyed very feeble shades by aqueous solutions of dyestuffs, it is found that, by addition of another solvent, such as acetone or an alcohol, to the dye-bath, any depth of shade can be produced. For example, 1 part of Naphthol Yellow S is dissolved in 50 parts of water and 50 parts of alcohol, and the threads containing acetylcellulose are dyed by immersion for one hour at 70° C.—T. F. B.

Paper, tissues, &c.; Machine for printing and embossing ——. C. H. Jeanson. Fr. Pat. 360,975, Dec. 27, 1905.

Paper, tissues, &c., are printed in designs in several colours, and embossed by means of a combined printing



and embossing machine. The printing "colours," inks, are conveyed from receptacles, 1 (see figure), t trains of rollers, 2, 2', to rollers, 3, bearing portions the designs to be printed. Each of the latter rolle transfers its colour to a smooth roller, 4, which in tu supplies the printing roller, 5, bearing the comple design, with colour. The tissue, &c., to be printed passed between this roller and a supporting roller, After being printed, it is embossed by the cylinde 7 and 8. Modifications of the apparatus are described b means of which the tissues, &c., may be simultaneous printed and embossed, or may be printed, embossed, a again printed. The tissues, &c., may be coloured b means of an embossing cylinder, a train of three cylinde being in this case employed, and "colour" being supplie to one of them.—E. B.

Tapestry, &c.; Colour distributor for the manufactu of ——. G. F. Steiner. Fr. Pat. 362,397, Jan. 1 1906.

The distributor consists of a vessel divided into a numb of compartments to hold the various colours. Each these compartments communicates with all the delive tubes which lead the colour to the orifices, where it com in contact with the material to be printed. The colo holders are separated from the delivery tubes by mea of a perforated plate, the perforations in which are arranged that the desired colours are allowed to r into special tubes according to the design to be printed. —A. B. S.

Formaldehyde-hydrosulphites; Production of —— Badische Anilin und Soda Fabrik. Fr. Pat. 362,44 Jan. 10, 1906. Under Int. Conv., Dec. 4, 1905.

See Eng. Pat. 81 of 1906; this J., 1906, 260.—T. F. B.

Formaldehyde-sulphoxylates and formaldehyde-hydr sulphites [Discharging agents]; Production of alka ——. J. Rohner. Fr. Pat. 362,405, Jan. 13, 1906.

This process depends on the reduction of formaldehyd sodium bisulphite by means of zinc dust or other fine divided metal in presence of oxalic acid. The reactio takes place thus:—

$$CH_2O.NaHSO_3 + Zn + (COOH)_2 = (COO)_2Zn + H_2O + CH_2O.NaHSO_2.$$

The insoluble oxalate of zinc is filtered off from the solutio of formaldehyde-sodium sulphoxylate, and the latter evaporated *in vacuo*. 250 parts of sodium bisulphit (25 per cent. of sulphur dioxide) are mixed with 110 part of formaldehyde (29 per cent.); a considerable rise temperature occurs, and combination takes place betwee the two substances. 110 parts of zinc powder are adde to this solution, and the whole heated to boiling; 12 parts of crystallised oxalic acid are then added, wit

constant stirring, a little at a time. The boiling is continued until the solution is neutral, when the zinc oxalate is filtered off, and the solution evaporated *in vacuo* to a syrup which crystallises on cooling. A similar process can be employed to obtain a solution of pure hydrosulphite:—

$$2.NaHSO_2 + Zn + (COOH)_2 = (COO)_2Zn + 2H_2O + Na_2S_2O_4.$$

Sodium bisulphite is mixed with zinc dust and oxalic acid in aqueous solution; on cooling and stirring until the oxalic acid has disappeared, one obtains, after separation of the zinc oxalate, a solution of pure hydrosulphite. By adding the necessary amount of formaldehyde and evaporating, the "formaldehyde-hydrosulphite compound" is obtained.—A. B S.

Textiles; Rendering —— impermeable. J. Cottin and D. Four. Fr. Pat. 360,946, March 20, 1905.

TEXTILE materials, composed of wool and silk, are rendered impermeable to water, by treatment, after dyeing, with aluminium salts, rosin, paraffin wax, and india-rubber. In dyeing, *e.g.*, with Naphthylamine Black, alum and sodium sulphate are employed as "assistants," the dyed materials, after wringing or squeezing, and "hydro-extracting," being immersed in a bath of sodium sulphoricinoleate (Turkey-red oil, 1 per cent.), acidulated with acetic acid (0·25 per cent.), and being thereupon dried. After being steeped for an hour, at a temperature of 5° C., in a bath of aluminium sulphate (3 per cent.) and "alumina" (3 per cent.), and again dried, they are immersed in succession in solutions (in solvent naphtha) of rosin (0·05 per cent.), paraffin wax (1 per cent.), and india-rubber (1 per cent.) respectively, being dried after each immersion.—E. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 636.)

ENGLISH PATENT.

Dyeing hides and skins; Apparatus for ——. R. Martinet and A. Dulac, Grenoble, France. Eng. Pat. 2998, Feb. 7, 1906.

SEE Fr. Pat. 352,095 of 1905; this J., 1905, 921.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 638.)

Selenium; Behaviour of —— in the sulphuric acid manufacture. S. Littmann. Z. angew. Chem., 1906, 19, 1039—1044; 1081—1089.

THE mode of occurrence of selenium in the chamber process is not what would be expected from our present knowledge of its behaviour, which may be summed up as follows:—Selenium exists as red selenium, the form in which it is precipitated from acid which contains it; as grey or metallic selenium, into which the red form is converted by rise of temperature, and which is more stable and less chemically active than the red form; and as collodial selenium. It is not oxidised by nitric acid to a higher state of oxidation than the dioxide (selenious acid), and this is reducible by sulphur dioxide or sulphurous acid to selenium again. Selenium dissolves in strong sulphuric acid to a green solution.

No selenium is deposited in the dust-chambers between the burner-flues and the Glover towers; the gases in the dust-chambers contain no selenium dioxide, nor do those in the Glover towers, though the Glover acid shows both selenium and the dioxide. The amount contained as dioxide, and that deposited as selenium from the red acid, do not together make up, however, more than about 2—4 per cent. of the total selenium contained in the pyrites. If the Glover acid contain any remaining nitrogen compounds, its selenium is entirely present as dioxide; but when it is completely denitrated, some, if not all, of the selenium exists in a form which the author provisionally terms "combined" selenium, and this is readily reduced to red selenium or oxidised to dioxide. In the Gay-Lussac acid, any selenium present is there as dioxide.

In the chambers, selenium exists in the immediate vicinity of the entrance, but at a little distance from it and throughout the rest of the chambers the gases contain only the dioxide, as does the acid formed. With a divided entry-pipe which delivered gases to the chambers at various points along their whole length, the author found selenium at every point of entry, and the acid contained "combined" selenium, which was afterwards partly precipitated, partly converted into dioxide.

In the concentration of the chamber acid, selenium is difficult to get rid of. Reducing substances, like charcoal, convert it into the red form, but it does not readily subside, and as concentration proceeds, it dissolves again in the acid as the green compound, $SeSO_3$. This, as the temperature rises, becomes oxidised to dioxide at the expense of some of the acid. The concentrated acid thus contains practically as much selenium as the chamber acid from which it was made. The concentrated acid begins to dissolve selenium, forming the green solution at 65° C., and complete solution occurs below 140° C., at which temperature there is already considerable evolution of sulphur dioxide, and hence formation of selenium dioxide. This evolution is very rapid at 210° C., and at 260°—280° C. the oxidation of the selenium is complete. Where the distillates are collected during concentration, the middle portions only contain selenium; neither at a low temperature, when the acid has not dissolved the selenium, nor at a high temperature, when the selenium is completely oxidised, does any pass over, but at intermediate temperatures, while the green solution exists, some volatile selenium compound is formed, and distils over.

The author considers that these phenomena all point to the existence of a selenium compound intermediate between the element and the dioxide—possibly SeO or a derivative of it, which is readily reduced to selenium, or further oxidised. The green solution he looks on as possibly a compound of this with sulphur dioxide (SeO,SO_2) or of both with sulphur trioxide ($SeO,SO_2.SO_3$), or at least as convertible into such a compound by intramolecular change. The solution of selenium in concentrated sulphuric acid, the precipitation of selenium from the solution by dilution, and the formation of selenium dioxide at a high temperature, are represented by the equations:—

$$Se + 2SO_3 = SeSO_3.SO_3.$$
$$SeSO_3 + H_2SO_4.H_2O = 2H_2SO_4 + Se.$$
$$SeSO_3.SO_3 = SeO_2 + 2SO_2.$$

The compound, $SeSO_3$, may act as $SeO.SO_2$. Either SeO itself or possibly this compound of it is volatile, and it is in this form that selenium is carried with the flue-gases right through into the chambers.

The ready oxidation of this compound, and its easy reduction to selenium, suggest as a means of reducing the amount of selenium in the chamber acid when working with seleniferous pyrites, to carry on the process with as little excess of nitrogen-compounds as possible. The author has found that by his method of dividing the gases for entry into the chambers, this condition is fulfilled, and he has succeeded in lessening considerably the content of selenium dioxide in the acid, and increasing correspondingly the amount of selenium precipitated in the mud; where it is possible to filter the acid from suspended selenium, an acid containing still less selenium is obtained. From chamber acid or stronger acids it is not practicable to remove dissolved selenium completely; but, from weaker acids it can be removed, most readily by precipitation by means of hydrogen sulphide or barium sulphide.

For the production of selenium from the Glover- or chamber-mud, the mud is treated with concentrated sulphuric acid and a quantity of sodium nitrate corre-

sponding to the amount of selenium. The mixture, diluted not below 85 per cent. of monohydrate, is well stirred, and then steam is blown in till the sp. gr becomes 1·25, any oxides of nitrogen still remaining being expelled by a stream of air. The solution is filtered, and in the filtrate and washings, after addition of hydrochloric acid or common salt, the selenium is precipitated by a stream of purified sulphur dioxide as a gelatinous mass, which, by warming and proper treatment, can be clotted together into a ball. This, after washing with water, and drying at 105° C., gives a 99 per cent. selenium.

For the analytical detection of selenium, its reduction, and precipitation as such must be relied on; stannous chloride is the most efficient agent. A red colour in the acid, due to nitroso sulphur compounds of iron, may sometimes suggest selenium, but this is destroyed on reduction, and gives, of course, no red precipitate of selenium. The quantitative determination of selenium in sulphuric acids is carried out by the author as follows. The substance is repeatedly treated in the water-bath with strong nitric acid, and evaporated down. Nitrogen oxides are removed by a stream of air passed first through the strong and then through the diluted solution; the solution is then treated with N/10 permanganate, and the excess of this titrated by oxalic acid. The amount of permanganate used is a measure of the selenium which has been oxidised from selenious acid to selenic acid.

—J. T. D.

Chamber process; Practical details of the ——. S. Littmann. Z. angew. Chem., 1906, **19**, 1177–1188.

In a set of three chambers, one 36 m., and the others each 30 m. long, the usual method of working was to send the gases from the Glover tower into the large and one of the small chambers, the united gases from the farther ends of these chambers passing through the third chamber. The large chamber having to be thrown out for repairs, the author used the opportunity to carry out some large-scale experiments. In the first small chamber were arranged, in vertical lines along a vertical plane parallel to the length of the chamber, and 2 m. from its centre, a number of cups, and over a period of some weeks' working the acid condensed in these was examined at intervals (quantity, concentration, nitrous contents, selenium, iron, &c.). Three cups were placed above one another (1 m. from floor, mid-height, 1 m. from roof) at each of four points in the chamber's length (4 m. from front wall, mid-length, 4 m. from back wall, 1 m. from back wall). Each cup was protected by a leaden lid above it from any drip of acid from above. Three sets of observations were made. In the first, the three chambers were working as usual. In the second, the large chamber was thrown out, and the smaller chamber was therefore working under forced conditions. In the third, the same conditions held, but the Glover gases, instead of entering the chamber by a single pipe in the end wall, were introduced at the top of the chamber by six openings distributed along its whole length. The detailed results are shown in a diagram in the paper, but the most important conclusions may be summarised as follows:—

Productivity of the chamber.—In expt. 1, 4·52; expt. 2, 6·56; expt. 3, 7·48 kilos. of 50 per cent. acid per cb. m. per 24 hours. *Nitre-consumption*, 1, 0·58; 2, 0·59; 3, 0·48 per cent.

It thus appears (comparing 2 and 3) that the alteration in the method of introducing the gases increased the rate of working of the chamber by 14 per cent., and at the same time reduced the nitre-consumption. Moreover, the floor-acid in expt. 3 was much less seleniferous (see preceding abstract), and the gases leaving the final chamber were colourless, while in both of the other experiments they were red. The examination of the acid in the cups showed that while in expts. 1 and 2, the production of acid was more considerable in the lower than the upper part of the chamber, in expt. 3 it was almost uniform throughout the height. The acid in expts. 1 and 2 contained in all parts more nitrous compounds than that in expt. 3; but while their proportion rose steadily and considerably in expts. 1 and 2 from front to back of the chamber, it varied very much less in expt. 3. The superior working of the chamber in the third experiment is attributed by the author to the greater uniformity of the conditions which arises from the much more thorough and complete mixture of the gases. The tendency of the nitrous gases is to rise, and in the ordinary method a certain amount of separation does occur, so that the acid is made chiefly in regions where there is a relative excess of nitrous gases, and consequently removes in solution an undue proportion of these, while there are other regions in which the reaction cannot proceed because of the insufficiency of nitrous compounds. In his opinion nitrosulphuric acid represents a stable and highly oxidised form of combination of nitrogen, which in a properly working chamber should not be formed at all; the work of oxygen transference should, he thinks, be effected by the formation and hydrolytic transformation of "nitrosisulphonic acid":—

$$NO + SO_2 + O + H_2O = OH.NO.HSO_3$$
$$OH.NO.HSO_3 + xH_2O = H_2SO_4.xH_2O + NO.$$

—J. T. D.

Glover tower process; Theory of the ——, and possibility of producing sulphuric acid in towers. M. Neumann. Chem.-Zeit., 1906, **30**, 598.

The reaction in the Glover tower and that in the chamber are identical as far as the formation of nitrosylsulphuric acid is concerned—

(1) $2SO_2 + 2NO + 3O + H_2O = 2SO_5NH$;

but whereas in the chamber this reacts with water alone—

(2) $2SO_5NH + H_2O = 2H_2SO_4 + N_2O_3$;

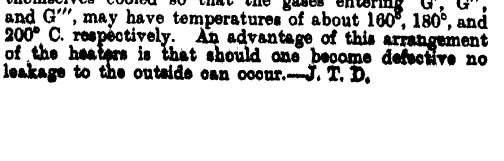
in the Glover tower it reacts with water and sulphur dioxide—

(3) $2SO_5NH + SO_2 + 2H_2O = 3H_2SO_4 + 2NO$;

and thus three molecules of sulphuric acid are formed through the action of the same quantity of nitric oxide which in the chamber forms only two. The author regards each of the reactions (1) and (3) as consisting of two stages—

α. $2NO + O = N_2O_3 + n$ cal.
β. $2SO_2 + N_2O_3 + O_2 + H_2O = 2SO_5NH + 2x$ cal.
γ. $2SO_5NH + H_2O = 2H_2SO_4 + N_2O_3 + 2y$ cal.
δ. $N_2O_3 + SO_2 + H_2O = H_2SO_4 + 2NO + x + y - n$ cal.

Thus $\alpha+\beta$, or (1), evolve $2x+n$, and $\gamma+\delta$, or (3), evolve $x+3y-n$ calories; where $x+y=54$ is the heat of combination SO_2, O, H_2O, and $n=20·1$ is that of 2NO, O. As the denitration in the lower parts of the tower implies the endothermic reduction of 1 mol. of nitrogen trioxide to 2 mols. of nitric oxide, with absorption of n calories, which are evolved again in the upper parts, the author suggests a series of towers, the upper parts of which are cooled, and the lower parts heated, the apparatus being so arranged that as the ratio of oxygen to sulphur dioxide increases, and consequently the tendency against the reduction of nitrogen trioxide to nitric oxide, the gases shall be heated to a correspondingly higher temperature to favour the endothermic reaction. The figure shows diagrammatically his proposal.



G′, G″, G‴, are three towers; the gases from G′, enter G″, only after passage through the heater, V′, and those from G″, reach G‴, after passage through V″. These heaters are contained in the flue from the pyrites burners, and are heated by the burner gases, which are themselves cooled so that the gases entering G′, G″, and G‴, may have temperatures of about 160°, 180°, and 200° C. respectively. An advantage of this arrangement of the heaters is that should one become defective no leakage to the outside can occur.—J. T. D.

Platinum; Corrosion of —— by sulphuric acid. L. Quennessen. Comptes rend., 1906, **142**, 1341—1343. (See also this J., 1906, 24 and 314.)

COMMERCIAL platinum is more readily attacked than the pure metal. Pure platinum, in absence of oxygen, is hardly affected by strong sulphuric acid even at 450° C., but the presence of oxygen causes the attack to be very sensible, some absorption of oxygen at the same time occurring. If the acid should contain anhydride, it will attack platinum even in the absence of oxygen, the anhydride becoming reduced, and thus furnishing oxygen. The author refers to the work of Dittmar (J. Chem. Soc., 1869, **7**, 446) on a similar subject.—J. T. D.

Nitric acid and nitrates; Direct synthesis of ——, from their elements, at the ordinary temperature. M. Berthelot. Comptes rend., 1906, **142**, 1367—1379.

THE author has examined the effect of the silent discharge of the induction coil on mixtures of nitrogen and oxygen in presence of water or of alkali hydroxide, using both a stream of gas passing through the apparatus, and also a fixed contained volume. The primary current was 12 ampères at 6 volts, and the poles of the coil were 20 mm. apart. The coil was used both with and without a condenser. It was found that the high tension of the coil was necessary (no effect was produced by connecting the apparatus directly with the public alternating supply at 100 volts), but that the condenser was practically without influence. In the circulation experiments, 0·0192 grm. of nitric acid per hour was produced from half a litre of air, or about 14 per cent. of the total amount possible. No effect was produced by substituting alkali hydroxide for water in the apparatus. Neither ammonia nor nitrous acid was produced. In the constant volume experiments, whether the gases were mixed in the proportions $N_2 : O_5$, or there was excess of nitrogen, reaction occurred to the (practically) complete disappearance of oxygen; and here, also, no other reaction than the direct formation of nitric acid took place. In these experiments, measurements of pressure and time showed an acceleration of the reaction after the beginning, followed by a gradual retardation as the pressure (and hence the concentrations of the reacting gases) diminished, so that the theoretical completion of the reaction would occur only after infinite time. It is to be remembered that the reactions here concerned—

$$N_2 + O_5 + H_2O + Aq = 2HNO_3 \text{ dilute};$$

or,

$$N_2 + O_5 + H_2O \text{ gas} = 2HNO_3 \text{ gas};$$

are exothermic, and differ in this from the formation in the arc of nitric oxide or nitrogen peroxide from their elements.—J. T. D.

Barium sulphate and barium chromate: Equilibrium in the reactions between potassium chromate and ——. M. Scholtz and R. Abegg. Z. Elektrochem., 1906, **12**, 425—428.

AT ordinary temperatures the reaction between barium sulphate and potassium chromate is only complete after a number of days, but if the solutions are maintained near 100° C., the time necessary to attain equilibrium is considerably curtailed. It appears that barium chromate is formed more quickly than barium sulphate, but that the sulphate in solution subsequently reacts with the precipitate, causing re-solution of the chromate. By working with varying proportions of sulphate and chromate it is found that in the presence of considerable excess of chromate, the barium sulphate becomes much less soluble, indicating the formation of a solid solution in which barium sulphate exists in a very dilute state. Similarly with large excess of sulphate the barium chromate becomes less soluble. The equilibrium in the reaction between barium carbonate and potassium chromate is much more quickly attained, at 100° C. only requiring some 12 hours. In this case barium carbonate is formed most rapidly, but is subsequently slowly redissolved; since, however, the ratio of chromate to carbonate varies with the relative quantities of the potassium carbonate and potassium chromate taken, a solid solution is also formed with this precipitate.

—R. S. H.

Potassium ferrocyanide; Action of light on ——. G. W. A. Foster. Chem. Soc. Proc., 1906, **22**, 136.

WHEN a neutral or alkaline solution of potassium ferrocyanide is exposed to light, ferric hydroxide is slowly precipitated; in presence of alkali sulphide, ferrous sulphide is thrown down.

No precipitation takes place if the solutions are protected from light; the action is therefore entirely photochemical. Potassium ferrocyanide is, in solution, dissociated in the usual manner into potassium ions and the complex "ferrocyan" ions $[Fe(CN)_6'''']$: this is in absence of light. On exposure to light, the complex ion is dissociated into iron ions and cyan ions, and on removing the source of light the complex ferrocyan ion is regenerated. Thus no precipitation of iron can take place in absence of light.

The relations Fe : (CN) were always below the theoretical 1 : 6, and this was found to be due to the oxidation of cyanide under the influence of light to cyanate and polymerides. In presence of alkali sulphide the cyanide is almost entirely converted into thio-cyano-compounds.

The source of light used was a mercury vapour lamp of quartz. It was water-cooled, and, using a direct current of 5—6 ampères at 240—250 volts, gave a very intense light, rich in ultra-violet radiation.

Ferro-cyanogen compounds; Reduction of blue ——. M. Kohn. Z. anorg. Chem., 1906, **49**, 443—444.

PRUSSIAN blue and Turnbull's blue are readily reduced by sodium bisulphite in presence of stannous chloride, provided the bisulphite be in considerable excess. Stannous chloride solution is added to excess of a concentrated solution of sodium bisulphite acidulated with a small quantity of dilute sulphuric acid. The mixture acquires an intense yellow colour, which disappears on standing. If freshly-precipitated Prussian blue or Turnbull's blue be introduced into this mixture, reduction takes place in the cold, and the colourless mixture can be kept for several hours in open test-tubes, without the blue colour returning. The blue compounds are regenerated immediately on addition of an oxidising agent, such as bromine water. The author considers that the reduction is effected by hyposulphurous (hydrosulphurous) acid formed according to the equation: $2NaHSO_3 + SnCl_2 + 2HCl = SnCl_4 + Na_2S_2O_4 + 2H_2O$, and the fact that the blue compounds mentioned are readily reduced by sodium hyposulphite is in agreement with this view. It has been pointed out frequently that hydrogen sulphide is formed by the action of stannous chloride on sulphurous acid, but this is only in presence of excess of stannous chloride, whereas the reducing action described above is in presence of excess of sulphurous acid.—A. S.

Lead oxychloride. R. Ruer. Z. anorg. Chem., 1906, **49**, 365—383.

THE author constructed the melting-point curve of mixtures of lead oxide and lead chloride in order to determine what compounds are formed when these two substances are fused together. It was found that three compounds ($PbCl_2$, PbO), ($PbCl_2$, 2PbO), and ($PbCl_2$, 4PbO), are formed in this way. The compound, $PbCl_2$,PbO, which occurs naturally as matlockite, forms long, thin, colourless needles, yielding a nearly white powder; it decomposes at 524° C. into a mixture of the compound, $PbCl_2$,2PbO, with about 36 per cent. of lead oxide, which fuses completely at 615° C. The compound, $PbCl_2$,2PbO, which occurs naturally as mendipite, melts without decomposition at 693° C. It forms long, glistening needles, which yield a nearly white powder. The compound, $PbCl_2$,4PbO, melts at 711° C. It forms glistening lamellar crystals, and yields a powder of an intense yellow colour.—A. S.

Bismuth peroxides, III. Oxidation of bismuth compounds by means of potassium persulphate in alkaline suspension, and the so-called "anhydrous bismuth tetroxide." A. Gutbier and R. Buenz. Z. anorg. Chem., 1906, **49**, 432—436.

THE authors have repeated Deichler's experiments on

the action of potassium persulphate on alkaline suspensions of bismuth compounds (this J., 1899, 616), but find that no definite compounds are produced, the reaction product consisting of a mixture of varying composition containing bismuth peroxides (see also this J., 1906, 263, 264). The concentration of the alkali has considerable influence on the composition of the reaction-product. The authors are thus unable to confirm Deichler's statement as to the existence of "anhydrous bismuth tetroxide."—A. S.

Phosphorus pentasulphide and ammonia; Reaction between ——. Thiophosphates and thiophosphoric acids. A. Stock and others. Ber., 1906, **39**, 1967—2008.

PHOSPHORUS pentasulphide dissolves in excess of liquefied ammonia, forming a yellow compound, ammoniumiminothiopyrophosphate, $(SNH_4)_2P(:NH).S.P(:NH)(SNH_4)_2$. If the solution be allowed to stand for some time, this yellow compound unites with another molecule of ammonia, and is converted into two colourless salts, one of which, triammoniumiminotrithiophosphate, $NH:P(SNH_4)_3$, crystallises out, whilst the other, diammoniumnitrilodithiophosphate, $N:P(SNH_4)_2$, remains in solution. Triammoniumiminotrithiophosphate, when allowed to stand in an exsiccator over sulphuric acid, loses ammonia, and yields at the ordinary temperature the corresponding diammonium salt, and at 100° C., the mono-ammonium salt. The disodium salt can be obtained by treating the triammonium salt with sodium ethylate. By shaking the triammonium salt with ether, to which 1 per cent. of water has been added, the imino group is attacked, and triammoniumtrithiophosphate, $OP(SNH_4)_3$, is produced, which is more stable than the imino compound, but decomposes slowly when its solution is allowed to stand, with formation of the corresponding diammonium salt. The alkaline-earth salts of trithiophosphoric acid are soluble in water. By heating triammoniumtrithiophosphate in a current of sulphuretted hydrogen, yellow monoammoniumdithiometaphosphate, $OPS(SNH_4)$, is produced. Triammoniumiminotrithiophosphate when heated in a current of sulphuretted hydrogen, yields the corresponding free iminothiophosphoric acid, $NH:P(SH)_3$, which, however, is not very stable. In contact with water it decomposes according to the equation:

$$(NH)P(SH)_3 + 3H_2O = OP(SNH_4)(OH)_2 + 2H_2S.$$

The monoammoniummonothiophosphate thus produced, loses hydrogen sulphide on heating, and yields ammonium metaphosphate. Iminothiophosphoric acid combines with anhydrous hydrogen chloride to form a white hydrochloride which, when heated to a high temperature, yields among other products, iminothiopyrophosphoric acid, $(SH)_2P(:NH).S.P(:NH)(SH)_2$. On heating iminothiophosphoric acid in a vacuum to 300° C., hydrogen sulphide is split off, and thiophosphoric acid nitrile, NPS, is produced. The latter is not decomposed by water in the cold; on heating to redness it yields phosphorus nitride, P_3N_5. The free thiophosphoric acids are produced when the ammonium salt is treated with anhydrous hydrogen chloride, but it was only found possible to isolate thiopyrophosphoric acid, $(SH)_2OP.S.PO(SH)_2$, and even this not in a pure state. The free acids are all unstable substances. Other sulphides of phosphorus besides phosphorus pentasulphide react in a somewhat similar manner with liquefied ammonia.—A.S.

Radium; Influence of —— on hydrogen-chlorine and oxyhydrogen mixtures. W. P. Jorissen and W. E. Ringer. Ber., 1906, **39**, 2093—2098.

HYDROGEN and chlorine exposed to the radiation from radium slowly combine to form hydrochloric acid. In 33 hours 1·13 c.c. of the mixed gases thus combined. No effect was produced upon oxyhydrogen mixture. The different result obtained by Davis and Edwards (this J., 1905, 266) arises from their having brought the radium compound into actual contact with the gases.
—J. T. D.

Air; Conductivity of ——, when in contact with oxidising substances. W. P. Jorissen and W. E. Ringer. Ber., 1906, **39**, 2090—2093.

WHEN air is mixed with traces of the vapour of oxidisable organic substances—triethylphosphine, pyrogallol, benzaldehyde, &c., its electrical conductivity is diminished; probably because, though increased ionisation occurs, the ions of the air are loaded by the formation of so-called "molions." The vapour of oxidising phosphorus increases the conductivity, but the addition of pinene, for example, to the air which has been previously subjected to the action of the phosphorus products, rapidly reduces it again. The authors have investigated the limits of pressure at which the oxidation of phosphorus occurs in oxygen, when in contact with mixtures of sulphuric acid and water. While the limit with concentrated sulphuric acid lies between 585 and 538 mm., and with water at 600 mm., it lies between 437 and 336 mm., with 75 per cent. acid, and between 564 and 545 mm. with 50 per cent. acid.—J. T. D.

Ammonia as a by-product in coke-making; Use of gypsum for the recovery of ——. H. Warth. III., page 686.

Nitrate of soda statistics. W. Montgomery and Co. June 30, 1906. [T.R.]

THE following table gives figures as to the shipments, consumption, stocks, and prices from 1904 to 1906:—

		1904.	1905.	1906.
Shipments from South American ports to all parts for the six months ending 30th June	Tons	578,000	689,000	704,000
Ditto ditto for the twelve months ending 30th June	,,	1,463,000	1,587,000	1,638,000
Afloat for Europe on 30th June	,,	199,000	232,000	278,000
Stocks in U.K. ports:—				
Liverpool, tons (1904: 5,800; 1905: 4,500; 1906: 5,000)				
London, ,, (1904: 800; 1905: 1,800; 1906: 1,000)				
Out ports, ,, (1904: 4,400; 1905: 4,900; 1906: 4,000)				
		11,000	11,200	10,000
Stocks in Continental ports on 30th June	Tons	21,000	36,800	39,000
Consumption in U.K. for the six months ending 30th June	,,	78,000	67,000	71,000
,, in Continent ,, ,,	,,	749,000	820,000	852,000
,, in U.K. for the twelve months ,,	,,	111,000	110,000	105,000
,, in Continent ,, ,,	,,	1,012,000	1,081,000	1,121,000
,, in United States ,, ,,	,,	286,000	264,000	330,000
,, in other Countries ,, ,,	,,	32,000	55,000	40,000
,, *in the World* ,, ,,	,,	1,441,000	1,510,000	1,596,000
Visible supply on 30th June (including the quantity afloat for Europe and stocks in U.K. and Continent)	,,	231,000	280,000	278,000
Price on 30th June	per cwt.	9/10½	11/-	10/10½

ENGLISH PATENTS.

Nitric acid; Concentration of dilute ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 19,986, Oct. 3, 1905.

SEE Fr. Pat. 358,373 of 1905; this J., 1906, 218.—T.F.B.

Sulphuric acid; Manufacture of ——. R. Cellarius, Sergiefski Possad, Russia. Eng. Pat. 22,080, Oct. 30, 1905.

SEE Fr. Pat. 360,634 of 1905; this J., 1906, 478.—T.F.B.

Salt; Manufacture of white —— from rock salt. H. Tee, Liverpool. Eng. Pat. 6611, March 29, 1905.

The rock salt to be purified is supplied to the upper part of a cupola furnace, the shaft of which is provided with a succession of narrow arches serving to support the salt while it is being heated and exposed to air and gases of combustion. The shaft is narrowed near its base to a restricted passage, above which the salt is held up by an inwardly projecting part, and descends, as it melts, into a chamber below, in which provision is made for injecting superheated steam, or carbon dioxide or monoxide, or air, into the molten mass. In a modified form of apparatus, the chamber near the bottom of the shaft communicates with a second chamber at its side, into which the molten salt flows, and into which air, steam, or gases may be injected, as in the first chamber, or in which the suspended impurities may be allowed to settle before discharging. (Reference is made to Eng. Pat. 8117 of 1903; this J., 1904, 749.)—E. S.

Alkaline prussiates; Manufacture of ——. G. E. Davis, London. Eng. Pat. 9793, April 26, 1906.

The ammonia distillate obtained from the product described in Eng. Pat. 26,566 of 1902 (this J., 1903, 1243), by its treatment in the ammonia still, is used in precipitating the "sulphide mud" therein named from galvanisers' spent pickle, or from other ferrous chloride or sulphate solution; and the "sulphide mud" so obtained is applied in producing the "alkali cream" which, in the said specification, is directed to be used to wash gaseous mixtures containing hydrocyanic acid or ammonium cyanide, with a view to the production of alkali cyanides. —E. S.

United States Patents.

Ammonia; Process of extracting —— from gases. R. Brunck, Dortmund, Germany. U.S. Pat. 824,092, June 26, 1906.

See Addition of Nov. 5, 1904, to Fr. Pat. 331,077 of 1903; this J., 1905, 432.—T. F. B.

Zinc sulphide; Process for the manufacture of ——. G. Ranson, Assignor to E. Marlier, Brussels. U.S. Pat. 823,896, April 19, 1906.

See Fr. Pat. 338,059 of 1903; this J., 1904, 545.—T. F. B.

French Patents.

Copper sulphate contaminated with salts of iron; Process for the refining of ——, and for the direct extraction of copper from ores. R. Conodera. Fr. Pat. 362,342, Jan. 11, 1906. Under Int. Conv., Feb. 19, 1905.

The process is based upon the following facts:—(1) Ferric oxide is the weakest base of those commonly occurring in the hydrometallurgical treatment of copper ores, and if, therefore, a neutral solution containing ferric and copper sulphates be treated with cupric hydroxide, copper sulphate is formed, and the ferric sulphate is converted into an insoluble basic sulphate, or even into ferric oxide. (2) Hydrated ferrous oxide is oxidised by atmospheric oxygen to basic ferric sulphate, and if cupric hydroxide be present, this basic sulphate at the moment of its formation gives up part or the whole of its sulphuric acid, with formation of copper sulphate. In carrying out the process the solution containing copper and ferric sulphates is made to diffuse into a large porous mass containing copper oxide, which mass is then exposed to the air to effect the complete conversion of the ferric sulphate into an insoluble basic sulphate. The copper sulphate is afterwards recovered by lixiviation. According to another claim, roasted copper ore is treated with water to convert it into a porous mass containing copper oxide, and copper and ferric sulphates, which is exposed to the air, and afterwards lixiviated to recover the copper sulphate, the distinctive feature of this modification of the process being that no separate porous mass is necessary as in the method first described.—A. S.

Catalytic apparatus [Production of nitric oxide from ammonia]. Nordyke and Marmon Co. Fr. Pat. 362,434, Jan. 16, 1906.

See Eng. Pat. 1204 of 1906; this J., 1906, 536.—T. F. B.

Tin and chlorine; Process for preparing compounds of ——. C. E. Acker. Fr. Pat. 362,571, Jan. 20, 1906.

See U.S. Pats. 810,454, 810,455, and 810,456 of 1906; this J., 1906, 180.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 638.)

Boron-ultramarine. J. Hoffmann. Z. angew. Chem., 1906, **19**, 1089—1095.

The author has revised and extended the work of Knapp on this substance. While sodium sulphide and borax melted together give a yellow or brownish glass, the further addition of boric anhydride gives a glass of lighter or darker blue tint, according to the proportions used. A similar glass is obtained from boric anhydride and sodium sulphide, in which case, however, the proportion of boric acid must be very considerable. Mixtures used by the author are: (1) anhydrous borax 3·6, boric anhydride 1·5, sodium sulphide 0·9 grm.; or (2) boric anhydride 17, sodium sulphide 2 grms. The blue glass cannot be obtained if sulphur is substituted for sodium sulphide, but the addition to the borax and sodium sulphide glass of either phosphoric anhydride or alum gives the blue colour. A solution of sodium triborate saturated with hydrogen sulphide, evaporated to dryness, and the residue fused, also gives a blue glass. This "boron-ultramarine" is stable in air, and gives a light-blue powder. It is only slightly soluble in water, giving a colourless solution with alkaline reaction. Dilute hydrochloric acid dissolves it readily, and, on warming, the solution gives off hydrogen sulphide. The glass appears to contain sulphide and sulphate, but no thiosulphate. Specimens prepared in porcelain crucibles contain silica and alumina, but these are not essential to the colour, nor is moisture nor access of air, for the blue glass is obtained equally well by fusing the pure (and anhydrous) materials in a platinum crucible in an atmosphere of nitrogen. The lowest temperature of reaction is about 720° C., but continued exposure to a high temperature slowly decolorises the substance. The colour goes more rapidly if the heating be done in a stream of air or oxygen, but even in a hydrogen stream it disappears. This is due to loss of sulphur, for three portions of the same preparation, heated for successively increasing periods, so as to be deep blue, light blue, and decolorised, contained 0·52, 0·13, and 0·00 per cent. of sulphur respectively. Boron sulphide and sodium oxide melted together do not give a blue glass, so that in the blue glass the oxygen of the boric anhydride can be only partially, if at all, displaced by sulphur. The lowest proportion of boric anhydride which will give a blue glass corresponds to a triborate, and the best colours are obtained with mixtures corresponding to tetraborate. The resemblances between boron-ultramarine and ordinary ultramarine are pointed out, and the similarity or relationship between boron and aluminium insisted on. The author thinks it probable that the sulphur in boron-ultramarine, in whatever form it may exist, is there neither as elementary sulphur nor as sodium sulphide.—J. T. D.

Quartz glass. A. L. Day and E. S. Shepherd. Science, 1906, **23**, 670—672. Science Abstracts, 1906, **9 A**, 331.

To obtain clear quartz glass free from bubbles, the authors recommend the following process:—The fragments of quartz are placed in an electric furnace, the heating chamber of which is composed of a thin-walled graphite box, and heated rapidly to about 2000° C., whereby the silica is rapidly volatilised, and the silica vapour displaces the air enclosed between the grains of the charge. The mass is then subjected to a pressure of 500 lb. by means of compressed air, and the temperature is reduced to about 1800° C., and maintained thereat for some time.

The current is then turned off, and the pressure gradually reduced. By this process the authors have succeeded in preparing blocks of quartz glass, measuring 3 by 5 by ½ in., almost entirely free from bubbles, and only occasionally slightly stained with free silicon. The residual bubbles are very small, and not numerous enough to interfere with the use of the glass for lenses or other optical purposes. —A. S.

UNITED STATES PATENT.

Sheet-glass; Apparatus for drawing ——. J. W. Colburn and E. Washburn, Franklin, Pa. U.S. Pat. 823,581, June 19, 1906.

THE apparatus consists of a receptacle containing molten glass, means for drawing glass therefrom in sheet form in a longitudinal direction, and two conical rollers revolving in opposite directions, each having a portion of its surface dipping into the mass of molten glass in the receptacle, and a portion engaging the surface of the sheet as drawn, whereby these rollers serve not only to draw glass from the receptacle, but also to stretch the sheet laterally. A corrugated sheet-metal bait may also be provided, together with means for lowering it into and withdrawing it from the receptacle.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 639.)

Wood; Action of bacteria on ——. B. Malenkovic. XXIV., page 717.

ENGLISH PATENTS.

Stone and the like; Artificial ——. W. Hoffmeister, Hamburg, H. Hundt, C. Eifler and A. Winther, Leipzig, Germany. Eng. Pat. 15,582, July 29, 1905.

SEE Fr. Pat. 356,663 of 1905; this J., 1906, 32. —T. F. B.

Fire-bricks; Manufacture of ——. W. R. Carr, Whitley Bay, and J. Urwin, Tynemouth, Northumberland. Eng. Pat. 11,696, June 3, 1906.

IN order to render the bricks lighter, the fireclay used is mixed with one-quarter of its weight of crushed coke or coke breeze, both ingredients being preferably ground after mixing, and not separately.—A. G. L.

FRENCH PATENTS.

Stone; Process for the manufacture of artificial ——. Internationales Patent und Maschinenges. R. Lueders. Fr. Pat. 362,418, Jan. 15, 1906. Under Int. Conv., Sept. 22, 1905.

ABOUT 75 kilos. of asbestos and 450 kilos. of slow-setting cement are ground in a roller-mill with about 3½ cb.m. of water. The ground material is mixed with a further 2½—3 cb.m. of water, and is then treated in filter-presses of varying shape and size, according to the objects it is desired to make. The cakes or slabs from the filter-presses are subjected to high pressure (800 kilos. per c.c.) in hydraulic presses, and then allowed to harden in the usual manner.—A. S.

Wood; Process for impregnating ——. A. A. V. Poulsen. Fr. Pat. 362,623, Jan. 23, 1906.

SEE Eng. Pat. 1325 of 1906; this J., 1906, 479. —T. F. B.

Erratum.—This J., 1906, 639, col. 1, line 3 from top. For Merino read Marino.

X.—METALLURGY.

(*Continued from page* 642.)

Steel; Phenomena during melting of —— [*Gas-bubbles*]. A. Ruhfus. Stahl u. Eisen, 1906, **26**, 775—777.

THE smaller a casting, and the quicker the cooling, the more gas is retained in it. Samples taken at different stages from a Siemens-Martin furnace, quickly cooled, and then sawn, and the sections examined, showed that as the temperature rises, and the fluidity of the charge increases, the gas-bubbles concentrate towards the centre of the ingot, and then gradually diminish in size and number towards the exterior.—J. T. D.

Copper-steels. P. Breuil. Comptes rend., 1906, **142**, 1421—1424.

THE author has examined steels with 0·10 to 0·17 (series A) and with 0·28 to 0·41 (series B) per cent. of carbon, each series containing 8 members with 0, 0·5, 1, 2, 4, 8, 16, and 32 per cent. approximately of copper. Analysis showed the copper to be uniformly distributed in all save the 32 per cent. member of series B, the upper part of which contained 34·2 at the centre and 21·2 at the surface, the lower 74·8 at the centre and 24·4 at the surface; the two parts were clearly distinguishable on the fracture. The ingots up to 4 per cent. showed no colour on the fracture, but from 8 per cent. upwards the red colour was marked and increasing. All of the alloys containing up to 4 per cent. of copper could be hammered or rolled, the others not. The hardness, by Brinell's method, increased with the copper.

Thermal's measurements of the transformation points were not very satisfactory, especially in series A. In that series copper seems to raise Ar, and lower Ar_3. In B series, Ar and Ar_2 are both lowered as the amount of copper rises. The point at 975°—980° C. noticed in all the steels seems to mean separation of cementite. All, even the coppery part of 32 per cent. B, were magnetic when cold.—J. T. D.

Copper; Attempts at refining —— *with silicon or silicides.* F. Gloger. Metallurgie, 1906, **3**, 253; Chem.-Zeit., 1906, **30**, Rep., 208.

THE crude metal under experiment contained 97·25 per cent. of copper, with 1·774 per cent. of oxygen present in combination as protoxide. Silicon proved incapable of properly reducing this protoxide, but better results attended the use of manganese silicide, containing 19·77 per cent. of silicon, sufficient being added to react in the proportion of one molecule to four of cuprous oxide. The refined copper is very dense, free from oxide as well as from manganese and silicon, and the loss of metal is below 1 per cent.—chiefly in the slag. An excess of manganese silicide furnishes a manganese-copper alloy, but when the manganese does not exceed 1 per cent., its effect appears to be beneficial.—C. S.

Platinum, Corrosion of ——, *by sulphuric acid.* L. Quennessen. VII., page 695.

Tin in the Transvaal. Mining World, June 30, 1906. [T.R.]

THE first output of tin in the Transvaal has recently been declared. It is little more than a year since the discovery of the tin-bearing greisen on the Vlaklaagte farm, about 60 miles east of Pretoria. The tin lode in various forms has been traced over a considerable area. Within the last six months a 10-stamp mill and a Krupp ball mill have been installed to crush the greisen rock, and also a complete concentrating plant. The details of the output are as follows: Five stamps ran 20 days, crushing 486 tons, giving an output of 4·8 tons per day. The Krupp mill ran 24 days and 20 hours, crushing 201 tons, equivalent to an output of 8·1 tons per day. From the 687 tons, 16·8 tons of tin oxide were won, equal to a yield of 2·44 per cent. per ton of ore treated, and an extraction of 97·7 per cent. The cost of production was 45*s.* per ton, inclusive of 6*s.* for development, and 2*s.* for renewals.

Other tin areas are being discovered from time to time. The most recent discovery has been made on a farm belonging to the Transvaal Consolidated Land and Exploration Company, in the Bushveld area. Here good ore has been found in pockets, but prospecting so far has not shown the continuity or permanency of the deposit.

Copper deposit in Ontario. Eng. and Mining J., June 30, 1906. [T.R.]

A COPPER deposit has been recently discovered near Dean Lake station, on the Canadian Pacific Railway, in the township of Thompson, on the Leizert mine. The ore occurs at the point of contact between a trap dike, bearing inclusions of granite and quartzite, rounded and angular, and clay slate. Both the slate and the trap are impregnated, for a width at present unknown, with chalcopyrite, which is accompanied by calcite, and carries small amounts of silver and gold. The calcite appears to be in sufficient quantity to form a fusible mixture with the silicates of alumina and iron, and a smelting test already made demonstrates a fusible mixture. Mining machinery, consisting of boilers, air compressors, &c., has been installed upon the property, and development work is actively engaged in. The shaft sunk on the Leizert vein is now at a depth of 80 ft., and preparations are being made to drift in various directions. The vein is shown up by cross-cuts and pits, and can be followed for more than 1000 ft. As a self-fluxing copper ore the development is looked forward to with much interest.

ENGLISH PATENTS.

Welding iron or steel; Method of ——, with each other or with other metals, and fluxes employed for that purpose. E. L. Davies and W. G. Clark, Wessels Nek, Natal. Eng. Pat. 13,811, July 4, 1905.

THE parts to be welded are raised to "the oxidising temperature of iron," that is, about 800° to 1000° C., and are then plunged into a bath heated to the same temperature, and containing a mixture of silica and calcium carbonate in equal quantities. This flux dissolves the iron oxide formed, and the pieces are then withdrawn quickly, and welded in the ordinary way. (Compare Eng. Pat. 17,660 of 1904; this J., 1905, 1309; also Eng. Pat. 10,763 of 1899.)—A. G. L.

Iron; Refining —— in a Siemens-Martin furnace. H. J. B. Delporte, Liège, Belgium. Eng. Pat. 494, Jan. 8, 1906. Under Int. Conv., Jan. 9, 1905.

SEE Fr. Pat. 350,750 of 1905; this J., 1905, 804.—T. F. B.

Tinned plates; Detinning of ——. K. Goldschmidt and J. Weber, Essen on the Ruhr, Germany. Eng. Pats. 12,868 and 12,869, June 21, 1905.

SEE Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

Slag; Process for dissolving solid fluxes in fluid ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 15,375, July 26, 1905.

SEE Fr. Pat. 356,252 of 1905; this J., 1905, 1308.—T. F. B

Ores and metals; Process and apparatus for concentrating or separating ——. F. Windhausen, Berlin. Eng. Pat. 17,250, Aug. 25, 1905.

SEE Fr. Pat. 357,120 of 1905; this J., 1906, 27.—T. F. B.

Furnaces for separating metals. M. Leitch, Brooklyn, N.Y., U.S.A. Eng. Pat. 17,651, Aug. 31, 1905.

SEE U.S. Pat. 800,222 of 1905; this J., 1905, 1070.—T. F. B

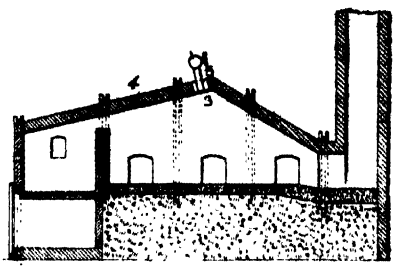
Furnaces; Impts. relating to ——. J. L. Babó and A. L. Louvrier, Honfleur, France. Eng. Pat. 26,076, Dec. 14, 1905. Under Int. Conv., Dec. 14, 1904.

THE furnace is intended for the extraction of zinc and lead from their ores by volatilisation. It consists of a scaphoid cavity, in the base of which is a slot through which the slag falls into the ash-pit below. An upward draught is maintained in the furnace by a blast or by suction, or by both, and the slot is cooled by circulation of air or water, in order to prevent its deformation.—A. S.

UNITED STATES PATENTS.

Furnace; Metallurgical ——. B. C. Lauth, Pittsburg, Pa. U.S. Pat. 823,057, June 12, 1906.

THE roof of the furnace, 4, has the shape shown in the figure,



and is provided near the top with a series of openings, 3, through which blast-nozzles, 5, discharge jets of air, under pressure, downwards into the furnace. The diameter of the openings is larger than that of the blast-nozzles, so that atmospheric air is drawn in by the jets of compressed air, and assists in promoting combustion on the hearth of the furnace.—A. S.

Roasting furnace [for ores]. A. W. Chase, New York. U.S. Pat. 823,393, June 12, 1906.

THE furnace consists of a casing in which several U-shaped troughs are disposed one above the other, each of them being provided with a spiral conveyor mounted on a hollow shaft, which is cooled internally with water. The conveyor-shafts are supported on bearings outside the furnace, and pass through circular openings in the furnace walls, these openings being closed by removable slotted plates which fit around the shafts. The furnace can be used as a muffle furnace or reverberatory furnace; in the former case the roasting-troughs are protected from the direct action of the fire by removable shelves, one situated below, and the other above the series of troughs. Means are provided for carrying the furnace gases around the troughs, and for supplying air to the roasting ore. Above the troughs, and resting on the cover of the furnace, there are placed a feed-hopper and conveyor, which also serves as a preliminary drier for the ore; the latter is here exposed to the gases escaping from the roasting-troughs, but is protected from the direct action of the fire.

—J. F. B.

Furnace; Tilting ——. J. C. Cromwell, Assignor to the Garrett-Cromwell Engineering Co., Cleveland, Ohio. U.S. Pat. 823,669, June 19, 1906.

IN each end of the framework of the furnace are mounted two "equalising-beams," on which two rollers are journalled. The rollers bear on a curved trackway, and means are provided for tilting the furnace. The rollers are mounted on the furnace in such a manner that they ride upon the curved trackway independent of the expansion of the furnace.—A. S.

Blast furnace. W. Kemp, Assignor to M. P. Freeman Tucson, Ariz. U.S. Pat. 824,485, June 26, 1906.

SEE Fr. Pat. 358,645 of 1905; this J., 1906, 270.—T. F. B

Metals [gold and silver]; Process of extracting —— from their ores. C. R. Arnold, Philadelphia, Pa. U.S. Pat. 823,576, June 19, 1906.

THE ground ore is mixed to a pulp with cyanide solution and air is drawn first through a heater, and through "a generator of halogen gas," and then through the pulp in sufficient amount to thoroughly agitate it. The movement of the air is effected by maintaining a partial vacuum in the space above the ore-pulp, the gases, &c., from such space being delivered first to a "regenerating solution" ("caustic solution"), and then to "an exhaust-pump or hydraulic type."—A. S.

Zinc alloys; Process of manufacturing ——. P. and A. Göhrs, Berlin. U.S. Pat. 824,644, June 26, 1906.

SEE Fr. Pat. 332,657 of 1903; this J., 1903, 1247.—T. F. B

FRENCH PATENTS.

eel; Production of ——. F. Andre. Fr. Pat. 362,371, Jan. 12, 1906.

DINARY iron or inferior steel is raised to a clear red at in a muffle furnace or in closed crucibles, while surunded with a mixture of potassium ferrocyanide, 300 rts; leather cuttings, 200; powdered wood charcoal, 0; colophony, 180; sodium carbonate, 20; finely ted earth, 40; potassium nitrate, 25; and graphite, parts.—J. H. C.

g-iron; Enrichment of ——. C. Brisker and G. Reitboeck. Fr. Pat. 362,479, Jan. 17, 1906.

ON already strongly decarburised is added to the mass molten iron contained in the "mixer," whereby strong emical and calorific reactions are set up which tend to prove the quality of the iron. By adding slags rich in osphorus, the iron is rendered suitable for treatment by basic process.—J. H. C.

timony ores; Treatment of auriferous ——. C. Savigny. Fr. Pat. 361,346, April 10, 1905.

E ore is mixed with carbon, and raised to a high temrature in a blast furnace, whereby the antimony is latilised, and the gold is concentrated in the slag. —J. H. C.

timony sulphide and oxysulphide; Production of colours nd of metallic antimony from ——. C. Savigny and M. Douxami. Fr. Pat. 361,383, April 15, 1905. XIII*A*., page 703.

senic and antimony; Process and furnace for the treatnent of pyritous minerals containing ——. E. Rasse-Courbet. Fr. Pat. 362,455, Jan. 16, 1906.

E minerals are strongly heated in a sort of muffle rnace, and the vapours so produced are drawn off by aspirator into condensing chambers, where they are oled by a water-spray.—J. H. C.

malgamation process, applicable even to refractory ores of gold and silver. H. J. M. A. Huguet. Fr. Pat. 362,347, Jan. 11, 1906.

E amalgamation is effected in the usual manner, but utions containing sulphurous or hyposulphurous acid added to the ore pulp, in order to prevent oxidation of mercury.—J. H. C.

ng; Production of ——. F. Benjamin. Fr. Pat. 362,419, Jan. 15, 1906.

the "finery" treatment of pig-iron, material contain- phosphoric acid is added, which passes into the slag a form soluble in citric acid, and so increases its nurial value. The phosphatic material may be added the charge, or be introduced during the refining process —J. H. C.

ast furnaces; Impts. in ——. Frodingham Iron and Steel Co., Ltd. Fr. Pat. 362,481, Jan. 17, 1906.

E Eng. Pat. 26,263 of 1905; this J., 1906, 319.—T. F. B.

ckel; Process for treating minerals containing —— *or oxidised nickel mattes.* The Metals Extraction Corporation, Ltd. Fr. Pat. 362,675, Jan. 25, 1906.

E Eng. Pat. 10,869 of 1905; this J., 1906, 588.—T. F. B.

ckel; Treatment of minerals containing ——. The Metals Extraction Corporation, Ltd. Fr. Pat. 362,676, Jan. 25, 1906.

E Eng. Pat. 6255 of 1905; this J., 1906, 541.—T. F. B.

tallic films or flakes; Process of making ——. T. A. Edison. Fr. Pat. 362,692, Jan. 25, 1906. Under Int. Conv., March 30, 1905.

E U.S. Pat. 821,696 of 1906; this J., 1906, 643.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 644.)

(*A*.)—ELECTRO-CHEMISTRY.

Electrolysis of dilute solutions of acids and alkalis at low potentials. Dissolving of platinum at the anode by a direct current. G. Senter. Faraday Soc. Trans., July 2, 1906. [Advance proof.]

WHEN dilute solutions of sulphuric acid and of sodium hydroxide are subjected to electrolysis at a potential of 1·4 to 1·55 volts (*i.e.*, below the potential at which oxygen is evolved) and a current density of $1·2 \times 10^{-7}$ ampères per sq. cm., an oxidising substance is formed in small amount at the anode. This substance is very stable, especially in alkaline solution, and is not destroyed by boiling; it is shown not to be hydrogen peroxide. The rôle which the oxidising agent plays cannot be determined until some method is discovered of producing it in greater concentration. In the case of dilute acid small amounts of platinum are dissolved from the anode, which the author considers to be due to the solubility of an oxide, formed superficially upon the electrode.—R. S. H.

Nitric acid and nitrates; Direct synthesis of ——, *from their elements at the ordinary temperature.* M. Berthelot. VII., page 695.

Ozone; Use of —— *in quantitative analysis.* P. Jannasch and W. Gottschalk. XXIII., page 715.

ENGLISH PATENTS.

Insulating material; Impts. in [electrical] ——. The British Thomson-Houston Co., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 19,035, Sept. 20, 1905.

AN electrical insulating material, resistant to heat and moisture, is prepared by mixing a fibrous substance such as asbestos with suitable quantities of silica and a metal hydroxide, *e.g.*, calcium hydroxide, moulding the mixture into the desired form, and subsequently treating it with steam, under pressure, to produce a hydrous silicate in the interstices of the fibrous material.—A. S.

Ozonisers; Electrical —— C. A. Sahlström, Ottawa, Canada. Eng. Pat. 12,367, June 14, 1905. Under Int. Conv., June 21, 1904.

SEE Fr. Pat. 355,411 of 1905; this J., 1905, 1178.—T. F. B.

UNITED STATES PATENTS.

Thermo-electric couple. H. E. Heath, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 824,015, June 19, 1906.

IN this thermo-electric couple one member is constructed of a body of cast silicon.—A. G. L.

Electrolysis of water; Apparatus for the ——. K. J. Vareille, Levallois-Perret, France. U.S. Pat. 823,650, June 19, 1906.

SEE Fr. Pat. 355,652 of 1905; this J., 1905, 1240.—T. F. B.

FRENCH PATENTS.

Electrode; Accumulator ——. T. A. Edison. Fr. Pat. 362,691, Jan. 25, 1906. Under Int. Conv., March 30, April 28, and Nov. 2, 1905.

SEE Eng. Pats. 1925 and 1927 of 1906; this J., 1906, 432.—T. F. B.

Ozone; Production of ——. Comp. Franç. de l'Ozone. Fr. Pat. 362,301, Jan. 10, 1906.

THE production of ozone from air by means of electric discharges is simplified, and rendered more economical by feeding one or both of the conductors with an alternating current with the aid of auxiliary condensers. A

Copper deposit in Ontario. Eng. and Mining J., June 30, 1906. [T.R.]

A COPPER deposit has been recently discovered near Dean Lake station, on the Canadian Pacific Railway, in the township of Thompson, on the Leizert mine. The ore occurs at the point of contact between a trap dike, bearing inclusions of granite and quartzite, rounded and angular, and clay slate. Both the slate and the trap are impregnated, for a width at present unknown, with chalcopyrite, which is accompanied by calcite, and carries small amounts of silver and gold. The calcite appears to be in sufficient quantity to form a fusible mixture with the silicates of alumina and iron, and a smelting test already made demonstrates a fusible mixture. Mining machinery, consisting of boilers, air compressors, &c., has been installed upon the property, and development work is actively engaged in. The shaft sunk on the Leizert vein is now at a depth of 80 ft., and preparations are being made to drift in various directions. The vein is shown up by cross-cuts and pits, and can be followed for more than 1000 ft. As a self-fluxing copper ore the development is looked forward to with much interest.

ENGLISH PATENTS.

Welding iron or steel; Method of ——, with each other or with other metals, and fluxes employed for that purpose. E. L. Davies and W. G. Clark, Wessels Nek, Natal. Eng. Pat. 13,811, July 4, 1905.

THE parts to be welded are raised to "the oxidising temperature of iron," that is, about 800° to 1000° C., and are then plunged into a bath heated to the same temperature, and containing a mixture of silica and calcium carbonate in equal quantities. This flux dissolves the iron oxide formed, and the pieces are then withdrawn quickly, and welded in the ordinary way. (Compare Eng. Pat. 17,660 of 1904; this J., 1905, 1309; also Eng. Pat. 10,763 of 1899.)—A. G. L.

Iron; Refining —— in a Siemens-Martin furnace. H. J. B. Delporte, Liège, Belgium. Eng. Pat. 494, Jan. 8, 1906. Under Int. Conv., Jan. 9, 1905.

SEE Fr. Pat. 350,750 of 1905; this J., 1905, 804.—T. F. B.

Tinned plates; Detinning of ——. K. Goldschmidt and J. Weber, Essen on the Ruhr, Germany. Eng. Pats. 12,868 and 12,869, June 21, 1905.

SEE Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

Slag; Process for dissolving solid fluxes in fluid ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 15,375, July 26, 1905.

SEE Fr. Pat. 356,252 of 1905; this J., 1905, 1308.—T. F. B

Ores and metals; Process and apparatus for concentrating or separating ——. F. Windhausen, Berlin. Eng. Pat. 17,250, Aug. 25, 1905.

SEE Fr. Pat. 357,120 of 1905; this J., 1906, 27.—T. F. B.

Furnaces for separating metals. M. Leitch, Brooklyn, N.Y., U.S.A. Eng. Pat. 17,651, Aug. 31, 1905.

SEE U.S. Pat. 800,222 of 1905; this J., 1905, 1070.—T. F. B

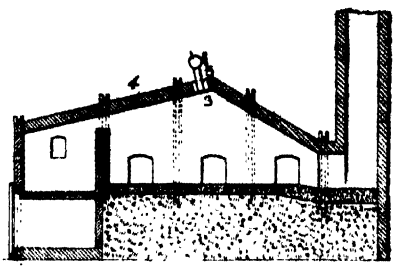
Furnaces; Impts. relating to ——. J. L. Babó and A. L. Louvrier, Honfleur, France. Eng. Pat. 26,076, Dec. 14, 1905. Under Int. Conv., Dec. 14, 1904.

THE furnace is intended for the extraction of zinc and lead from their ores by volatilisation. It consists of a scaphoid cavity, in the base of which is a slot through which the slag falls into the ash-pit below. An upward draught is maintained in the furnace by a blast or by suction, or by both, and the slot is cooled by circulation of air or water, in order to prevent its deformation.—A. S.

UNITED STATES PATENTS.

Furnace; Metallurgical ——. B. C. Lauth, Pittsburg, Pa. U.S. Pat. 823,057, June 12, 1906.

THE roof of the furnace, 4, has the shape shown in the figure,



and is provided near the top with a series of openings, 3, through which blast-nozzles, 5, discharge jets of air, under pressure, downwards into the furnace. The diameter of the openings is larger than that of the blast-nozzles, so that atmospheric air is drawn in by the jets of compressed air, and assists in promoting combustion on the hearth of the furnace.—A. S.

Roasting furnace [for ores]. A. W. Chase, New York. U.S. Pat. 823,393, June 12, 1906.

THE furnace consists of a casing in which several U-shaped troughs are disposed one above the other, each of them being provided with a spiral conveyor mounted on a hollow shaft, which is cooled internally with water. The conveyor-shafts are supported on bearings outside the furnace, and pass through circular openings in the furnace walls, these openings being closed by removable slotted plates which fit around the shafts. The furnace can be used as a muffle furnace or reverberatory furnace; in the former case the roasting-troughs are protected from the direct action of the fire by removable shelves, one situated below, and the other above the series of troughs. Means are provided for carrying the furnace gases around the troughs, and for supplying air to the roasting ore. Above the troughs, and resting on the cover of the furnace, there are placed a feed-hopper and conveyor, which also serves as a preliminary drier for the ore; the latter is here exposed to the gases escaping from the roasting-troughs, but is protected from the direct action of the fire.

—J. F. B.

Furnace; Tilting ——. J. C. Cromwell, Assignor to the Garrett-Cromwell Engineering Co., Cleveland, Ohio. U.S. Pat. 823,669, June 19, 1906.

IN each end of the framework of the furnace are mounted two "equalising-beams," on which two rollers are journalled. The rollers bear on a curved trackway, and means are provided for tilting the furnace. The rollers are mounted on the furnace in such a manner that they ride upon the curved trackway independent of the expansion of the furnace.—A. S.

Blast furnace. W. Kemp, Assignor to M. P. Freeman Tucson, Ariz. U.S. Pat. 824,485, June 26, 1906.

SEE Fr. Pat. 358,645 of 1905; this J., 1906, 270.—T. F. B

Metals [gold and silver]; Process of extracting —— from their ores. C. R. Arnold, Philadelphia, Pa. U.S. Pat. 823,576, June 19, 1906.

THE ground ore is mixed to a pulp with cyanide solution and air is drawn first through a heater, and through "a generator of halogen gas," and then through the pulp in sufficient amount to thoroughly agitate it. The movement of the air is effected by maintaining a partial vacuum in the space above the ore-pulp, the gases, &c., from such space being delivered first to a "regenerating solution" ("caustic solution"), and then to "an exhaust-pump or hydraulic type."—A. S.

Zinc alloys; Process of manufacturing ——. P. and A. Göhrs, Berlin. U.S. Pat. 824,644, June 26, 1906.

SEE Fr. Pat. 332,657 of 1903; this J., 1903, 1247.—T. F. B

ENGLISH PATENTS.

Oleïne and stearine; Process and apparatus for extracting —— from fatty acids. M. Lanza and L. Garnna, Turin, Italy. Eng. Pat. 4481, Feb. 23, 1906. Under Int. Conv., Feb. 27, 1905.

SEE Fr. Pat. 352,337 of 1905; this J., 1905, 933.—T. F. B.

Soap; Manufacture of ——. L. and W. H. Burley, Waverton, Chester. Eng. Pat. 25,425, Dec. 7, 1905.

ORDINARY soap is incorporated with water and gum tragacanth in varying proportions; claim is also made for the use of borax in addition to water and gum tragacanth. It is stated that the bulk, as also the detergent and antiseptic properties of the soap are thus increased.

—C. A. M.

UNITED STATES PATENT.

Fats and the like; Apparatus for the recovery of —— from waste waters. C. Kremer, Berlin. U.S. Pat. 823,688, June 19, 1906.

SEE Eng. Pat. 24,030 of 1905; this J., 1906, 382.—T. F. B.

FRENCH PATENT.

Cocoa-nuts or copra; Process of preserving ——. R. Marot. Fr. Pat. 362,369, Jan. 12, 1906.

THE flesh of the cocoa-nuts or copra is subjected to the action of a mixture of sulphur dioxide and air, which has been passed through an apparatus where it is submitted to an electrical discharge. The copra is treated preferably before exportation.—W. P. S.

GERMAN PATENT.

Liquids of different specific gravity, especially oil and water; Apparatus for the separation of ——. G. B. Bibolini and C. Baulino. Ger. Pat. 168,083, July 16, 1904.

THE separator comprises a number of superposed, closed chambers, communicating with one another by openings in the division walls. The mixture of liquids is supplied under pressure to the two lower chambers by a vertical pipe from an elevated reservoir. On the opposite side of the separator to the reservoir a vertical tube rises, through which the separated water rises to a height somewhat less than that of the supply reservoir, so that a continuous flow of the liquid in the lower chambers, in a horizontal or nearly horizontal direction, is caused. The oil which separates, collects in an upper chamber, and is removed from time to time.—A. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*Continued from page 646.*)

(A.)—PIGMENTS, PAINTS.

Colouring matters in molasses, vinasse, &c. Wichardt. IV., page 687.

Paints and colours in which dry carbonate of lead or red lead is used; Regulations for the manufacture of ——. Home Office Circular. [T.R.]

THE following draft regulations apply to all factories and workshops in which dry carbonate of lead or red lead is used in the manufacture of paints and colours, provided as follows:—

(1) The Regulations shall not apply to factories and workshops in which paints and colours are manufactured not for sale but solely for use in the business of the occupier; or in which only the manufacture of artists' colours is carried on.

(2) Regulation 2, and so much of Regulation 3 as prevents the employment of a woman in manufacturing dry lead colour, shall not apply to the packing in parcels or kegs not exceeding 14 lb. in weight, unless and until so required by notice in writing from the Chief Inspector of Factories.

(3) Regulations 4, 5, 6, 11, and 12 shall not apply to factories or workshops in which the grinding of lead colours occupies less than three hours in any week, unless and until so required by notice in writing from the Chief Inspector of Factories.

Definitions for the purpose of these Regulations—

"Lead colour" means carbonate of lead and red lead, and any colour into which either of these substances enters.

"Lead process" means any process involving manipulation of materials containing lead.

PART I.—*Duties of Employers.*

1. No dry lead colour shall be placed in any hopper or shoot without an efficient exhaust draught and air guide so arranged as to draw the dust away from the worker as near as possible to the point of origin.

2. No dry lead colour shall be mixed, ground in oil, sifted, or otherwise manipulated so as to give rise to dust, save either—

(*a*) in an apparatus so closed as to prevent the escape of dust; or

(*b*) with an efficient exhaust draught and air guide so arranged as to carry away the dust as near as possible to the point of origin.

Provided that this regulation shall not apply to the immersion and manipulation of dry lead colour in water.

3. No woman, young person, or child shall be employed in mixing, grinding in oil, sifting, or otherwise manipulating dry lead colour.

4. Every person employed in a lead process shall be examined once in each calendar month by the certifying surgeon of the district, who shall have power to suspend from employment in any lead process.

5. No person after suspension in accordance with Regulation 4, shall be employed in any lead process without written sanction entered in the health register by the certifying surgeon.

6. A health register in a form approved by the Chief Inspector of Factories shall be kept and shall contain a list of all persons employed in any lead process. The certifying surgeon will enter therein the dates and results of his examinations of such persons with particulars of any directions given by him.

The health register shall be produced at any time when required by any of His Majesty's Inspectors of Factories or by the certifying surgeon.

7. Overalls shall be provided for all persons employed in lead processes; and shall be washed or renewed at least once every week.

8. The occupier shall provide and maintain for the use of all persons employed in lead processes—

(*a*) a cloak-room or other suitable place in which such persons can deposit clothing put off during working hours, and separate and suitable arrangements for the storage of overalls required by Regulation 7;

(*b*) a dining-room, unless all workers leave the factory during meal hours.

9. No person shall be allowed to introduce, keep, prepare, or partake of any food, drink (other than a medicine provided by the occupier and approved by the certifying surgeon), or tobacco in any room in which a lead process is carried on. Suitable provision shall be made for the deposit of food brought by persons employed.

10. The occupier shall provide and maintain in a cleanly state and in good repair for the use of persons employed in lead processes a lavatory (see this J., 1905, 1263).

Part II. relates to the duties of persons employed, as set forth in Part I.

It is also directed that no person shall, without the permission of the occupier or manager, interfere in any way with the means and appliances provided for the removal of dust or fumes and for the carrying out of these Regulations.

United States Patents.

White-lead; Apparatus for making ——. J. W. Bailey, New York, Assignor to United Lead Co., N.J. U.S. Pat. 823,097, June 12, 1906.

The apparatus consists of a number of corroding-chambers arranged side by side; these chambers are open at both ends, and are provided with a series of ledges one above the other, on which trays containing the comminuted lead are fed, so that when the trays are in position the open ends of the chambers are filled up. Externally to the corroding-chambers, there is a charging mechanism mounted on a carriage, which can serve all the corroding-chambers in turn. This mechanism contains tray-supporting and tray-feeding devices, which are vertically adjustable, to advance the trays into the corroding-chamber one above another. Molten lead is contained in a reservoir at the top of the machine, and is caused to flow through small openings, from a height, on each tray, whilst it is being pushed into the chamber. The tray which is being pushed into the chamber is caused to displace the tray containing the corroded lead which was already in the chamber, the latter tray being received on a washing device placed on the other side of the chamber. —J. F. B.

Paint or composition; Non-corrosive or anti-fouling ——. F. E. Dunnett, Assignor to Humidine, Ltd., London. U.S. Pat. 824,069, June 19, 1906.

See Fr. Pat. 358,592 of 1905; this J., 1906, 325.—T. F. B.

Pigments from antimony and arsenic, lithopone from white antimony or cerussite, yellow and red antimony sulphides, or antimony minium; Process of making ——. L. Brunet. Fr. Pat. 361,380, April 15, 1905.

See Eng. Pat. 16,490A of 1905; this J., 1906, 32.—T. F. B.

French Patents.

Antimony sulphide and oxysulphide; Production of colours and of metallic antimony from ——. C. Savigny and M. Douxami. Fr. Pat. 361,383, April 15, 1905.

Stibnite, or other sulphide rich in antimony, is powdered, intimately mixed with an alkali or alkali carbonate, and smelted in a cupola at a red heat for several hours. The mass is boiled with water, and the solution so obtained is precipitated with acid, avoiding all excess; the precipitate is separated, washed, and dried at 40°—50° C. Metallic antimony is often produced during the fusion, and settles to the bottom of the fused mass.—J. H. C.

Antimony oxysulphide [Pigment]; Production of orange-red ——. C. Savigny and M. Douxami. Fr. Pat. 361,384, April 15, 1905.

100 parts of antimony oxide and 36 to 37 parts of sodium carbonate are mixed together, and heated to redness for two or three hours. After cooling, the mass is finely powdered, mixed with sulphur or an alkali or alkaline-earth sulphide, and boiled with water. The solution thus obtained is treated with an acid, or with an acid solution of antimony chloride, and the orange-red or orange precipitate so formed is collected, and dried at 40°—50° C. The tint may be varied by varying the quantity of sulphur or of alkali sulphide employed. —J. H. C.

Lakes [from azo dyestuffs]; Production of red ——. Badische Anilin und Soda Fabrik. First addition, dated Jan. 18, 1906, to Fr. Pat. 297,330, Feb. 17, 1900. Under Int. Conv., Dec. 4, 1905.

See Eng. Pat. 82 of 1906; this J., 1906, 224.—T. F. B.

(B.)—RESINS, VARNISHES.

Turpentine production in India. Ch. of Comm. J., July, 1906. [T.R.]

The German Consul-General at Calcutta reports the probability of expansion in the production of turpentine in the pine forests of Kumaon Himalaya. In the year 1904—05, 62,000 trees were tapped in the Forest District of Naini Tal, and yielded 4,260 maunds of raw resin. More than 6,000 gallons of turpentine were manufactured, and also 3,300 maunds of colophony, for which there was a good demand. The cost of working amounted to 14,000 rupees, and the proceeds of the sale were nearly 30,000 rupees. Great hopes are entertained for the development of this new branch of industry, which is at present only in the initial stages, and experiments are being made to determine the influence exerted by the tapping upon the growth of the tree and upon the quality of the wood, as well as the best means of procuring a maximum yield of resin.

Varnish manufacture in the United States; Census of ——. Oil, Paint, and Drug. Rep., July 2, 1906. [T.R.]

The Director of the Census has announced the result of the census of varnishes for the calendar year ending December 31, 1904, forming a part of the Census of Manufactures of 1905.

The statistics show that there has been a substantial increase in this industry in the United States, as compared with the statistics of 1900, which covered the fiscal year ending May 31.

Comparative figures for 1905 and 1900 are shown in the following summary:—

	1905.	1900.
Number of establishments	190	181
Capital	$19,702,955	$17,550,892
Materials used—		
Total cost	$13,520,491	$10,989,181
Gums—		
Pounds	33,091,256	*
Cost	$3,704,161	$2,947,060
All other pigments—		
Pounds	26,265,342	*
Cost	$737,647	$260,317
Linseed oil—		
Gallons	3,765,309	4,308,943
Cost	$1,647,101	$2,056,469
Alcohol (grain)—		
Gallons	51,070	65,146
Cost	$118,433	$151,089
Alcohol (wood)—		
Gallons	1,217,008	274,221
Cost	$693,402	$255,354
Mixed acids—		
Tons	26	72
Cost	$1,046	$3,567
All other materials	$6,618,701	$5,265,275
Products—		
Total value	†$23,561,699	$18,687,240
Dry colours—		
Pounds	7,209,028	6,600,000
Value	$317,410	$304,000
Paints in oil, in paste—		
Pounds	6,992,059	2,950,370
Value	$414,700	$195,687
Paints already mixed for use—		
Gallons	556,265	287,850
Value	$368,963	$245,849
Oil and turpentine varnishes—		
Gallons	14,926,695	12,909,248
Value	$14 001,846	$13,096,693
Alcohol varnishes—		
Gallons	1,467,887	503,442
Value	$2,046,492	$833,522
Pyroxylin varnishes—		
Gallons	144,428	142,836
Value	$158,160	$162,601
Liquid driers, japans, and lacquers	$2,846,944	$2,781,115
All other varnishes and japans	$1,249,244	$745,657
All other products	$2,162,940	$322,166

* Quantity not reported in 1900.

† Exclusive of varnish products valued in 1905 at $312,418, made in establishments engaged primarily in the manufacture of other products.

English Patent.

Manila copal, sandarach, and like resinous substances; Process for rendering —— insoluble in oil, and especially suitable for use in the preparation of polishes. W. Baringer, Berlin. Eng. Pat. 3788, Feb. 15, 1906. Under Int. Conv., Feb. 25, 1905.

See Fr. Pat. 352,323 of 1905; this J., 1905, 234.—T. F. B.

(C.)—INDIA-RUBBER, Etc.

Asclepiadeæ; New rubber-producing —— from Madagascar. J. Constantin and I. Gallaud. Compt. rend., 1906, **142**, 1554—1556.

The two plants examined belonging to the *Asclepiadeæ* are distinguished by the names Kompitsé and Dangolora. The Kompitsé belongs to the group *Periplocæ*, and the authors propose the name *Kompitsia elastica*, as it represents a new genus. The Dangolora is allied to the genus *Marsdenia*. The latex of the two plants is mixed by the natives, and the rubber produced is known in Madagascar under the name Manomby.—F. Shdn.

Rubber-yielding plants; Experiments with —— in Dominica. J. Jones. West Indian Bull., 1906, **7**, 16—20.

Specimens of *Castilloa elastica* planted 13 years ago have thriven remarkably well, and have suffered little from storms. In 1904 they yielded 1 lb. per tree of high-class but somewhat dark rubber. Two distinct methods of tapping are found to give good results. In Fig. 1, the lines represent series of cuts made with the triangular tapping tool commonly used in Ceylon; this scheme of lines has considerable advantages over the older "herring-bone" scheme. In Fig. 2, the cuts are made with an ordinary chisel. The method, shown in the figures, of collecting the whole yield in one cup by means of the sheathing base of a leaf-stalk from a cabbage or other palm is strongly recommended. During tapping, the trunk of the rubber tree is sprayed with water to aid the disengagement of

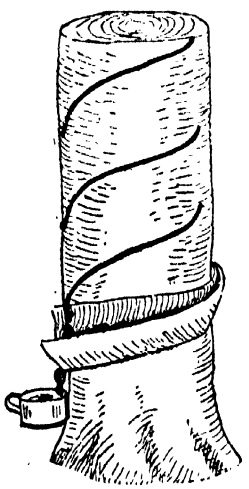


Fig. 1.

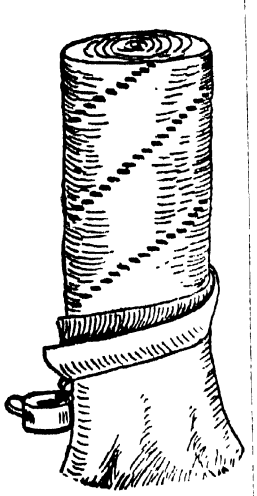


Fig. 2.

the latex. The rubber is separated without artificial coagulants.

Experiments with the Lagos rubber tree (*Funtumia elastica*) indicate that this tree does not lend itself to culture in Dominica so well as *Castilloa*.—W. A. C.

Rubber experiments in St. Lucia. J. C. Moore. West Indian Bull., 1906, **7**, 21—29.

Some *Castilloa elastica* trees planted 15 to 17 years ago are, on the whole, of poor growth, doubtless owing to the swampy ground. The total yield from nine trees amounts, so far, to 150 ozs. of biscuit and scrap rubber. From tapping experiments made on these trees it is inferred that the best yield is obtained if the tapping is done in the early morning on alternate days.—W. A. C.

India-rubber; Vulcanisation of Guayule ——. R. Ditmar. Gummi-Zeit., 1906, **20**, 972.

Guayule rubber imported one year ago, and containing 13 per cent. of resin and 0·45 per cent. of water, was dried, and vulcanised under pressure for 45 minutes at 145° C. with rising percentages of sulphur. With less than 15 per cent. of sulphur, vulcanisation was found to be incomplete. From 15 to 50 per cent. the strength of the vulcanised rubber rose continuously, whilst the elasticity reached a maximum at 35 per cent. of sulphur.—W. A. C.

English Patent.

Plastic substances [Vulcanite and celluloid] used as bases in dental prothesis; Method of colouring ——. L. Eilertsen, Paris. Eng. Pat. 12,203, June 13, 1905.

The rubber or celluloid is coloured by the addition of ferric oxide, insoluble carmine, or alizarin and its derivatives, in conjunction with zinc oxide and sodium thiosulphate, or with zinc sulphite.—W. P. S.

United States Patents.

Rubber; Process of recovering — from rubber waste. W. A. Koeneman, Chicago, Ill. U.S. Pat. 823,053, June 12, 1906.

The rubber waste in a finely divided condition is boiled with a solution of a mineral acid containing "a halogen salt of the alkaline group, such as sodium or calcium chloride, without setting free in a gaseous state the chlorine, bromine, or iodine." The dissolved matters are removed, and the residual rubber is boiled with "a solution of an alkaline salt, such as soda or potash," with the addition of a substance having a preservative effect on vegetable matter, *e.g.*, boric acid or sodium borate, and of a "soluble gum," such as rosin or shellac. The product is afterwards treated with a "weak astringent solution" of an aluminium salt to precipitate any soluble compounds remaining from the previous operations, and is then washed, and dried.—A. S.

Rubber waste; Process of treating vulcanised —. W. A. Koeneman, Chicago, Ill. U.S. Pat. 823,054, June 12, 1906.

The finely-divided rubber waste is boiled first with an aqueous solution of sulphuric and hydrochloric acids, free from oxidising agents, and then with an alkaline solution, and is afterwards washed, and dried.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 647.)

Gelatin; Rendering —— insoluble by the atmospheric oxidation products of phenolic compounds. A. L. Lumière and A. Seyewetz. Collegium, 1906 [212], 205—207.

Phenolic compounds which possess photographic developing properties are not the only ones which will render gelatin insoluble (see this J., 1906, 496); certain other phenols, in alkaline solution, possess this property in a greater or less degree, the most active being gallic acid, tannin, phloroglucinol, β-naphthol, and dihydroxynaphthalene, in the order named. In absence of air, even in presence of alkali, none of the compounds tried produced insolubility of the gelatin. It appears thus that quinone is not the only substance which can render gelatin insoluble in absence of air, since its formation from resorcinol and the naphthols is highly improbable. Since tannin can only render gelatin insoluble in presence of air, and in alkaline solution, it would seem that oxygen plays an important part in tanning operations, which might explain the necessity for various processes to which hides must be subjected to ensure satisfactory tanning.
—T. F. B.

Albuminous and gelatinous substances; Determination of ——, by means of acetone. F. Bordas and Touplain. **XXIII., page 716.**

ENGLISH PATENT.

Leather; Process for rendering chrome —— waterproof and durable. A. Flöring, Wermelskirchen, and M. Lønneberg, Remscheid, Germany. Eng. Pat. 23,299, Nov. 13, 1905.

SEE Fr. Pat. 358,894 of 1905; this J., 1905, 327.—T.F.B.

UNITED STATES PATENT.

Tannin; Apparatus for the extraction of ——. L. Castets, Dax, France. U.S. Pat. 823,508, June 19, 1906.

SEE Fr. Pat. 343,679 of 1904; this J., 1904, 1036.—T. F. B.

XV.—MANURES, Etc.

(*Continued from page* 647.)

Humus [in soils]; Formation of ——. S. Suzuki. Bull. Coll. Agric., Tokyo Imp. Univ., 1906, 7, 95—99.

FIVE Erlenmeyer flasks of about 1200 c.c. capacity were each charged with 100 grms. of dry, coarsely-powdered leaves of *Quercus serrata*, Thunb. (used as a litter in Japan), which had been previously moistened with 200 c.c. of water, and mixed with 1 grm. of humous soil. One flask served as a check; to the second was added 5 grms. of precipitated basic magnesium carbonate mixed with water to a fine milk, and 0·5 grm. of dipotassium-hydrogen phosphate; to the third, 5 grms. of precipitated calcium carbonate, 0·5 grm. of dipotassium phosphate, and 0·5 grm. of magnesium sulphate; and to the fourth, 5 grms. of precipitated calcium carbonate. The fifth flask received the same substances as the second; it was then sterilised, and the contents inoculated with the chocolate-coloured mycelium of a peculiar kind of penicillium, which produces a black substance when cultivated in koji-extract. The flasks were then allowed to stand, and from time to time about 10 litres of purified moistened air were sucked through each of the vessels, and then through caustic potash solution to absorb carbon dioxide. Test portions of the leaves were also examined under the microscope. The author states that the results show that humification of the leaves proceeds parallel with the development of carbon dioxide. Magnesium carbonate promotes the development of carbon dioxide, and, consequently, the humification process, whilst calcium carbonate retards it. The potassium phosphate had a favourable effect on the process.

In the fifth flask the amount of carbon dioxide produced was much less than (about one-third of) that produced in the control flask. The author proposes to continue the experiments until all the particles of leaves are transformed into black humus. After eleven months the colour of the leaves had become very dark, and the cohesion of the particles had been almost destroyed.—A. S.

Barley; Degree of stimulating action of manganese and iron salts on ——. T. Katayama. Bull. Coll. Agric., Tokyo Imp. Univ., 1906, 7, 91—93.

IT has been shown previously that the stimulating effect of manganese salts on oats, upland rice, barley, and wheat is not so great as on leguminous plants. An application of 0·015 per cent. of manganous sulphate (calculated on the weight of the soil) caused an increase of 50 per cent. in the yield of straw, and 25 per cent. in that of seeds, in the case of the pea, whereas the same quantity (and also an increased quantity of 0·04 per cent.) caused a total increase in the yield of only about 10 per cent. in the case of cereals. Further experiments on barley with manganous sulphate and ferrous sulphate, and also with mixtures of the two salts, have now shown that a mixture of 0·01 per cent. each of crystallised ferrous sulphate and manganous sulphate produces a moderate increase of yield, *viz.*, 6·21 per cent. more straw and 7·21 per cent. more seeds, but that greater quantities of the salts caused a general decrease of yield.—A. S.

Slag; Production of ——. F. Benjamin. Fr. Pat. 362,419, Jan. 15, 1906. X., page 700.

UNITED STATES PATENTS.

Fertiliser. W. B. Chisolm, Charleston, S.C. U.S. Pat. 824,280, June 26, 1906.

SEE Eng. Pat. 6249 of 1906; this J., 1906, 647.—T. F. B.

Fertilising material; Method of making ——. W. B. Chisolm, Charleston, S.C. U.S. Pat. 824,281, June 26, 1906.

SEE Eng. Pat. 6249 of 1906; this J., 1906, 647.—T. F. B.

GERMAN PATENT.

Sludge [from sewage purification]; Dehydration and utilisation [as manure] of ——. H. Grosse-Bohle. Ger. Pat. 167,700, May 26, 1904. XVIII*B.*, page 711.

XVI.—SUGAR, STARCH, GUM, Etc.

(*Continued from page* 648.)

Steffen's [sugar] extraction process. Scharffenberg. Z. Ver. deutsch. Zuckerind., 1906, 604—609.

IN this process the beetroot slices fall directly from the slicing machine into the hot sugar juice contained in the so-called steeping trough. The latter is perforated for one-third of its length, and the perforated portion is enclosed in a metal box. The beet slices are carried through the trough by a transport belt. The juice flows through the perforations into the outer box, and thence into a centrifugal pump, whence it passes through a heating apparatus, and then back to the other end of the trough. The temperature of the juice in the trough is kept at 95°—100° C. The beetroot slices remain in the trough for about three minutes. At the end of the trough the slices are removed by an ascending spiral, at the top of which they are pressed, the juice being returned to the trough. Hot water is added as required to the juice circulating through the trough, the sweet water from the pressed mud being used for this purpose; the excess juice runs from the trough through an overflow tap, and is then treated in the usual way. The pressed slices are sprayed with diluted syrup; in very good years the whole of the syrup may be used in this way. The slices are then again pressed, the pressed juice being returned to the trough. Owing to the high temperature (at least 80° C.) at which the slices are pressed, a cake is obtained which contains 30—35 per cent. of dry substance and 10—12 per cent. of sugar. After drying, it contains 30—35 per cent. of sugar, and is known as "Zuckerschnitzel." The yield of refined sugar obtained by this method is less than that obtained by the diffusion method; the total yield, however (*i.e.*, including the sugar in the "Zuckerschnitzel"), is considerably greater; the value of the products from 50 kilos. of beetroot (average of three years) obtained by the steeping process was 1·543 marks, and by the diffusion process 1·403 marks. Moreover, the working expenses are less by the former method. The "Zuckerschnitzel" finds a ready sale as a cattle food.—L. E.

Beetroot juice; Chemical purification of ——. K. C. Neumann. Z. Zuckerind. Böhm., 1906, 30, 477—479.

FOR the decolorisation of beetroot juice crystallised hyposulphites (hydrosulphites) ($R_2S_2O_4+2H_2O$) and double salts of hyposulphites have been proposed, but they readily undergo decomposition. Anhydrous sodium hyposulphite is much more stable, but its complicated method of preparation renders it costly. The product formed by the reaction of sodium hyposulphite and formaldehyde according to the equation

$$Na_2S_2O_4+2CH_2O+H_2O=$$
$$(NaHSO_2\cdot CH_2O)+(NaHSO_2\cdot CH_2O),$$

and which consists, therefore, of sodium bisulphite formaldehyde and sodium sulphoxylate formaldehyde, is both stable and inexpensive, and it possesses a very great decolorising power. The results obtained so far with this substance have been very encouraging.

Twenty hectolitres of thin juice treated with ½ litre

of the preparation (sp. gr. 1·26), and 20 hectolitres of thick juice treated with ½ litre, were completely decolorised. Twenty hectolitres of green syrup were considerably clarified by 1 litre of the preparation. Owing to the small quantity of the preparation required, the juice is not injuriously affected, and no invert sugar is formed.—L. E.

Beetroot juice; Chemical purification of ——. V. Halousek. Z. Zuckerind. Böhm., 1906, **30**, 479—480.

THE "double compound of sodium hyposulphite and formaldehyde" (see preceding abstract) has been used successfully in a sugar factory at Radotin. Twenty-two hectolitres of green syrup (32° B.) were treated with ½ litre of the hyposulphite preparation of density 1·26. The clarification was better than that obtained with sulphur, whilst the yield and colour of the sugar were quite as good.—L. E.

Beetroot juice; Chemical purification of ——. R. Mandelik. Z. Zuckerind. Böhm., 1906, **30**, 480—481.

THE author has used anhydrous sodium hyposulphite (hydrosulphite) in the treatment of thick juice, and has compared its decolorising effect with that of aluminium sulphite. The former was a much stronger decolorising agent. Similar results were obtained with refined sugar juice.—L. E.

Sugar juice; Saturation of —— with sulphur dioxide. Von der Ohe. Z. Ver. deutsch. Zuckerind., 1906, 588—592.

THE author is of opinion that sugar juice should be subjected to three saturations, and not two only, as is done in some factories. The use of sulphur dioxide, however, for saturation has one disadvantage. A portion of the calcium bisulphite formed by decomposition of organic calcium salts, separates in the evaporating pans, thus producing incrustation of the latter. This annoyance may be removed by saturating the thin juice with carbonic acid instead of sulphur dioxide. Since sulphur dioxide is a valuable clarifying agent, however, the author recommends the saturation of the thick juice, subsequently obtained, with sulphur dioxide. Owing to the slimy precipitate formed in this last operation, filtration is somewhat difficult, but the author considers that the more exact saturation thus obtained, and the prevention of incrustation in the evaporation of thin juice, outweigh this disadvantage. In the discussion which followed, Preissler disputed the formation of incrustation in the evaporating pans when the thin juice has been previously treated with sulphur dioxide, and remarked also that the saturation of the thin juice may be so regulated that the alkalinity of the thick juice may be of any desired degree.—L. E.

Thick [sugar] juice sludge; Periodic occurrence of copper in ——. Bülow. Z. Ver. deutsch. Zuckerind., 1906, 601—604.

AN analysis of the sludge collected on the thick juice filter showed that on two successive Mondays it contained 1·42 and 1·17 per cent. of copper respectively, while on the Wednesday of the second week it contained 0·006 per cent. only. The thick juice pan was washed every Sunday with sodium carbonate and hydrochloric acid, and then carefully rinsed with water. The copper was present in the mud in the cuprous state. The copper must have come from the brass tubes of the evaporating pan, since this was the only part of the apparatus containing copper. By acting on a strip of polished brass with thin juice, the author shows that the latter is capable of dissolving out copper from the brass to a considerable extent, and sufficiently so, to account for the amount of copper found in the thick juice mud. In conclusion, the author considers that the following is the true explanation: The boiling juice evolves an appreciable quantity of ammonia, which attacks the freshly cleaned tubes, and the ammoniacal copper compounds thus formed are then reduced either by reducing substances in the juice or by salts of sulphurous acid. During the week the tubes again become coated with lime, thereby being protected from the action of the juice. Hence, by the middle of the week, traces only of copper are found in the thick juice mud.—L. E.

Mother-liquors from first products [sugar] by Raabe's method; Treatment of ——. Stutzer. Z. Ver. deutsch. Zuckerind., 1906, 610—614.

THE mother-liquor from the first products (purity about 73—78) is heated by a current of steam to 90° C., and diluted at the same time to 60°—65° Brix. The juice is then filtered through a Neumann sand filter, and subsequently saturated in a saturator (Raabe's system). The alkalinity of the syrup should not be less than 0·04 nor greater than 0·06 per cent.; otherwise the subsequent boiling is rendered difficult. After saturation, the syrup is filtered through doubled, not too fine, cotton cloth. The clear filtrate, which is ready for boiling, now passes into the reservoir, which must be provided with steam tubes in order that the syrup may be again heated, and diluted if necessary. The syrup that passes into the vacuum boiler from the reservoir should be at a temperature of 90° C., and have a density of 60°—65° Brix; it is heated with steam at a pressure of 1—1·5 atmospheres; the steam pressure is reduced to 0·3—0·5 atmosphere when the syrup has granulated sufficiently; it should be raised again to 1—1·5 atmospheres during the boiling off. The steam pressure is regulated by means of a regulator devised by Poensgen. The boiling temperature is maintained at 75° C., and must not fall below this. The juice is boiled for 30 to 36 hours; the massecuite is boiled down until its water content is 8—9 per cent. During the boiling off, the melt is raised to a temperature of 80° C., and is then run off as quickly as possible. Each boiling pan must either be provided with a separate condenser, or if only a central condenser is used, the connection between it and each pan must be so arranged that the vacuum may be maintained in each pan independently of the others. The melt which has run off from the boiling pan is now stirred. Under normal conditions the melt must be stirred for 72 hours in order to attain a quotient of 60—61 in the final molasses. The melt should be stirred for two hours, and then allowed to stand for one hour, and so on alternately. Five per cent. of molasses (diluted to 55°—60° Brix) is added to the melt one hour before the latter is centrifugalised. At the beginning of the last operation the melt must be at a temperature of 50° C.

The granulated sugar obtained by this method contains comparatively little mineral matter, and possesses a "rendement" of 88—92.—L. E.

Mucilage-forming bacteria observed in the course of sugar manufacture; New ——. Gonnermann. Z. Ver. deutsch. Zuckerind., 1906, 600—601.

THE author submitted the mucilaginous matter found on the plates of some pans used for the second saturation of sugar juice, to bacteriological examination. From this source he isolated three, and from the air of the room in which the pans were placed, two different varieties of bacteria, which formed mucilage-like substances in all kinds of nutrient media. These bacteria are new varieties. The formation of mucilage was specially noticeable with cultivation on sugar beet. The author concludes that the production of the mucilage is caused by the bacteria which it contains, and that the latter owe their existence to the very great resisting power of their spores, which are capable of withstanding the action of the hot acidified water, used for cleaning the pans, and also the subsequent varnishing. After the varnish has been worn away, the spores begin to develop, and when the juice has cooled to 37° C. mucilage is produced.—L. E.

Melezitose and turanose. G. Tanret. Comptes rend., 1906, **142**, 1424—1426.

MELEZITOSE is a trisaccharide composed, not, as has been thought hitherto, of three dextrose residues, but of two dextrose residues and one lævulose residue. On regulated hydrolysis, melezitose yields dextrose and turanose. *Turanose* is best prepared by heating melezitose with 20 per cent. acetic acid for two hours on a boiling water-bath. The acid is extracted by ether, and the mixture of sugars

is treated with yeast. In this way the dextrose can be completely fermented, whilst the turanose is but little attacked. Turanose, when purified by means of alcohol, is obtained in the form of hygroscopic, non-crystalline granules which retain alcohol, and have the composition $C_{12}H_{22}O_{11},\frac{1}{2}C_2H_6O$. This compound melts at 60°—65° C., and loses its alcohol when dried at 100° C. The rotatory power of the dried turanose in 5—10 per cent. solutions is $[\alpha]_D = +71{\cdot}8$; it shows no bi-rotation. The reducing power is equal to 60 per cent. of that of dextrose. Turanose is not hydrolysed by any of the ordinary enzymes, and is consumed very slowly by yeast. Hydrolysis by acids yields a mixture of equal proportions of dextrose and lævulose, but it cannot be effected completely without the destruction of some of the lævulose.—J. F. B.

Sucrose and raffinose; Optical determination of mixtures of ——. J. Pieraerts. XXIII., page 716.

Colouring matters from molasses, vinasse, &c. Wichardt. IV., page 687.

FRENCH PATENTS.

Carbonating apparatus for sugar works. E. L. Tanchon. Fr. Pat. 362,470, Jan. 17, 1906.

THE sugar syrup, treated previously with lime, is pumped into a cylindrical vessel, the upper part of which is surrounded by a second cylinder. When the inner cylinder is about one half filled, the syrup flows through pipes into the lower part of the outer cylinder. The gas is passed down a central pipe to the bottom of the inner cylinder, the end of the pipe being divided into a number of branches which are surrounded by an inverted dome. The gas rises through the syrup, and is conducted from the top of the cylinder through pipes to the bottom of the outer cylinder. A chimney is provided at the top of the outer cylinder for the escape of the excess of gas, and the treated syrup leaves this cylinder by a pipe provided for the purpose.—W. P. S.

Beet-sugar; Process for making —— without formation of by-products. O. W. Luther. Fr. Pat. 362,492, Jan. 18, 1906. Under Int. Conv., Jan. 19, 1905.

SEE Ger. Pat. 162,955 of 1905; this J., 1905, 1316.—T. F. B.

Beetroot wash and diffusion waters; Process for purifying ——. Soc. Anon. des Raffinerie et Sucrerie Say, and J. B. H. Pellet. Fr. Pat. 362,535, Jan. 19, 1906.

THE residuary waters are treated with lime, and subsequently with carbon dioxide, in order to remove organic matters in suspension and solution. The precipitates formed are separated by decantation or filtration, when the water is ready for use again.—W. P. S.

Sugar production of Europe. For. Off. Ann. Series No. 3653. [T.R.]

THE Association of Sugar Manufacturers furnishes the following figures as to the area under cultivation with beets, and the production of sugar in Europe during 1903, 1904, and 1905:—

Country.	Area under cultivation in 1000 acres.			Production of sugar in 1000 tons.		
	1905.	1904.	1903.	1905.	1904.	1903.
Germany	1168	1036	1047	1873	1350	1708
Austria-Hungary ...	935	808	778	1173	798	1026
France	621	476	590	865	529	703
Russia	1325	1183	1348	876	839	1016
Belgium	173	113	149	281	152	180
Other countries ...	325	274	296	365	303	365
Total	4547	3890	4208	5433	3971	4998

Sugar production of Russia. For. Off. Ann. Series No. 3653. [T.R.]

THE campaign of 1905—06, with 277 factories in operation, showed a production of 875,717 tons of sugar, or 36,989 tons more than was produced by the previous campaign of 1904—05. The stock of sugar on hand from the previous campaign is 172,968 tons, comprising 32,073 tons of the inviolable reserve, 112,344 tons of finished sugar and 28,551 tons of products calculated as white crystals. There will thus be an available supply of 1,048,685 tons, which is 80,347 tons under the "normal profitable production" stipulated by the Government as the quantity for the campaign of 1905—06. 870,967 tons are destined for the supply of the home market.

The actual yielding area was 1,324,540 acres, which gave a yield of roots of 7,780,287 tons or 117½ cwts. to the acre, an increase in area of 141,224 acres and in yield of roots of 391,545 tons compared with 1904.

The quantity of sugar supplied for consumption was 542,003 tons of refined and 292,429 tons of white crystals. The quantity of sugar exported by Russia in 1905 was 97,234 tons, as against 170,243 tons in 1904, and 236,673 tons in 1903.

XVII.—BREWING, WINES, SPIRITS, Etc.

(*Continued from page* 651.)

Malt; Regulation of the moisture and the colour of ——, *on the kiln.* K. Guttwein. Woch. f. Brau., 1906, **23**, 296.

THE rate of the removal of the water from the malt on the kiln, and the temperature at which the evaporation is effected, are factors of the highest importance in determining the colour and aroma of the finished product. The author describes an arrangement by which the attendant is able to control exactly the quantity of water remaining in the malt at every stage of the process, and to regulate the temperature and draught accordingly. This arrangement consists of a ventilating fan, the speed of which can be varied, and of a lever balance, placed under the drying hurdle of the kiln, by means of which the weight of the hurdle and its contents can be ascertained from time to time. The percentage of moisture in the green malt is determined by some rapid process, such as Hoffman's, at the time of loading the kiln, the total weight of the green malt is ascertained, and from these data a table is constructed, showing the temperatures and weights which are to be followed by the attendant at definite intervals of time, according to the course of treatment it is desired to adopt.—J. F. B.

Malt extracts; Some new properties of ——. L. Maquenne and E. Roux. Comptes rend., 1906, **142**, 1387—1392.

CONTINUING their previous investigations (this J., 1906, 601), the authors have found that filtered malt infusions, prepared by one hour's contact between malt and water, undergo an increase of activity on storage similar to that produced by the limited addition of acid. This property of auto-stimulation appears to be associated with the action of the proteolytic enzymes. When digested at 56° C., the activity of the infusion increases to a maximum in five hours, and then decreases; at 50° C., however, the increase continues for a much longer time before it is stopped by the destructive action of the heat, whilst at 15° C. the auto-stimulation steadily increases for several days. On the other hand, if the malt extract be previously stimulated by the addition of acid, it undergoes a continuous loss of activity on digestion at 50° C. The maximum stimulation is obtained by digesting the malt extract in the ordinary condition at 15° C for several days, until a considerable auto-intensification has taken place, and then adding acid to the "optimum" point of alkalinity. An extract so treated yielded 103·4 per cent. of maltose in 24 hours. The "optimum" alkalinity is the same for extracts which have undergone auto-stimulation as for fresh extracts, *viz.*, about 8 mgrms. of potash per litre of 2 per cent. mash. In the case of extracts which have been digested at 50° C. a further stimulation on the addition of acid is only obtainable when the digestion has not been too prolonged, since the heat partially destroys the zymogen on which the acid acts. From a consideration of the experimental facts, it would appear that the stimulation of malt extracts by age or acids relates only to the

saccharification of the dextrins derived from the amylopectin (see this J., 1905, 650). Amylocellulose, freed from amylopectin, is completely converted into maltose almost instantaneously by ordinary malt extracts. It is suggested, therefore, that a special diastase is required for the conversion into maltose of the amylopectin or "residual dextrins," that this special diastase exists in malt extract only in the form of zymogen, and that it is liberated from this zymogen, either immediately by acids, or gradually by digestion.—J. F. B.

Respiratory enzymes in plants; The work of ——. W. Palladin. Z. physiol. Chem., 1905, **47**, 407—451; Woch. f. Brau., 1906, **23**, 317.

The author concludes that the carbon dioxide evolved by the respiration of plants has various origins. The carbon dioxide evolved under anaërobic conditions is the result of the activity of the carbonases. That which is evolved from the uninjured frozen plants, when the atmosphere of hydrogen is replaced by air, without the addition of any reagents, is the product of the activity of the oxydases. That which comes off after the addition of pyrogallol is the product of the activity of the oxygenases. The oxygenase-carbon dioxide, *plus* that produced after the addition of hydrogen peroxide, represents the product of the activity of the peroxydases. The respiratory energy of plants depends on their contents of nucleoproteids. When the plants are surrounded by water instead of gas, the production of carbon dioxide falls off very considerably, owing probably to extraction of enzymes, co-enzymes, and nutrients. Plant germs developed in a decoction of wheat-embryos, evolve far more carbon dioxide than those grown in water, but sugar solutions have the same effect, so that the question whether the stimulus is due to the presence of a co-enzyme in the wheat-decoction, or merely to that of nutrients, is left undecided.—J. F. B.

Yeasts; Anomalus —— [Saccharomyces anomalus], and a new species, Willia Wichmanni. H. Zikes. Woch. f. Brau., 1906, **23**, 318.

The author describes a new species of anomalus yeasts [*Saccharomyces anomalus*], which he has isolated from a soil near Vienna, and to which he gives the name of *Willia Wichmanni*. This species differs from others of this genous in that its growths are not compact, flat, and dry, adhering firmly to the sub-stratum, but form a raised, slimy layer resembling the colonies of certain wort-bacteria. The sedimentary cells grown in wort are 3—5 μ in length and 3 μ in width; the film cells are elongated from 6 up to 40 μ. The temperature limits are 5°—32°C., with an optimum at 22° C. The cells are strongly refractive, stain well with Methyl Green, and occur in single elements, very rarely in pairs. The spores are pileate, 2 μ in height, and generally occur in the cells in twos, but sometimes in threes and fours. They germinate on gypsum blocks most readily at 21° C. The strongly mucous nature of the cell walls is made evident by staining with acetic acid and aniline-Gentian Violet solution; the sheath forms a zone about 3 μ in width. This variety consumes only dextrose and lævulose. The author enumerates the other species of *Saccharomyces anomalus* hitherto described, and gives a table setting forth comparatively the various characteristics of the eight best-known species.—J. F. B.

Saccharomyces ellipsoideus I. Hansen, The division of the cell-nucleus of —— during budding. F. Fuhrmann. Centr. Bakt. (Abth. 2), **15**, 709—717; Woch f. Brau., 1906, **23**, 318—319.

The observations of the author on the process of the division of the nucleus in *Saccharomyces ellipsoideus I.* agree on the whole with those of Swellengrebel on pressed yeast (see preceding abstract). The author prepared his specimens in a somewhat different manner, preferring to cut sections of the yeast cells fixed in a substratum. For this purpose a quantity of the culture was spread on an object-glass in a layer of 1 mm. in thickness, and egg-albumin was poured over the surface, the preparation then being fixed in a suitable solution. The films were then washed in running water for several hours, and gradually hardened by means of solutions of alcohol of increasing strengths. The films were embedded in paraffin, and sections were cut. Since a large number of the yeast cells were cut through, the preparations absorbed the stains very freely; the best results were got by staining with an iron mordant, followed by hæmatoxylin; other characters were brought out by alizarin mordanted with chrome. The results showed that *S. ellipsoideus I.* follows the type of a complete caryokinesis, the phenomena being similar to those described above by Swellengrebel. The author failed to confirm Hirschbruch's observations of a bisexualism and of a self-fertilisation of the yeast.—J. F. B.

Yeast cells; Influence of highly concentrated sugar solutions on the function of the endotryptase in dead ——. J. Gromow. Z. physiol. Chem., 1906, **48**, 87; Woch. f. Brau., 1906, **23**, 317.

The author had observed that solutions of cane sugar exerted a retarding influence, increasing with their concentrations, on the auto-digestion of the albuminoids in dead yeast cells. Further experiments, made with 60, 80, and 100 per cent. concentrations of cane sugar, and with 60 per cent. solutions of dextrose, showed either a complete inhibition of the auto-digestion or even a slight synthesis of albumin. This synthesis of albumin, though scarcely exceeding the limits of experimental errors, points to the possibility of synthetic enzymatic action by the reversal of the activity of the yeast endotryptase. Zaleski had arrived at an analogous conclusion in his study of the enzymatic synthesis of albumin in ripening seeds.—J. F. B.

Yeast; Absorption of dyestuffs and metallic salts by ——. T. Bokorny. Allgem. Brauer- u. Hopfen-Z., 1905; Woch. f. Brau., 1906, **23**, 299.

Yeast is rapidly stained by a solution of Methylene Blue at a concentration of one per 10,000, and the cells retain their power of budding and fermenting. In the budding chains coloured and uncoloured cells can be detected side by side. A solution of Methyl Violet containing one part per 10,000 also stains yeast, but the cells are killed at the same time. Yeast has the property of absorbing salts of the heavy metals from their solutions. Experiments with silver nitrate at concentrations ranging from one per 10,000 to one per 1,000,000 showed that the silver was deposited in the yeast after contact for several hours, whilst the bath was exhausted of silver. Copper salts were absorbed in the same manner, but mercuric chloride gave negative results. Yeast behaves in these respects similarly to aquatic plants which also possess specific powers of absorbing certain metals from dilute solutions. The process appears to depend on the formation of insoluble metallic compounds in the cells with the continuous diffusion of further quantities of the salt into the organism.—J. F. B.

Lactic acid fermentation; Influence of small quantities of metals on ——. E. Richet. Comptes rend. Soc. Biol., 1905, **60**, 455—456; Woch. f. Brau., 1906, **23**, 317.

The author has observed that minute quantities of barium, platinum, cobalt, manganese, vanadium, and the salts of spring waters exert a slight stimulating influence on the lactic acid fermentation.—J. F. B.

Beer pediococci; Occurrence of ——. N. H. Claussen. Z. ges. Brauw., 1906, **29**, 397—400.

The existence of several well-defined kinds of beer pediococci is generally doubted, and the varying disease symptoms observed in beer infected with these organisms is, as a rule, ascribed to a variation in the degree of virulence of the latter. The author shows experimentally that the virulence of the pediococci is not affected by the nature of the yeast used in fermentation, nor by the quality of the wort, nor by the method of fermentation; he considers that the varying effects of pediococci on beer is due, not to different degrees of virulence of these organisms, but to their specifically different characters. In another series of experiments the author endeavoured to trace the source of pediococci infection. The air of a dusty street

was found to be free from these organisms, both in March and August. Typical beer pediococci were found, however, in the air of a fermenting cellar in March. Out of 25 samples of barley and malt, two were found to contain beer pediococci. Hence, in comparison with other organisms, beer pediococci very seldom occur in nature. Of the two organisms, one, obtained from barley, appeared to be a *Pediococcus damnosus*; the other, obtained from green malt, showed the same properties as *Pediococcus perniciosus*. The latter organism affects beer injuriously, without any preliminary acclimatisation. Hence it is possible for a naturally occurring beer pediococcus to exert an injurious action directly it is placed in fermenting wort, and therefore the theory of acclimatisation must be abandoned.—L. E.

"Brettanomyces"; Occurrence of —— in American lager beer. N. H. Claussen. Amer. Brewers' Rev., 1905, **19**, 525; Z. ges. Brauw., 1906, **29**, 407—408.

So far as experience goes, in the presence of "*Brettanomyces*," a pure and agreeable taste is only obtained with top fermentation and completely fermented beer. Hence the organism is quite useless for primary fermentation. H. Schiönning has isolated *Brettanomyces* from Danish beer. It was necessary, however, to subject the beer to a preliminary treatment, adapted to the properties of the organism, in order that a considerable growth of the latter might occur. The author has also found *Brettanomyces* in American lager beer, and is of the opinion that this organism occurs fairly frequently in lager beer. Hence, cells of *Brettanomyces*, capable of development, occur fairly often in beers of most various kinds; they are only of real importance, however, in the case of certain English beers. Since the *Brettanomyces* occur occasionally in beers of very different kinds, there is probably a permanent natural source of infection existing here and there, from which, according to the time of year and local conditions, small numbers of organisms are introduced into the brewery; these organisms are retarded in development, however, or altogether suppressed (stage 1). If, however, exceptionally favourable conditions obtain in the brewery, the organism is enabled to produce its specific effect, accompanied by vigorous development, and an acute form of the characteristic disease occurs (stage 2). If the conditions in the brewery are frequently, or even permanently favourable to growth, the disease passes into the third stage. The organism increases enormously, the fresh infecting material, in a very vigorous state, spreads continuously, independently of all external conditions, and the disease has now become chronic. The *Brettanomyces*, in English breweries, present a typical example of such an infection in the third stage.—L. E.

Beer: Peculiar sediment in pasteurised ——. N. H. Claussen. Amer. Brewers' Rev., 1905, **19**, 578; Z. ges. Brauw., 1906, **29**. 407.

THE author has examined the sediment of a pasteurised beer, consisting of relatively large, bulky flocks, more or less dark in colour. Microscopic examination showed that the sediment consisted of unorganised matter, in which crystals, cork cells, and sundry indefinite particles, besides a moderately large number of bacteria, were embedded. In addition, diatoms and green algæ were found in the flocks. For soaking the bottles, the brewery used lye, prepared with water from Lake Michigan, and the bottles were afterwards rinsed with water from the same source, and then with filtered water. The water from the lake was found to contain exactly the same organisms as were present in the bottles. In order to determine the cause of the formation of the sediment, various samples of the lake water were placed in open bottles in the laboratory. All the samples showed a considerable quantity of diatoms and green algæ, and, in addition, more or less numerous protozoa and bacteria developed. Amongst the latter a rod-shaped organism was observed, which formed a very bulky mucilage. In a bottle rinsed out with this water, and then filled with beer, and pasteurised, flocks were formed, quite similar to those contained in the bottles originally examined. The same result was obtained when 1 c.c. of the water was added directly to the beer in the bot before pasteurisation. The greater the amount of bacte mucilage in the water, the more abundant was the forn tion of flocks in the pasteurised beer.—L. E.

Wine from the loquat fruit. T. Takahashi. Bull. C Agric., Tokyo Imp. Univ., 1906, **7**, 111—112.

THE fruit of the loquat, *Eriobotrya japonica*, Lindl., a yellow colour, "very fragrant flavour," and sweet tas it is used as a foodstuff. The fruits contain 73·57 cent. of water and 26·43 per cent. of dry matter, compo of 13·72 per cent. of seeds and 12·71 per cent. of fle The must has a density of 12°—13° B. at 17·5° C., contains: dextrose, 7·3; pentosans, 0·395; pec 3·266; citric acid, 0·284; malic acid, 0·070; and 0·544 per cent. On adding 15 per cent. of cane sugar the must, and allowing it to ferment, a wine rosembl "Tokayer" in taste and flavour was obtained. By mentation of 108 hectolitres of the juice with a p culture of wine yeast, a wine having the sp. gr. 1·02 and of the following composition, was obtained: alcol 7·130; glycerol, 0·0873; volatile acids (as acetic ac 0·145; non-volatile acids (as citric acid), 0·437; su (dextrose), 0·284; extractive matter, 3·116; and 0·490 per cent.—A. S.

Amylocelluloses [Insoluble amyloses] in natural starch Determination of the ——. J. Wolff. XXIII., p 716.

Colouring matters from molasses, vinasse, &c. Wichar IV., page 687.

Alcohol Bill; Industrial —— in the United States. Paint. and Drug Rep. [T.R.]

ON May 24th the Senate passed unanimously the providing for the freeing from taxation, after Jan. 1, 19 of denatured alcohol used for industrial purposes: Bill has since received the President's signature. Foll ing is the text:—

"Sec. 1. Be it enacted, &c., that from and after th months from the passage of this Act domestic alcohol such degree of proof as may be prescribed by the Comm sioner of Internal Revenue and approved by the Secret of the Treasury, may be withdrawn from bond without payment of internal revenue tax, for use in the arts industries, and for fuel, light, and power, provided alcohol shall have been mixed in the presence and un the direction of an authorised government officer bef withdrawal from the bonded warehouse, with denatur material suitable to the use for which the alcohol is wi drawn, but which destroys its character as a bever and renders it unfit for liquid medicinal purposes.

"The character and quantity of the said denatur material and the conditions upon which said alcohol n be withdrawn free of tax shall be prescribed by the C missioner of Internal Revenue, who shall, with the proval of the Secretary of the Treasury, make all necess regulations for carrying into effect the provisions of Act.

"Sec. 2. That any person who uses alcohol withdra from bond under the provisions of Section 1 of this for manufacturing any beverage or liquid medici preparation, or knowingly sells any beverage or liq medicinal preparation made in whole or in part from a alcohol, or knowingly violates any of the provisions this Act, or who shall recover or attempt to recover redistillation or by any other process or means any alco rendered unfit for beverage or liquid medicinal purpo under the provisions of this Act, or who knowingly u sells, or conceals alcohol so recovered or redistilled, sh on conviction of each offence, be fined not more th $5,000 or be imprisoned for not more than five years, both; provided that manufacturers employing processes which alcohol, used free of tax under the provision of t Act, is expressed or evaporated from the articles ma factured, shall be permitted to recover such alcohol and have such alcohol restored to a condition suitable sol for re-use in manufacturing processes under such re lations as the Commissioner of Internal Revenue, with approval of the Secretary of the Treasury, shall prescri

"Sec. 3. That for the employment of such additional force of chemists, Internal Revenue agents, inspectors, deputy collectors, clerks, labourers, and other assistants as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may deem proper and necessary to the prompt and efficient operation and enforcement of this law, and for the purchase of locks, seals, weighing beams, gauging instruments, and for all necessary expenses incident to the proper execution of this law, the sum of $250,000, or so much thereof as may be required, is hereby appropriated out of any money in the Treasury not otherwise appropriated.

"For a period of two years from and after the passage of this Act, the force authorised by this section of this Act shall be appointed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, and without compliance with the conditions prescribed by the Act entitled 'An Act to regulate and improve the Civil Service,' approved January 16, 1883, and amendments thereof, and with such compensation as the Commissioner of Internal Revenue may fix, with the approval of the Secretary of the Treasury."

ENGLISH PATENT.

Beer and the like; Apparatus for cooling and carbonating ——. L. Chew and H. J. West and Co., London. Eng. Pat. 20,086, Oct. 4, 1905.

THE invention relates to improvements in the cooling and carbonating cylinders employed in the production of the beer described in Eng. Pat. 17,951 of 1902 (this J., 1903, 223). Cross tubes are now arranged through the cylinder in such a manner that there is a natural circulation of the cooling liquid through them from one part of the jacket to another. The ends of the cylinder may also be provided with cooling jackets.—W. P. S.

FRENCH PATENT.

Alimentary product [Albuminoid containing metal salts]; Preparation of an —— from yeast. G. Jacquemin. Fr. Pat. 361,356, April 12, 1905. XVIII.*A.*, next column.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 652.)

(*A.*)—FOODS.

White of egg; Phosphorus content of ——. K. Kaas. Monatsh. Chem., 1906, **27**, 403—409.

THE author quotes analyses to show that white of egg and crystallised ovum albumin contain phosphorus in varying amounts. Thus the white of a fresh egg contained 0·155 per cent., whilst that of an egg, from the same fowl, which had been kept for a month contained 0·228 per cent. Crystallised preparations obtained either by the Hammarsten or Hopkins-Pinkus methods from white of egg contained as much as 3·0 per cent. of phosphorus. It is suggested that the phosphorus is not present as an impurity, but forms an essential constituent of the ovum albumin.—E. F. A.

Milk: A condensed vegetable ——. T. Katayama. Bull. Coll. Agric., Tokyo Imp. Univ., 1906, **7**, 113—115.

A LIQUID closely resembling cows' milk is obtained by soaking soy-beans in water, crushing them, and boiling with water. It has the following average composition: Water, 92·53; protein, 3·02; fat, 2·13; fibre, 0·03; non-nitrogenous extract, including carbohydrates (galactan), 1·88; and ash, 0·41 per cent. This soy-milk can be easily converted into a durable product resembling condensed cow's milk, by adding cane sugar and a small quantity of dipotassium phosphate (to prevent separation of protein), and evaporating *in vacuo*. The condensed soy-milk has a considerable nutritive value, but cannot replace cows' milk or mothers' milk in the nourishment of infants. Adulteration of condensed cows' milk by condensed soy-milk could be detected by addition of sodium carbonate, when a yellow coloration would indicate the presence of the latter. Also, if a portion of the suspected milk were mixed with twice its bulk of water, treated with a few drops of dilute sulphuric acid, and one-tenth of the whole distilled off, the distillate would possess the characteristic odour of the raw beans, if soy-milk were present. Adulteration might also be detected by separating the casein from the suspected sample with rennet, and adding calcium nitrate to the filtrate; the formation of a precipitate would indicate the presence of the globulin of soy-milk, the so-called glycinin.—A. S.

Cheese; Preparation of a vegetable —— from the protein of the soy-bean. T. Katayama. Bull. Coll. Agric., Tokyo Imp. Univ., 1906, **7**, 117—119.

THE soy-bean when boiled with water yields a milk (see preceding abstract), of which the chief proteid constituent is glycinin, a globulin similar in properties to legumin, and having the following composition: Carbon, 52·12; hydrogen, 6·93; nitrogen, 17·53; sulphur, 0·79; and oxygen, 22·03 per cent. (See Osborne and Campbell, this J., 1898, 784). Soy-milk when treated with calcium and magnesium salts, yields a precipitate, which is sold in Japan under the name of Tofu. The author has attempted the preparation of a cheese from Tofu. 450 grms. of pressed Tofu were mixed with 60 grms. of common salt, 50 grms. of pressed milk casein, 2 grms. of milk sugar, and 2 grms. of finely-ground Swiss cheese, and the mixture was wrapped in a linen cloth saturated with brine, and left for five months in a room with an average temperature of 15° C. At the end of this time the mass was of a grey colour, and quite compact; it was free from the numerous pores produced by evolution of gas in Swiss cheese. The cheese had an agreeable taste different from that of Swiss cheese, and when extracted with water, yielded a solution in which the presence of albumoses and peptones was detected. Further experiments with mixtures containing larger quantities of milk-sugar, but no casein, gave similar results.—A. S.

Algæ; Fresh water —— as an article of human food. S. Namikawa. Bull. Coll. Agric., Tokyo Imp. Univ., 1906, **7**, 123—124.

Nostoc Phylloderma, of the group of the *Schizophyceæ* (Suizenji-nori, kotobuki-nori). The algæ are collected in small nets, and cleaned from other algæ; they are then cut into small pieces, spread on bricks, and dried in the sun into thin sheets. About 2 litres of fresh algæ yield one sheet of 2 square ft.; five sheets weigh 90 grms., and cost 2½ yen. The commercial product contains 18·07 per cent. of moisture, and the dry substance has the following composition: Crude protein, 24·75; crude fat, 0·93; crude fibre, 3·64; pentosans, 4·50; galactan 1·86; ash, 12·28; other matters (chiefly starch), 58·40 per cent. It contains lecithin, but no mannan, sugar, or tannin.

Another kind of fresh water algæ used as a foodstuff in Japan is *Prasiola japonica* of the group of the *Chlorophyceæ* (Daiyagawa-nori, Nikko-nori).—A. S.

Albuminoid and gelatinous substances; Determination of —— by means of acetone. F. Bordas and Touplain. XXIII., page 716.

FRENCH PATENTS.

Alimentary product [Albuminoid containing metal salts]; Preparation of an —— from yeast. G. Jacquemin. Fr. Pat. 361,356, April 12, 1905.

SEVERAL ways of obtaining the product are described, all of which are based on the fact that yeast is capable of absorbing and fixing metallic and other salts. The yeast, for instance, may be grown in a medium containing a soluble iron salt, or boiled with an iron solution. The cells of the yeast may be burst, and the mass then mixed with the metallic salt solution; the product is finally precipitated from the mixture by the addition of alcohol or sodium sulphate. In all the above cases the

product is dried, and powdered for use, or it may be dissolved in suitable solvents, and evaporated to form a scale preparation.—W. P. S.

Cereals and their husks; Process of bleaching and sterilising ——. O. Zimmermann and C. H. Buchenau. Fr. Pat. 361,363, Dec. 4, 1905.

See Eng. Pat. 25,010 of 1905; this J., 1906, 387.—T.F.B.

Milk, &c.; Alkali-butyrometric method for the determination of fat in ——. A. Sichler. Fr. Pat. 362,444, Jan. 10, 1906. XXIII., page 716.

(*B.*)—SANITATION; WATER PURIFICATION.

Water bacteria; Biology of the ——. E. Kohn. Cent. Bakt. (Abth. 2), 1906, **15**; Woch. f. Brau., 1906, **23**, 319.

When samples of good natural water are kept for a long time, the micro-organisms vary in quantity and relative proportions. The increase in the number of germs is greatest in vessels of those sorts of glass which are the most soluble in water. At high temperatures, the micro-organisms increase faster than at low temperatures, but their number again decreases faster than at low temperatures. The relative proportions of the different species vary according to the rule that the most exacting forms appear first, but are subsequently replaced by forms which have lower requirements. The former species grow in presence of 15 per cent. of dextrose, but the latter are already somewhat at a disadvantage with only 5 per cent. of dextrose; they prefer some simpler form of carbonaceous nutrient. The minimum proportions of dextrose necessary for the development of the more exacting species lie between the limits of 198×10^{-10} and 198×10^{-13} per cent. The minimum proportions of dextrose required by the species which appear later lie between 198×10^{-14} and 198×10^{-18} per cent. The minimum limits of nitrogenous nutrition are, in the case of ammonium sulphate and ammonium phosphate, between 66×10^{-18} and 66×10^{-19}. The minimum limits of phosphatic nutrition could not be determined, since water extracts, even from the most insoluble sorts of glass, more phosphates than the minimum required.—J. F. B.

English Patent.

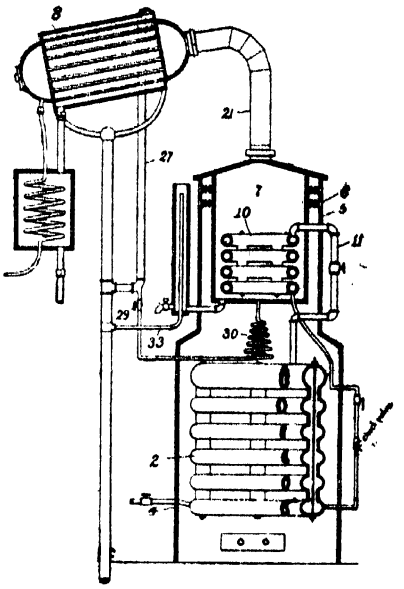
Sewage and the like; Separation of solid matters from ——. C. Kremer and Ges. für Abwasserklarmy, m.b. H., Berlin. Eng. Pat. 5908, March 12, 1906.

The sewage is first freed from floating and heavy impurities by treating it in tanks similar to those described in Eng. Pat. 14,603 of 1901, and 14,461 of 1903 (this J., 1902, 917; 1903, 1095). The sludge settling at the bottom of the tank is moved, by means of a scraper extending across the bottom of the tank, to a channel communicating with a second tank. Instead of the channel, a screw conveyor, situated in a tubular channel at the front of the tank, may be employed. The scraper is curved upwards, so that when it is moved to its final position, the channel or the screw conveyor, is completely cut off from communication with the tank. The sludge ferments in the second tank, and is separated into a floating layer, which is removed and can be used as a manure, and a layer consisting chiefly of sand, which remains at the bottom of the tank. The fermentation of the sludge may be accelerated by the application of heat.—W. P. S.

United States Patent.

Water-still. R. P. Barnstead, Boston, Mass. U.S. Pat. 823,488, June 12, 1906.

A boiler, 2, is enclosed above a source of heat by a casing, 4, and communicates by the pipe, 11, with the coil, 10, in the evaporator, 7, which is placed above the boiler, 2, and is enclosed by the casing, 5, having openings, 6, in its upper part to allow the products of combustion to escape. The vapours from the evaporator, 7, pass by the pipe, 21, to the tubular condenser, 8, the water overflow of which, 27, is connected by the pipe, 33, provided



with a valve, 29, to the coil, 30. The latter is placed immediately above the boiler, 2, and communicates at its upper end with the under side of the evaporator, 7. —W. H. C.

French Patent.

Water and sewage; Process for purifying and sterilising Mme. Salarnier, *née* M. A. Lagogué, and la Soc. J. Jean et Cie. Fr. Pat. 361,332. April 6, 1905.

The water is led into a funnel, where it is mixed with kaolin, and then falls on to horizontal fans revolving at a high speed and placed in the upper part of a tall cylinder. The fine spray of water thus formed falls on to a circular plate inclining towards the centre of the cylinder, and passes down a central pipe to the bottom of the cylinder, whence it rises through the space between the pipe and the outer wall. This space is provided with a number of superposed baffle-plates on which the solid matters are collected, whilst the clear water leaves the cylinder by a pipe, and is conducted to a filter. Besides atomising the water, the fans draw a strong current of air into the cylinder for the purpose of aërating the water and oxidising the organic matter present. Means are provided for removing the sediment from the cylinder. Other substances, besides kaolin, may be added to the water; for instance, talc, infusorial earth, and phosphoric acid can be used. If phosphoric acid be employed, a corresponding amount of calcium carbonate must also be added.—W. P. S.

German Patent.

Sludge [from sewage purification]; Dehydration and utilisation [as manure] of ——. H. Grosse-Bohle. Ger. Pat. 167,700, May 26, 1904.

The sludge from sewage purification is difficult to utilise on account of its high content of moisture, the water-retaining properties being due to the fatty matters contained in the sludge. According to the present invention, the crude sludge, freed from coarser suspended particles, and, if necessary, diluted with water, is heated to a temperature above 50° C., whereby it separates into two layers; the upper layer, consisting mainly of froth, contains a large proportion of the fat originally present in the sludge. This layer of froth is removed, and is worked up for fatty acids and soaps, or is used for the manufacture of gas. The lower layer of sludge, poor in fat, can now be easily dehydrated by draining, filter-pressing, or centrifugalising, and yields a friable residue which can be used directly as a fertiliser.—A. S.

XIX.—PAPER, PASTEBOARD, Etc.

(*Continued from page* 653.)

Wood [*Wood pulp*]; *Action of bacteria on* ——. B. Malenkovic. XXIV., page 717.

ENGLISH PATENTS.

Plastic substances [*Vulcanite and celluloid*] *used as bases in dental prothesis; Method of colouring* ——. L. Eilertsen. Eng. Pat. 12,203, June 13, 1905. XIIIC., page 704.

Threads, films, and laminæ from viscose; Preparation of ——. S. Peessarer. Eng. Pat. 16,583, Aug. 15, 1905. V., page 691.

UNITED STATES PATENT.

Parchment [*Paper*]; *Process for manufacturing artificial* ——. G. Sachsenröder, Barmen-Unterbarmen, Germany. U.S. Pat. 821,434, May 22, 1906.

SEE Fr. Pat. 362,463 of 1906; following these.—T. F. B.

FRENCH PATENTS.

Parchment paper; Manufacture of opaque and non-hygroscopic ——. G. Sachsenröder. Fr. Pat. 362,463, Jan. 16, 1906.

OPAQUE and non-hygroscopic parchment papers are prepared by incorporating with the parchmentising bath opaque substances, such as barium sulphate or other metallic salts or oxides, and water-repellent substances, such as metallic soaps, or emulsions of paraffin and mineral oils. These substances penetrate the paper, together with the parchmentising acid, and are held during the fixing and washing processes by the viscous nature of the modified cellulose.—J. F. B.

Collodion for artificial silk; Compression of —— by special solvents. Collodion for artificial silk; Preparation of a concentrated ——. *Collodion* [*for artificial silk*]; *Filter-press for* ——. Soc. anon. des Plaques et Papiers Phot. A. Lumière et ses Fils. Fr. Pats. 361,323, 361,324, and 361,329, April 4 and 5, 1905. V., page 691.

Silk; Process for the manufacture of artificial ——. E. Crumière. Fr. Pat. 361,048, Nov. 27, 1905. V., page 691.

Silk; Process for the manufacture of brilliant threads of artificial ——, *by precipitating cellulose in alkaline solutions.* Soc. Gen. de la Soie Artificielle Linkmeyer. Fr. Pat. 361,061, Dec. 4, 1905. V., page 692.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 654.)

Alkaloid salts of inactive secondary butyl-benzenesulphonic acid. A. Klages. Ber., 1906, **39**, 2131—2135.

ATTEMPTS were made to separate the alkaloid salts of racemic secondary butyl-benzenesulphonic acid into its active components by successive extractions with small quantities of solvent, but without success. If the anhydrous barium salt of secondary butyl-benzenesulphonic acid be warmed with phosphorus pentachloride, a colourless sulphochloride is produced, boiling at 179°—180° C. at 20 mm. The anilide melts at 63°—64° C., and the sulphamide at 80°—81° C. The alkaloid salts were produced by treating the barium salt of the sulphonic acid with the sulphate of the required base. Quinine secondary butyl-benzenesulphonate melts at 184° C., and has $[\alpha]_D^{20} = -10{\cdot}5°$. The cinchonine and morphine salts could not be properly crystallised. Cinchonidine secondary butyl-benzenesulphonate forms colourless glistening needles, melting at 205° C., and with $[\alpha]_D^{20} = -7{\cdot}34°$. The brucine salt was oily. Strychnine secondary butyl-benzenesulphonate crystallises in fine needles, melting at 189°—190° C., and is optically inactive.—F. SHDN.

Brazilian drugs; Notes on some ——. T. Peckolt. Ber. Deutsch. Pharm. Ges., **16**, 176. Pharm. J., 1906, **76**, 757.

Jatropha Curcas.—The seeds of the ripe kernel yield, by cold pressure, 22 per cent., and by hot pressure, 40 per cent. of a colourless, odourless fixed oil, with a taste resembling that of castor oil. By extraction with petroleum spirit, 44 per cent. of oil is obtained, but some resin is also extracted, and imparts an acrid taste to the oil. The seeds, freed from their cotyledons, or slightly roasted to remove the poisonous principle, curcin, are employed as a purgative. A 10 per cent. decoction of the leaves has hæmostatic properties.—A. S.

Lime juice; Ascertaining the strength of concentrated ——, *by means of a hydrometer.* F. Watts. West Indian Bull., 1906, **7**, 36—39.

THE strength of a concentrated lime juice can readily be ascertained by diluting the liquid ten times, reading the specific gravity with a hydrometer, and referring to a table. By this procedure, the citric acid contents of a variety of juices of different concentrations were found to agree within technical limits with the results of titrations. The author deprecates carrying the concentration further than 8 : 1, and recommends boiling down till the citrometer shows 60° in the boiling liquid, when the strength will be approximately 100 oz. of citric acid per gallon.
—W. A. C.

Terpenes and ethereal oils; Contributions to our knowledge of ——. 81*st Communication.* O. Wallach. Annalen, 1906, **347**, 316—346.

THE present communication deals with the simplest methene hydrocarbons, and their transformation into alicyclic aldehydes. The subject is treated under the following headings:—Pentacyclic compounds: methene cyclopentane. Hexacyclic compounds: derivatives of cyclohexanone; methenecyclohexane, hexahydrobenzaldehyde; derivatives of 1.2-(α-) methylcyclohexanone; derivatives of active 1.3-(β-) methylcyclohexanone, methene-1-methyl-3-cyclohexane; derivatives of 1.4-(γ-) methylcyclohexanone, methene-1-methyl-4-cyclohexane.

Pyrazolones; New methods of synthesis of ——. C. Moureu and I. Lazennec. Compt. rend., 1906, **142**, 1534—1537.

ETHYL amylpropiolate, $C_5H_{11}.C{:}C.COOC_2H_5$, and ethyl caprolylacetate, $C_3H_{11}.CO.CH_2.COOC_2H_5$, condense with phenylhydrazine to give the same amylphenylpyrazolone melting at 96° C. Similarly, ethyl hexylpropiolate, $C_6H_{13}C{:}C.COOC_2H_5$, and methyl heptylylacetate, $C_6H_{13}.CO.CH_2.COOC_2H_5$, give the same hexylphenylpyrazolone melting at 84°—85° C. Hydrazine will also react with acetylenic amides, ammonia being eliminated. Phenylpropiolamide, $C_6H_5.C{:}C.CONH_2$, when heated with hydrazine gives a phenylpyrazolone melting at 237° C. This product is identical with that obtained either from ethyl phenylpropiolate or ethyl benzoylacetate. Another method of making pyrazolones is by the interaction of hydrazines and alkylated β-hydroxyacrylic esters. Thus hydrazine hydrate and phenylethoxyacrylic ester, $C_6H_5.C(OC_2H_5){:}CH.COOC_2H_5$, give the phenylpyrazolone melting at 237° C. If phenylhydrazine be used in place of hydrazine in this latter reaction, diphenylpyrazolone is produced, melting at 256° C., and identical with that obtained by Knorr on heating cinnamyl phenylhydrazide. The author considers that where the acetylene linking is absent, the hydrazine replaces the alkyl grouping of the ester, and then the chain closes to form a pyrazolone. But where the acetylene linking is present, the acetylene linking itself is first attacked.
—F. SHDN.

Sulpho-acetic acid. O. Stillich. J. prakt. Chem., 1906, **73**, 538—544.

THE preparation of sulpho-acetic acid by heating together sulphuric and acetic acids was tried at different temperatures and with different proportions of the reacting substances. The yield varies with the temperature and with the amount of water in the sulphuric or acetic acids. Using 15 grms. of acetic acid and 25 grms. of sulphuric acid, both being free from water, 4 grms. of sulpho acetic acid were obtained by heating at 198° C. for 30 minutes. Sulpho-acetic acid may also be prepared from chlorosulphonic acid and glacial acetic acid, or from acetic anhydride and sulphuric acid, but the yields obtained are small.

The best method of preparation is from chloracetic acid, and sodium sulphite. Fifty grms. of chloracetic acid, 300 c.c. of water, 70 grms. of sodium carbonate, and 130 grms. of crystallised sodium sulphite are boiled together for 20 minutes, when no more sulphur dioxide should come off. 130 grms. of barium chloride in 200 c.c. of water are then added; any sulphate in the solution is precipitated; from the filtrate barium sulpho-acetate can be crystallised, the yield being 92 per cent. of the theoretical. The free acid is obtained from its barium salt by means of sulphuric acid. On evaporating the aqueous solution of the acid *in vacuo*, crystals are obtained; these are sulpho-acetic acid with one molecule of water (m. pt. 84°—86° C.). The acid is soluble in acetone and alcohol, insoluble in ether, nitrobenzene, and chloroform. It is not decomposed by boiling with water, acids, or alkalis.

—C. E. F.

s-Tetrachlorethane and hexachlorethane; Methods of preparation of ——. F. Michel. Z. angew. Chem., 1906, **19**, 1095—1097.

s-Tetrachlorethane.—Into a mixture of sulphur chloride with 1 per cent. of its weight of reduced iron, chlorine gas is led, the unabsorbed chlorine expelled by carbon dioxide, and dry acetylene led in, keeping the temperature below 40° C. When absorption slackens, excess of acetylene is expelled by carbon dioxide, and chlorine led in. The alternation of chlorine and acetylene is kept up till neither gas is absorbed to any extent, and the mixture is then shaken with water to decompose the remaining sulphur chloride, and steam-distilled. The distillate is washed with dilute sodium carbonate solution, separated from this, dried, and fractionated. It is chiefly *s*-tetrachlorethane, with a little of the penta- and hexachloro-compounds.

Hexachlorethane.—Through the same original mixture, boiling under a reflux condenser, acetylene is first led, then (after expulsion of excess) chlorine till yellow incondensable vapours appear, and the alternation continued as above, ending with excess of chlorine. The hot liquid is poured off, and allowed to cool, separated from the crystals of hexachlorethane (which are pressed between filter-paper), and treated again as above, after adding a little more reduced iron. This treatment is repeated as long as practicable, and the final mother liquor is concentrated by distillation, and leaves a further crop of crystals on cooling. The crystals are sublimed in steam, dried, and crystallised from alcohol.—J. T. D.

Formaldehyde; A comparison of some of the methods for determining ——. F. Russ and B. Larsen. Mitt. techn.-Gew. Museums, 1906, **16**, 85—98.

WITH solutions of pure formaldehyde Romijn's iodometric method (this J., 1897, 366), Legler's ammonia method (this J., 1897, 367), and Lemme's sulphite method (this J., 1903, 1107) all give trustworthy results, and the concentration of the solution has no influence on the figures obtained. It is quite otherwise, however, in the case of commercial formaldehyde. With solutions containing 0·8 per cent., or more, of the aldehyde, concordant results are obtained by all the methods, but the more the solution is diluted, the higher the apparent percentage of aldehyde becomes. For instance, a sample of commercial formaldehyde showing an average content of 40 per cent. when a 0·8 per cent. solution of it was employed for the determinations, gave 78 per cent. of aldehyde when a 0·1 per cent. solution of it was analysed. These anomalous results are due presumably to impurities in the commercial aldehyde. Of these impurities, methyl alcohol and acetone are the most common, and the authors record a number of experiments the results of which show that the presence of acetone leads to the formation of iodoform in the iodine method, whilst methyl alcohol acts as a non-electrolyte, and depresses the dissociation of the electrolytes in the reaction. This depression depends on the ratio of the non-electrolyte to the electrolyte. The reason for the inaccurate results obtained on decreasing the strength of the solution is not thus, however, fully explained, and at present remains an open question. The investigation simply shows that solutions containing not less than 0·5 per cent. of aldehyde must be used, to obtain trustworthy results.—W. P. S.

Iodomercurates of magnesium and manganese. A. Duboin. Comptes rend., 1906, **142**, 1338—1339.

BY the same process as in the case of calcium (this J., 1906, 283), the author has obtained the salts $MgI_2.2HgI_2.7H_2O$; $MgI_2.HgI_2.9H_2O$; and $3MgI_2.5HgI_2.20H_2O$. Their general behaviour is similar to that of the calcium iodomercurates.—J. T. D.

Mercurous and mercuric sulphates; Action of iodine on ——. K. Brückner. Monatsh. Chem., 1906, **27**, 541—349.

MERCUROUS oxide and iodine mixed in the proportions $6Hg_2O+12I_2$, interact, when gently warmed, forming a mixture of mercuric iodide and iodate, which can be separated by dissolving the iodide in alcohol. In presence of water the change only takes place slowly, but may be facilitated by boiling; in alcoholic solution interaction only takes place very slowly. The author assumes that the mercurous iodide is first converted into mercuric oxide and mercuric iodide. Mercuric oxide interacts with iodine in accordance with the equation

$$6HgO+12I=5HgI_2+HgI_2O_6,$$

both when carefully heated in the dry state, and also, more rapidly, in the presence of water. Alcohol causes a more gradual change, being itself oxidised to aldehyde by the iodate.

Mercurous sulphate and iodine, when powdered together and heated, react to form a yellowish-white, hard crystalline substance, which is decomposed by water into mercuric iodide and mercuric sulphate, and is probably the double salt, $HgI_2.HgSO_4$. In presence of water the reaction takes place very rapidly, mercury iodide and iodate being formed, and sulphuric acid going into solution. With alcohol the change is also rapid: the alcohol is oxidised in part to aldehyde by the iodate, whilst the sulphur trioxide collects in the alcohol.

Mercuric sulphate and iodine do not interact when heated together dry. If, after water has been added to the sulphate, converting it into yellow basic sulphate, iodine be introduced, the first result is the formation of mercuric iodide, which in course of time reacts with the residual sulphate, forming colourless compounds, probably double salts of mercuric iodide and sulphate. A similar compound is at once formed on moistening a finely-powdered mixture of sulphate and iodine. In presence of alcohol only iodide and iodate are formed, whilst the alcohol is oxidised to aldehyde.—E. F. A.

ENGLISH PATENTS.

Acetylene and chlorine gases; Manufacture of compounds of ——. J. H. Lidholm, Alby, Sweden. Eng. Pat. 22,094, Oct. 30, 1905. Under Int. Conv., April 28, 1905.

SEE Fr. Pat. 358,146 of 1905; this J., 1906, 197.—T. F. B.

Formates; Process for the manufacture of ——. Electrochemische Werke G.m.b.H., Bitterfeld, Germany. Eng. Pat. 772, Jan. 11, 1906. Under Int. Conv., April 14, 1905.

SEE Fr. Pat. 362,417 of 1906; following these.—T. F. B.

Isobornyl esters; Manufacture of ——. Chem. Fabr. von Heyden, Akt.-Ges., Radebeul, Germany. Eng. Pat. 10,999, May 10, 1906. Under Int. Conv., Sept. 4, 1905.

Isobornyl esters are prepared by heating pinene hydrochloride or hydrobromide with fatty acids and fatty acid salts of zinc, copper, or iron, or of other heavy metals, in presence of zinc halide. For example, isobornyl acetate is obtained by boiling under a reflux condenser a mixture of 172 parts of pinene hydrochloride and 500 parts of glacial acetic acid with 45 parts of zinc oxide, or with 165 parts of lead oxide and 30 parts of zinc chloride. —A. S.

Lithium salt [*Lithium thymate*]; *Manufacture of a new* ——. G. B. Ellis, London. From Firm E. Merck, Darmstadt, Germany. Eng. Pat. 21,280, Oct. 19, 1905.

Lithium thymate is prepared by adding lithia lye to an aqueous solution of thymic acid, until the liquid is slightly alkaline, and then precipitating the salt by means of alcohol. It may also be obtained by adding a solution of lithium sulphate to barium thymate solution, filtering off the barium sulphate, and precipitating the lithium thymate from the solution by alcohol.—A. S.

United States Patents.

Camphoryl-ethoxyphenylimide, and process of making same. A. H. C. Heitmann and E. C. Clemmensen, Assignors to Parke, Davis, and Co., Detroit, Mich. U.S. Pat. 824,357, June 26, 1906.

Camphoric acid and aminophenetol are condensed together, forming camphoryl-ethoxyphenylimide, a substance possessing antipyretic and analgesic properties; its m. pt. is 119°C., it is colourless, tasteless, insoluble in water, readily soluble in hot dilute alcohol and in "organic" solvents; it is insoluble in acid or alkali solutions. The general process of preparing camphoryl-alkyloxyphenylimides, by condensing two substances containing respectively the camphoryl group and the alkyloxyphenyl radical, one of which substances is also an amino-compound, is also claimed. The condensation is effected by heat and in presence of a solvent of high boiling point. —T. F. B.

Remedy; Process of making an internal —— [*from m-iodo-o hydroxyquinoline-sulphonic acid*]. R. Griese, Berlin. U.S. Pat. 824,539, June 26, 1906.

See Eng. Pat. 9656 of 1905; this J., 1905, 1188.—T. F. B.

French Patents.

Mono-iodo substitution products of higher fatty acids: Production of ——. Farbenfabrik. vorm. F. Bayer und Co. Fr. Pat. 362,370, Jan. 12, 1906. Under Int. Conv., May 5, 1905.

Higher fatty acids of the oleic series, such as erucic, oleic, elaidic, and brassidic acids, &c., are heated with hydriodic acid and glacial acetic acid at a low temperature under pressure. In order to make products which can be kept, the iodo acids are converted into their neutral earthy-alkaline or magnesium salts.—F. Shdn.

Formates; Production of ——. Elektrochem. Werke Ges.-m.b.H. Fr. Pat. 362,417, Jan. 15, 1906. Under Int. Conv., April 14, 1905.

In this process for the production of formates, caustic alkali is broken into large pieces, and carbon monoxide led over it at a temperature of about 100°—120° C., and under pressure. There is no necessity to reduce the alkali to fine powder, nor need it be subdivided by any inert medium as chalk or carbon.—F. Shdn.

1-Phenyl-2.3-dimethyl-4-amino-5-pyrazolone [*Amino-antipyrine*]; *Process for the alkylation of* ——. Soc. Chim. des Usines du Rhône ancien. Gilliard, P. Monnet, and Cartier. Fr. Pat. 362,465, Jan. 17, 1906. Under Int. Conv., Jan. 18, 1905.

A quantitative yield of a di-alkyl product can be obtained by the action of dimethyl sulphate on 1-phenyl-2.3-dimethyl-4-amino-5-pyrazolone (amino-antipyrine) at a temperature of about 100° C. with or without the use of indifferent solvents. The dimethyl sulphate can be replaced by ethyl sulphate or other homologues.—F. Shdn.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 655.)

English Patent.

Flash lights for photographic purposes. G. Krebs, Offenbach on Maine, Germany. Eng. Pat. 24,875, Nov. 30, 1905.

See Fr. Pat. 357,478 of 1905; this J., 1906, 135.—T.F.B.

XXII.—EXPLOSIVES, MATCHES, Etc.

(*Continued from page* 655.)

Explosion of gunpowder; Circumstances attending an ——, *which occurred on the premises of Messrs. Truloch, Harriss, and Richardson, Ltd., of 9, Dawson Street, Dublin, on March 22, 1906.* By Major A. Cooper-Key, H.M. Inspector of Explosives.

A violent explosion took place whilst two workmen were engaged in breaking up a number of old 0·442 revolver cartridges in order to recover the lead of the bullets. The method employed consisted in holding the cartridges on the edge of a steel hammer, and tapping round the rim to knock out the bullet. A large quantity of loose explosive had already been removed, and was scattered about the bench, and a 25 lb. tin, two-thirds filled with old powder, stood on the floor. Whilst a cartridge was undergoing the tapping operation a flash occurred, followed by a loud explosion, which injured the men, and did considerable damage to the premises and to a public hall adjoining. It is pointed out that it is illegal to carry on the operation of breaking up loaded cartridges except in a licensed factory. The use of steel tools and the practice of carrying out such work in unsuitable premises is strongly condemned. An examination of the powder safe which was situated some distance from the scene of the explosion revealed the fact that 12 lb. of powder and a quantity of safety cartridges were stored together. Attention is drawn to the need for greater stringency in the administration of the Explosives Act by the local authorities.—B. J. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 656.)

APPARATUS, ETC.

Thermometer for low temperatures. A. Stock and C. Nielsen. Ber., 1906, **39**, 2066—2069.

From a bulb of 25 c.c. capacity there issues downwards a narrow tube 85 c.m. long, graduated in m.m. The lower end passes through and is rigidly fastened in the narrow opening of one limb of a wide U-tube, and dips 3 or 4 cm. below the mercury which half fills the U-tube. The graduations on the narrow tube are marked from 780 at the bottom up to 740. The limb of the U-tube containing the narrow tube is furnished with a second opening, which is plugged with cotton-wool; and the other limb is provided with a stopcock. This arrangement allows of the instrument being adjusted at any time, so that the level of the mercury in the inner limb shall stand at the graduation corresponding to the barometer for the time being. A thin-walled vertical glass tube, 3 mm. outside diameter and 65 c.m. long, sealed at its lower end, is connected to the top of the 25 c.c. bulb through a glass spiral or zig-zag, which allows some play. The apparatus is filled with pure dry oxygen by means of a side-tube in the bulb which can be connected with an air pump and a supply of the gas, and which is ultimately sealed off. When the long sealed tube is placed in a substance of

low temperature, the pressure is reduced to the vapour-pressure of oxygen at that temperature, and the mercury rises in the graduated tube. This tube can either be marked in millimetres, and the temperature read off from a table, or it can be directly marked with temperatures. The author has constructed a mean curve from the observations of Estreicher, Olszewski, Baly and Travers, and Senter and Jaquerod, from which the following table of temperatures and vapour pressures is taken :—

—200°	75 mm.	—194°	289 mm.	—188°	402 mm.
—199°	89	—193°	218	—187°	449
—198°	105	—192°	249	—186°	503
—197°	123	—191°	282	—185°	560
—196°	142	—190°	319	—184°	621
—195°	164	—189°	358	—183°	687

The principle of the apparatus can be applied to other gases or vapours besides oxygen.—J. T. D.

Ultramicroscope ; The ——, and its application in chemistry. L. Michaelis. Z. angew. Chem., 1906, **19**, 948—953.

THE construction of the ultramicroscope is based upon the principle that if a powerful beam of light be projected on an object at right angles to the axis of the microscope, instead of parallel to it, as in the ordinary instrument, particles much smaller than those which it is possible to see under the microscope, are rendered luminous, and appear as round spots of light to the observer. With the ordinary microscope, it is impossible to distinguish objects with a diameter less than 0·2 μ, but with the ultramicroscope the limit is 4 $\mu\mu$, and lenses of very great magnifying power are not required. It should be noted that the colour of particles observed in the ultramicroscope is frequently complementary to the ordinary colour by reflected light. The ultramicroscope has been used in the examination of solutions of albumin, glycogen, and dyestuffs, and also colloidal metal solutions. It has been found that dyestuffs may be divided into classes according to the optical behaviour of their solutions when examined by the ultramicroscope. Some dyestuff solutions behave exactly like colloidal gold solution (this J., 1902, 1250), the particles of dyestuffs showing up in their complementary colour on a dark ground. To this class belong "soluble Prussian Blue" and some organic colouring matters of high molecular weight, as Violet Black, Indulin, and Nigrosin. Fluorescent dyestuffs, on the other hand, give solutions in which no distinct particles can be perceived, although when a beam of light is projected through such a solution, its path appears luminous. It appears evident that the particles in a fluorescent solution are of a much smaller size than those in a colloidal metal solution. Many dyestuffs belong to neither of the groups mentioned, but occupy an intermediate position ; luminous particles can be observed in their solutions by the ultramicroscope, but not in sufficient quantity to represent the whole of the dyestuffs present, the remainder being in the form of a true solution. In the case of Thionine (Lauth's Violet), the salts of the dyestuff dissolve to a true solution, whereas the solution of the colour base itself in water is a suspension of ultramicroscopic particles ; a toluene solution of the colour base exhibits fluorescence when examined by the ultramicroscope, but no luminous particles can be observed.—A. S.

ENGLISH PATENT.

Gas ; Automatic apparatus for analysing ——. E. Schatz, Frankfort on Maine, Germany. Eng. Pat. 1841, Jan. 24, 1906. Under Int. Conv., April 12, 1905.

SEE Addition of Nov. 28, 1905, to Fr. Pat. 359,352 of 1905 ; this J., 1906, 529.—T. F. B.

INORGANIC—QUALITATIVE.

Arsenic, antimony, and tin ; Detection and separation of ——. O. Materne. Bull. Soc. Chim. Belg., 1906, **20**, 46—68.

THE method recommended for the separation of arsenic, antimony, and tin, when stannous sulphide is present (A), differs somewhat from that to be used in the presence of stannic sulphide (B).

A. *The mixed sulphides are boiled with a 2 per cent. solution of borax, containing ammonium chloride.*

Residue. Boiled with a 5 per cent. solution of sodium carbonate, containing ammonium chloride.		*Filtrate.* Arsenic sulphide precipitated by hydrochloric acid.
Residue is stannous sulphide.	*Filtrate.* Antimony sulphide is precipitated by hydrochloric acid.	

B. *The mixed sulphides are digested with a cold 2 per cent. solution of borax, containing ammonium chloride, for 10 minutes.*

Residue. Dissolved in a 5 per cent. solution of caustic soda. Heated with tartaric acid and ammonium chloride.		*Filtrate.* Arsenic sulphide precipitated by hydrochloric acid.
Precipitate is antimony sulphide.	*Filtrate.* Stannic sulphide precipitated by hydrochloric acid.	

Another very rapid method is the following :—

The mixed sulphides are boiled with sodium carbonate solution.

	Filtrate. Cooled.	
Residue is stannous sulphide.	*Precipitate* is Antimony sulphide.	*Filtrate.* Arsenic sulphide precipitated by hydrochloric acid.

The methods may be applied quantitatively for the separation of arsenic from antimony and tin, but not for separating these from each other. The three sulphides are completely removed from those of the cadmium group by a 10 per cent. solution of caustic soda, if allowed to stand for half-an-hour after being heated to boiling.

It has been incidentally established that stannous sulphide is oxidised to a mixture of stannic sulphide and stannic chloride, when boiled with dilute hydrochloric acid in the presence of air ; and also that antimony sulphide is dissolved by alkali chromates or bichromates, chromium hydroxide being precipitated.—F. SODN.

INORGANIC—QUANTITATIVE.

Gas analysis ; Sodium hyposulphite (hydrosulphite) in ——. H. Franzen. Ber., 1906, **39**, 2069—2071.

THE author uses sodium hyposulphite as an absorbent for oxygen. In Hempel's apparatus, the pipette is filled with rolls of iron wire gauze, and the solution used is made by dissolving 50 grms. of the salt in 250 c.c. of water, and adding 40 c.c. of sodium hydroxide solution (500 grms. of hydroxide dissolved in 700 c.c. of water). Of this solution, 1 c.c. will absorb about 10 c.c. of oxygen, and five minutes standing in the pipette is enough. In Bunte's burette, a solution of 10 grms. of hyposulphite in 50 c.c. of water, to which has been added 50 c.c. of 10 per cent. sodium hydroxide solution is used.

This reagent is cheaper and much more comfortably handled than pyrogallol, can be used in presence of carbon monoxide, and absorbs as readily at low as at high temperatures. Comparison with analyses by other methods has proved its accuracy.—J. T. D.

Ozone ; Use of —— in quantitative analysis. P. Jannasch and W. Gottschalk. J. prakt. Chem., 1906, **73**, 497—519.

A CONVENIENT apparatus for the preparation of ozone is described. The discharge from a small induction coil is passed between the walls of five or six Berthelot tubes arranged in series. The tubes are filled with water containing a little sulphuric acid, and stand in a cylindrical glass vessel filled with the same liquid. The inner coat-

ings of each tube are all joined to the same pole, and the outer coatings to the other pole. A current of air or oxygen after first passing through a tube containing sulphuric acid and another containing soda-lime, is passed through the ozonising apparatus. The current is controlled by a stopcock, and no rubber connections are possible. By passing oxygen through an apparatus containing six tubes, the resulting gas was found to contain 8 per cent. of ozone. Ozone is an excellent precipitant for manganese. An ammoniacal solution containing 0·0001 grm. of manganous sulphate gives with ozone, a precipitate of hydrated peroxide of manganese. The deposition is complete, and the precipitate is bulkier and lighter in colour than when hydrogen peroxide is used as the precipitant, and it is easy to filter. To determine manganese in a manganous salt, the salt is dissolved in a small quantity of warm water, or hydrochloric acid if necessary, and is placed in a dropping funnel. Every 12 seconds one drop of the solution is allowed to fall into 100 c.c. of a solution of ammonia saturated with ozone, and through which ozone is being passed. After all the liquid has run out, the funnel is rinsed with water, and the current of ozone continued for about 15 minutes. The precipitate is filtered, and ignited to protosesquioxide, Mn_3O_4. The results obtained by the author with this method are very good.

By this method, the separation of manganese from sodium, calcium, zinc, and nickel is complete. In solutions containing copper, cadmium, or magnesium, the manganese precipitate is impure owing to absorption of the other salts. In these cases, the precipitate is dissolved in hydrochloric acid, and again dropped into an ammoniacal solution containing ozone. Methods for the separation of manganese from other metals are being investigated.—C. E. F.

ORGANIC—QUALITATIVE.

Milk; A condensed vegetable ——. T. Katayama. XVIIIA., page 710.

ORGANIC—QUANTITATIVE.

Beeswax; Examination of ——. P. Bohrisch and R. Richter. XII., page 701.

Sucrose and raffinose; Optical determination of mixtures of ——. J. Pieraerts. Bull. Assoc. Chim. Sucr. et Dist., 1906, **23**, 1261—1265.

Under suitable conditions, raffinose is completely converted into melibiose and lævulose by citric acid. Upon this reaction the author has based a method for the polarimetric determination of mixtures of sucrose and raffinose. To determine the degree of resistance of levulose during hydrolysis with citric acid, solutions of known strength containing pure sucrose and raffinose were analysed. 10 grms. of the substance were dissolved in 50 c.c. of warm distilled water, poured into a 100 c.c. cylinder, cooled, made up to volume, mixed, and filtered. 25 c.c. of the filtrate were transferred to a 50 c.c. flask, 2 c.c. of alumina cream added, the solution made up to volume, mixed, filtered, and polarised in a 200 mm.-tube. 50 c.c. of the original solution were hydrolysed by boiling for 15 minutes with 10 c.c. of 20 per cent. citric acid solution in a 250 c.c. flask fitted with a reflux condenser. The solution was then rapidly cooled, transferred to a 100 c.c. cylinder, and 2 c.c. of alumina cream added. The solution was then made up to volume, mixed, filtered, and the filtrate polarised in a 200-mm. tube. For degrees of angular rotation, the following equations give the percentages of sucrose and raffinose in the sample:—

$$a = 40\frac{66{\cdot}5}{100}x + 40\frac{104{\cdot}5}{100}y\,;\quad a' = -40\frac{19{\cdot}84}{95}x + 40\frac{53}{100}y$$

a = direct polarimeter reading; a^1 = reading after hydrolysis.

x = amount of sucrose contained in 100 c.c. of the 5 per cent. solution.

y = amount of hydrated raffinose contained in 100 c.c. of the 5 per cent. solution.

From the above equations the following values are obtained for x and y:—

$$x = 9{\cdot}287003a - 18{\cdot}31116a^1$$
$$y = 3{\cdot}6594667a + 11{\cdot}65256092a^1$$

The results, which are tabulated, show that the levulose remains quite unaltered during the above process of hydrolysis, and that the method may be used for rapid and accurate estimations of mixtures of sucrose and raffinose. The equations are valid only for a temperature of 20° C. The author gives tables of corrections for temperatures from 15° to 25° C.—L. E.

Amylocelluloses [Insoluble amyloses] in natural starches; Determination of the ——. J. Wolff. Ann. Rev. Chem. anal., 1906; Woch. f. Brau., 1906, **23**, 316.

The principle described in a previous paper (this J., 1906, 139) for the determination of starch coagulated by malt extract, may be applied to the determination of the various grades of amylocelluloses (insoluble starch) present in the natural starches. The method is based on the observation of Roux, that even the most resistant amylocelluloses are soluble in water at 145° C., and that the solution, if rapidly cooled to 65° C., and treated immediately with malt extract, can be completely saccharified before any reversion has taken place. (*a*) 2·5 grms. of starch are mixed with 50 c.c. of water, and heated for 30 minutes at 145°—150° C.; the solution is cooled rapidly to 65° C., and 10 c.c. of a 10 per cent. malt extract are added at once. When the liquid is saccharified, it is diluted to 200 c.c., and filtered; 100 c.c. of the filtrate are then converted into dextrose by adding 1 c.c. of sulphuric acid, and heating in the autoclave at 120° C. for 20 minutes. The dextrose solution is diluted to 200 c.c., and the reducing sugar is determined. (*b*) 2·5 grms. of starch and 50 c.c. of water are heated at 100° C., and subsequently treated in exactly the same manner as (*a*). (*c*) 2·5 grms. of starch and 50 c.c. of water are gelatinised by raising the temperature to 100° C.; the paste is allowed to remain for four hours at the ordinary temperature, and is then saccharified by malt extract at 65° C., the subsequent conversion into dextrose being effected in the same manner as that of *a* and *b*. The difference *a*—*c* then gives the dextrose equivalent of the amylocelluloses which are insoluble at 65° C. The difference *a*—*b* gives the dextrose equivalent of the amylocelluloses which are insoluble at 100° C., whilst the difference (*a*—*c*)—(*a*—*b*) gives those which are soluble only between 65° and 100° C. The value *a*, corrected for the dextrose equivalent of the malt extract, gives the dextrose equivalent of the total starch substance, soluble and insoluble amyloses.—J. F. B.

Albuminoid and gelatinous substances; Determination of —— by means of acetone. F. Bordas and Touplain. Comptes rend., 1906, **142**, 1345—1346.

Acetone, whether pure or diluted with water, precipitates completely albuminoids, gelatinous substances, diastases, and peptones. This, coupled with the fact that pure acetone dissolves fats and resins, while aqueous acetone dissolves many salts, affords a basis for the separation of these classes of bodies, in, for example, foods, gelatinous or caseous distempers, "polygraph" gelatins, &c. The following are details in the case of certain foods:—*Butter:* 10 grms. are exhausted, first with pure acetone, then with aqueous acetone; the weight of the dried residue less the ash gives the casein. *Cheese:* About 2 grms. are emulsified in 5—10 c.c. of water, and 35 c.c. of acetone are added gradually and with continuous agitation. The insoluble portion is thoroughly washed with aqueous and finally with pure acetone, and then the residue consists of casein and ash. *Milk:* 10 c.c. are poured into 20 c.c. of acetone, shaken, the precipitate separated centrifugally from the liquid, and washed with aqueous and then with pure acetone. The proteids so separated dry very readily, and are weighed and incinerated, deducting the ash as usual.—J. T. D.

French Patent.

Milk, &c.; Alkali-butyrometric method for the determination of fat in ——. A. Sichler. Fr. Pat. 362,444, Jan. 10, 1906. Under Int. Conv., Jan. 10, 1905.

Ten c.c. of the milk, 10 c.c. of a solution containing

sodium phosphate or sodium carbonate, and 1 c.c. of butyl or isobutyl alcohol are placed in a butyrometer tube, and well mixed. After standing, the fat separates completely, and its volume may be read off. A colouring matter, preferably an alizarin derivative, may be added to the butyl alcohol to facilitate the reading of the volume of the fat.—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 611.)

Metallic "ferments." P. Sabatier. Bull. Soc. Chim. Belg., 1906, **20**. 13—15.

THE author defines a ferment as any substance which, by virtue of forming unstable compounds, can bring about some transformation in an unlimited quantity of material. He views both oxidations and hydrogenations attained through the agency of finely-divided metals as fermentations, and for the following reasons:—

1. The activity of the metallic ferments depends on the conditions of preparation. 2. Their action is seriously affected by the presence of traces of other bodies. 3. Their activity exhibits three stages: development, normal exercise, and decline.—F. SODN.

Catalysis [*Platinum-black*] *and enzyme action; Similarity between* ——. E. H. Neilson. Amer. J. Physiol., 1905, **15**. 148—152; Woch. f. Brau., 1906, **23**. 303.

THE author treated the glucosides, salicin and amygdalin, with platinum-black at a temperature of 40°—42° C., and observed a hydrolytic splitting similar to that which takes place under the action of the enzyme emulsin. The hydrolysis of the salicin could be conducted under conditions exactly comparable with those of enzyme hydrolysis, but that of the amygdalin could only be effected in open flasks, since the hydrocyanic acid produced in the reaction and a strong inhibitive influence on the catalysis; benzaldehyde was also produced.—J. F. B.

Metallic oxides; Employment of —— as oxidising catalysts. P. Sabatier and A. Mailhe. Comptes rend., 1906, **142**, 1394—1395.

IN consequence of a note on this subject by Matignon and Trannoy (Comptes. rend., **142**, 1210), the authors make a preliminary statement as to the behaviour of cupric oxide, a train of which, in a glass tube, with a stream of oxygen containing the vapour of a paraffin hydrocarbon directed upon it, becomes incandescent at the point of impingement when heated in the first place to 200° C., and remains incandescent in the stream without further external heating. The oxides of nickel and cobalt behave similarly. The paraffins from methane to heptane behave thus, and are oxidised completely, save a trace which is converted into aldehyde or fatty acid.—J. T. D.

Wood; Action of bacteria on ——. B. Malenkovic. Z. landw. Vers. Oesterr., 1905, **8**; Woch. f. Brau., 1906, **23**. 300.

A CONCENTRATED aqueous decoction of wood-sawdust has an acid reaction, and, when solidified by agar, it forms a medium on which moulds will develop, but which will not support the growth of bacteria. The resins of the coniferous woods and the tannins of the dicotyledonous woods possess an antiseptic influence against bacteria. If, however, the wood-extract be neutralised, preferably by chalk, the solution forms a fairly good nutrient medium for a vast number of aërobic and anaerobic species of bacteria. This extract does not, however, afford support for the development of the bacteria which bring about the fermentation of cellulose. Whilst these bacteria, which occur in the soil, readily ferment cotton, filter-paper, and similar forms of cellulose, they have practically no action on wood-cellulose [sulphite pulp]. The lignocellulose of wood, after purification by solvents, is also perfectly resistant to the attack of bacteria, but mould fungi grow on it readily. Sawdust treated with dilute solutions of potassium phosphate and ammonium nitrate, was found to be considerably decayed after a year, but bacteria were present only in traces. A round-shaped budding fungus, apparently a torula yeast, is always present in decaying wood, and appears to play an important part in the decomposition. If wood be placed in a solution containing 0·1 per cent. of potassium phosphate and 0·25 per cent. of ammonium nitrate, a vigorous fermentation, accompanied by frothing and evolution of gas, sets in after a few days, but this fermentation does not take place if the wood has previously been purified by extraction. The denitrifying bacteria attack only the extractive matters of the wood.—J. F. B.

Cholesterol; Constitution of ——. A. Windaus. Ber., 1906, **39**, 2008—2014.

CHOLESTEROL can be converted by way of a nitro derivative into a saturated ketonic alcohol, cholestanonol, $C_{27}H_{44}O_2$ (this J., 1903, 1261), and into a diketone, cholestandione (Ber., 1903, 3752), in which the two ketonic groups must stand in a 1:4, 1:5, 1:6, or 1:7 position towards each other (Ber., 1904, 4753). Wallach concluded that cholestanonol differed from cholesterol only in the group $CH:C<$ of the latter being converted into CO.CH; whilst Diels and Abderhalden (Ber., 1906, 884) considered that the reactions observed in the reduction of cholesterol and the corresponding ketone, cholestenone, agreed best with the α,β-position of the double bond. To test this assumption, the author oxidised cholestenone with a neutral solution of potassium permanganate, 20 grms. of the ketone in 200 c.c. of benzene being shaken for six hours with the reagent. The manganese peroxide was then destroyed by means of sulphurous acid, and the organic matter taken up with ether, and separated into acid and neutral products by means of dilute potassium hydroxide solution. The main product was a ketomonocarboxylic acid, $C_{26}H_{42}O_3$, which on further oxidation yielded a tricarboxylic acid, $C_{26}H_{42}O_6$, and there was also a small quantity of a mono-carboxylic acid, $C_{27}H_{44}O_4$, which the author regarded as an intermediate product. This crystallised in long thin needles melting at 217°—218° C. The acid, $C_{26}H_{42}O_3$, crystallised mainly in white plates melting at 155° C. It formed an oxime crystallising in long thin prisms melting at 191° C., and a bromine derivative, $C_{26}H_{41}O_3Br$., in microscopic needles melting at 154°—156° C. The tricarboxylic acid, $C_{26}H_{42}O_6$, formed by the oxidation of the acid, $C_{26}H_{42}O_3$, by means of bromine, crystallised from benzene in star-shaped clusters of microscopic needles (m. pt., 120°—131°). It was very hygroscopic. The author's general conclusion from these experiments is that the simplest explanation for the conversion of cholestenone into the ketomonocarboxylic acid is to assume the presence of a group, $CH.CH_2$, which is decomposed on oxidation thus:—

$$C_{25}H_{41}O.CH.CH_2 + 5O = C_{25}H_{41}O.COOH + H_2O + CO_2.$$

He considers that the conception of cholestenone as an α,β-unsaturated ketone cannot be accepted. (See also this J., 1904, 1117.)—C. A. M.

Lactic acid; Resolution of —— by morphine. J. C. Irvine. Chem. Soc. Proc., 1906, **22**, 159.

FERMENTATION lactic acid may be readily resolved into its active components by the crystallisation of the morphine salts. On neutralising an aqueous solution of the inactive acid with the alkaloid, the sparingly soluble morphine *l*-lactate separated almost quantitatively, whilst the compound with the *d*-acid remained in solution. The crystalline morphine salt was converted into zinc *l*-lactate, which gave $[\alpha]_D^{20^\circ} = +6{\cdot}84^\circ$, and a more accurate test of the purity of the active acid was obtained by its conversion by means of the silver oxide reaction into methylic *l*-methoxypropionate, which showed $[\alpha]_D^{20^\circ} = +94{\cdot}7^\circ$

The latter compound was reduced by hydriodic acid to *l*-lactic acid, a reaction which shows that silver oxide does not affect the configuration of an active lactate.

By decomposing the syrup containing the soluble morphine *d*-lactate, more than 50 per cent. of the theoretical yield of the active zinc salt ($[\alpha]_D^{20} = -6{\cdot}83^\circ$) was obtained.

Trade Report.

GERMANY; TRADE OF —— IN 1905.
For. Off. Ann. Ser. No. 3657.

The following table shows the value of the general imports and exports for the year 1905, as compared with those of the years 1903—04. The figures for 1905 are calculated according to the prices fixed for 1904:—

Value in 1000 marks (50*l.*).

Articles.	Imports.			Exports.		
	1905.	1904.	1903.	1905.	1904.	1903.
Chemicals and dyestuffs	317,938	298,052	274,376	463,925	412,746	393,975
Ores, fine metals, asbestos, &c.	576,681	748,527	533,676	197,989	173,248	189,778
Glass and glassware	10,761	9,785	9,255	54,878	55,649	51,450
Hides	379,310	349,054	329,838	190,969	166,440	148,966
Hops	18,263	10,785	5,024	42,712	45,499	43,993
Caoutchouc, guttapercha, and goods thereof	147,592	122,301	93,605	92,328	69,730	62,888
Copper and copper goods	165,468	168,780	132,242	206,141	180,927	156,437
Leather and leather goods	71,359	69,695	69,433	193,306	183,761	172,766
Candles	223	247	187	847	740	864
Oils, not otherwise mentioned, and fats	250,212	227,169	228,926	52,632	54,953	46,916
Paper and cardboard goods	21,736	24,991	18,067	143,176	127,165	121,903
Petroleum	100,732	100,747	110,581	2,646	2,161	1,726
Soap and perfumery	3,032	2,935	2,810	15,364	13,987	14,104
Stones and earthenware	56,440	47,326	43,708	42,211	35,603	37,981
Coal, lignite, coke, and peat	202,736	167,634	162,274	301,929	299,143	287,983
Tar, pitch, resin, and asphaltum	50,088	48,292	45,343	16,682	14,814	13,516
Clay goods	7,833	7,350	7,040	101,527	98,739	84,218
Oilcloth	870	875	925	3,546	3,220	3,129
Zinc and zinc goods	13,645	12,203	11,191	48,272	49,213	42,454
Tin and tinware	35,141	37,411	36,270	14,882	14,358	12,664

New Books.

INDUSTRIAL FURNACES AND METHODS OF CONTROL. By EMILIO DAMOUR. Translated and augmented by A. L. Queneau. The Engineering and Mining Journal, New York and London. 505, Pearl Street, New York; 20, Bucklersbury, London, E.C. 1906. Price 4 dols., post paid.

CROWN 8vo volume, containing 299 pages of subject matter, with 88 engravings and illustrations, six pages of bibliography, and the alphabetical index. There are also 24 tables. The contents are subdivided as follows:—PART I. (i) Heat of Combustion and Calorific Power, &c.; (ii) Gas Furnaces; (iii) Heat Utilisation in Furnaces, Efficiency, &c.; (iv) Direct-fired Furnaces; (v—vii) Gas-fired Furnaces; (viii) Classification of Furnaces; (ix) Experimental Study of Heat Utilisation in Furnaces; (x) Theory of Heat Recuperation, &c. PART II. (xi) Pyrometric Practice and Instruments, &c.; (xii) Gas Analysis; (xiii) Calorimetry; (xiv) Elementary Fuel Analysis, &c. PART III. (xv) Chimneys—Construction, Height, &c.; (xvi) Regenerators; (xvii) Recuperators; (xviii) Reversing Valves, Hearth, Ports; (xix) Powdered Fuel; (xx) United States Patents covering the Stoking of Powdered Fuel.

DANGEROUS TRADES.—ACTION TAKEN BY THE HOME OFFICE. [Cd. 3037.]

THE Home Office has issued in the form of a circular, particulars as to the action taken respecting various dangerous trades under the Factory and Workshops Acts, 1891, 1895, and 1901. The circular is to be obtained from any bookseller, price 1d.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1905. [Cd. 3036.] Wyman and Sons, Fetter Lane, E.C. Price, 3s. 6d.

THE report contains a general review of the work of the Factory Department in 1905; sectional reports (including appendices on paints and colours, tar distilling, air samples, and other subjects); statutory orders; appeals; memoranda (including Aniline Black dyeing, industrial mercurial poisoning, notification of industrial poisoning xylonite and celluloid); and statistical tables.

RESEARCHES ON CELLULOSE. II. (1900—1905). By C. F. CROSS and E. J. BEVAN. Longmans, Green, and Co., London, New York, and Bombay. 1906. Price, 7s. 6d.

CROWN 8vo volume, containing 174 pages of subject-matter, 6 pages of bibliographical notes, and indexes of authors and of subjects. The purpose of the volume is to record the recent progress in our knowledge of cellulose, and chiefly to answer the question, "What is cellulose?" The work is sub-divided as follows:—Section I. General résumé and forecast. (1.) Cellulose as a typical colloid. (2.) Cellulose as a chemical individual. (3.) Cellulose and structural forms—Dimensions. Section II. Account of original investigations in the period 1900—1905; abstracts of authors' communications, followed by critical examination of matter and results from the point of view of theoretical forecast of Section I. A. Reactions of synthesis: Nitric esters; aceto-sulphates, cellulose-xanthogenic acid; cellulose and alkaline hydrates; theory of dyeing; electrolytic phenomena; constitution of cellulose. B. Reactions of resolution and decomposition; hydrocellulose; mixed esters—chloracetyl derivatives of hydrocelluloses, &c.; animal digestion, and assimilation of cellulose; destructive fermentation. General summary and conclusions as to experimental verifications of views expounded in Section I. Section III. Technical progress in cellulose industries, and general forecast of technological developments from the point of view of matter in Section I.

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DECENNIAL INDEX, 1896-1905.

A Decennial Index to the first fourteen volumes of the Journal (1882—1895), a volume of 800 pages, was published in 1897. A few copies of this are still left, price 21*s.* net, embracing the period 1896—1905, is in course of preparation, and will be ready for printing in [illegible] will be a volume of about 800 pages, [illegible] Members who wish to secure a copy of the Index should [illegible]

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" 16,752. Heys (Liesinger Druckfabrik Popper and Ornstein and F. Wertheeker). Method of sealing chambers in which webs of fabric and the like are continuously treated and apparatus therefor. July 25.
" 16,908. Kalle und Co., A.-G. *See under* IV.
" 16,945. Cowper-Coles. Process for printing on textile fabrics. July 27.
[C.S.] 19,328 (1905). Longley. Calico, paper, and like printing. July 25.
" 22,101 (1905). Loring. *See under* VII.
" 6206 (1906). Schramm. Imitation silk and process of making same. July 25.
" 7928 (1906). Gesner. Vacuum apparatus for drying fabrics. July 25.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

[C.S.] 19,250 (1905). Longley. Dyeing of wood and similar pulp. July 25.
" 19,328 (1905). Longley. *See under* V.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 16,340. Clayton. Self-regulation of a sulphur furnace. July 19.
" 16,442. Lecœur. Preparation of ammoniacal copper solutions. July 20.
" 16,520. Dolphin. Manufacture of copper and other metallic sulphate. July 21.
" 16,612. Heinrici. Process for preparing a stable solution of hydrogen peroxide. [Ger. Appl., Aug. 28, 1905.]* July 23.
" 16,640. Klein. Process of manufacturing aluminates, hydrochloric acid and soda from aluminous materials.* July 24.
" 16,714. Engelhorn. Process for manufacture and treatment of composite aluminium oxides.* July 24.
" 16,852. James and Richardson. Method of and means for producing liquid air. July 26.
" 16,910. Johnson (Verein Chemischer fabriken). Separating arsenic and other impurities from gases and liquids. July 26.
[C.S.] 14,972 (1905). British Thomson-Houston Co. (General Electric Co.). Process of obtaining thorium applicable for making incandescent electric light filaments. Aug. 1.
" 18,492 (1905). Thwaite. *See under* XVIII*C*.
" 22,101 (1905). Loring. Machinery or apparatus for producing a gaseous bleaching medium. Aug. 1.
" 2450 (1906). Elworthy. Processes for solidifying carbonic acid and apparatus therefor. Aug. 1.
" 5852 (1906). Brünler. Apparatus for the oxidation of the nitrogen of the air for the purpose of obtaining nitric acid. Aug. 1.
" 15,445 (1906). Carlson. Production of nitrogen compositions. Aug. 1.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 16,165. Jonkergouw and Destrez. Manufacture of glass articles. [Fr. Appl., April 11, 1906.]* July 17.
[A.] 16,770. Jones. Method of hardening glass. July 25.
[C.S.] 3162 (1906). Jörgensen. Production of imitation stained glass. July 25.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 16,104. Deidesheimer and Jurschina. Manufacture of artificial stones, bricks, or like articles.* July 16.
" 16,164. Boult (Neuberger). Manufacture of Sorel cement.* July 17.
" 16,422. Ridley. Treatment of molten slag for making paving material and for other purposes. July 20.
" 16,423. Labour. Materials suitable for building or engineering purposes. [Fr. Appl., Aug. 12, 1905.]* July 20.
" 16,512. Vollbehr. Production of a dust-binding material. [Ger Appl., July 22, 1905.]* July 21.
" 16,826. Schmidt. Manufacture of artificial stone. July 25.
" 17,006. Timofeeff. Manufacture of cement for building and like purposes. July 27.
[C.S.] 21,486 (1905). Nicholls. Cementing of lead lights. Aug. 1st.

X.—METALLURGY.

[A.] 16,041. Mayo. Metallic alloy. July 16.
" 16,283. Bates and Peard. Annealing or heating metals.* July 19.
" 16,322. Charles and Heinze. Method of lining converters.* July 19.
" 16,364. Isherwood. Treatment of refractory zinc-lead ores. July 19.
" 16,420. Collins. Manufacture of briquettes for metallurgical and other purposes. July 20.
" 16,440. Flohr. Manufacture of iron or steel by the basic Bessemer process. July 20.
" 16,701. Edison. Process of making metallic films or flakes. [Amer. Appl., Dec. 5, 1905.]* July 24.
" 16,710. Hesketh and Willcox. Means for drying air more especially for blast and other furnaces and for regulating such supply. July 24.
" 16,723. Richardson. Processes for smelting and refining metals and apparatus therefor. July 24.
" 16,912. MacIvor and Fradd. Treatment of sulphide ores containing zinc. July 26.
" 17,001. MacIvor and Fradd. Treatment of zinc residues. July 27.
" 17,002. MacIvor and Fradd. Extraction of tin from ore. July 27.
[C.S.] 14,733 (1905). Wilkins. Alloy. July 25.
" 17,178 (1905). Gredt. Manufacture of iron and steel in an electric furnace. Aug. 1.
" 19,709 (1905). Sulman. Ore concentration. July 25.
" 21,963 (1905). Mackenzie, and Colville and Sons, Ltd. Manufacture of steel and apparatus therefor. July 25.
" 2146 (1906). Lake (Aluminiumwarenfabrik Gontenschwil A.-G.). Manufacture of aluminium foil Aug. 1st.
" 3901 (1906). Brinton. Process of treating manganese steel. July 25.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 16,209. The Gröndal-Kjellin Co., Ltd., and Härden. Electric induction furnaces.* July 18.
" 16,789. Moseley. Electric smelting furnaces. July 25.
" 16,870. Greenfield. Anodes for electrolytic purposes. July 26.
" 16,905. Basset. Thermo-chemical generator of electricity. [Fr. Appl., July 27, 1905.]* July 26.
[C.S.] 14,884 (1905). Parker. Electrical furnaces. Aug. 1.
" 17,178 (1905). Gredt. *See under* X.
" 16,484 (1905). British Thomson-Houston Co. (General Electric Co.). *See under* II.

[C.S.] 22,673 (1905). Knight. Electrical storage batteries. July 25.
„ 1924 (1906). Edison. Electrode for storage batteries Aug. 1.
„ 1928 (1906). Edison and Aylsworth. Storage battery electrodes. Aug. 1.
„ 3004 (1906). Soc. Electro-metallurgique Française Electric mixing furnace for mixing steel. Aug. 1.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[C.S.] 22,241 (1905). Haddan (Edson Reduction Machinery Co.). Apparatus for rendering or reducing vegetable or animal matter capable of yielding grease or oil. July 25.
„ 3864 (1906). Proude. Soap for use in finishing woollen goods. Aug. 1.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—Pigments, Paints.

[A.] 16,516. Ephraim. Manufacture of permanent white paint. [Ger. Appl., July 24, 1905.]* July 21.
„ 16,833. Goddard. Anti-corrosive paint.* July 25.

(C.)—India-Rubber.

[A.] 16,084. Ormandy. Manufacture of vulcanised rubber or other sheets and articles. July 16.
„ 16,368. Fenton. Production of elastic magma. July 20.
„ 16,519. Litzler. Rubber substitute and process for producing the same. July 21.
[C.S.] 17,452 (1905). Neilson. Process of regenerating rubber waste of all kinds. July 25.
„ 22,504 (1905). Körner. Process for the devulcanisation of vulcanised india-rubber. Aug. 1.

XIV.—TANNING; LEATHER, GLUE, SIZE, &c.

[A.] 16,348. Lake (Lederfabrik Hirschberg vorm, H. Knoch und Co.). Chrome tanning process.* July 19.
„ 16,443. Heintz. Process of chrome tanning. [Ger. Appl., Sept. 13, 1905.]* July 20.
„ 16,450. Heintz. Process of chrome tanning. [Ger. Appl., March 13, 1906.]* July 20.
„ 16,598. Mills (Patent Leather Co., U.S.A.). Leather and process of making it.* July 23.
[C.S.] 25,957 (1905). Klugmann. Process of treating skins and furs. July 25.

XVI.—SUGAR, STARCH, GUM, &c.

[C.S.] 16,269 (1905). Stewart and Co., and Wishart. Evaporators for sugar. July 25.
„ 17,554 (1905). Bertels. Purification of sugar juices. July 25.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 16,510. Newlands. Production of alcohol from wood. July 21.
„ 16,741. Cousins. Processes for treating spirituous liquors.* July 24.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—Foods.

[A.] 16,276. James. Food preparations. July 18.
„ 16,628. Burckhardt. Method of manufacturing cocoa products, especially chocolate, containing large quantities of albumin.* July 23.
„ 16,674. Nyeboe and Nissen, and Sodemann. Pasteurising apparatus. [Dan. Appl., July 25, 1905.]* July 24.
„ 17,003. Lochtin. Process of manufacturing mineral waters. July 27.
[C.S.] 15,304 (1905). Budde. Sterilisation of articles of food. Aug. 1.

(B.)—Sanitation; Water Purification.

[A.] 16,558. Ellis and Slade. Manufacture and treatment of filtering and deodorising material, and its adaptation for forming and filling bacteria beds and filters for the purification of sewage water and foul liquids. July 23.
„ 16,890. Candy. Manufactures for use in the purification of water and other liquids. July 26.
[C.S.] 15,514. (1905). Hannig. *See under* I.

(C.)—Disinfectants.

[C.S.] 18,492 (1905). Thwaite. Apparatus for destroying bacteria in the blood and tissues by the influence of carbon monoxide. Aug. 1.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 16,082. Plews. Compoboard. July 16.
„ 16,271. Lake (Chem. Fabr. vorm. Weiler-Ter Meer). Manufacture of celluloid. July 18.
„ 16,978. Bluen. Method of and apparatus for treating sheets of paper and the like. [Ger. Appl., July 28, 1903.]* July 27.
[C.S.] 23,748 (1905). Beresford. Method of and apparatus for manufacturing half stuff from peat moss as a basis for millboard and paper-making. Aug. 1.
„ 26,201 (1905). Kraemer und van Elsberg Ges., and Kraemer. Producing highly brilliant transparent coatings on paper, pasteboard, cardboard and the like. July 25.
„ 4304 (1906). Dobler. Apparatus for impregnating paper and card in a paper-making machine during its manufacture. Aug. 1.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 16,258. Newton (Bayer und Co.). Manufacture of new pharmaceutical compounds and of intermediate products. July 18.
„ 16,429. Badische Anilin und Soda Fabrik. Manufacture of camphene. [Ger. Appl., July 20, 1905.]* July 20.
[C.S.] 15,517 (1905). Fabriques de Produits de Chimie Organique de Laire. Manufacture of products of condensation of phenol alcohols. Aug. 1.
„ 17,374 (1905). Cooper, Exor. of Newton (Farb. vorm. F. Bayer und Co.). Manufacture and production of iodine preparations. Aug. 1.
„ 26,818 (1905). Ellis (Merck). Manufacture of a salt of oserine. July 25.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 25,922 (1905). Brookes. Photographic printing paper or films. July 25.
„ 9100 (1906). Mills (Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils). Sensitive plate for colour photography. July 25.
„ 10,078 (1906). Bloxam. (Neue Photographische Gesellschaft, A.-G.). Reproduction of pictures by aid of catalytic action. Aug 1.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 16,367. Blum. Explosive. July 20.
„ 16,453. Stange. Manufacture of matches and igniting surfaces therefor. [Ger. Appl., Jan. 3, 1906.]* July 20.
„ 16,676. Cocking and Kynoch, Ltd. Manufacture of nitrocellulose. July 24.
„ 16,725. Claessen. Process for manufacture of smokeless gunpowder.* July 24.
„ 16,882. Bichel. Process of producing plastic explosive from trinitrotoluol. July 26.
[C.S.] 3005 (1906). Bloxam and Manganite Explosives Syndicate. Manufacture of explosives. Aug. 1.
„ 3661 (1906). Nikolsky. Process and apparatus for distilling off and recovering the solvents used in the manufacture of explosives. Aug. 1.
„ 10,927 (1906). Reishoff. Process for imparting to guncotton a greater intensity of explosive force. Aug. 1.

Official Notice.

ALCOHOL FOR INDUSTRIAL PURPOSES.

The Revenue Bill, which includes facilities for the use, without payment of duty, of spirits in arts and manufactures (this J., 1905, 397—426; *ib.* 706) has received the Royal assent. After having been considered in Committee, the report stage passed the House of Commons without discussion on July 27, and the Bill was read a first time in the House of Lords on the same date. The second reading was carried without dissent on July 31, and the third reading took place on the same afternoon. Rules and regulations for the use of duty-free spirit will be issued on October 1st next.

Birmingham and Nottingham Sections.

Meeting held at Burton on Tuesday, April 26th, 1906.

MR. J. M. C. PATON IN THE CHAIR.

THE BEHAVIOUR OF COLLOIDS IN SEWAGE.

BY F. R. O'SHAUGHNESSY, A.R.C.SC., F.I.C., AND H. W. KINNERSLEY, F.I.C.

The object of this communication is to bring forward a number of results of observations and experiments made by one of us at different times over several years, together with the results of a more special investigation undertaken jointly by us during the past few months.

Messrs. W. Biltz and O. Köhnke,* and Messrs. Jones and Travis,† of Hampton-on-Thames, have made statements with respect to colloidal matter in domestic sewages, and Dr. Fowler and Mr. Ardern,‡ of Manchester, have investigated the effects of the presence of manufacturing refuse on these liquids.

It occurred to us that useful information might be obtained by experimenting separately with the two principal ingredients of sewage, *viz.*, urine and solid fæcal matter. The apparatus used in these and the other experiments where the method of dialysis was adopted, was similar to that described by Dr. Fowler in his excellent paper above referred to.

Method of experiment.—A parchment cylinder 8 cm. in diameter (supported on a rigid framework) and a glass cylinder of exactly double the sectional area of the first cylinder were used.

Five hundred c.c. of the liquor under investigation were placed in the glass vessel, and an equal bulk of distilled water was introduced into the parchment cylinder. The smaller vessel was then placed in the larger, and as the parchment is slightly collapsable the two liquids readily adjusted themselves to the same level. It was ascertained that diffusion was not always complete in 24 hours (theoretically it requires an infinite time), so the operation was allowed to proceed for a minimum time of two days.

By this means one may separate a known portion (one-half) of the crystalloids present in the original liquor and so compute the ratio of crystalloids to colloids.

Dr. Fowler is not very clear as to the meaning of the ratio he gives. When dialysis is complete the following formula will give the true ratio of crystalloids to colloids:—

Let x represent, say, the "oxygen absorbed" figure outside parchment.

Let y represent, say, the "oxygen absorbed" figure inside parchment.

Then $\frac{x-y}{2.y.}$ gives the ratio of oxidisable crystalloids to oxidisable colloids in the original liquid.

In our tables we have preferred to express the percentage of colloids on the total matter present.

We may illustrate the method by taking a table from Dr. Fowler's paper as follows:—

"*Comparison of settled septic tank effluent with settled sewage.*"

Results in grains per gallon.

Samples taken after diffusion was complete.	3 mins. oxygen test.		Album. ammonia.	
	Settled sewage.	Settled septic liquor.	Settled sewage.	Settled septic liquor.
I.				
From inside parchment cylinder.....	0·80	0·66	0·06	0·04
From outside parchment cylinder.....	1·20	1·28	0·19	0·165
Fowler's ratio ..	1—1·5	1—1·9	1—3·2	1—4
Ratio of crystalloids to colloids	4—1	2·1—1	1—1·1	1—1·6
Ditto as per cent. of colloids ...	25%	47·6%	52%	61%

This does not alter Dr. Fowler's conclusion, however, but it shows—what would naturally be expected in a sewage like that of Manchester—that the oxidisable crystalloids are greatly in excess of the oxidisable colloids; and, moreover, this method of expressing by percentages brings the main fact out at once quite clearly.

In our tables we give comparative figures for four hours, and three minutes, oxygen tests, together with a number of "Albuminoid Ammonia" figures and "Dissolved Solids." Besides this we give a figure which we call the "Permanent Colloids Ratio," which is obtained as follows:—

$$100 \times \frac{\text{(4 hrs. ox.) (outside)} - \text{(3 mins. ox.) (outside)} - \text{(4 hrs. ox.) (inside)} - \text{(3 mins. ox.) (inside)}}{\text{(4 hrs. ox.) (outside)} - \text{(3 mins. ox.) (outside)} + \text{(4 hrs. ox.) (inside)} - \text{(3 mins. ox.) (inside)}}$$

Experiments with fæcal solids.—(*a*) About 150 grms. of fæces was shaken up in a stoppered cylinder with 1000 c.c. of water and allowed to subside for 24 hours, when the supernatant liquor (which was quite opaque owing to colloidal matter) was syphoned off and dialysed in the above apparatus. The results are given under (*a*) Table I.

(*b*) The same liquor was diluted (1 : 19) and dialysed.

(*c*) It was also incubated for 10 days and dialysed after incubation. The results are given under (*b*) and (*c*) in Table I.

(*d*) About 1 lb. of fresh fæcal matter was incubated at 80° F. with 6 qts. of tap water in a vessel open to the air for seven days; 500 c.c. of the liquor were drawn off, settled, diluted with an equal bulk of tap water, and dialysed. The results are given under (*d*) in Table I.

(*e*) The incubation in the foregoing experiment was continued for 13 days and the liquor treated as before. The results are given under (*e*) in Table I.

(*f*) Experiment (*d*) was conducted in the absence of air. The results are given under (*f*) in Table I.

The effect of adding lime and chloride of iron separately and together to a solution of fæcal matter was tried with the following results:—

	3 mins. oxygen absorbed
Untreated liquor	5·20 parts per 100,000.
After adding lime and settling 24 hours	2·51 „ „ „
After adding ferric chloride and settling 24 hours	4·00 „ „ „
After adding both together and settling 24 hours	1·50 „ „ „

* "Organic Colloids from Town Sewage," Berichte der deutschen chemischen Gesellschaft, Vol. xxxvii., p. 1745.

† "Elimination of Suspended Solids and Colloidal Matters from Sewage." Proceedings of the Institution of Civil Engineers, 1905–06.

‡ "Suspended Matters in Sewage and Effluents." This J., 1905, 483.

Experiments with urine.—(*a*) The urine was settled and the clear liquid syphoned off and diluted (1:9). It was then dialysed with an equal bulk of tap water. The results are given under (*a*) in Table II.

(*b*) Another sample of mixed urine from eight persons was settled and diluted (1:19). The diluted liquid was then dialysed with an equal bulk of tap water. The results are given under (*b*) in Table II.

(*c*) A sample of urine which had been standing in stoppered bottle for six years was diluted (1:19) and dialysed with an equal bulk of tap water.

Note.—A thick sediment had settled at the bottom of the bottle containing the urine. The results are given under (*c*) in Table II.

(*d*) *Examination of pan liquor.*—The liquor from a pan which was used occasionally for the reception of defæcations was drawn off and settled. The pan was emptied five weeks previously. The liquor consisted, of course, of urine and such matter as was taken up from the solids present. It was diluted (1:9) and dialysed with an equal bulk of tap water. The results are given under (*d*) in Table II.

Birmingham sewage.—In Table III. *A.* is given the results of examination of samples of Birmingham settled crude sewage by dialysis.

In Table III. *B.* is given the results of a similar examination of Birmingham sewage discharged during a holiday, when most of the works were stopped. The flow was reduced about 30 per cent.

Birmingham tank liquors.—All the sewages on Table III. mix together and pass through the roughing tanks, where partial sedimentation (four hours) and septic action takes place. The liquor then passes on to the septic tanks, where it sojourns for an average period of 8½ hours.

The results are given in Table IV.

The septic liquor passes on to the main conduit, which is five miles long, and from which the liquor is drawn off at various points on to the land.

Domestic sewages.—At a point some two miles from the septic tanks 2,500,000 galls. of the liquor—in Table V. designated "sedimentation tank effluent"—enter the conduit. This Cole Valley sewage is typical of a fairly fresh domestic sewage, as is also the Hanley sewage given in the same table.

Septic liquor for bacteria beds.—The Birmingham septic liquor arriving at the end of the five-mile conduit passes first through a series of silt tanks, where the suspended solids are reduced to about 8 parts per 100,000.

The results of the examination of this important liquid after issuing from the silt tanks are given in Table IV.

Solids arrested in silt tanks.—The silt tank is of the shape of an inverted cone, and the finely divided matter in the septic liquor entering the tanks sinks slowly to the bottom during the four hours required for the passage of the liquid through the tank.

The solid matter is discharged in small quantities three times daily from a valve situate at the apex of the inverted cone. It was found that it was necessary to empty the tanks three times per day in order to prevent them from acting as septic tanks. The number of organisms present in the liquor entering and leaving the tanks was estimated under varying conditions in order to settle this point. This sludge is quite black in colour, has very little smell, "works" vigorously, and contains some 45 per cent. of organic matter.

Solids precipitated in bacteria beds.—Both the solids accumulating in the top of the bacteria beds, and those passing out in suspension in the bacteria beds' effluent, must consist very largely of colloidal matter precipitated from the liquor passing on to the bed in addition to the usually small quantity of sediment also present in the liquor.

Solids from the top 12 in. of a Percolation Bed.

General characteristics.—The sludge adheres to the particles of medium, filling up the interstices as a black slimy mass. It appears to be pulverulent (in finely divided grains), but is so finely divided for the most part that it has a soapy feel in the fingers. It has, when fresh, the faint, not unpleasant odour of well-digested septic sludge.

Microscopical characteristics.—Under a magnification of 100 diameters, the sludge appears to consist almost entirely of dark structureless matter, along with some small portions of organic matter in the last stages of disintegration (cellulose of cell-walls ?). Many fine quartz grains appear intermixed with the dark matter.

Under magnification of 650 diameters the same characteristics were observed. Some particles of organic matter showed fragmentary cell structure (cellulose); very few organisms of the larger forms could be seen (two spindle-shaped forms as well as several other forms were observed), but the mass is crowded with non-motile coccus forms, whilst a much smaller number of bacteria were observed.

Chemical characteristics.—The sample under examination was found to contain 42 per cent. of organic matter. On extraction with ether the dry matter yielded 2·95 per cent. of ether extract having a gummy consistence and very pungent smell.

Solids passing out of the Bacteria Bed in Suspension in the Effluent.

General description.—The sludge, arrested by the "separator tank" from the effluent, is of very fine texture, and has the appearance of impalpable slime. It is of a very dark brown colour when fresh, and has an earthy smell. In wet bulk after a time it sets up putrefactive decomposition with objectionable smell.

Microscopical characteristics.—Under a magnification of 100 diameters it appears to consist almost entirely of structureless "blobs" of dark matter interspersed with dead bodies of some of the higher water organisms, and many zooglea.

Under a magnification of 650 diameters the dead organisms appear to be undergoing disintegration, their cell walls being ruptured. The structureless matter above showed no structure under the higher power, and many zooglea were observed. The organisms were mostly coccus forms, and were present in huge numbers, whilst some bacteria and rod-like forms appeared. Also a number of what appeared to be rudimentary filaments were present.

Chemical characteristics.—The dry matter was found to contain 38·31 per cent. of organic matter in the sample under examination.

Another sample gave 40·6 per cent. of organic matter, 19 per cent. of silica, and much iron.

The chemical characteristics of these substances will be examined more fully later.

Mechanical examination.—The rate of fall of this sludge in water was determined with the following results:—

Heaviest (small) portion fell at rate of 170 ft. per hour.

Medium portion (the bulk of sludge) fell 21 ft. per hour.

Lightest particles fell at an average rate of 5·7 ft. per hour.

Subsequently the effluent was passed through the "separator tank" (an inverted cone) at varying rates, and the limiting speed of upward flow consistent with good sedimentation was found to be about 21 ft. per hour.

It may be remarked here that a number of experiments were made on a fairly large scale, both by sedimentation and filtration, to ascertain the most efficient method of arresting the suspended solids from the bacteria bed effluent. The Birmingham separator tank has been adopted as a result of these experiments.

Colloidal matter in land effluents.—The colloidal matter usually present in land effluents is very small in quantity and contains much mineral matter. The portion which separates on standing consists largely of hydrated oxide of iron and some silica, but the maximum amount so separating has not been found to exceed (even in an extreme case) 3 parts per 100,000. The average iron in solution in Birmingham land effluents when freshly sampled is 0·9 part per 100,000.

The effluent from Field 29 (east) is particularly interesting (see Table VI.). This effluent persistently gives a copious ferruginous deposit.

In 1901 an experiment was tried with this field, at the suggestion of one of us, with a view to preventing the iron in the sub-soil from going into solution in the effluent. The surface of the field was dressed with waste gas lime at the rate of 50 tons per acre, with the intention of increasing the basicity of the soil. The more soluble constituents of the gas lime quickly disappeared, but although the quantity of lime in the effluent was very large, the copious deposition of hydrated oxide of iron from the effluent was arrested only for a short time; some analyses of the dissolved matter present in this effluent are given below:—

Results in parts per 100,000.

Dissolved matter.	3 days after liming field.	6 days after liming field.	8 months after liming field.
$Fe_2O_3 + Al_2O_3$.	39·2	31·6	Fe = 2·2
CaO	40·0	6·4	41·0 ($CaCO_3$)
MgO	6·3	5·5	aftr. 9 dys. Fe = 0·27
Total solid matter	220·0	—	108·5

After four and a half years from time of liming the solids separating from the original clear liquid on standing 30 days = Total, 2·8 parts per 100,000; volatile, 0·5 part.

Colloids in biological bed effluents.—These effluents are usually similar in this respect to land effluents. (See Table VI.)

In Table VII. is given a series of analyses of a most interesting sewage containing enormous quantities of manufacturing waste.

The examination of such a liquid by dialysis furnishes extremely useful information.

Conclusions.

1. The amount of colloidal matter in solution in sewage varies greatly. The chief sources from which organic colloidal matter is derived are urine and fæcal matter. Urine is known to contain very little relatively to its other constituents, and our experiments demonstrate that the principal source of soluble colloids in sewage is fæcal matter. It is also shown that the fæcal matter passes into pseudo solution or emulsion by agitation with water, and that the amount usually taken up depends on (*a*) the nature of the other constituents of the liquor; (*b*) the time of contact and amount of agitation between the water and the fæcal solids.

The amount taken up under any circumstances is, of course, limited. Old or badly laid sewers will influence this result, and an interesting point is raised here with respect to the methods adopted in sampling and examining crude sewage.

2. Speaking generally, domestic sewage—unless very fresh—will contain more colloidal matter than a sewage containing much trades' waste. In the Hockley sewage (Birmingham) much pickling liquor is usually present with very little colloidal matter; as much as 12 parts of iron per 100,000 have been observed in this sewage.

We have experienced the greatest difficulty in inducing septic action in a sewage containing much iron salts. Apart from any sterilising action, this effect seems to be due more to the small amount of colloidal organic matter which such a sewage is capable of taking up in solution.

3. It is now generally admitted that the efficiency of the septic tank as a means of destroying sludge was at first greatly overrated.

The highest published figures are to the effect that some 25 per cent. of the sludge disappears in the resolving chamber; but our own observations make the figure 10 per cent. in our case. The exact figure is probably the result of local and more or less accidental conditions.

Also, care should be taken to discriminate between solid matter *eliminated as gas*, and solid matter which merely passes into emulsion on account of the agitation taking place as a result of the escape of this gas.

4. Resolution *per se*, *i.e.*, decomposition of the original solid sludge in a septic tank, must take place for the most part *after* the organic matter has passed into solution; for the organisms can only act on this matter through their enzymes. The amount of matter capable of passing into solution appears to be limited, so that the amount capable of bacterial disintegration in a reasonable time must be still more limited. The efficiency of anaërobic chambers where a large surface is presented to the dissolved colloidal matter can, therefore, be more readily understood.

5. Our experiments support the view that the amount of dissolved colloidal matter is increased by septic action. (See figures in Table IV.)*

6. It appears to us, therefore, that where a rapid means of getting rid of sludge *without nuisance* is at hand, septic treatment is a mistake; for the colloidal matter taken up in the septic tank is re-precipitated in the subsequent treatment of the liquor, and is then usually very troublesome to deal with.

7. In our own case the chief reason for continuing the septic treatment is because by this means the immense bulk of sludge to be dealt with on the land can be deprived of its objectionable smell. This deodorising effect on the large scale operations was observed by Mr. J. D. Watson, Engineer to the Birmingham Drainage Board, several years ago.

8. Septic liquor from which all visible suspended solids have been removed by sedimentation still contains much potential sludge, as Dr. Fowler has shown in the case of Manchester sewage.

The following table gives the amounts of matter separating from various samples of Birmingham sewages and septic liquors (clarified by settling) on being allowed to stand exposed to air.

Parts per 100,000.

Sample.	Total deposited matter.	Organic matter.		Days standing.
		Total.	Per cent. of dry matter.	
Hockley sewage (receives much iron pickle)	7·5	4·3	57·5	12
Cole Valley (Birmingham) sedimentation tank effluent (domestic)	6·7	4·8	71·6	7
Birmingham (silt tank) septic liquor (mixed sewages) ..	6·7	4·4	65·6	12
Ditto. ditto.	16·0	—	—	—
Ditto. ditto.	12·2	7·3	59·9	24
Ditto. ditto.	14·0	8·3	59·3	28

A sample of the strong solution of fæcal matter (see (*a*) Table I.) was diluted (1:9) and allowed to stand for six weeks. The liquor deposited 9·1 parts per 100,000 of solid matter which contained 86·4 per cent. of organic matter. The supernatant liquor was no longer opaque, but was still opalescent, and had lost its disagreeable odour.

9. The matter which separates on allowing a clear sample of septic liquor to stand is insoluble, has only a faint odour, is extremely stable, and even when incubated with water under most favourable circumstances decomposes with extreme slowness. These properties sharply distinguish this matter from the original sewage sludge.

10. One of the chief functions of any process of purification of the clarified sewage liquor is the removal of the potential sludge which it still contains. Where the liquor is treated on good land, only a trace of this matter is left in the effluent, and the same applies to effluents from efficient bacteria beds.

But whereas the land retains the whole of the solids in a condition requiring little further manipulation, this

* *Note.*—Owing to the easy liability of the "Albuminoid Ammonia" figure to error in these comparisons, this estimation is not regarded by us as being so reliable for this purpose.

matter passes out in part in suspension in the bacteria bed effluent, but a large part remains in the bacteria bed. From time to time this matter must either be flushed out of the bed, or the medium must be dug out and washed. At Birmingham the open tile floors of the percolation beds permit of each bed being easily flushed, whereby the solids accumulating are washed out of the bed.

Such flushings are passed through the same tank as the ordinary effluent from the bacteria bed. This tank, known as the "Birmingham Separator Tank," consists of a chamber of the shape of an inverted pyramid with a sump and exit pipe at the apex. The sludge accumulating is discharged on to the land. By this means the suspended solids are reduced to a little over 1 part per 100,000, and this method in common with land treatment ensures that the *whole* of the sludge is arrested from the various effluents.

Note.—The conflicting statements which are frequently made with respect to the rate at which bacteria beds tend to choke, are probably due to the varying proportions of colloidal solids (*i.e.*, potential sludge) present in different sewage liquors. How much of the sludge arrested *in* the bed is destroyed by bacterial action remains to be determined.

11. Our observations on the rate of disappearance of sludge are to the effect that even under very favourable circumstances it disappears for the most part with extreme slowness. Unless it is broken up and spread out in very thin layers it may remain apparently unaltered for years. Wherever it is kept in bulk it will remain for indefinite periods.

12. Iron appears to play a peculiar and most important part in the phenomena discussed above.

Iron (Fe) in solution in Birmingham crude sewage	0·24	parts	per	100,000.
Iron (Fe) in solution in Birmingham septic tank effluent	0·46	„	„	„
Iron (Fe) in solution in Birmingham land effluent	0·96	„	„	„

The form in which the iron is present seems to determine whether it assists or retards the operations. This matter, however, requires further investigation.

In conclusion, we wish to express our thanks to Mr. J. D. Watson for his permission to use these results, and for much valuable information supplied.

Examination of Fæces.

TABLE I.

All analytical figures expressed in parts per 100,000.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs. test.	Percentage of colloids on 3 mins. test.	Percentage of permanent colloids.
Fæcal liquor—									
(a) Outside	—	—	—	—	—	50·30	—	92·7	—
Inside	—		—		—	1·90			
Fæcal liquor—									
(b) Outside	—	—	—	—	—	2·40	—	86·2	—
Inside	—		—		—	0·18			
Fæcal liquor—									
(c) Outside	25·0	58·1	—	—	7·14	4·04	76·1	69·0	86·2
Inside	6·5		—		0·97	0·74			
Fæcal liquor—									
(d) Outside	71·0	27·9	2·48	54·5	16·67	6·38	45·7	44·7	46·3
Inside	40·0		0·73		6·22	2·44			
Fæcal liquor—									
(e) Outside	73·5	33·0	2·75	57·6	20·56	7·08	48·8	38·5	54·8
Inside	37·0		0·74		7·08	3·14			
Fæcal liquor—									
(f) Outside	137·5	47·8	4·50	75·8	32·92	12·92	66·3	61·8	68·9
Inside	49·0		0·62		6·67	3·00			

Examination of Urine.

TABLE II.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
Diluted urine—									
(a) Outside	289·0	3·96	11·15	?	35·20	7·70	8·98	15·8	7·2
Inside	267·0		—		29·40	5·60			
Diluted urine—									
(b) Outside	76·0	8·96	1·43	26·0	7·93	2·11	18·0	23·7	9·6
Inside	63·5		0·84		6·10	1·30			
Old urine, diluted—									
(c) Outside	48·0	15·7	2·05	13·0	13·10	2·13	35·4	23·1	38·1
Inside	35·0		1·56		6·25	1·33			
Pan liquor, diluted—									
(d) Outside	113·0	18·6	1·72	41·0	15·69	6·73	42·1	46·8	38·8
Inside	77·5		0·73		6·39	2·44			

Birmingham Crude Sewage.

TABLE IIIA.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
Settled Saltley sewage—									
(1) Outside	98·5	31·1	0·48	41·2	8·33	2·70	51·7	59·8	48·2
Inside	51·0		0·20		2·65	0·68			
Settled Saltley sewage—									
(2) Outside	78·0	11·0	—	—	—	2·66	—	16·4	—
Inside	62·5		—		—	1·91			
Note.—Chiefly domestic sewage, with varying manufacturing waste.									
Settled Rea sewage—									
(1) Outside	—	—	—	—	—	5·41	—	23·2	—
Inside	—		—		—	3·37			
Settled Rea sewage—									
(2) Outside	93·5	25·1	0·57	46·2	11·04	4·33	30·3	22·6	35·8
Inside	56·0		0·21		5·90	2·73			
Note.—Contains varying quantities of tar products and other manufacturing waste.									
Settled Hockley sewage—									
(1) Outside	—	—	—	—	—	3·51	—	26·2	—
Inside	—		—		—	2·05			
Settled Hockley sewage—									
(2) Outside	68·5	1·5	0·74	22·3	8·74	2·77	1·9	11·2	*nil.*
Inside	66·5		0·47		8·41	2·21			
Settled Hockley sewage—									
(3) Outside	65·5	6·9	—	—	6·28	2·05	9·4	13·6	7·5
Inside	57·0		—		5·20	1·56			
Note —Contains varying proportions of waste iron pickling liquors, &c.									
Settled Aston sewage—									
(1) Outside	66·0	8·2	1·17	33·8	9·53	2·63	14·6	28·3	10·0
Inside	56·0		0·58		7·11	1·47			
Settled Aston sewage—									
(2) Outside	64·0	13·8	0·91	15·9	7·42	2·33	23·4	39·1	17·3
Inside	48·5		0·66		4·61	1·02			
Note.—Contains mixed manufacturing refuse.									

Birmingham Crude Sewage.

TABLE IIIB.

Manufacturing refuse absent.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
Settled Saltley sewage—									
Outside	44·5	19·5	—	—	6·35	1·84	32·2	34·9	33·0
Inside	30·0		—		3·18	0·91			
Settled Rea sewage—									
Outside	47·0	26·2	—	—	4·73	1·84	50·6	56·6	47·1
Inside	27·5		—		1·55	0·51			
Settled Hockley sewage—									
Outside	58·5	28·6	—	—	6·49	1·98	50·1	59·1	46·4
Inside	32·5		—		2·16	0·51			
Settled Aston sewage—									
Outside	48·0	26·3	—	—	5·41	1·49	60·1	34·8	72·3
Inside	28·0		—		1·35	0·72			
Tank Liquors.									
Settled roughing tank effluent—									
Outside	50·5	24·7	—	—	5·07	2·25	56·2	—	—
Inside	30·5		—		1·42	—			
Settled septic tank effluent—									
Outside	48·5	19·0	—	—	5·34	2·25	51·9	—	—
Inside	33·0		—		1·69	—			
Settled silt tank effluent—									
Outside	55·5	21·8	—	—	5·74	2·51	30·8	27·1	33·8
Inside	43·0		—		3·04	1·44			

Birmingham Tank Liquors.

TABLE IV.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed.		Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
					4 hrs.	3 mins.			
Roughing tank effluent—									
(1) Outside	56·0	9·8	0·68	19·8	6·08	1·83	12·6	29·3	6·6
Inside	46·0		0·46		4·92	1·00			
Septic tank effluent—									
(1) Outside	52·0	13·0	0·56	16·7	4·90	1·80	16·3	14·3	17·4
Inside	40·0		0·40		3·53	1·35			
Roughing tank effluent—									
(2) Outside	80·5	7·7	0·60	15·4	8·71	3·41	11·5	13·3	10·4
Inside	69·0		0·44		6·91	2·61			
Septic tank effluent—									
(2) Outside	80·5	12·2	0·67	25·2	7·98	3·12	16·4	22·1	12·7
Inside	63·0		0·40		5·73	1·99			
Roughing tank effluent—									
(3) Outside	42·5	21·4	0·33	32·0	3·88	1·45	37·6	29·5	42·9
Inside	27·5		0·17		1·76	0·79			
Septic tank effluent—									
(3) Outside	52·0	17·5	0·39	41·8	5·03	1·81	33·6	33·6	33·6
Inside	36·5		0·16		2·50	0·90			
Silt tank effluent—									
(1) Outside	56·0	10·9	0·49	24·1	5·43	2·06	23·7	23·7	23·7
Inside	45·0		0·30		3·35	1·27			
Silt tank effluent—									
(2) Outside	61·0	12·4	0·48	32·7	5·34	1·93	18·0	19·1	17·4
Inside	47·5		0·24		3·71	1·31			
Silt tank effluent—									
(3) Outside	58·5	8·8	0·48	29·7	4·93	2·05	20·8	21·3	20·5
Inside	49·0		0·26		3·23	1·33			
Silt tank effluent—									
(4) Outside	57·5	8·0	—	—	4·26	1·78	16·6	16·5	16·7
Inside	49·0		—		3·05	1·28			
Silt tank effluent—									
(5) Outside	53·0	10·9	—	—	3·89	1·70	13·1	8·6	16·8
Inside	43·5		—		3·00	1·43			
Silt tank effluent—									
(6) Outside	—	—	—	—	5·47	2·32	32·1	25·7	37·2
Inside	—		—		2·81	1·37			

TABLE V.

Cole Valley (Birmingham) Sewage (Domestic).

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed.		Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
					4 hrs	3 mins.			
Settled crude sewage—									
Outside	46·5	24·8	—	—	2·92	0·77	36·1	45·3	33·1
Inside	28·0		—		1·37	0·29			
Settled sewage after screening—									
Outside	39·5	21·5	—	—	2·79	0·80	39·5	43·8	37·8
Inside	25·5		—		1·21	0·31			
Settled tank (sedimentation) effluent—									
Outside	39·0	18·2	—	—	2·82	0·83	38·6	45·6	35·8
Inside	27·0		—		1·25	0·31			

Note.—Sediment precipitated after standing 7 days. Total, 6·7. Organic, 4·8.

Hanley Sewage (Domestic).

Settled crude sewage—									
Outside	—	—	0·53	76·7	3·95	1·55	38·6	40·8	37·5
Inside	—		0·07		1·75	0·66			
Settled septic liquor—									
Outside	—	—	0·53	82·8	1·63	0·66	41·7	12·8	69·9
Inside	—		0·05		0·67	0·51			

Note.—Sediment precipitated after standing 14 days. Total, 5·8. Organic, 3·4.

TABLE VI.

Land Effluents.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
Castle Bromwich effluent—									
Outside	—	—	—	—	1·10	0·49	19·6	*nil.*	38·6
Inside	—		—		0·80	0·49			
Minwarth effluent—									
Outside	44·0	6·7	0·18	44·0	1·49	0·51	23·1	24·4	22·5
Inside	38·5		0·07		0·93	0·31			
Water Orton effluent—									
Outside	40·5	6·6	—	—	1·03	0·34	27·9	6·2	42·2
Inside	35·5		—		0·58	0·30			
Curdworth effluent—									
Outside	—	—	—	—	1·55	0·56	15·7	*nil.*	26·9
Inside	—		—		1·13	0·56			
Field 29, east half—									
Outside	—	—	—	—	0·92	0·50	18·7	21·0	13·5
Inside	—		—		0·63	0·31			
Field 29, west half—									
Outside	—	—	—	—	1·01	0·50	5·9	13·6	*nil.*
Inside	—		—		0·95	0·38			
Percolation Bed Effluents.									
Bed A effluent—									
Outside	—	—	—	—	1·63	0·64	21·6	4·1	36·5
Inside	—		—		1·05	0·59			
Bed E effluent—									
Outside	51·5	4·0	—	—	1·46	—	19·7	—	—
Inside	42·5		—		0·98	—			
Bed No. 4 effluent—									
Outside	—	—	—	—	1·67	0·91	14·8	21·3	7·8
Inside	—		—		1·24	0·59			
Bed No. 5 effluent—									
Outside	—	—	—	—	2·30	1·05	9·3	13·8	5·7
Inside	—		—		1·91	0·80			

TABLE VII.

X Sewage and Effluents.

Nature of sample.	Dissolved solids.	Percentage of solid colloids.	Albuminoid ammonia.	Percentage of albuminous colloids.	Oxygen absorbed. 4 hrs.	Oxygen absorbed. 3 mins.	Percentage of colloids on 4 hrs.	Percentage of colloids on 3 mins.	Percentage of permanent colloids.
Settled crude sewage—									
Outside	89·0	7·9	0·73	11·5	22·74	11·01	5·8	5·1	6·4
Inside	76·0		0·58		20·26	9·95			
Settled precipitation tank effluent—									
Outside	133·0	5·1	1·49	23·6	32·54	17·86	3·0	0·25	7·3
Inside	120·0		0·92		30·40	17·77			
Ditto from 1st contact bed—									
Outside	121·0	1·7	—	—	17·23	11·30	4·7	4·2	5·6
Inside	117·0		—		15·69	10·39			
Ditto from 2nd contact bed—									
Outside	114·0	3·9	0·38	18·8	7·06	—	4·2	—	—
Inside	106·5		0·26		6·49	—			
X Sewage after Septic Treatment and Contact Beds.									
Settled septic liquor—									
Outside	106·5	5·4	1·25	6·4	19·47	12·58	4·8	2·6	9·0
Inside	95·5		1·10		17·70	11·95			
Ditto after 1st contact—									
Outside	98·0	5·4	—	—	12·32	7·00	6·6	*nil.*	16·7
Inside	88·0		—		10·80	7·00			
Ditto after 2nd contact—									
Outside	95·5	2·1	—	—	4·64	—	13·7	—	—
Inside	92·5		—		3·52	—			
Ditto after 3rd contact—									
Outside	96·0	1·9	0·31	26·5	2·40	1·14	16·5	14·0	18·9
Inside	92·5		0·18		1·72	0·86			

Note.—Chlorine in above samples over 50 parts per 100,000.
CNS. in septic liquor, 7·00 parts per 100,000.
CNS. in 3rd contact, 0·55 parts per 100,000.

Discussion.

Mr. C. G. Matthews understood that the liquor remained eight and a half hours in the septic tank; was that a matter of convenience, or was it the time that gave the best results?

Mr. O'Shaughnessy said it was a matter of convenience.

Mr. Matthews, continuing, asked whether, in the case of an effluent from bacteriological beds which required a further sedimentation, it would not be possible to make the bacteriological beds in such a way that filtration would be efficient enough to provide an effluent that did not require another sedimentation and separation.

Mr. J. T. Wood asked if the percentage of colloids was really per 100 grms. of sewage?

Mr. O'Shaughnessy: No. The percentage was on 100 grms. of the dissolved matter in the sewage.

Mr. Wood said the whole question of colloids was a very important one. The general impression was that there was no sharp difference between colloids and crystalloids except one of degree. Had Mr. O'Shaughnessy read a very important paper by Zsigmondy, who proposed a classifying test for colloids which depended on the action of the colloids on a solution of metallic gold (this J., 1902, 192)? Zsigmondy was still working on the subject.

Mr. O'Shaughnessy said that he had not tested it in that way.

Mr. S. F. Burford said that although the septic tank had not fulfilled the expectations held out—that it was a universal solvent—it certainly was a most useful preliminary treatment in that it produced a uniform liquor from a sewage varying in flow and character.

Mr. J. Golding asked whether the iron could in any way be dealt with. In Lincolnshire the drains were often blocked up with it. He was very much interested to hear about the application of gas lime.

Mr. J. O'Sullivan said that the authors had referred to the size of the material used in the septic tank. Was it coke?

Mr. O'Shaughnessy replied that it was so in some of the filter beds.

Mr. O'Sullivan, continuing, said that the amount of septic change must depend upon the surface area of the medium.

The Chairman (Mr. J. M. C. Paton) asked what amount of sediment, say per million gallons, was left finally to be dealt with? When bacteria beds first became the fashion, it was said there would be absolutely no sludge left to be dealt with, but now in many places the sludge question had become a very important one.

Mr. F. E. Lott asked if in cases of excessive amount of iron in the soil the colloidal matter in the effluent was mainly organic, and whether it was usually precipitated before it was discharged from the land drains. In connection with the silt tank, the sludge had been referred to as "working vigorously and without smell." Did that vigorous working continue on exposure, and was there still no smell, or did further oxidation produce a more objectionable smell?

Mr. O'Shaughnessy, in reply to Mr. C. G. Matthews, said that in the course of time even the best bacteria beds tended to become choked and useless, and had to be stopped and cleaned out, unless provision were made for self-cleansing. He was grateful to Mr. Wood for his reference to Zsigmondy's work; he would take advantage of it. While admitting that the septic tank provided a means of mixing the sewage and rendering the flow uniform, the amount of sludge which it was said the septic tank would destroy was at first altogether overstated. In reply to Mr. F. E. Lott, who asked if, in the case of excessive iron in some sub-soils, the colloid matter in the effluent was chiefly organic, it was almost completely retained in the soil, and the colloid matter which passed out from such a sub-soil contained but a trace of organic matter. In the case given, the organic matter was only 0·05 parts per 100,000. Mr. Golding had asked if this precipitate in the land effluent could be kept from choking drains. The colloid matter itself would not choke the drains, but there was choking from another cause. An effluent furnished an excellent pabulum for the growth of certain organisms, iron bacteria chiefly, which had not, to his knowledge, been elaborately investigated, but the cost of removing them was considerable. They could not be eliminated, and the only means of preventing the land drains from being completely choked on account of the growth of these organisms was to flush them out two or three times a week. Provision was made for flushing them by putting stops in the manhole, and allowing the excessive quantity of water, which in this case accumulated rapidly to head up. The suspended matter is afterwards screened out of the effluent. With regard to the size of the medium in the beds, the cost of experimenting on a large scale was so prohibitive that it had not been done exhaustively. It was not safe to dogmatise as to the best size of the medium, in the absence of more substantial evidence than was available at present. The amount of solid coming out of any particular bacteria bed varied greatly. It might be only a mere trace. The effluent, especially when beginning to use a bed, might be as clear as tap water. That was because the suspended matter, the colloidal matter chiefly, was being held up in the bed. A rough sort of equilibrium was established after some time. The suspended matter increased until it reached in some cases from 16 to 20 parts per 100,000. After that had passed through this separator tank, the suspended matter was less than two parts per 100,000.

Liverpool Section.

Meeting held at the University, on Wednesday, February 14, 1906.

MR. EUSTACE CAREY IN THE CHAIR.

THE VOLUME-EXPANSION OF PORTLAND CEMENT.

BY F. G. DONNAN AND J. T. BARKER.

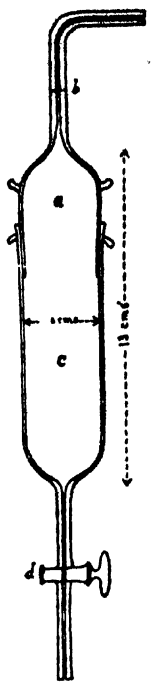
(*From the Muspratt Laboratory of Physical and Electro-Chemistry, University of Liverpool.*)

Introduction.—The examination of Portland cement for volume-stability or soundness involves two points, (*a*), the method of measuring the expansion, (*b*), the conditions to which the cement is subjected. With regard to the first point, most specifications for cement have, until quite recently, only required the crude "pat" test, which consists in observing the behaviour of a thin-edged pat of cement when exposed to a damp atmosphere at ordinary temperatures for varying periods of time (usually a week to 28 days). This still forms the German "normal" test.(1) More or less accurate methods of measuring the linear expansion of cylindrical blocks or slabs of cement have, however, been in existence for a long time. Writing in 1893, Le Chatelier(2) stated that Durand-Claye and Debray had for a long time employed a lever arrangement for measuring the expansion of long rods of cement. In the same place Le Chatelier describes his own arrangement of split-cylinder and lever-fork. This apparatus does not, however, measure linear expansions directly. For this purpose Bauschinger(3) has devised a somewhat elaborate apparatus, consisting essentially of a multiplying lever with compensating screw and divided circle. Quite recently, Martens(4) has described a much simpler apparatus in which the principle of multiplying lever is also employed. The Engineering Standards Committee(5) adopted in

1904 a slightly modified form of Le Chatelier's apparatus for employment in the British Standard Specification for Portland cement. They have also adopted Le Chatelier's method of allowing the cement to set for 24 hours in cold water, and then heating it in boiling water for six hours. This brings one to the second of the two points referred to at the beginning, namely, the method of treating the cement for the expansion test. With regard to this point, there has been, and doubtless still is, considerable diversity of opinion. Le Chatelier's method of heating the cement in boiling water for six hours was based on the results of a long experimental research on the nature and behaviour of hydraulic cements.(6) Like other chemical reactions, the hydration of lime and magnesia is greatly accelerated by rise of temperature. Any free lime or magnesia occurring in a badly manufactured cement only hydrates slowly at ordinary temperatures, owing to the high temperature to which it has been heated in the cement kilns. If this hydration occurs in the set cement or concrete, it will cause expansion (and sometimes even disintegration) of the solid mass, this expansion being due, not so much to any intrinsic increase of volume, as to the expansive force of crystallisation. The object, therefore, of the six hours' boiling is to ascertain the possible maximum of expansion due to these causes. The results obtained by Le Chatelier have been confirmed by the exhaustive experiments made by Tetmajer,(7) which indicate that the "accelerated" test (i.e., in boiling water) is necessary. It must be stated, however, that the Committee appointed by the Union of German Portland Cement Manufacturers arrived at a different conclusion.(8) According to their report, the ordinary pat test is sufficient. Besides the method of heating in boiling water (method of Le Chatelier and Michaëlis), there exist other accelerated tests which need not be enumerated here.(9)

The present investigation arose out of some experiments made to test the volume-stability of the Portland cement used in building the Muspratt Laboratory of Physical Chemistry of the University of Liverpool. For this purpose, the Le Chatelier apparatus was at first employed, but it seemed desirable to devise some more accurate and at the same time simple method of measuring the expansion produced. The idea naturally occurred that the most advantageous method would consist in measuring the total volume-expansion by some simple form of dilatometer. Having devised a suitable apparatus, some 20 different samples of English and Continental Portland cement were obtained from the manufacturers or their agents. These samples were all described as being fit and ready for use, and were not subjected to any preliminary process of aeration. The chief object in making these experiments was to ascertain the maximum volume-expansion exhibited by a large number of ordinarily used cements when exposed to boiling water, in the hope of obtaining thereby a standard test-value, which would apply to the majority of well manufactured cements. In certain cases, comparison tests were made with the Le Chatelier apparatus, in order to calibrate the latter by obtaining reduction-factors wherewith to convert its readings to true linear or volume-expansions. In all cases, duplicate bars of cement were allowed to remain in water at ordinary room temperature for considerable periods of time, in order to compare the hot and cold water tests.

Apparatus and method of measurement.—The volume-dilatometer employed is shown in Fig. 1. It is made entirely of glass, and consists of an upper portion, (*a*), to which is sealed the capillary tube, (*b*). By means of a well-ground joint, the upper part can be securely attached to the lower portion, (*c*), which consists of a cylindrical glass vessel, to the lower end of which is sealed the tube and small glass tap, (*d*). By employing a good vacuum-grease, such as the well-known mixture of vaseline, paraffin wax, and rubber, the joint between the upper and lower portions can be made perfectly air-tight. Owing to the porosity of the cement, it is necessary to use mercury as the dilatometric fluid. It might be possible to employ other liquids, such as dry mineral or vegetable oils, but no experiments have been made in that direction owing to the undoubted advantages possessed by mercury.



The apparatus is used as a weight-dilatometer. The capillary tube, (*b*), is attached by thick-walled pressure-tubing to a water-pump and the apparatus exhausted. The tap, (*d*), is then opened, and mercury allowed to fill the apparatus to a mark made on the vertical stem of the upper capillary tube. In order to avoid the changes of volume of the glass vessel due to considerable differences of pressure, the mercury is first allowed to rise to a point somewhat above the fixed mark, the tap, (*d*), is then closed, and air admitted to the upper capillary. It is then easy to run out mercury until it falls to the mark. The mercury in the stem of the lower tube below the tap having been removed,(10) the apparatus is disconnected from the pump, and the mercury filling it from the tap, (*d*), to the mark is run out into a porcelain dish and weighed. In this way the inner volume of the apparatus, expressed as a weight of mercury (about 1000 grms.), is obtained. The two halves of the apparatus are now disconnected, and the cylindrical test-bar of cement inserted into the lower half. The cylinder of cement was prepared by working the cement on a glazed fireclay slab with just enough water to form a plastic mass. The mixture was worked with a trowel for several minutes, and then introduced into a thin glass test-tube of the proper size (about 1 in. diameter), care being taken to remove air-bubbles and to obtain a compact mass. Although the different masses were not tested specially for equal plasticity, it was found that the amount of water could be gauged so accurately, that in different experiments with the same cement the amounts of water used did not differ by more than 1 per cent. The cement having been allowed to set hard for 24 hours, the thin glass walls of the tube were chipped off and the cement cylinder cut to the size required. The volume of the bar was then ascertained by inserting in the apparatus as described, connecting with the pump, exhausting, and then admitting mercury slowly through the tap, (*d*). During this process bubbles of air appear at the surface of the bar. These must be removed as much as possible by tapping. It was found best to admit the mercury until it had about half filled the upper portion of the apparatus, to then close the tap, (*d*), and exhaust again.

fairly completely. On now admitting air from the top any remaining air is driven into the pores of the cement. Sufficient suction is then finally applied to bring the mercury to the mark on the capillary, as described previously. The mercury in the apparatus from the tap, (*d*), to the mark on the capillary tube is then run out and weighed. The difference between this and the previous weight gives the volume of the bar expressed as a mass of mercury (usually about 300 grms.). Duplicate measurements of volume made in this way agreed within less than 0·1 per cent. The bars whose initial volumes had been ascertained were then heated in boiling water for successive periods of three to four hours, the volume of each bar being measured in the dilatometer after each period of heating. This was continued until no further increase of volume occurred. The period of heating required for complete expansion varied with different cements from 3 to 16 hours. The bars dry very quickly and can be inserted into the dilatometer as soon as they are cold. The diameter of the test pieces was such that they fitted easily into the lower portion of the dilatometer, but could not be pushed up by the mercury into the upper part.

3. *Experimental results.*—The following table gives the results of the expansion-measurements made in boiling water. In some cases comparison-tests were made with the Le Chatelier apparatus. The results of these are given in column (3). Column (2) gives the percentage of water by weight used in making the test cylinders. Column (4) gives the volume-expansion measured by the dilatometer expressed as a percentage. Column (5) the linear expansions obtained therefrom by dividing by three. In column (6) is given the number of hours' boiling required to produce maximum volume-expansion —*i.e.*, the expansion as given in column (4). In most cases duplicate determinations of volume-expansion were made. These determinations together with the mean values are given in column (4):—

TABLE I.—*Expansion of Portland Cement.*

(*Boiling Water.*)

Refce. No. of cement.	Water.	Expansion in Le Chatelier apparatus.	Volume expansion.	Linear expansion.	No. of hours boiling.
	per cent.	mm.	per cent.	per cent.	
1	26·0	14·5	5·64 5·93 } 5·78	1·92	7½
2	28·0	35·6	14·5	4·83	8
2	28·0	—	14·0	4·87	10½
3	25·0	—	7·34	2·45	7½
3	24·3	16·4	3·92 3·98 } 3·96	1·32	7½
4	29·2	—	2·37	0·79	16
4	25·2	—	0·44 0·57 } 0·50	0·17	12
5	24·2	—	1·00 1·17 } 1·08	0·36	15
5	27·0	(6·5)	0·47 0·45 } 0·46	0·15	7
6	27·2	—	1·05 0·90 } 0·97	0·32	11
7	27·0	—	0·93 0·58 } 0·75	0·25	2½
8	34·3	—	0·60 0·63 } 0·61	0·20	8
9	32·0	—	0·55	0·18	13
10	26·3	—	0·44	0·15	17½
11	25·0	(4·6)	0·34	0·11	19
12	26·0	5·5	0·43 0·34 } 0·38	0·13	7½
13	24·0	4·6	0·26 0·43 } 0·34	0·11	4
14	26·4	(4·6)	0·30 0·38 } 0·34	0·11	8
15	24·0	3·0	0·22 0·23 } 0·225	0·075	12
15	28·3	(2·6)	0·18 0·19 } 0·18	0·06	8
17	27·7	(2·2)	0·14	0·05	3
17	24·7	(1·74)	0·17 0·07 } 0·12	0·04	3
18	29·3	2·0	0·026 0·076 } 0·05	0·02	14
19	24·0	3·5	0·28 0·16 } 0·22	0·07	18

The numbers in brackets in column (3) were not obtained by direct measurement in the Le Chatelier apparatus, but were calculated as explained later on. The foregoing table exhibits the following noteworthy points:—

(*a*) Out of about 20 different cements tested, only five gave a volume-expansion of over 1 per cent.

(*b*) In four cases varying amounts of water were used in making the test-bars. In one case, (No. 4), the expansion was increased four and a half-fold by an increase in the water of 4 per cent. In another case, (No. 5), the expansion was diminished by one-half by an increase in the water of 3 per cent.

(*c*) In the case of No. 3, an interval of four days, during which the cement was standing in a paper bag exposed to the air of the laboratory, reduced the volume-expansion from 7·34 per cent. to 3·96 per cent. This result shows the great effect of even a comparatively short exposure to a damp atmosphere.

In most cases a third test-piece was made from the same mixture of cement and water, and after 24 hours' setting was immersed in water at ordinary room temperature for a considerable period of time, after which the increase in volume was determined by the dilatometer. The results are given in Table II.:—

TABLE II.—*Expansion of Portland Cement.*

(*Cold Water.*)

Refce. No. of cement.	Water.	Volume expansion.	Linear expansion.	Days in water.
	Per cent.	Per cent.	Per cent.	
A*	28·0	0·66	0·22	28
1	26·0	0·00	0·00	20
2	28·0	0·55	0·18	20
3	25·0	0·18	0·06	17
5	24·2	0·61	0·20	33
5	27·0	0·45	0·15	33
6	27·2	0·00	0·00	27
7	27·0	0·70	0·23	27
8	34·3	0·06	0·02	36
10	26·3	0·26	0·09	26
11	25·0	0·40	0·13	25
12	26·0	0·05	0·02	23
13	23·3	0·04	0·01	19
14	26·4	0·37	0·12	34
15	24·0	0·47	0·16	26
15	28·3	0·46	0·15	26
17	27·7	0·17	0·06	31
17	24·7	0·34	0·11	31
18	29·3	0·19	0·06	23

*In the boiling-water test this sample of cement completely disintegrated.

In connection with Table II. the following points may be noticed:—

(*a*) The first four samples of cement, which showed very large expansions when exposed to boiling water, only exhibited small expansions in cold water during the period of testing.

(*b*) The expansions in all cases are comparatively small.

(*c*) There does not seem to be any definite relationship between the two series of expansions. It may be noted, however, that with the exception of those cements which showed large expansions by the boiling water test, the expansions obtained in both cases are of the same order of magnitude.

In Table I. are given several measurements made on the same samples of gauged cement both with the Le Chatelier apparatus and the dilatometer. The following table shows the results of these comparisons:—

TABLE III.—*Comparison of Le Chatelier Apparatus and Dilatometer.*

Refce. No. of cement.	Linear expansions from dilatometer. (A)	Displacement of ends of arms of Le Chatelier's apparatus. (B)	A / B
	Per cent.	mm.	
15	0·075	3·0	0·025
19	0·073	3·5	0·021
13	0·113	4·6	0·025
12	0·127	5·4	0·023
3	1·32	16·4	0·081
1	1·927	14·5	0·133
2	4·83	35·6	0·136

It will be seen from this table that for small expansions the displacement of the arms of the Le Chatelier fork is proportional to the linear expansion, and that the percentage linear expansion can be calculated from the reading of the Le Chatelier apparatus by multiplying by 0·023. This proportionality ceases to hold when the expansions become greater, but it would seem that for expansions greater than about 2 per cent. linear, the readings of the Le Chatelier apparatus again become proportional to the linear expansion, the necessary multiplying factor now being about 0·134. The experiments recorded in Table III. are not sufficiently numerous, however, to enable one to construct a complete calibration-curve for the Le Chatelier apparatus.

4. *Conclusions.*—Judging from the results recorded in Table I., it may be said that a well-manufactured cement should not exhibit a greater maximum volume-expansion than 1 per cent. when exposed to the boiling water test. This applies to the cement as delivered for use, and to test-bars made as described in this paper. The allowance of 1 per cent. would seem to be amply sufficient, since the majority of the cements examined showed a smaller, and in many cases a very much smaller, expansion.

The allowance of 12 mm. displacement (in the Le Chatelier apparatus) permitted by the British Standard Specification for cement aerated for 24 hours, corresponds pretty closely to an expansion of 1 per cent. by volume. The allowance of 6 mm. (after seven days' aeration) corresponds to 0·144 per cent. volume-expansion.

These relationships may prove of use to those who wish to employ the dilatometer described in this paper in conjunction with the limits imposed by the British Standard Specification. In that case, of course, the bars need not be boiled for a longer period than the six hours mentioned in the Specification. The dilatometer described in this paper may be obtained from Messrs. Orme and Co., of Manchester and Liverpool (212, Mount Pleasant).

In conclusion, we have much pleasure in thanking Mr. W. Riding, Clerk of Works to Messrs. Willink and Thicknesse, for much assistance in the correct gauging of the cements.

(1) *Vide* "Der Portland Cement" (Büsing and Schumann), Berlin, 1905.

(2) Annales des Mines, 4, 381, 1893.

(3) Mitteilung aus dem mech.-techn. Laboratorium der techn. Hochschule in München, 8, 13.

(4) Mitteilungen aus dem Königl. Materialprüfungsamt, Berlin, 1905, p. 203.

(5) See their report (Crosby, Lockwood, and Son, London, December, 1904).

(6) *Vide* Annales des Mines, 4, 252 and 367, 1893. Also, Thèse, Paris, 1887.

(7) Methoden und Resultate der Prüfung der hydraulischen Bindemittel, 1893.

(8) See Gary's report. Mitteilungen aus dem Königl. techn. Versuchsanstalten zu Berlin, Ergänzungsheft I., 1899.

(9) For an account of these, see the article by Schoch, in Lunge's "Chemisch technische Untersuchungsmethoden," vol. I., p. 749.

(10) If the stem is narrow, it is better to include this mercury in the amount weighed.

London Section.

Meeting held at Burlington House, on Monday, June 11th, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

THE DETERMINATION OF INDIGOTIN IN COMMERCIAL INDIGO AND IN INDIGO-YIELDING PLANTS.

BY CYRIL BERGTHEIL AND RICHARD VICTOR BRIGGS.

The determination of indigotin in commercial indigo is a matter of great importance to the dyeing trade, and many methods have been described for its accomplishment. An excellent summary and bibliography of the subject may be found in a paper by J. Grossmann (this J., 1905, **24**, 308). Recent criticism by Bloxam (Trans. Chem. Soc., 1905, **87**, 974) has thrown doubt on all the methods hitherto proposed, and it has become necessary, for the purpose of the research work now in progress in India on the cultivation and manufacture of indigo, to re-examine the whole question.

As summarised by Grossmann (*loc. cit.*) the analytical methods hitherto proposed all fall under one of the following heads:—

I. The extraction of indigotin by solvents, and weighing the extracted material after more or less purification.

II. Sulphonation of the indigo, and volumetric determination of the indigotin by an oxidising agent.

III. Sulphonation of the indigo, and volumetric determination of the indigotin by a reducing agent.

IV. Reduction of the indigo, and separation of the indigotin by re-oxidation.

V. Sublimation of the indigotin.

To these should be added a method proposed by Möhlau and Zimmermann (Zeits. Farb. Text. Chem., 1903, **10**, 189) in which the indigo is acted upon by a mixture of acetic and sulphuric acids, whereby the indigotin is converted into a sulphate which remains dissolved in the acetic acid, and is subsequently hydrolysed by pouring the solution into water, and the precipitated indigotin weighed as such.

Our experience has led us to agree with the opinions expressed by Grossmann on the methods coming under headings I., IV., and V. In our attempts to obtain the impurities occurring in natural indigo free from indigotin, we had occasion to test the extractive action of all the solvents hitherto proposed, and in no case were we able to entirely remove the indigotin from the material, or to obtain the indigotin from the solvent direct in a pure condition. Analytical methods founded on this principle are, therefore, valueless. The same applies to methods coming under headings IV. and V.; in neither case can the indigotin be obtained direct in a pure form. We have, therefore, confined our attention to methods depending on the oxidation or reduction of sulphonated indigos, and the acetic-sulphuric acid method of Möhlau and Zimmermann.

The preparation of pure indigotin.—The fundamental objection raised by Bloxam (*loc. cit.*) to all the methods of indigotin estimation hitherto described is that there is no evidence that they have been founded upon application of the methods to pure indigotin as a standard: a fact which he suggests has been due to the difficulty of obtaining the substance in a pure condition. We have not experienced this difficulty. We have relied, throughout the work to be described, on the estimation of the nitrogen content as a criterion of purity of the indigotin used as our standard. The existence of an isomeric substance as an impurity has, therefore, not been totally excluded, but is rendered exceedingly improbable by the fact that analytical results, agreeing substantially

with the indigotin content indicated by estimation of the nitrogen, have been obtained with all the methods used.

Average Bengal indigos containing no indirubin were used as raw material for the preparation of pure indigotin, and were preliminarily purified in either of the two following ways:—

1. The finely powdered indigo was intimately mixed with plaster of Paris and water, and spread out in thin layers on tin sheets. When dry, gentle heat was applied until the indigotin sublimed on to the surface in the form of a velvety layer of crystals. Two nitrogen estimations of crystals obtained in this way gave N = 10·49 and 10·448 per cent. (mean value 10·469), corresponding with an indigotin content of 97·88 per cent.

2. The finely powdered indigo was suspended in lime water, and reduced with sodium hyposulphite, the solution of indigo-white re-oxidised by agitation with air, and the precipitated indigotin filtered off and washed; this was then boiled with hydrochloric acid and again filtered off and thoroughly washed. The substance thus obtained showed on analysis by the permanganate method (next column) a content of 93 per cent. indigotin.

Approximately pure indigotin obtained by either of these methods was further purified by dissolving the substance in a mixture of 100 parts glacial acetic acid and 4 parts sulphuric acid, and hydrolysing the indigotin monosulphate formed by water in the manner described by Möhlau and Zimmermann (*loc. cit.*); the precipitated indigotin was thoroughly washed and dried. Five nitrogen estimations of the product obtained in this way gave as a mean value N = 10·615, corresponding with 99·33 per cent. indigotin.

Attempts to isolate the impurities occurring in natural indigo.—It appeared to us that a much more real difficulty in checking the accuracy of the various methods of indigo analysis than that of obtaining pure indigotin lay in the direction of obtaining the naturally occurring impurities of commercial indigo free from indigotin, so that their effect on the methods could be directly traced. The ideal way of doing this would be to obtain a selective solvent for indigotin, so that the whole of the substance could be extracted from commercial indigo, and the impurities be left intact. A large number of indigotin solvents, including naphthalene, nitrobenzene, aniline, and phenol, were experimented with to this end, but in no case could the whole of the indigotin be extracted, whilst substances other than indigotin were invariably removed by the solvent. This method had, therefore, to be abandoned.

A second attempt to obtain the impurities free from indigotin was made by adopting the principle involved in the method of Möhlau and Zimmermann for the analysis of indigo, but it failed. Some other attempts were made, but were equally unsuccessful.

Finding this an apparently impossible task when starting from finished indigo, we had recourse to the indigo plant as a source of the impurities. Indigo is manufactured by steeping the plant in water for several hours, and oxidising the infusion with air, whereby the dye separates out, and settles to the bottom of the vessel in which the operation is conducted; the supernatant liquid is then run off and the indigo collected. This supernatant liquid contains a great deal of matter in solution, and it seemed probable that if these dissolved substances could be separated from the waste water, they would be of a very similar nature to those precipitated with the indigotin, and eventually constituting the impurities we were desirous of isolating. This was easily accomplished by evaporating the liquid to small bulk, and the brown bodies precipitated were found, on sulphonation and testing in the manner previously described, to behave exactly like the impurities of finished indigo. They were used as impurities in testing some of the methods of analysis to be described, but the idea only occurred to us late in the manufacturing season, and sufficient material could not be obtained to extend the principle to all the methods investigated; we hope to do so during the next season. Meanwhile we have had recourse to the use of obviously artificial impurities as diluents for pure indigotin. Starch and vegetable gluten have been selected as being of approximately the same type of bodies as those occurring in natural indigo, and have been used in the particular manner which the method under investigation demanded.

Indirubin.—The occurrence of indirubin as a constituent of natural indigo has been disputed by Bloxam (*loc. cit.*); but we have not been able to confirm his observations. On the contrary, the investigation into the nature of the red bodies existing in some indigos, at present in progress in this laboratory, has not only shown that indirubin is a very common constituent of natural indigo, but also that its formation from the indigo plant can be very easily explained. Being isomeric with indigotin, it behaves in a sufficiently similar manner towards reagents to profoundly affect methods for the estimation of that substance, and we have therefore thought it of value to trace its effect on the processes we have examined separately from that of other impurities. Synthetic indirubin showing a nitrogen content of 10·06 per cent. (corresponding with 94·275 per cent. indirubin) has been used for this purpose, sufficient natural indirubin not being available.

Methods depending on the oxidation of sulphonated indigos.—Of these methods only those in which potassium permanganate is used as an oxidising agent are reliable, and only these are at all generally used.

Rawson's method.—A full description of the permanganate method as worked out by Rawson will be found in that author's papers (J. Soc. Dyers and Colourists, 1885, **1**, 74; this J., 1899, **18**, 251) and in "A Dictionary of Dyes and Mordants," by Rawson, Gardner, and Laycock. Briefly, the method consists in sulphonating the indigo by heating with pure sulphuric acid at 70°—80° for an hour, diluting, purifying the solution of indigotindisulphonic acid obtained by addition of barium chloride, and titrating a known volume of the solution, diluted with a large column of water, with approximately N/50 permanganate until all the blue colour disappears.

The method is open to criticism from three points of view:—(1) The reaction involved may not be a quantitative one; (2) the method of purifying the solution may lead to the precipitation of indigotin; (3) the impurities present may not be entirely removed by the precipitant and may affect the permanganate. We have investigated the method from each of these points of view.

Bloxam (*loc. cit.*) lays great stress upon the objection, first raised by him, that the reaction is not a quantitative one, and points out that, even if pure indigotin be dealt with, and the conditions laid down by Rawson be strictly adhered to, the reaction is a progressive one and no definite end point can be arrived at in titration. Our experience of this method has extended over a good many years, and we have never found this objection to hold; with a little practice the end point is absolutely sharp and distinct even when an impure indigo is used, whilst with pure indigotin no previous practice should be necessary. The reaction is admittedly a progressive one, and it is therefore necessary to conduct the titration rapidly and to take the disappearance of the blue colour as an indication of its completion: for this reason Bloxam's experiments on the subject are irrelevant. The exact reaction which is measured by the process is a matter for future investigation; it is clear that it is not represented by the equation given by Rawson as expressing the interaction of concentrated solutions of permanganate and indigotindisulphonic acid, since, as Rawson himself points out, the equation does not indicate the proportion found to exist between these two bodies when they react in dilute solution; but the fact that the reaction measured is a quantitative one, and that the relation between the reacting substances is accurately expressed by that found by Rawson (2·373 indigotin = 1 permanganate) is demonstrated by the following results obtained by an application of the method to pure indigotin. No barium chloride or other purifying agent was used in these tests, since no impurities were present.

Nitrogen per cent. in substance.	Indigotin per cent., calculated from nitrogen content.	Grms. of substance sulphonated, solution made up to 500 c.c.	Volume of solution titrated in c.c.	Titre of permanganate.	Volume of permanganate required in c.c.	Indigotin per cent. in substance, calculated from permanganate using Rawson's factor.
10·59	99·1	0·3	25	N/49·45	10·05	99·39
10·59	99·1	0·3	25	N/49·45	10·00	99·9
10·59	99·1	0·3	25	N/49·45	10·05	99·39
10·59	99·1	0·5	25	N/49·45	16·7	99·1
10·62	99·4	0·5	25	N/50·20	16·5	99·39

Method of sulphonation.—It is clear from the above table that Rawson's method of sulphonation and titration leads to correct results. The sulphonating process is, however, somewhat troublesome, and we have investigated a more rapid and convenient method of conducting this operation suggested by Dr. Schulten, of Calcutta, and used in his laboratory. The method differs from that of Rawson, in that small glass-stoppered bottles, which can be easily and rapidly shaken, are used instead of open crucibles, which require frequent stirring; and the sulphonation is conducted at the temperature of a briskly boiling water-bath for a quarter of an hour, instead of at 70°—80° for an hour. Pure indigotin, sulphonated in this way, has been found to give correct analytical results when diluted and titrated in accordance with Rawson's recommendations. Some results obtained by its application to commercial indigos of varying qualities are given later (page 734).

Method of purifying the solution of indigotindisulphonic acid.—In applying the permanganate method to the analysis of commercial indigos it is always necessary to employ some method of removing the undissolved impurities which remain in suspension when the solution of indigotindisulphonic acid in sulphuric acid is diluted with water; otherwise the end point of the titration is masked and the result obtained too high. Rawson's methods of filtering and of salting out the sodium salt of the acid, have now been entirely replaced by the same author's plan of producing a precipitate of barium sulphate in the solution by the addition of barium chloride, whereby the impurities are carried down; of this method Rawson states, "Tests made with pure indigotin show that no colouring matter is precipitated by the barium chloride" ("Dictionary of Dyes and Mordants"). Owing to the insoluble nature of the barium salt of indigotindisulphonic acid this seemed antecedently improbable, though the amount of the salt precipitated might conceivably be too small to affect the analysis due to the greater insolubility of barium sulphate. The following experiments were carried out on this point:

Four samples of a pure natural indigotin, showing by estimation of their nitrogen a content of 99·4 per cent. indigotin, were sulphonated. The solutions were made up to 500 c.c., without the addition of barium chloride, and 25 c.c. titrated with permanganate; 10 c.c. of a 20 per cent. solution of barium chloride were then added to each of the solutions, the volumes made up again to 500 c.c., and after thoroughly shaking and allowing the solutions to remain for the precipitates to settle, 25 c.c. were again titrated, the results obtained being calculated back to the volume of the original solution (*i.e.*, multiplied by 20/19). This process was repeated a second time, making the solution up to 500 c.c., and again calculating back from the titration of 25 c.c. to the volume of the first solution. The results obtained were identical in the case of each series of experiments, and were as follows:—

	Percentage content of indigotin.
Without addition of barium chloride	99·39
With addition of 10 c.c. of 20 per cent. barium chloride solution	95·78
With addition of 20 c.c. of 20 per cent. barium chloride solution	92·77

There thus appears to be a distinct precipitation of indigotin and consequent drop in the amount estimated. This was confirmed with two samples of synthetic indigo made by the Badische Anilin und Soda Fabrik, in which cases the effect of further addition of barium chloride was tried and the following results obtained:—

Percentage content of indigotin.

	B.A.S.F. "Indigo Pure" 1898.	B.A.S.F. "Indigo Pure" 1905.
Without addition of barium chloride	98·1	93·7
With addition of 10 c.c. of of 20 per cent. barium chloride solution	96·8	92·1
With addition of 20 c.c. of 20 per cent. barium chloride solution	95·2	90·3
With addition of 30 c.c. of 20 per cent. barium chloride solution	93·3	88·1

It is clear therefore that an appreciable amount of indigotin is precipitated by the addition of the quantity of barium chloride recommended by Rawson, and that the precipitation is progressive with successive additions of the precipitant.

Grossmann's method.—An alternative method of removing the suspended impurities from the diluted solution of indigotindisulphonic acid has been proposed by Grossmann (this J., 1905, **24**, 308). This consists in neutralising the solution with pure calcium carbonate, whereby a heavy precipitate of calcium sulphate is formed which carries down all suspended impurities, whilst, according to the author of the method, the neutralisation of the solution leads to the precipitation of other impurities which would otherwise remain dissolved in the dilute acid. In this latter respect, the author claims that his method of purification has advantages over that of Rawson.

This method seemed to us open to the same objection as we had found to exist when barium chloride was used as a precipitant: that indigotin would inevitably be carried down as the disulphonic acid salt of the base of the substance used for precipitation, in this case calcium. On applying the method to a specimen of pure natural indigotin, showing by estimation of its nitrogen and by titration with permanganate without addition of a precipitant, a content of 99·35 per cent. indigotin, the result indicated a content of only 96·0 per cent.; showing that 3·35 per cent. of the indigotin present had been carried down by the calcium carbonate.

To confirm this explanation of the low result obtained, the following experiments were carried out:—1 grm. of each of three different indigos of high purity was sulphonated and the solutions made up to 1 litre; five portions of 100 c.c. each were then withdrawn from each of these solutions and varying quantities of calcium carbonate added to each, after which they were made up to 500 c.c., and the precipitates having been allowed to settle, 249 c.c. titrated with permanganate (1 c.c. being allowed for the bulk of the precipitate, *vide* Grossmann). The remainder of these solutions were then made up again to 500 c.c. in each case, well shaken, and, after allowing the precipitates to settle, 249 c.c. were again withdrawn for titration. The results were calculated back to the weight of the indigo originally taken, and the following results obtained:—

Amount of calcium carbonate added.	Indigo A (natural) containing 96·96 per cent. indigotin.		Indigo B (synthetic) containing 98·1 per cent. indigotin.		Indigo C (synthetic) containing 99·1 per cent. indigotin.	
	1st titration.	2nd titration.	1st titration.	2nd titration.	1st titration.	2nd titration.
4 grms. (solution acid).....	96·96	96·96	97·8	98·1	95·4	98·1
4·5 grms. (solution acid).....	95·75	96·65	96·6	97·2	92·7	99·3
5 grms. (solution slightly acid)....	94·53	97·26	95·7	98·4	91·8	100·2
5·5 grms. (solution neutral).....	92·71	97·86	95·7	98·4	92·4	99·0
6 grms. (solution neutral).....	93·0	97·5	95·7	98·4	92·4	100·2

These results clearly indicate that indigotin is carried down by the calcium carbonate added and that the action is progressive with successive additions of the precipitant up to the point of neutrality. This is shown not only by the falling off in the amount of indigotin estimated in successive experiments in the first series of titrations, but also by the corresponding gradual increase in the amount estimated in the second series, this no doubt being due to the redissolution of the precipitated calcium indigotindisulphonate on addition of more water. In this way the results obtained considerably exceed the truth in some instances in the second series of titrations. This method of purifying the solution of indigotindisulphonic acid is therefore liable to lead to very erroneous results when applied to high grade indigos, but the error is not so large as that inherent in the barium chloride method, due to the solubility of the calcium salt being greater than that of the barium salt, and it will be seen in the table on page 734 that when applied to indigos of average commercial purity it is very small indeed.

Precipitation of impurities by barium sulphate.—We have found that if a precipitate of barium sulphate is freshly formed out of contact with the solution of indigotindisulphonic acid, and added to the latter as such, the precipitation of indigotin does not take place, and, by thoroughly shaking the barium sulphate in the solution, it is as efficiently purified as by either of the methods previously described.

In the following experiments 10 c.c. of a 20 per cent. solution of barium chloride were placed in the 500 c.c. flask and barium sulphate precipitated by addition of an excess of sulphuric acid before the addition of the solution of indigotindisulphonic acid. The solution was then made up to volume, well shaken, and the precipitate allowed to settle, and 25 c.c. titrated with permanganate as in the previous experiments.

Percentage content of indigotin.

	Natural indigotin.	B.A.S.F. "indigo pure," 1905.
Without addition of barium chloride	99·5	93·7
With addition of barium sulphate precipitated from 10 c.c. of 20 per cent. barium chloride solution	99·7	93·91

A large number of commercial indigos were analysed by titration with permanganate to compare this method of purifying the solution of the sulphonic acid with that of Rawson. The following are a few of the results obtained :—

Percentage content of indigotin.

With addition of 10 c.c of 20 per cent. barium chloride solution (Rawson).	With addition of barium sulphate precipitated from 10 c.c. of 20 per cent. barium chloride solution.
73·9	75·11
71·0	73·35
69·24	69·82
58·68	60·70
53·1	55·2

Thus a higher result is obtained in every case by precipitating the barium sulphate before the addition of the indigotindisulphonic acid solution. This was found to be true of every indigo analysed. The higher results could not be accounted for by impurities remaining in suspension, since portions of the solutions were filtered simultaneously with the performance of the titrations, and no traces of impurity were found in suspension. The end point in titration was perfectly sharp and clear, whilst the fact that higher results were obtained with this method when dealing with pure indigotin confirmed the explanation that they were due to the precipitation of indigotin when Rawson's method of purification was used.

We have therefore adopted the barium sulphate method of purification, and have used it in the following experiments on the influence of dissolved impurities on the permanganate method.

Effect of dissolved impurities.—In titrating a solution of a sulphonated commercial indigo, purified by either of the above-described methods with permanganate, a very much darker end point is obtained than if a pure indigotin is dealt with, showing that certain impurities are left in solution in the dilute acid, and are therefore not carried down by precipitants. It was with a view to tracing the effect of these bodies that the attempts, previously described, to obtain the natural impurities free from indigotin were made. It has been shown that these attempts were unsuccessful, but that other bodies very closely resembling them were obtained by evaporation of the waste water from indigo manufacture. In the following experiments a solution of such impurities was made by sulphonating, diluting, and purifying as previously described, under the identical conditions used for indigo. Three different specimens of impurities, derived from three different samples of waste water, were employed, and in each case a known weight was taken, and the solution made up to known volume. A solution of "B.A.S.F. Indigo pure" containing 98·4 per cent. indigotin was made in the same manner but without purification, and known volumes of this solution were mixed with known volumes of each of the solutions of impurities in such proportions as together represented indigos of various degrees of purity. The mixed solutions were then titrated with permanganate, and the following results obtained :—

Percentage content of indigotin in mixture.

By calculation.	By experiment (Impurities A.)	By experiment (Impurities B).	By experiment (Impurities C).	Average. Percentage error.
73·8	74·7	74·4	73·9	0·5
61·5	62·4	62·4	62·4	0·9
49·2	50·4	50·4	50·3	1·16
24·6	27·0	27·0	26·96	2·39

The error is thus seen to be progressive with decreasing purity of the indigo, amounting, in the case of an indigo of average commercial purity (60 per cent.), to about 1 per cent.

To confirm these results, a mixture of equal weights of starch and vegetable gluten was used as impurity, and the experiments carried out exactly as before. The following figures were obtained :—

Percentage content of indigotin in mixture.

By calculation.	By experiment.	Average percentage error.
74·25	74·4	0·15
49·50	49·8	0·3
24·75	25·05	0·3

Here again the error is found to increase with decreasing purity, but it is considerably smaller than in the previous set of experiments for indigo of like purity. The end points in titration were also considerably lighter and brighter than in dealing with natural indigos of the same degree of purity. Experimental facts obtained indicate that starch and gluten do not provide impurities of a type truly representative of those of natural indigo, but the results are worthy of record as showing how little effect such bodies have upon the method of analysis.

Effect of indirubin.—A solution of sulphonated indirubin was made exactly as described for the solution of the impurities dealt with in the preceding paragraph. Volumes of this solution were then mixed with volumes of a solution of pure natural indigotin so as to represent indigos of known indirubin content and titrated as before. The following results were obtained :—

Percentage content of indigotin in mixture.

By calculation.	By experiment.	Percentage error due to indirubin.
96·5	97·62	1·12
94·0	94·97	0·97
89·0	91·62	2·62

Thus a very small proportion of indirubin affects the results considerably, but concordant results within the limits of accuracy shown in the table can be obtained with practice by conducting the titration until all the blue colour is destroyed.

Methods depending on reduction of sulphonated indigo.—The principle underlying these methods is the quantitative reduction of indigotindisulphonic acid to the corresponding leuco compound by titration with a reducing agent until all the blue colour is destroyed. It is therefore necessary to conduct the operations out of contact with air so that the apparatus required is somewhat complicated.

Hyposulphite method.—Sodium hyposulphite has been most commonly used as a reducing agent, and a full description of a method involving its use will be found in "A Dictionary of Dyes and Mordants," by Rawson, Gardner, and Laycock. We have found the method to give correct results when applied to pure indigotin, but the method of standardisation of the hyposulphite with ammoniacal copper sulphate is troublesome: the solution of hyposulphite is exceedingly unstable, and it is necessary to carefully expel all air from the solution to be titrated, and to cool it thoroughly out of contact with air before titration, if correct results are to be obtained. The following experiments were carried out to trace the effect of dissolved impurities on the method. The substances derived from waste water in indigo manufacture were used as impurities, and the solutions made up for titration in exactly the same way as previously described in testing their effect on the permanganate method. The following results were obtained :—

Percentage content of indigotin in mixture.

By calculation.	By experiment.	Percentage error.
74·475	75·95	1·475
49·65	51·26	1·61
24·825	27·26	2·436

The end points in titration were not very clear, and the error is no doubt to some extent due to the uncertainty of determining the exact completion of the reaction. This was also found to be the case in dealing with ordinary commercial indigos, but fairly accurate results were obtained by the application of Grossmann's method of purification to the solutions before titrating with hyposulphite (see table, page 734).

Effect of indirubin.—It is stated in "A Dictionary of Dyes and Mordants" (*loc. cit.*) that the hyposulphite method does not estimate indirubin in the presence of indigotin. With a view to determining the effect of this substance on the determination of indigotin, a similar series of experiments to those described for tracing the effect of indirubin on the permanganate method was carried out, and the following results obtained :—

Percentage of indigotin in mixture.

By calculation.	By experiment.	Percentage error.
96·5	99	2·5
94·0	99	5·0
89·0	99	10·0

The error due to indirubin is thus in every case equal to the amount of that substance added. The end points in titration were perfectly sharp and the solutions obtained at the conclusion of the operation of a brownish-yellow colour exactly like that obtained when pure indigotin is estimated. It is evident, therefore, that the method determines the two constituents simultaneously.

To confirm this the method was applied to a specimen of pure indirubin (N = 10·06 per cent., corresponding to 94·275 per cent. indirubin), and was found to show a content of 94·5 per cent. indirubin, coinciding very nearly with the truth.

Titanous chloride method.—This method has recently been described by Knecht (J. Soc. Dyers and Colourists, 1905, 21, 292), and depends upon precisely the same reaction as the hyposulphite method. It has the advantages over the latter method, however, that the solution of the reagent is more stable, the standardisation is more easily accomplished, the end point in titration (using Grossmann's method of purifying the sulphonic acid solution) is sharper, and the solution may be titrated warm without any ill-effect. The method gives correct results with pure indigotin, but, as is pointed out by its author, no clear end point in titration can be obtained with an impure indigo unless the solution to be titrated is purified by Grossmann's method. The results obtained are therefore subject to the same errors as we have show to be inherent in this means of purification, but these are small when indigos of average quality are dealt with (see table, page 734). The effect of starch and gluten added as impurities to pure indigotin is shown in the following table :—

Percentage content of indigotin in mixture.

By calculation.	By experiment.	Percentage error.
74·475	74·66	0·185
49·65	49·7	0·05
24·825	24·88	0·055

The error introduced by these impurities is thus very slight.

We have confirmed the author's statement that this method determines indirubin together with indigotin,

having obtained by its use a precisely similar set of figures to those above showing the effect of indirubin on the hyposulphite method. Indirubin is also correctly estimated alone.

Acetic-sulphuric acid method.—This method is founded on the formation of the monosulphate of indigotin in glacial acetic acid solution, its hydrolysis by pouring the solution into water, and weighing of the precipitated indigotin as such. The method of formation of the monosulphate was first described by Binz and Kufferath (Annalen, 1902, **325**, 196), and its application as a means of analysis by Möhlau and Zimmermann (Zeit. Farb. Text. Chem., 1903, **10**, 189). Bloxam (*loc. cit.*) shows that a method of quantitative analysis of indigo cannot be founded upon the use of the mixture of acetic and sulphuric acids used by Binz and Kufferath, containing five parts of the former acid to one part of the latter, since the product derived from a commercial indigo by pouring the solution obtained into water is not pure indigotin, even after thorough washing with alcohol. Pure indigotin is, however, obtained if a fairly pure specimen of indigo is used as a starting point. We have confirmed these observations and have experimented with the modification suggested by Möhlau and Zimmermann (*loc. cit.*), which mainly consists in using a mixture of acetic and sulphuric acids containing only four parts of the latter acid to 100 of the former. We have found this method to give correct results with pure indigotin, and with indigos showing a content of over 90 per cent. of this constituent, the precipitate obtained containing over 99 per cent. of indigotin, as has already been shown in describing our methods of obtaining this substance in a pure condition. In dealing with commercial indigos the operations of sulphate formation and hydrolysis must be repeated many times before pure indigotin is obtained as a precipitate, and the manipulations necessary are very liable to lead to errors, which assume a considerable magnitude when calculated on to the small weight of substance with which it is requisite to work. We have found that as much as 0·25 grm. of indigo can be safely dealt with by this method, using the quantity of mixed acids recommended by its authors, but it is not advisable to exceed that amount. The precipitates obtained should always be thoroughly washed with alcohol to remove red impurities which are carried down with the indigotin. In the analyses of commercial indigos by this method, given in table above, these precautions were adopted and precipitates ultimately obtained showing a content of 99·8 per cent. indigotin by titration with permanganate. The procedure is, however, tedious, and the method does not recommend itself.

Effect of indirubin.—A set of experiments, similar to those carried out to trace the effect of this constituent on the other methods of analysis, gave the following results:—

Percentage content of indigotin in mixture.

By calculation.	By experiment.	Percentage error.
96·5	97·85	1·35
94·0	95·6	1·6
89·0	92·85	3·85

Thus the indirubin is partially, but not wholly, estimated by the method, being soluble to some extent in dilute acetic acid; correct results for indigotin can, therefore, not be obtained in the presence of this constituent.

Application of the methods investigated to commercial indigos.—In the following table we have summarised the results obtained in estimating the indigotin content of six typical Bengal indigos. All the results are expressed on dry material and are the mean of duplicate experiments.

	Permanganate methods.				Reduction methods using Grossmann's of purification.		Acetic-sulphuric acid method of Möhlau and Zimmermann.
	Sulphonation by Rawson's method.			Sulphonation in boiling water-bath and purification of solution by barium sulphate.			
	Purification of solution by barium chloride.	Purification of solution by barium sulphate.	Purification of solution by Grossmann's method.		Hyposulphite method.	Titanous chloride method.	
I.	75·14	77·26	77·26	77·0	76·26	77·09	75·8
II.	68·81	70·31	69·71	70·5	70·25	69·77	70·0
III.	68·81	69·11	68·81	69·8	68·95	68·99	70·37
IV.	60·36	61·86	61·26	62·4	61·63	61·41	62·35
V.	54·92	55·53	54·92	55·8	54·32	54·88	55·3
VI.	45·87	47·08	47·08	47·2	47·01	47·3	46·4

The table shows that fairly concordant results are obtained with all the methods investigated except that in which barium chloride is used as a precipitant. The permanganate methods are a good deal simpler, and more rapid in execution than the reduction or gravimetric methods, and we were unable to find any superiority in the sharpness of the end point when applying Grossmann's principle of purification to the solutions titrated with permanganate, whilst we have shown that the use of calcium carbonate, besides requiring more manipulation than that of barium sulphate, involves a small error. Purification with calcium carbonate is essential to reduction methods, and one of these should be used in estimating indigotin in indigos containing indirubin, the latter constituent being then separately determined by a special method and deducted. For all other indigos the highest accuracy is combined with the most rapid working by proceeding as follows:—0·5 grm. of finely-powdered indigo is placed in a small, narrow-necked stoppered bottle, and mixed with a few Bohemian garnets; 20 c.c. of pure concentrated sulphuric acid are added, and the bottle, with its stopper removed, placed in a shallow water-bath containing just enough water to cover the depth of acid in the bottle. The bath is now brought to the boil, and when briskly boiling, the stopper is replaced in the bottle, which is shaken periodically for 15 minutes. At the end of this time the bottle is removed from the water-bath, and allowed to remain in cold water with its stopper removed until the contents are cool. These are then transferred to a 500 c.c. flask in which 10 c.c. of a 20 per cent. barium chloride solution and sufficient sulphuric acid to precipitate all the barium has previously been placed, and the whole made up to volume, well shaken, and set aside for the precipitate to settle for one hour. An aliquot part of the supernatant liquid is then titrated with approximately N/50 permanganate, and the result calculated on the basis that 1 c.c. N/50 permanganate is equivalent to 0·0015 grm. indigotin.

The determination of indigotin in indigo-yielding plants.—The work now in progress in India on the improvement of the cultivation and manufacture of indigo has rendered it imperative that a reliable method of estimating the amount of indigotin a given plant is capable of yielding should be available. Such a method was devised by Rawson in 1900, and an account of it published in his "Report on the Cultivation and Manufacture of Indigo," in 1904. The method consists in extracting 20 grms. of leaf (in which all the colour-yielding principle resides) with boiling water, straining off the leaves, and precipitating the indigotin from the solution of the glucoside so obtained by the addition of 5 c.c. of hydrochloric acid (containing 20 per cent. HCl) and 40 c.c. of a 5 per cent. solution of ammonium persulphate. The

[illegible] with the case of an (Trans. Chem. Soc., 1904, 85, 877) that this method of precipitating the indigotin from an extract of the indigo plant did not give the same result as was obtained by fermenting the extract with the enzyme extracted from indigo leaves and oxidising the fermented liquid with air, a larger amount of indigotin being invariably obtained by the latter method. We have investigated the cause of this anomaly, and, as a preliminary, have submitted the fermentation method to a careful examination, with a view to determining the accuracy in the results obtained by its application. The plant extract and enzyme solution were prepared exactly as described in the previous paper (*loc. cit.*) and the same methods for determining the completion of the fermentation process and for oxidising the solutions have been adopted. The following experiments were carried out:—

Experiment A.—450 c.c. of extract were fermented with 180 c.c. of enzyme solution, and the fermentation being complete after two hours and forty minutes, two portions of 280 c.c. each were withdrawn and oxidised, and the indigotin precipitated, determined in each case (I. and II.); 450 c.c. of the same extract were fermented with 75 c.c. of enzyme solution, in which case the fermentation process took four hours and forty minutes for completion, and two portions of 245 c.c. each were then withdrawn from this solution, oxidised, and the indigotin determined (III. and IV.).

Experiment B.—440 c.c. of extract were fermented with 220 c.c. of enzyme solution, and after four hours, the fermentation being complete, two portions of 300 c.c. each were withdrawn, oxidised, and the indigotin estimated (I. and II.); 440 c.c. of the same extract were fermented with 110 c.c. of enzyme solution, and on completion of the fermentation after seven hours, two portions of 250 c.c. each were withdrawn, oxidised, and indigotin determined (III. and IV.). The following results, expressed as the amount of indigotin obtained from 200 c.c. of extract in each case were obtained:—

	I.	II.	III.	IV.
	grm.	grm.	grm.	grm.
Experiment A.	0·1666	0·1675	0·1687	0·1665
Experiment B.	0·100	0·100	0·100	0·098

It is thus shown that the results obtained by fermenting an extract of plant under varying conditions are concordant, and it is therefore probable that the figures obtained represent the true amount of indigotin obtainable from the extract.

Attempts were accordingly made to bring the chemical method of precipitation into line with the fermentation method. It was thought probable that the difference was due to the employment of an excess of persulphuric acid in Bergtheil's method, since indigotin is oxidised and dissolved by an excess of this reagent, and the amount used [illegible] far exceeds the requirements on the assumption that it was only oxidised to indoxyl. We have found this to be the case, and that results coinciding exactly with those obtained by fermentation may be obtained by [illegible] as follows:—The extract of leaf is made as [illegible] Extracts were being taken to keep the [illegible] possible. The extract is then [illegible] and [illegible] as previously described. We have found that [illegible] with 30 grms. of lead (i.e., of 2 /) was sufficient for complete precipitation of the indigotin. This solution is the maximum required.

The identity of the results obtained by the [illegible] and by fermentation with enzyme is shown by the following experiments:—

Experiment A.—The quantity of indigotin [illegible] from two portions of extract of 150 c.c. each was determined by the persulphuric acid method (I. and II.); 220 c.c. of the same extract were fermented with 110 c.c. of enzyme solution, and two portions of 150 c.c. each were withdrawn, oxidised, and indigotin precipitated and determined when fermentation was complete (III. and IV.).

Experiment B.—The indigotin obtainable from two portions of extract of 150 c.c. each was determined by persulphuric acid (I. and II.), and 175 c.c. of the same extract were fermented with the same volume of enzyme solution, and the indigotin precipitated by acidifying determined in 300 c.c. of the fermented solution (III. and IV.). The following results, expressed as the amount of indigotin obtained from 100 c.c. of extract, were obtained:—

	Persulphuric acid method.		Fermentation.	
		grm.		grm.
Experiment A	I.	0·0847	III.	0·0843
	II.	0·0852	IV.	0·0822
Experiment B	I.	0·0950	III.	0·0950
	II.	0·0950	IV.	0·0930

The accuracy of the persulphuric acid method as a means of determining the amount of [illegible] from an extract of indigo plant is thus established.

Yorkshire Section.

Meeting held at the University, Leeds, on Monday, June 18th, 1906.

PROF. A. G. GREEN IN THE CHAIR.

THE ANALYSIS OF INDIGO.

BY W. FORTESCUE HARRISON.

Introductory.—The author was employed [illegible] —1904) in research work on plants [illegible] Seed Station (Bengal), and during the [illegible] tion was made of the results obtained.

In October, 1903, arrangements were [illegible] Government of India that the work should [illegible] in the Cloth Testing Laboratory [illegible] Leeds, under the personal [illegible] This [illegible] of the [illegible] the [illegible]

possible to develop an accurate method of analysis for both pure indigotin and crude indigo, there would become available a large amount of information for planters and dyers using plant indigo.

For here was material on which could be determined the daily yield of indigotin, obtained in an ordinary factory from known weights of green plant, throughout the period of manufacture; and, in addition, the results attained by the use of manures upon the experimental plots at Dalsingh Serai.

In order to be able to judge of the accuracy of the methods already in existence for the analysis of indigo, it was absolutely necessary to be able to prepare pure indigotin in quantity for use as a standard. (See this J., 1904, 746—747). Two methods were available for this purpose:—

(*a*) *Recrystallisation from nitrobenzene.*—This process proved somewhat laborious, some 30 grms. only being obtained after a week's work. Moreover, later experiments tended to throw doubt on the purity of the product obtained by this method.

(*b*) *Sublimation under diminished pressure.*—This method has already been briefly described (Chem. Soc. Trans., 1905, **87**, 983). A slight modification was now made by immersing the Jena flask in a bath of fusible metal, the level of the fusible metal just coinciding with the upper surface of the indigo within the flask. A square of asbestos-cardboard was so arranged that the portion of the flask, between the level of the fusible metal and the asbestos-cardboard was raised to such a temperature that only indigotin vapour was there present, and this zone of the flask remained quite clean at the close of the operation, the sublimate being deposited in the upper portion of the flask above the asbestos card.

Sublimation was observed to commence when a thermometer (filled with mercury under pressure of nitrogen) placed in the fusible metal indicated 300° C., the sublimation being finally effected between 370° and 390° C. The sublimate was beautifully crystalline and quite pure.* This statement is considered necessary, as Knecht states (J. Soc. Dyers and Colourists, 1904, **20**, 97). "Without going into any detail with regard to the work we carried out on this subject, I may say that, of the various methods of purification tried, sublimation under reduced pressure, though yielding large crystals, gave the least pure product."

In this fashion indigotin can be obtained in any desired quantity. Using the "B.A.S.F. rein" as source, 100 grms. can easily be prepared in a day. Examination and analysis showed: (*a*) That it contained no ash; (*b*) that it contained no impurity which could be removed by solvents; (*c*) on analysis it yielded theoretical figures when tested by the methods of analysis later described in detail (see p. 741).

An Examination of the Practicability of the Methods which have been proposed for the Analysis of Indigo.

Section I.—Methods involving the use of potassium permanganate.

This method, originally introduced by Mohr (Dingl. pol. J., cxxxii. 363), has been modified by Rawson, and has been examined critically by the present writer (Chem. Soc. Trans., 1905, **87**, 984). Although this method may be of use for commercial purposes in determining the relative merits between two samples of indigo, it is generally admitted that the process cannot, as it stands, be used for accurate determination of the indigotin percentage of a crude indigo. (See also this J., 1904, 747.) This statement is sustained after a critical examination of the improvements suggested by Rawson and by Grossmann. ("A Manual of Dyeing," Knecht, Rawson and Lowenthal; Griffin, London, 1901. "An Improved Method of Indigo-testing," Grossmann; this J., 1905, 308.) These processes, although no doubt effecting a clearer end-point of the reaction, entail at the same time losses of indigotin; for the precipitates given by barium chloride and calcium carbonate, respectively, are always blue coloured. Feeling that this might be due either to some error in the manipulation, or to some fault in the process of sulphonation, it was decided to prepare the various sulphonic acids of indigotin in a pure condition, and to study the behaviour of their barium and calcium salts, for it was considered probable that failure was due to the degree of sulphonation being too low. In this case it might be possible, at a higher degree of sulphonation, to throw down the impurities by the action of calcium carbonate without loss of the indigotin content of the solution.

I.—*Preparation of Potassium Indigotinmonosulphonate.*

One part of indigo (B.A.S.F. rein), 20 parts of sulphuric acid (100 per cent.), and 10 parts of treated pure sand, were thoroughly mixed together, and allowed to stand for about one hour with frequent stirring. The progress of the reaction was tested from time to time by transferring a drop of the mixture into water. When a violet solution was obtained in hot water, the whole mass was poured into water, cooled, and the precipitate filtered off and pressed on a porous plate. It was then re-dissolved in a large volume of boiling water, and the potassium salt precipitated by the addition of potassium carbonate. The salt could not be obtained in a crystalline form, but it was purified by repeated solution in boiling water. On analysis, 0·3018 grm. of sulphonate gave 0·0656 grm. potassium sulphate,

K = 9·74 per cent. (theory = 10·26 per cent.);

0·2213 grm. of sulphonate gave 0·1396 grm. barium sulphate,

S = 8·50 per cent. (theory = 8·42 per cent.).

Indigotin could not be determined by titration with potassium permanganate owing to the slight solubility of the mono-sulphonic acid.

II.—*Preparation of Potassium Indigotindisulphonate.*

6 grms. of "indigo B.A.S.F.," 120 grms. of sulphuric acid (96 per cent.), and purified sand, were heated in the water oven for an hour and a half, the product was poured into water, and the solution filtered hot. To the filtrate potassium carbonate was added until the potassium salt was nearly all salted out. The temperature of the mother liquor was then raised to the boiling point, when solution took place, and on cooling the disulphonate separated as a crystalline precipitate, which was collected on the filter pump, and washed thoroughly, first with a solution of potassium acetate, and then with alcohol. It may be further purified by redissolving in boiling water, cooling, filtering off the precipitate and washing as before. As a result of analysis 0·3190 grm. of sulphonate gave 0·1029 grm. potassium sulphate, K = 14·46 per cent. (theory = 15·6 per cent.).

0·423 grm. of sulphonate gave 0·3884 grm. barium sulphate. S = 12·53 per cent. (theory = 12·85 per cent.).

Titration of indigotin by permanganate gave 51·68 per cent. (theory = 52·2 per cent.).

III.—*Preparation of Potassium Indigotintrisulphonate.*

10 grms. of "indigo B.A.S.F.," 100 grms. of fuming sulphuric acid (15 per cent. SO_3), and 100 grms. of purified sand, were heated together for three hours at 45°—55° C., with frequent stirring, and the product poured into water. The procedure for the isolation and purification of the potassium salt was similar to that given above for the disulphonate. Potassium indigotintrisulphonate crystallises well from hot water in very minute blue needles, thus

* In the Chem. Soc. Proc., 1904, **20**, 189, and in the full paper (Chem. Soc. Trans., 1905, **87**, 982), the author claimed priority of production of pure indigotin by sublimation as described. A paper has, however, recently been discovered, "The Molecular Weight of Indigo," by E. von Sommaruga. (Annalen, 1879, 195, 109), in which the author shows he prepared pure indigotin by sublimation of the refined natural product under diminished pressure, and subjected it to analysis.

wandering filtration and purification, easy. 0·2072 grm. of this sulphonate gave 0·1832 grm. potassium sulphate; hence K = 18·4 per cent. (theory = 18·0 per cent.).

0·2522 grm. gave 0·2868 grm. barium sulphate: S = 15·61 per cent. (theory = 15·57 per cent.).

By titration with permanganate the indigotin percentage was found to be 41·6 per cent. (theory = 42 per cent.)

IV.—*Preparation of Potassium Indigotintetrasulphonate.*

6 grms. of "indigo B.A.S.F." were stirred into a paste with sand and a few cubic centimeters of 100 per cent. sulphuric acid, to this was added 60 grms. of 50 per cent. fuming sulphuric acid, and the whole heated to 110° C. for half an hour with frequent stirring. The method of isolation and purification of the sulphonate is the same as that adopted for the trisulphonate. Potassium indigotintetrasulphonate crystallises exceedingly well from hot water in fairly large transparent red crystals. 0·2585 grm. of the sulphonate gave 0·1201 grm. potassium sulphate: K = 20·8 per cent. (theory = 21·25 per cent.).

0·2982 grm. of the sulphonate gave 0·387 grm. barium sulphate: S = 17·7 per cent. (theory = 17·4 per cent.).

Indigotin by titration with permanganate gave indigotin, 34·7 per cent. (theory = 35·15 per cent.).

Conditions under which the sulphonation of pure indigotin can be effected without loss.

It was now considered necessary to determine whether loss of indigotin was involved in the process of sulphonation. For, if sulphonation could not be effected without loss, then it would be obviously useless to try the Grossmann or other modes of removing the impurities from crude indigo, as the fault of loss on sulphonation would be a vital one. The only detailed information on this subject seems to be found in a paper by Wangerin and Vorländer on "The Titration of Indigotin with Hydrosulphite." (Zeits. f. Farben- und Textilchemie., 1902, 1, 281.) These authors state that 60 per cent. sulphuric acid does not sulphonate indigotin, even when used in great excess.

The ordinary concentrated (94 per cent.) acid, as is well known, dissolves indigotin without leaving any residue. With sufficient shaking, half an hour's heating at 95°—100° suffices with 10 volumes of 94 per cent. or stronger acid for sulphonation. The authors then proceed to determine by titration with hydrosulphite how much indigotin is lost by oxidation in sulphonating with sulphuric acid of various strengths for different times. Employing as the temperature limits 95°—100° C., they state that loss occurs with acid of so low strength as 94 per cent. when heating is continued for half an hour. Acid of 100 per cent. is stated to give rise to a loss of 2·4 per cent. indigotin on heating for one hour at 95°—100° C. Acid of 5 per cent. fuming is stated to give rise to losses of indigotin ranging from 2 per cent. to 14·7 per cent., according to the time of heating (half an hour to one hour at 95°—100° C.). It is not possible to agree with these statements of Wangerin and Vorländer, for the figures given in the following table show that with pure indigotin, no loss was experienced on using 20 per cent. fuming sulphuric acid for three-quarters of an hour at 97° C.

In the present sulphonation experiments the indigotin, placed in a small beaker, was first mixed with sand (purified by exhaustive treatment at the boiling point with strong sulphuric acid, and a trace of nitric acid, to remove iron and organic matter, and finally washed and dried at 140° C.) and then treated with acid and placed in the water oven, the mixture being stirred at regular intervals. In this way, pure indigotin can be converted almost entirely into the tetrasulphonic acid in half an hour by treatment with 20 per cent. fuming sulphuric acid in the water oven—and this without loss. In the case of pure indigotin, acids of greater strength than 20 per cent. fuming do cause decomposition when the duration of sulphonation is three-quarters of an hour at the temperature of the water oven.

Later experiments showed that temperatures above that of the water oven gave rise to considerable loss where fuming acid is used with pure indigotin (*v.* p. 741).

The following table shows some of the conditions under which a loss of indigotin may be expected on sulphonation:—

Sulphonation of crude Bengal indigos.

Mode of Sulphonation.	Indigotin crystallised from Nitrobenzene.		Sublimed Indigotin.	
	Permanganate used.	Percentage of Indigotin.	Permanganate used.	Percentage of Indigotin.
	c.c.	per cent.	c.c.	per cent.
12·5 per cent. fuming acid—				
½ hour at 97° C.	9·0 9·0 8·95 9·0	100 99·7	—	—
20 per cent. fuming acid—				
½ hour at 97° C.	9·0	100	9·0 9·0	100
½ hour at 110° C.	—	—	8·9 8·9	99
2 hours at 97° C.	—	—	8·85	98·3
30 per cent. fuming acid—				
10 minutes at 97° C.	8·90	99	—	—
20 minutes at 97° C.	8·90	99	—	—
37 per cent. fuming acid—				
½ hour at 97° C.	—	—	8·85	98·3

Sufficient pure indigotin was sulphonated by 100 per cent. sulphuric acid to just colour the liquid, the coloured liquid was then kept at a temperature between 90°—100° C., and a current of sulphur dioxide (dried by means of concentrated sulphuric acid) passed through the coloured liquid. No alteration or diminution of colour was observed after the gas had passed for one hour. Thus it was established that there was no fear of loss of indigotin by the evolution of sulphur dioxide in sulphonating, the gas being without action on the sulphindigotic acid in presence of concentrated sulphuric acid. Crude indigos are not so highly sulphonated as is pure indigotin when acted on by acid of the same strength for the same length of time and at the same temperature. Thus pure indigotin can be converted almost entirely into the tetrasulphonic acid by treatment with 20 per cent. fuming acid for half an hour in the water oven at 97° C.; whilst under similar conditions, a crude Bengal indigo would not be so completely converted into the tetrasulphonic acid on account of the impurities acting as a resistance or diluent to the sulphuric acid. Fuming sulphuric acid of some 5—10 per cent. greater strength is required to give the same degree of sulphonation as that attained by the pure indigotin. This lower degree of sulphonation

experienced in the case of crude indigos was revealed only during the course of the latter experiments (*v.* p. 76), which led to the adoption of the potassium tetrasulphonate method for the analysis of indigo.

Action of the di-, tri-, and tetra-sulphonic acids of indigotin on calcium carbonate.

These acids and their potassium salts having been prepared and the conditions established for sulphonation without loss, the way was now clear to determine whether Grossmann's process could be safely employed. Experiments showed, however, that the disulphonic acid, when treated at Grossmann's prescribed concentration (1 : 1000), yielded the blue calcium salt as a precipitate—but the solutions of tri- and tetra-sulphonic acids, when treated similarly, yielded no precipitates. Here then seemed possible an application of Grossmann's method for the purification of crude indigos after sulphonation, if the degree of sulphonation were carried as far as tri- or tetra-sulphonate. But again disappointment was experienced. On sulphonating crude cake indigos with fuming sulphuric acid of various strengths, the red (tetrasulphonate) product was obtained (see preceding page). But now a new difficulty arose, for, although no precipitation was now observed of the blue calcium disulphonate, on the addition of calcium carbonate, much less of the impurity was removed than when a lower degree of sulphonation was effected. So with regret it was determined that Grossmann's method could not be employed in the purification of crude indigos.

At this stage the author was driven to the following conclusions as to the applicability of the permanganate process to the estimation of indigotin :—

(1) It can only be used for the estimation of absolutely pure indigotin. Even in the case of synthetic indigos the impurities are estimated, wholly or in part, and the results thereby obtained are too high (*v.* p. 736).

(2) Its application to the analysis of synthetic and crude indigos is not possible, at this stage, for the several processes recommended for preliminary purification of the crude indigo fail in the following respects :—

(*a*) They fail to remove the impurities completely and too high results are obtained on titration.

(*b*) Whilst impurities are removed, indigotin is also thrown down, and the results of titration are too low.

SECTION II.—*Estimation of indigotin by means of titanium trichloride.*

This method had already been successfully employed by Knecht* for the analysis of other colouring matters, and its employment recommended in the case of indigo. In his paper of 1904, Knecht describes the method for the estimation of indigotin by titanium trichloride,† but he states that it is not possible to apply this new method to samples of natural and artificial indigo. In his paper of 1905 (*loc. cit.*), however, Knecht claims to have been able to apply the titanium method with success to the estimation of indigotin in crude indigo. He states that he is able to do so by making use of Grossmann's method of preliminary purification with calcium carbonate and titrating the filtrate.

As a result of experiments made, and of which an account follows, the author cannot agree that the method as published by Knecht is, as it stands, suitable for the quantitative estimation of indigotin in crude indigo. His suggestion of using titanium trichloride for this purpose was, however, a most valuable one.* For it is found that, with certain modifications, it can be employed with complete success, as an adjunct to the process shortly to be described.

In the first place, dealing with pure indigotin only (reserving the question of the possibility of accurate analysis by titanium trichloride of synthetical and crude plant indigos), it appeared from the simple details of the process given by Knecht, that the reaction was a quantitative one, free from complications. It was found, however, on investigation that the quantitative reduction of indigotin depended upon two main factors: (1) the relative concentrations of the solutions of indigotin and titanium trichloride; (2) the relation of tartaric acid to mineral acid present during the reduction. This is made clear by consideration of the following experiments :—

(1) *Influence of the relative concentrations of the solutions of indigotin and of titanium trichloride.*

The reaction is not a quantitative one under all conditions of concentration. If relatively weak solutions of indigotin are used, then the consumption of titanium trichloride is greater than that demanded by theory for the indigotin in solution. There is probably a reduction beyond the indigo-white stage, due to local excesses of titanium trichloride. Knecht employed an indigotin solution at a concentration of 1 grm. of indigotin in 500 c.c., and the titanium trichloride about twice as strong. These conditions, for the selection of which, however, no reason is given, only give accurate results when certain precautions are adopted. Thus, though not apparently recognised by Knecht, it is absolutely necessary in order to get constant and quantitative results, to adjust the proportions existing in the solution between the mineral acid and tartaric acid, and to add the titanium trichloride slowly, *i.e.*, drop by drop, and not in a constant stream, and to keep the flask constantly agitated during titration.

Having ascertained the conditions for accurate determination of indigotin at a concentration of 1 grm. per 500 c.c. of solution; the effect of different concentrations of indigotin was determined as follows :—

In order to make the test as consistent as possible, the indigotin solution titrated in each case was that containing for each dilution the same amount of indigotin in solution and the same amount of acid, *viz.* :—

(A) 25 c.c. = $\frac{1}{10}$ of 0·5 grm. indigotin + $\frac{1}{10}$ of 10 c.c. sulphuric acid.

(B) 50 c.c. = $\frac{1}{10}$ of 0·5 grm. of indigotin + $\frac{1}{10}$ of 10 c.c. sulphuric acid.

(C) 100 c.c. = $\frac{1}{5}$ of 0·25 grm. indigotin + $\frac{1}{2}$ of 5 c.c. sulphuric acid.

(D) 200 c.c. = $\frac{1}{5}$ of 0·25 grm indigotin + $\frac{1}{2}$ of 5 c.c. sulphuric acid.

So that every titration was a reduction of 0·05 grm. indigotin in presence of 1 c.c. of sulphuric acid (100 per cent.) and of 4 grms. of neutral sodium tartrate.†

On titration with titanium trichloride, the following results were obtained :—

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* J. Soc. Dyers and Col., 1903, 86 and 189; 1904, 97 and 1905 192.

† Knecht points out that three chlorides are known :—$Ti Cl_2$, $Ti_2 Cl_6$, $Ti Cl_3$—and of these $Ti Cl_3$ is the true titanous chloride. $Ti Cl_3$ is, in this paper, written titanium trichloride.

* The author wishes to express here his indebtedness to Dr. Knecht, who was so kind as to allow Mr. S. H. Wood to visit his laboratory, and see his new method at work.

† Sodium tartrate (neutral) was substituted for the Rochelle salt of Knecht for reasons stated later (see next page). The relation of 4 grms. sodium tartrate to 1 c.c. acid was established by experiments (*ibid.*).

Concentration of Indigotin.	Burette readings.	Indigotin found per cent.	Actual per cent. of indigotin.
A.—25 c.c. of 1/500 + 4 grms. sodium tartrate	14·21, 14·25 (Mean 14·23)	98·9	100
B.—50 c.c. of 1/1000 + 4 grms. sodium tartrate	14·75, 14·75 (14·75)	103·6	100
C.—100 c.c. of 1/2000 + 4 grms. sodium tartrate	15·3, 14·9, 15·15, 14·7 (15·0)	105·4	100
D.—200 c.c of 1/4000 + 4 grms. sodium tartrate	16·8, 15·9 (16·1)	113·0	100

It will be seen from the results just given that the percentage of indigotin obtained increases as the solution becomes more dilute, and, moreover, that irregularity of the readings is apparent at greater dilutions. This irregularity is due to variations in the rate of addition of the titanium trichloride, which, as might be expected, has a greater effect on dilute than on concentrated solutions.

Even at a concentration of 1/1500 the rate of addition of the titanium trichloride solution is an important factor, as the following results show:—

Concentration.	Rate.	Burette readings.	Indicated per cent.	Actual per cent.
1/500	3 drops per sec.	14·2	99·74	100·00
	Continuous stream	14·6	102·6	
1/1000	3 drops per sec.	14·65	102·9	100·00
	Continuous stream	14·95	105·1	

It was thought at first that this increased consumption on dilution was due to the dissolved oxygen of the water, and, undoubtedly, that accounts for a small fraction of the error. Thus it was determined experimentally, that the dissolved oxygen in 300 c.c. of distilled water was only equivalent to 1 c.c. of the trichloride; so that (*v.* table above) 25 c.c. = 0·09 c.c.; this would cause a rise of only 0·5 per cent. when comparing 25 c.c. of a solution 1/500 concentration, with 50 c.c. of a concentration of 1/1000. That oxygen solution cannot account for the total error is shown by the fact that, if the titanium trichloride solution is correspondingly diluted, the results become quantitative again, though the burette readings are more liable to variation. Indigotin solution at a concentration of 1/5000, and titanium trichloride correspondingly diluted, gave, as a mean of three readings, 99·7 per cent.

It was finally determined that the most suitable concentration for the solution of indigotin was 1/500, the titanium solution being of about the same strength (N/60). This solution can then be used on pure indigotin and on crude indigos without introducing any error, for a crude indigo (of 50 per cent. indigotin content) would become, on making up for titration, 1/1000; and the reaction is quantitative when the titanium trichloride is not more than twice as strong as the indigotin solution, provided the titanium trichloride be run in slowly, and the flask constantly shaken.

(2) *The relations which must exist between tartaric and the mineral acids.*

As has been stated by Knecht (*loc. cit.*, 1904), if the reduction of indigotindisulphonic acid by titanium trichloride is effected in presence of mineral acid, the solution turns green, and no definite end point can be determined for the reaction. The addition of salts of tartaric acid he finds effectual in rendering the end point quite definite. Knecht used for this purpose Rochelle salt in excess; but, owing to the insolubility of the acid, potassium salt, which is produced, it was found preferable to use normal sodium tartrate. As will be shown, a serious error is introduced if excess of these salts be used.

The amount of salt necessary depends upon the amount of acid used in sulphonation, and upon the amount of hydrochloric acid used in making up the standard solution of titanium trichloride. Before the effect produced by the presence of an excess of the tartrate was known, several analyses of pure indigotin had given values of 103·6 per cent., 107·6 per cent., &c., because the same amount of salt had been used for pure indigotin sulphonated with different amounts of acid. This effect is shown by the following results:—

1 grm. of indigotin was sulphonated, with 20 c.c. of sulphuric acid (fuming 20 per cent. SO_3), for half an hour in the water oven, and subsequently made up to 500 c.c.

Volume of Indigotin solution.	Sodium tartrate.	Consumption of titanium trichloride.	Indicated per cent. of indigotin.	Actual per cent. of indigotin.
c.c.	grms.	c.c.		
25	3	No end point, merely green colour.		
25	4	13·95	100·2	100·0
25	5	13·5	101·4	100·0
25	6	13·65	102·3	100·0
25	7	13·85	102·8	100·0
25	8	13·85	104·0	100·0
25	9	13·9	104·5	100·0

So that every 25 c.c. of the indigotin solution used (containing 1 c.c. of acid) requires 4 grms. of normal sodium tartrate to give quantitative results, when titrated with a solution of titanium trichloride containing 1 c.c. of concentrated hydrochloric acid per 50 c.c. of solution.

The sodium value of the acid in the 25 c.c. of the solution of indigotin (used in the results shown in the table above) is, in terms of normal sodium tartrate, equal to 4·9 grms. of the salt. So that the requisite conditions for accurate titration, at this concentration, are not the addition of an amount of the neutral salt equivalent to the acid, but rather less of the tartrate. In using this process in general, it is therefore necessary, in order to obtain quantitative results, to ascertain the smallest amount of normal sodium tartrate necessary to give a sharp end-point, under the given conditions of sulphonation and of acidity of the solution of titanium trichloride, and then to adhere to these conditions rigorously. A further danger attends the use of sodium tartrate in large quantity, especially when added to a cold solution of indigotin. It tends to salt out the sulphonic acid, and, in this case, when the reduction appears to be complete, on close inspection blue masses of the salted-out sulphonic acid can be seen in the fluid, which have escaped titration and are now slowly dissolving. In this fashion low and irregular results are obtained.

To obviate the necessity for adding a large amount of tartrate, the amount of acid used for sulphonation should be reduced to a minimum—in the present experiments the standard relation adopted for indigotin to acid is 1 grm. of indigotin to 2 c.c. of acid—and the [illegible] (in the form of solution of 50 per cent. [illegible]

should be added to the hot solution of the sulphonic acid about to be titrated. When these two fundamental conditions had been determined for the quantitative interaction of indigotin with titanium trichloride, *e.g.*, the relative concentrations of the solutions of indigotin and titanium trichloride, and the relations which must exist between tartaric and mineral acid during reduction, excellent figures were obtained on sulphonation of pure indigotin, thus, in sequence, 99 per cent., 100·2 per cent., and 100·01 per cent. It may be stated here that all the foregoing results have been obtained on pure indigotin, prepared by sublimation, under diminished pressure, as stated at the commencement of this paper.

Several other organic salts were employed in place of normal sodium tartrate. The free acids of oxalates and acetates proved to be too strong to give the yellow end-point. Sodium citrate, however, was found to work as well as the tartrate. Citric and tartaric acids have the same conductivity, and are therefore of the same strength.

Use of titanium trichloride for the estimation of indigotin in crude indigos.

Titanium trichloride was tried by Knecht (J. Soc. Dyers and Col., 1904, **20**, 98) for the estimation of indigotin in natural and synthetical indigo. He states, "I was much disappointed to find that the impurities present marred the delicacy of the end-point to such an extent as to render the method quite unreliable, and further work on it was consequently abandoned." In a subsequent paper, however, (J. Soc. Dyers and Col., 1905, **21**, 292) he withdraws this opinion, stating that he has applied Grossmann's method of purification with calcium carbonate with success. "By adopting Grossmann's modification, all difficulties were removed, and even in the case of low grade indigos absolutely sharp end reactions were obtained." It is, however, to be noted here, that, in reality, Knecht does not seem to have followed Grossmann's modification. For Grossmann prescribes as being present in the flask of 500 c.c. capacity, after adding calcium carbonate and making up to the mark 500 c.c. = (0·1 grm. indigo + 2 c.c. acid + about 6 grms. pure calcium carbonate.) Whilst Knecht used 500 c.c. = (1·0 grm. indigo + 5 c.c. acid + 12 grms. "chalk"). Putting this point aside, the results obtained by the author, when Grossmann's method was tried in conjunction with potassium permanganate, indicated so complete a failure, that it seemed somewhat surprising that complete success could be claimed for the method when used in conjunction with titanium chloride. Experiments were now made both with pure indigotin and crude cake indigos under the conditions used by Knecht, and attributed by him in error to Grossmann. Of several experiments made, the following four suffice to show the inaccuracies of the method:—

	Buretto readings.	Indigotin per cent.
(1) *Pure Indigotin* (before treatment with calc. carb.)	14·35 / 14·40	99·65
(2) *Pure Indigotin* (after treatment with calc. carb.)	6·30 / 6·45	44·30
(3) *Crude Indigo* (before treatment with calc. carb.)	9·9 / 9·9	68·50
(4) *Crude Indigo* (after treatment with calc. carb.)	6·80 / 6·85	47·75

Here both pure indigotin and crude Bengal indigo are reduced in value by this process of "purification" to below 50 per cent.

The value 68·5 per cent. indigotin found for the crude indigo, before treatment with calcium carbonate, is of course high, as the impurities were all present and reacted with the titanium trichloride. The true value of this crude indigo was afterwards determined by the potassium tetrasulphonate method to be 61 per cent. indigotin.

So that the loss of indigotin involved in this process is—

Indigotin.

(1) Pure indigotin (100·0—44·3) = 55·7 per cent. loss.

(2) Crude cake (61·00—47·75) = 13·25 per cent. loss.

Several other experiments were made in order to remove the impurities with calcium carbonate, but in every case the values of both pure and crude indigos were reduced to between 40 and 50 per cent. indigotin.

An experiment was now made to see whether, if the titration were made as rapidly as possible after treatment with calcium carbonate, better results could be obtained. Grossmann does not state the time allowed for the precipitate to settle. Knecht prescribes 20—30 minutes as the time required for subsidence of the precipitate. In the present case, it was found possible to pipette off portions of the clarified solution 15 minutes after treatment with calcium carbonate.

So experiments were made at the intervals of time stated below, the solution being one of pure indigotin. 25 c.c. pipetted off after 15 minutes gave 47·7 per cent. indigotin, after 30 minutes gave 44·0 per cent. indigotin, after 45 minutes gave 44·0 per cent. indigotin, and after 60 minutes gave 44·0 per cent. indigotin.

Thus 15 minutes standing is sufficient for 50 per cent. of the indigotin to be carried down in the case of pure indigotin, and no further deposition was observed after standing 30 minutes to 1 hour. Thus the employment of Grossmann's process fails to give accurate results, whether potassium permanganate or titanium trichloride be used for estimation of the indigotin remaining in this filtrate. Further, Knecht's employment of calcium carbonate (in twice as great quantity) in an indigotin solution (10 times as strong) and in presence of acid (2·5 times as strong), as that prescribed by Grossmann—accentuated the short-comings of Grossmann's process, and, yielded a clear fluid for titration of 40—50 per cent. indigotin content, independent of the original value of the indigo or indigotin present.

It is now definitely claimed that it was possible, for the first time, to make accurate estimation of pure indigotin, if strict attention be paid to the experimental conditions prescribed in this paper—by both the permanganate method and that of titanium trichloride. The problem remaining was a difficult one. Was it possible to isolate quantitatively the indigotin of crude and synthetic indigos, in a state fit for estimation by one or both of these methods?

Conditions under which indigotin may be separated, with quantitative accuracy, as potassium tetrasulphonate, from the solutions of sulphonates of either pure indigotin or of crude indigo, by the use of potassium acetate.

In the investigation into the reason for the failure of Grossmann's method, it was made clear that this was due to the production of the disulphonic acid. If, however, sulphonation were carried further, *i.e.*, to the stage of tetrasulphonation, then within moderate limits of dilution, the addition of calcium carbonate was not followed by precipitation of the calcium salt of the tetrasulphonic acid. So it was thought possible that from such solution, after partial neutralisation with calcium carbonate the tetrasulphonate might be precipitated as its potassium salt, by the addition of potassium acetate. This salt had previously been used with success for a similar purpose by A. G. Perkin ("Notes on the purification of some Congo and Acid Red Colours," this J., 1903, **14**).

In the early experiments, success was occasionally obtained, the filtrate being almost colourless, but no standard conditions for success could be determined. The use of magnesium carbonate followed by potassium acetate gave, at intervals, successful results, but no general method could be prescribed. Finally, the use of potassium acetate alone was completely successful. The method of analysis developed on this basis is as follows for pure indigotin:—

The indigotin is dried at 110° C., and, after cooling in a desiccator, 1 grm. is weighed out into a small (6 oz.) spouted beaker. To the indigotin is added 2—3 grms. of purified sand, and 5 c.c. of fuming sulphuric acid (20 per cent. SO_3) is run in from a burette. After well stirring with a short glass rod, the beaker is covered with a watch glass and heated in the water-oven for half-an-hour, stirring being repeated at intervals. After cooling, the sulphonic acid is poured into a 500 c.c. flask containing some water and finally the beaker, stirring rod, and sand are repeatedly washed with water, when cold, the solution

is made up to the mark with water (when 500 c.c. = 1 grm. of indigotin + 5 c.c. fuming sulphuric acid.)

The following solutions are necessary :—

(a) *The precipitant*, a filtered solution of potassium acetate, 450 grms. per liter.

(b) *The isotonic*, prepared by adding 5 c.c. of glacial acetic acid to 200 c.c. of the precipitant, and then to 400 c.c. with water.

The analysis is carried out as follows :—100 c.c. of the indigotin solution (of 1/500 concentration) is delivered by a pipette into a fairly capacious conical spouted beaker. To this is now added from a burette (provided with a constant supply of the precipitant solution) 100 c.c. of the precipitant. Precipitation is observed when the solutions are well agitated in the conical beaker. The beaker and its contents are now well warmed until complete solution is attained. Cooling is now effected in a stream of running water, and when the contents of the flask are water-cold, the beaker is transferred to a vessel containing ice and water. Here the beaker is left for one hour, during which time the tetrasulphonate settles out as a fine-grained crystalline precipitate, which will filter well. Meanwhile the isotonic solution is placed in a spouted conical beaker and cooled by immersion in ice and water. The whole is filtered by suction through a Gooch crucible, the paper in which is set by a small quantity of the cooled isotonic solution. With good manipulation the operation is complete in a few minutes. In the case of pure indigotin a carefully performed analysis will yield a filtrate almost colourless. The very pale blue colour can be imitated by diluting a solution of tetrasulphonate of known indigotin value. In this way the indigotin strength of the filtrate, when the process is working well, is estimated at one part of indigotin in three millions of water, a loss which is entirely negligible. The Gooch crucible is now placed in a funnel which rests in the neck of a 200 c.c. flask. With the aid of hot water this is washed free from blue, and any precipitate which adheres to the walls of the conical beaker is dissolved and added to the main fluid, which on cooling is made up to the mark. Portions of this solution are used for the estimation of indigotin :—

(a) *By means of potassium permanganate.*—20 c.c. of the solution are transferred to a shallow porcelain dish and 80 c.c. of distilled water and 0·5 c.c. of pure concentrated sulphuric acid are added. This solution, which is not of a greater concentration than 1 in 5000, is titrated with the solution of potassium permanganate (1 in 1000), until the addition of a drop produces no longer a cloud in the pure yellow liquid. Indigotin (100 per cent.) would require under these circumstances 9·0 c.c. of permanganate, and percentages are calculated from this standard.

(b) *By means of titanium trichloride.*—In this case 25 c.c. of the solution of potassium tetrasulphonate is used for each estimation. This volume of solution is delivered into a conical Erlenmeyer flask of Jena glass of 300 c.c. capacity; to it is added 1·5 c.c. of a 20 per cent. solution of normal sodium tartrate, and the liquid is raised to boiling point, and then titrated whilst hot with a current of carbon dioxide passing through the flask.

Determination of the degree of sulphonation attained to in this process.—It was considered necessary to determine the nature of the precipitate obtained by the use of potassium acetate under the foregoing conditions. Accordingly 2 grms. of sublimed indigotin was sulphonated under the conditions stated, and made up to a liter. Of this 500 c.c. was precipitated with potassium acetate, collected on a filter, and washed with ice-cold "isotonic" solution. It was then redissolved in water and again precipitated (to remove any traces of potassium sulphate), filtered, and the precipitate washed with hot alcohol (to remove potassium acetate) and finally dried at 150° C. The freshly prepared precipitate was dark red, but on drying became pale blue. Analysis of the product gave [illegible] manganate), 35·5 per cent. and 35·6 per cent. Theory for tetrasulphonate, 35·69 per cent. indigotin.

Potassium: 0·2964 grm. salt yielded 0·1344 gr. potassium sulphate or 20·28 per cent. of potassium (theory, 21·25 per cent.).

Sulphur: 0·2068 grm. yielded 0·2508 grm. barium sulphate, i.e., 17·32 per cent. of sulphur (theory, 17·4 per cent.).

The salt was regarded as the tetrasulphonate from an inspection of these figures, showing the theoretical value of tri-, and tetrasulphonate.

——	Trisulphonate.	Tetrasulphonate.	Salt obtained.
Indigotin....	42·5	35·69	35·3
Potassium ..	19·9	21·25	20·3
Sulphur	15·57	17·4	17·32

In view of these results it was decided to call this process the "potassium tetrasulphonate method" for the analysis of indigotin.

One of the good points of this process is that it will reveal the presence of unsuspected impurities (present in the indigotin believed to be pure), or of degradation products produced by sulphonation with too strong acid, or by heating to too high a temperature. In both these cases, when the tetrasulphonate is precipitated, the impurities pass away in the filtrate, and as a result, the percentage of indigotin will be lower on resolution and estimation than if estimation be made direct on the original sulphonation product. Thus, in an experiment made to test whether pure sublimed indigotin would bear heating with 20 per cent. fuming acid in a glycerin bath at 110° C. for 15 minutes, the following figures were obtained :—After sulphonation and *before* precipitation with potassium acetate, 98·9 per cent. indigotin (permanganate), 98·2 per cent indigotin (titanium). After precipitation with potassium acetate and resolution, 97·2 per cent indigotin (permanganate), 97·35 per cent. indigotin (titanium); whence it was plain that destruction of indigotin had occurred to the extent of practically 3 per cent., and that this destruction was revealed by the aid of potassium acetate, whilst the results obtained before precipitation show that the destruction products were acted upon both by permanganate and titanium.

In the case of synthetic indigos, when sulphonation has been made under proper conditions, the sulphonate, before precipitation, will give results close to 100 per cent. with both the permanganate and titanium processes. But after precipitation, the indigotin value falls on titration to 91—92 per cent., the impurities having been removed in the filtrate. Evidence of this fact is obtained from the appearance of the filtrate after precipitation with potassium acetate. Thus, in the case of pure indigotin properly sulphonated, the filtrate is only very faintly blue or bluish-green. In the case just cited, where destruction occurred through faulty sulphonation, the filtrate showed the colour of a dilute solution of chrome alum. The filtrate obtained from synthetic indigos was also characteristic being green in the case of the Meister, Lucius und Brüning, and deep red in the case of the B.A.S.F. products.

It will thus readily be understood that great difficulty was experienced in the beginning in setting this process upon an exact quantitative basis, for it was necessary to be in possession of absolutely pure indigotin, to know the conditions under which it could be tetrasulphonated without loss, and to be able to recover and estimate this tetrasulphonate after precipitation and resolution. This degree of success was attained when the standard sublimed indigotin gave figures within a few decimal points of 100 per cent. before and after precipitation with potassium acetate. In one case only has the process failed to work, i.e., when the degree of sulphonation has been too low—thus, if the acid used has been too weak, or the temperature of sulphonation too low, or the time of sulphonation too short, then disulphonic acid is formed. This, on precipitation with potassium acetate, [illegible]

the acid of the water pump, the potassium disulphonate, which is non-crystalline, passes through the paper, appearing in the filter flask as a uniform blue fluid. Sodium acetate (anhydrous as supplied by Kahlbaum), has been tried as a substitute for the more expensive potassium salt, but it failed to produce the desired effect, the sodium tetrasulphonate being obtained in the non-crystalline state.

Application of the potassium tetrasulphonate method to the quantitative estimation of the indigotin of crude Bengal indigo.—Although the conditions for tetrasulphonation of pure indigotin without loss had been determined, a similar degree of knowledge was still to be attained in the case of crude indigos.

Thus, although pure indigotin is completely converted without loss into tetrasulphonate by heating with 20 per cent. fuming sulphuric acid for thirty minutes at 98° C., in the case of crude cake indigo it is found that the diluent effects, caused by the oxidation of some portion of the impurities, are so great on the fuming acid, that in this case an acid of some 5—10 per cent. greater strength in sulphuric anhydride is required to produce only the trasulphonate.

Air dry average factory "Mahai."—In order that the large number of experiments now to be made should be comparable one with the other, it was necessary to work always on the same material. There was fortunately available a large stock of air dry average factory "Mahai." This material was obtained in India by setting aside the superfluous pieces remaining after bottling specimens of the finished cake representing each day's output throughout the season of "Mahai" (manufacture), 1903—1904. The pieces were then well mixed together and reduced to fine powder, and finally passed through a very fine sieve. Thus an air dry powder was obtained, representing a fair average of the season's output. It was found by preliminary experiments that if the brown red impurities were separated from the crude cake indigo (*v.* next column), and if these were then subjected to sulphonation, the addition of potassium acetate, under the conditions of concentration adopted for analysis of pure indigotin, did not produce precipitation, the sulphonation products of the brown red impurities being, fortunately, more soluble. It was then decided that if fuming acid of 25—26 per cent. sulphuric anhydride were used to sulphonate the crude indigo, tetrasulphonate was obtained. Precipitation was effected with potassium acetate, and the process conducted as previously described (p. 741), but with two modifications. On filtration coming to an end, the tetrasulphonate precipitate was washed with the "isotonic" solution until the brown colour of the washings passed to colourless or faintly blue. The Gooch crucible and washed precipitate was then set aside and the main filtrate passed through a second Gooch crucible. In this way any traces of the sulphonate which escaped the first filtration were detained, washed, and finally dissolved and added to the main solution for titration. With these stated exceptions, the process was carried out as described in the case of pure indigotin. As a result of a large number of experiments the indigotin value of the "air dry average factory mahai" was found to lie between 57—59 per cent., whilst, after drying at 110° C., the values obtained were 60·3—61·9 per cent. indigotin (*v.* tables p. 743). These results were obtained by both the permanganate and titanium methods, good agreement being obtained, but the permanganate gave a result always about 1 per cent. higher than the titanium. An observation, which afforded great hope for the process as applied to crude indigos, was that the end point obtained on titration with permanganate was practically that of pure indigotin.

A large number of determinations have been made, in duplicate, on the "average factory mahai," the duplicates being in agreement and giving uniformly the figures just stated. Moreover, an extension of the enquiry to specimens of the daily output of the factory "mahai" (season 1903—1904) shows that, whilst duplicates are obtained agreeing well on one and the same sample, the examination of the product of other days' manufacture shows a different percentage of indigotin, but with the duplicates in good agreement (see tables, p. 743). Thus all the experimental evidence is in favour of the conclusions that the potassium tetrasulphonate method, when carried out as prescribed, gives the indigotin in the total quantity present in the cake, and that all the impurities pass away with the filtrate. But having regard to the fact that the establishment of an absolutely trustworthy process for the estimation of indigotin, both in pure indigotin, in synthetical and crude indigos, seemed a matter of such vital importance from the point of view both of the Indian indigo industry and of buyers and users of plant indigo, an attempt was made to remove all possible doubt on this matter.

Purification of Crude Indigo by Solvents.—Whilst in India, the author attempted to prepare pure indigotin by the action of solvents (acetic-sulphuric acid followed by methyl acohol); in this way residues were obtained from a crude cake indigo, which, weighed as being pure indigotin, gave in duplicate 70·34 per cent. and 69·34 per cent. as the indigotin content of the crude Bengal cake (dry at 110° C.). But a determination of the nitrogen value showed the real percentage indigotin to be 63·69 per cent. (Chem. Soc. Journ. Trans., 1905, 87, 982.) The present experiments showed that, using the potassium tetrasulphonate method, the indigotin value of average crude factory mahai (dry at 110° C.) was 60—62 per cent. So it appeared advisable to attempt to remove the several impurities of crude indigo by solvents, with a view to leaving a residue of pure indigotin, and thus finally testing the accuracy of the tetrasulphonate method.

The main impurities associated with crude cake indigos are the so-called indigo gluten (Berzelius, Jahresber., 7, 256), indigo brown (Berzelius loc. cit.), together with varying proportions of mineral matter and what may be termed leaf débris. The indigo yellow or Kampheral of Perkin (Chem. Soc. Proc., 1905, 20, 172) was absent in the material dealt with, and need not at present be discussed. The indigo gluten and some of the mineral matter are readily removed, as is well known, by means of hot dilute hydrochloric acid (1 : 4). But, as regards the indigo brown, which is undoubtedly a mixture of substances, no satisfactory solvent has previously been suggested for its complete removal. After numerous experiments, however, it was found that pyridine effected this object, for whereas by this solvent indigotin is almost inappreciably attacked in the cold, the indigo brown is very readily dissolved.* In carrying out this process finely powdered crude indigo was digested with boiling pyridine (Kahlbaum II.) for a few minutes and the mixture allowed to cool and set aside overnight. On filtration a deep brownish red liquid was obtained and the residue on the filter was washed with pyridine several times, until the filtrate no longer possessed this tint. The final washings possessed a very pale blue colour, but this, it was ascertained, represented an almost negligible quantity of indigotin. Proceeding in this manner, the following results were obtained, the analyses being made in duplicate :—

	(I.)	(II.)
Loss of weight after treatment with hydrochloric acid (1 : 4)	21·58 per cent.	21·21 per cent.
Loss of weight after treating with pyridine the residue from HCl.	17·49 per cent.	18·03 per cent.

These residues, after pyridine extraction, were dried at 120° until no smell of pyridine could be detected, and then sulphonated. Titration was then effected with permanganate, before and after treatment with potassium acetate, with the following results :—

(*a*) Before treatment with potassium acetate, 95·0 per cent. and 95·0 per cent. indigotin.
(*b*) After treatment with potassium acetate, 91·1 per cent. and 90·5—91·9 per cent.

The fact that the purified indigo only contained 91 per cent. of indigotin then received attention.

* The author, in conjunction with Mr. A. G. Perkin, is at present investigating this brown substance, and desires to reserve to himself at present this method for its isolation.

The end reaction on titration showed that the residue was free from coloured impurities. Estimation of the ash showed the value to be 1·85 per cent. Now if this mineral matter were present as oxalate, as seems quite possible, it might account for nearly 4 per cent. of the impurity. Nitrogen estimations showed that there was still some nitrogenous impurity remaining which had escaped extraction, thus two determinations, gave 10·63 and 10·65 per cent. = indigotin 99·46 and 99·65 per cent.

It was suggested that the high nitrogen value might be accounted for by the presence of leaf débris. This would naturally be resistent to solvents, would contain nitrogen, and on sulphonation, would almost certainly give rise to products upon which permanganate would act, but which would be removed in the filtrate after treatment with potassium acetate, and hence the observed lower values in the figures set forth.

An experiment was carried out to determine whether leaf débris could be detected in the residue after extraction with acid and pyridine. A weighed portion of the residue was placed in an extraction thimble and subjected, in a Soxhlets' apparatus, to prolonged extraction with pyridine. When the pyridine washings came through colourless, the thimble was heated in an air oven until no smell of pyridine could be detected. On again weighing the thimble and residue, the weight of the residue was determined to amount to 3·55 per cent. of the material subjected to experiment. The residue proved, on ignition, to contain mineral matter to the extent of 1·27 per cent., leaving more than 2 per cent. as leaf débris.

This experiment is not regarded as final, and an attempt is being made to make quite clear the chemical nature of the material which resists solution after treatment with acid and prolonged extraction with pyridine.

Before leaving this portion of the subject, it is to be noted that if the figures, obtained as above on treatment of the average crude factory mahai (air dry) with acid and pyridine, are calculated back to show the indigotin content of the air dry material, we have the following close relation between the results obtained by the extraction process and the potassium tetrasulphonate method (60—62 per cent.). Two calculations gave 61·57 and 61·17 per cent. respectively.

So that at present, although it is not proved possible to be able, by the action of solvents to remove from crude cake indigo all impurities save indigotin; and thus by direct experiment to prove the absolute accuracy of the tetrasulphonate method—all the evidence is in favour of its being an accurate method. As a final proof of the accuracy of the potassium tetrasulphonate process, pure indigotin was mixed with known weights of the brown material (previously removed from crude Bengal cake by the action of pyridine and dried at 140° C.); on sulphonating these mixtures, and separating the indigotin as potassium tetrasulphonate, the indigotin percentage obtained on titration was precisely that of the mixture made.

In conclusion, it is confidently hoped that, as a result of the experiments previously described, the way is now open, for the first time, for the quantitative examination of natural indigo in the finished cake, and at all stages of its manufacture; and that it may be possible to apply the potassium tetrasulphonate method in India to the detection of the defects of the present method of manufacture, and also to the many methods in which assistance can be now rendered to enable natural indigo to hold its own against the competition of the synthetic product.

In the report on the work done at Dalsingh Serai for the Government of Bengal (*loc. cit.*, Section II., p. 7.), the author expressed the opinion that the "efficiency" of the present method of manufacture was very low. This prediction is fulfilled, as is clearly shown, by inspection of the results obtained on applying the potassium tetrasulphonate process to the products of the Pembercandah Factory Mahai, Season 1903—1904.

Tables showing the results of analyses, employing the potassium tetrasulphonate method, of the Pembercandah Factory "Mahai" Season, 1903—1904:—

TABLE I.—*Showing the results of "Moorhum." (First cuttings of plant).*

No. of cake.	Per cent. of moisture of air-dry cake.	On samples dried at 110°C. Per cent. of Indigotin by $KMnO_4$.	On samples dried at 110°C. Per cent. of Indigotin by $TiCl_3$.	Per cent. of Indigotin obtained from whole plant.*
1	5·9	57·0	56·5	0·1282
2	5·7	57·3	56·2	0·6729
3	5·5	59·0	59·1	0·0902
4	5·8	56·7	55·8	0·0846
5	6·0	60·4	59·8	0·1491
6	6·4	62·2	60·6	0·0927
7	6·7	57·2	55·6	0·1334
8	6·7	65·5	64·9	0·1670
9	6·7	62·2	60·6	0·1468
10	6·0	58·6	57·6	0·1194
11 & 12	—	Missing	—	—
13	4·8	62·7	61·5	0·1661
14	5·7	56·1	55·3	0·1475
15	6·1	67·6	65·5	0·1924
16	5·4	64·4	62·6	0·1618
17	5·4	66·0	63·6	0·1835
18	6·0	62·4	61·2	0·1711
19	5·4	62·7	61·5	0·1778
20	5·2	63·0	62·1	0·1908
21	5·3	64·4	63·7	0·1837
22	5·8	59·5	58·8	0·1875
23	5·2	63·0	61·6	0·2019
24	5·0	64·8	64·5	0·2062
25	5·1	61·1	60·0	0·1831
26	5·4	61·6	60·5	0·1646
27	5·5	60·0	59·1	0·1644
28	5·0	63·0	61·6	0·1787
29	5·4	61·1	60·3	0·1828
30	5·2	62·3	60·0	0·1887
31	4·8	62·0	61·3	0·1609
32	5·4	59·0	57·3	0·1618
33	4·9	62·5	61·6	0·1930
34	5·6	60·0	59·3	0·1457
35	4·6	60·0	58·8	0·1876
36	4·8	66·6	63·7	0·1970
37	4·7	65·2	63·8	0·1677
38	5·7	57·3	55·1	0·0999
39	—	59·0	56·7	—
40	7·4	54·5	53·8	0·2158
41	—	55·0	53·8	—
42	6·4	63·3	62·2	0·2539
Average	5·4	61·2	60·3	0·1495

* These figures are obtained by calculation from the Factory Mahai Book, the necessary details for each day being:
(*a*) The weight of whole plant steeped.
(*b*) The weight of cake obtained (of indigotin per cent. as stated in the table).

TABLE II.—*Showing the results of "Khoonties" (Second cuttings of plant).*

No. of cake.	Per cent. of moisture of air dry cake.	On samples dried at 110°C. Per cent. of Indigotin by $KMnO_4$.	On samples dried at 110°C. Per cent. of Indigotin by $TiCl_3$.	Per cent. of Indigotin obtained from whole plant.
43	5·8	57·7	59·5	0·0964
44	5·23	61·1	59·6	0·1700
45	6·0	60·5	58·8	0·1170
46	—	Missing	—	—
47	5·5	62·7	59·5	0·1480
48	4·95	65·5	62·2	0·1600
49	5·7	58·8	57·5	0·1213
50	5·55	62·7	61·1	0·1327
51	5·1	62·7	62·0	0·1555
52	5·96	60·0	58·6	0·1460
53	4·40	66·1	64·3	0·1688
54	4·4	65·0	63·9	0·1504
55	4·6	63·9	61·7	0·1570
56	4·3	66·1	64·9	0·2243
57	4·7	63·9	63·4	0·2208
58	4·5	62·0	61·5	0·1891
59	4·4	58·9	58·7	0·1736
60	5·24	58·8	58·2	0·1962
61	4·6	58·9	57·3	0·1072
62	4·7	62·7	60·8	0·1651
63	4·7	58·9	58·2	0·1727
64	4·7	62·0	60·5	0·1826
65	4·9	62·3	60·9	0·1868
66	4·95	62·7	60·9	0·1834
67	—	Missing	—	—
68	4·90	62·2	60·9	0·1767
69	4·7	66·0	59·7	0·1854
70	4·7	60·0	60·5	0·1826
71	5·7	60·5	59·2	0·1796
72	5·27	63·3	62·4	0·1896
Average	5·0	61·9	60·5	0·1834

From these results, it will be seen that if the percentage of indigotin contained in the whole plant (ordinary Indian varieties) be taken, as seems reasonable, at 0·6 per cent. Then from consideration of the weights of plant steeped and the indigotin recovered in the finished cake—the highest efficiency attained does not reach 50 per cent. of the total indigotin obtainable, whilst the average efficiency of the "Mahai" is 25 per cent., falling thence to 12·6 per cent. (cake No. 2). The attention of the Government of India will be called to this wasteful method of manufacture, with a view to the long-needed improvements being introduced to India without delay.

The author's thanks are due to the university authorities for the excellent facilities so freely placed at his disposal; also to Prof. A. G. Green for his unvarying kindness in this direction. In connection with the work itself, he is greatly indebted to his assistants Messrs. I. Q. Orchardson and S. H. Wood, who have been unremitting in their efforts to bring the work to a successful conclusion, and to whom much of the experimental work has naturally fallen.

He has finally to express his deep sense of gratitude to Mr. A. G. Perkin, F.R.S., with whom he has been daily associated, for the many and most valuable suggestions which have borne fruit in this investigation.

Discussion.

Prof. A. G. Green congratulated Mr. Bloxam on the results which he had obtained and said that they were a good example of what could be achieved by skilled analytical work. It was 50 years since Mohr had first put forward the permanganate titration method and had clearly set out its faults. It had thus taken 50 years to perfect the process. Mr. Bloxam was an optimist, and believed in the future of plant indigo. Recent news from India showed that there was every probability of an increase of yield of 50 per cent. in the production of most factories, and a simultaneous rise in quality of the product from second to first-class. The introduction of the Java-Natal plant had been the chief factor in bringing about this improvement.

Mr. T. Fairley asked if colorimetric tests would be of any value in supporting Mr. Bloxam's work. He suggested the use of Lovibond's tintometer. Possibly leaf debris might be separated from powdered crude indigo cake by suspension of the latter in solutions of various specific gravities and subsequent spinning in a centrifugal machine.

Mr. S. H. Davies said he presumed that the accurate determination of indigotin would be applied not only in the factory but to agricultural problems involved in the cultivation of indigo, and to the selection of the best varieties of the plant.

Mr. A. G. Perkin said that having frequently seen Mr. Bloxam's process working, he had no doubt that it was effective and simple, and might be worked by the average student with success. Much that was unreliable had been written on indigo analysis, and it was difficult to understand Wangerin and Vorländer's paper. The confidence placed in their results had greatly hindered Mr. Bloxam's work. Again, it did not seem to be known that powdered glass, recommended by some writers as useful during sulphonation, contained iron, and yielded with the acid a ferrous salt, which, of course, reacted with the potassium permanganate in the titration. The salting out process, again, did not entirely remove this defect. Purification of the glass by digestion with acid had been resorted to by Mr. Bloxam, but was tedious, and only removed the iron from the surface of the glass, so that during the stirring some iron again entered solution.

Mr. W. P. Bloxam, in reply, said he thought the new method would meet the present needs. What he still desired to discover, however, was the function of the impurities of plant indigo, and to ascertain what body or bodies was or were responsible for the scouring experienced by dyers in using plant indigo. In applying the potassium tetrasulphono-indigotate process to the analysis of synthetical indigos some curious results were obtained. None of them had been found to contain more than 92 per cent. of indigotin, and it was found possible to recognise the product by the colour of the filtrate—thus that from Meister, Lucius und Brüning gave a green, whilst the B.A.S.F. product gave a red filtrate. The method of analysis was so delicate that an instance might be cited in proof. The process was originally established on pure indigotin obtained by sublimation as standard. It was later found necessary to prepare more pure indigotin for use as standard. Three separate sublimation products were obtained and examined separately with solvents, &c., and pronounced to be pure. The three products were then mixed together and the value determined by the potassium tetrasulphono-indigotate process. The results showed the indigotin value to be slightly below 100 per cent., and on making a more stringent examination of the sublimation product with solvents, &c., the results of the analysis were confirmed, showing that one at least of the three sublimation products contained a small quantity of impurity which had at first escaped detection.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 683.)

English Patents.

Separators; Impts. in centrifugal liquid ——. J. P. Johansson, Enkaping, Sweden. Eng. Pat. 18,444, Sept. 12, 1905.

The invention relates to liners for centrifugal machines which are formed of a number of vertical plates arranged round an axis, and bent in a direction inclined to the radii of the liner. The cover and bottom piece of the drum and the top and bottom of the liner are convex, so as to correspond to one another in order that the plates of the liner may be supported along the whole length of their upper and lower edges by the top and bottom of the drum, thus obviating the use of distance pieces between the plates. The distance between adjacent plates is gradually decreased from the axis to the periphery of the liner, and the spaces are quite free from obstructions of any kind, so that the liner can be easily cleaned.

—W. H. C.

Separating machines; Impts. in ——. W. S. Ayres, Hazleton, Pa., U.S.A. Eng. Pat. 19,914, Oct. 3, 1905.

The materials to be separated are caused to pass over a number of overlapping, rotating, flat or slightly conical discs. A forward movement among the particles to be separated is caused by inclining the series of discs from the inlet to the outlet, and a lateral movement is caused by the rotation of the discs. The discs are rotated "synchronously," and the lighter particles travel forward by gravity, being directed by a guide-bar, passing across the whole series of discs, from the feed to the outlet about. The heavier particles are carried but laterally by the rotating discs, and are finally dropped off the edges

of the latter into another trough. A modification in which only one disc is used, is described, and reference for further details is made to Eng. Pat. 19,913 of 1905 (this J., 1906, 981).—W. H. C.

Liquids; Apparatus for the continuous supply of two —— to a vessel. W. P. Thompson, London. From A. Schmitz, Aachen, Germany. Eng. Pat. 19,378, Sept. 25, 1905.

See Fr. Pat. 358,007 of 1905; this J., 1906, 168.—T. F. B.

Straining or filtering water or other liquids; Apparatus for ——. E. Gobbi, Asnières, France. Eng. Pat. 7616, March 29, 1906. Under Int. Conv., Dec. 23, 1905.

The filter is formed of a number of rings or discs piled one upon the other, and held tightly pressed together. A central tube passes through the pile. The liquid to be filtered passes through the interstices between the discs to the central tube. The filter can be cleaned by allowing some of the filtered water to flow backwards between the discs, which are loosened for the purpose, and are provided with springs between each pair of adjacent discs to keep them apart when the pressure holding them together is removed.—W. H. C.

United States Patents.

Ammonia-still [for ice-machines]. B. Thoens, New York. U.S. Pat. 818,858, April 24, 1906.

The patent relates to absorption ice and refrigeration machines, and consists in improvements whereby practically anhydrous ammonia gas can be produced for delivery to the absorption apparatus. The vapours from the ammonia generator, before entering the absorption apparatus, pass through a "rectifier-coil" cooled by water, and then to a separator, whereby practically the whole of the water vapour present is condensed. The condensed water from the coil and from the separator is returned to the ammonia generator.—A. S.

Ammonia [in refrigerating machinery]; Regenerating and purifying ——. L. Werlin, Elsmere, Del. U.S. Pat. 824,459, June 26, 1906.

Of the compressed ammonia, a portion is condensed, and of this portion a part is expanded to obtain the cooling effect, and the residual portion is evaporated "by the heat of condensation of the remaining [second] portion of the warm compressed gas." The vapours thus produced are purified by the action of the cold exhaust gas from the expansion device, whereby the less volatile impurities are condensed to a liquid free from ammonia; then the exhaust gas and the purified ammonia vapours are mixed and re-compressed.—E. S.

Separating liquids from solids; Apparatus for ——. W. H. Lomas, Doornfontein, Transvaal. U.S. Pat. 825,331, July 10, 1906.

See Eng. Pat. 149 of 1905; this J., 1906, 184.—T. F. B.

French Patents.

Volatile solvents diffused as vapours in the air of factories; Process for the recovery of ——. J. Douge. Fr. Pat. 362,611, Jan. 22, 1906.

The large volumes of air or of air and aqueous vapour with which the vapours of the volatile solvents are usually mixed, render the usual methods of recovery, such as condensation, refrigeration, absorption by liquids, or compression and subsequent expansion, of little practical value. The object of this invention is to remove the greater portion of the diluting air or air and aqueous vapour before proceeding to any of the above-mentioned methods of recovery. To attain this object, the mixture of air and vapour is aspirated from the localities in which it is produced, by a centrifugal aspirator separator, which, owing to the difference in the specific gravities of the air and vapour, is able to separate it into two parts, one of which consists chiefly of air and aqueous vapour, containing only a small proportion of the vapours to be recovered, and which is either returned to the building or discharged direct into the atmosphere. The other part, consisting of a mixture much richer in valuable vapours, is sent through a second and if necessary through a succession of similar machines. Finally, when the desired concentration has been attained, the vapours are recovered by passing this rich mixture through any of the ordinary types of apparatus to carry out the methods mentioned above.—W. H. C.

Centrifugal apparatus; Impts. in ——. L. Fuchs. Fr. Pat. 362,673, Jan. 24, 1906.

The claim is for improvements in that type of centrifugal machines in which the contents are discharged through the bottom, which is lowered for that purpose. This in the improved method is lowered not by an arrangement of levers, as in the ordinary machines, but by hydraulic or pneumatic pressure applied from below to a chamber surrounding the axis of the machine.—W. H. C.

Dryer for loose materials. B. Schilde. Fr. Pat. 362,853, Jan. 30, 1906.

The loose materials are placed on trays, the sides of which are grooved on the outside to form a kind of rack. The trays are piled one upon the other in a drying chamber, and are slowly lowered one by one on to guide-rails at the bottom, by means of toothed wheels, which engage with the racks on the sides of the trays. When the bottom tray is lowered upon the guide-rails, it is moved away horizontally, emptied, recharged, and replaced on the top of the pile, and another tray lowered.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

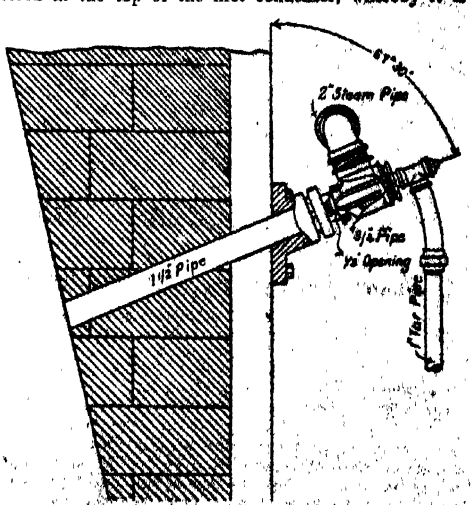
(*Continued from page 686.*)

Hydrocarbons; Oxidation of —— by ozone at low temperatures. J. Drugman. III., page 748.

Carbon; Solubility of —— in calcium carbide. H. M. Kahn. VII., page 758.

Tar; Use of —— in making water-gas. G. H. Waring. J. Gas Lighting, 1906, 95, 35—36.

Oil tar has been used successfully as a generator fuel since 1898 in the works of the Omaha Gas Company, U.S.A. The tar is first freed from water by passage through two separators, and subsidence, and is then stored in the top of the first condenser, whereby it is



brought to about 130° F. The hot tar is sprayed into the generator along with steam, the spraying device being that shown in the accompanying illustration. Tar is admitted with the steam only on a down run, which is about every third one. To keep the 1-in. inlet pipe clear, the steam is turned on before, and is also cut off after the

tar supply. The gas maker admits the tar to the generator after turning on the oil in the carburetter, and shuts it off before turning off the oil. No unusual fouling of the plant occurs, the amount of smoke produced is unobjectionable, and the tar made is not affected in any way. Experience has shown that not more than 0·5 gall. of tar per 1000 cb. ft. of carburetted water-gas made can be used efficiently with oven coke, or 0·4 gall. when using gas coke, unless the down runs are more frequent than once in three. On the average, 1 gall. of water-free tar is equal to 8 lb. of oven coke or 10 lb. of gas coke. At the Philadelphia Gas Works the experience of several years shows that 1 gall. of tar is equal to 7 lb. of anthracite, and that not more than 0·25 gall. per 1000 cb. ft. of gas can be used efficiently along with anthracite. The tar has also an enriching effect upon the gas. There is a marked increase in the proportions of hydrogen and methane in the gas, and the calorific value is increased by about 11 per cent. Of the tar produced in the water-gas plant, from one-third to two-thirds can be used as fuel in the above manner, and it is suggested that if the process were adopted generally, the market value of the disposable balance of the tar would increase.—H. B.

Gas-engines built in Great Britain; Notes on ——, and upon gas-cleaning. T. Westgarth. Iron and Steel Inst., July, 1906. [Advance proof.]

SCHEDULES are given showing the number and particulars of gas-engines of 500 h.p. or more which have been built or are being built by British makers, together with some notes on the various systems of gas cleaning.

Gas-engines; Application of large —— in the German iron and steel industries. K. Reinhardt. X., page 761.

Hefner, Harcourt, and Carcel lamps. Photometric investigations by the Physical-Technical Imperial Institute at Charlottenburg on the relation of the intensity of light of the Hefner lamp to the 10*-candle pentane lamp and the carcel lamp.* E. Liebenthal. J. Gas Lighting, 1906, **95**, 102—103.

INVESTIGATIONS at the Charlottenburg Institute have shown that the light of the 10-candle pentane lamp (as prescribed by the London Gas Referees), at an atmospheric pressure of 760 mm. and a humidity of 8·8 litres of aqueous vapour per cubic metre of dry air, is equal to 11 Hefner units under the same conditions. With a humidity of 10 litres (which is regarded at the National Physical Laboratory as the average humidity applicable to London), the value is 10·9 Hefner units (taking the Hefner unit at 8·8 litres). Harcourt's statement, that the light of the lamp does not vary if the flame fluctuates by as much as 6 mm. above or below the prescribed height, is found to be nearly correct if the flame be higher, but not if it be lower; if the tip of the flame plays about the lower edge of the inspection window, the light is about 3 per cent. lower than the normal. Using all precautions, the variations in the light of one and the same lamp, with the same pentane, and under the same meteorological conditions, were found to be upwards of 1 per cent. in the course of several hours. The light of the lamp decreased 0·55 per cent. for an increase of 1 litre in the amount of aqueous vapour per cubic metre of air—a decrease which is the same as that of the Hefner and 1-candle pentane lamps. The light increased 0·6 per cent. for an increase of 10 mm. in the barometric pressure, whereas the increase in the light of the Hefner and 1-candle pentane lamps respectively was only 0·1 and 0·4 per cent. The standard of light used for the above comparisons was a constant incandescent electric lamp. Earlier comparisons with the English candle gave a value of 1·14 Hefner units, and from these and the above results it would appear that the illuminating power of the 10-candle pentane lamp is about 4 per cent. lower than 10 English candles.

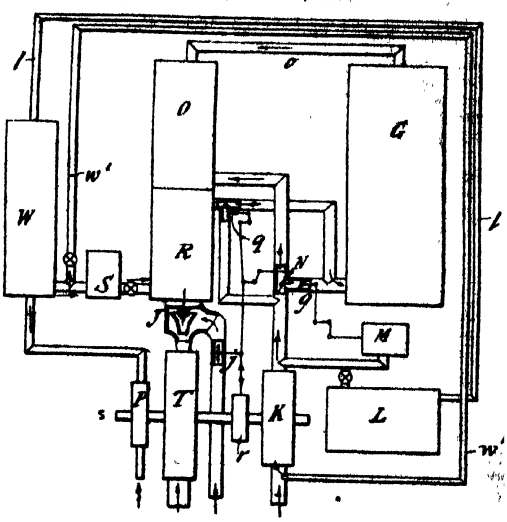
The carcel lamp was found to have an illuminating power (on the basis of the like atmospheric humidity) equal to 10·8 Hefner units, on the average; but the light fluctuated considerably, and the figures from which the mean value, 10·8, was deduced, vary among themselves by upwards of 10 per cent.—H. B.

Coke; Comparison of Rhenish-Westphalian foundry and blast-furnace ——. F. Wüst and G. Ott. X., page 761.

Calorimetric method; New ——. M. Casaubon. XXIII., page 778.

ENGLISH PATENTS.

Fuel; Method of converting the chemical energy of —— into the kinetic energy of a moving fluid, and apparatus for use in connection therewith. A. Vogt, Tulse Hill, Surrey. Eng. Pat. 3607, Feb. 21, 1905.



A TURBINE, T, a water-pump, P, an air-compressor, K, and a governor, r, are all coupled together on the shaft, s. The compressor, K, delivers compressed air into the air-reservoir, L, the generator, G, and the combustion chamber, O, the distribution being controlled by the regulator, N, operated by the governor, r. In the generator, G, gas is produced by the action of the compressed air on the fuel, and is conducted by the pipe, o, to the combustion chamber, O, where it meets with a further supply of air, and is burnt. The water-pump, P, delivers water into the reservoir, W, which is connected to the compressed-air store, L, by the pipe l. From W, the water is forced by the compressed air partly along the pipe, w^1, to the intake of the compressor, K, and partly through the float valve, S, into the regenerator, R, where it is converted into steam, and passes on to the generator, G, or to the compressed-air main, the distribution being regulated by the valve, q. From the combustion chamber, O, the gases issue through an expansion nozzle of the "Laval" type to the regenerator, R, where the heat is utilised in converting the water into steam; the partly cooled gas then passes through the injector, J, into the turbine, T, where its velocity is utilised. By means of the valve, j, connected to the governor, r, a regulated amount of air is drawn by the injector from the atmosphere to further cool the gas issuing from the regenerator, R. The quantity of air entering the generator, G, is further controlled by the damper, g, connected to the diaphragm regulator, M, on the compressed-air main. The heat generated by the compressor is partly absorbed by the water entering by the pipe, w^1, and the generator and combustion chamber are very thoroughly protected against loss of heat by radiation.—W. H. C.

Gas fires and the like; Manufacture of refractory bodies for use in ——, for heating purposes. M. Delage, Paris. Eng. Pat. 12,466, June 16, 1905. Under Int. Conv., Oct. 26, 1904.

Cerium oxide is mixed, in the proportion of 10 to 50 per cent., with other refractory substances, such as aluminium silicate, and the mixture is moulded into the

desired forms. The refractory bodies so prepared emit practically no light, but are said to radiate a large quantity of heat.—H. B.

Burners for liquid fuel; Impts. in ——. W. Dieckmann, Edmonton; F. C. Ormrod, Walthamstow; J. A. Curle, Woodford; and S. F. Stockard, Muswell Hill. Eng. Pat. 13,013, June 23, 1905.

THE burner consists of three concentric nozzles, the intermediate one being for the supply of liquid fuel, whilst the outermost and innermost are for the supply of air or steam. The mouthpiece of one or more of the nozzles is shaped to have an orifice of a non-circular (*e.g.*, an oval) cross-section. The innermost nozzle is rotatable, so as to constitute a needle valve for regulating the fuel supply, and when its mouthpiece is of non-circular cross-section, it is provided with a connection whereby the nozzle may be rotated without rotating the mouthpiece.—H. B.

Gas producers; Impts. in ——. H. Foster and O. T. Greener, Newport, Mon. Eng. Pat. 14,575, July 14, 1905.

THE producer is provided with an iron hearth or combustion chamber in the form of a hollow, inverted, truncated cone, the hearth being of sufficient depth to contain the whole of the fuel, and the slope of the side being such that the clinker will be forced downwards by the weight of the superincumbent fuel into the water-sealed ash-pit at the bottom. The lower part of the sides of the hearth is provided with grids for the admission of air and steam. A casing with vertical sides surrounds the hearth. The air and steam blasts enter the top of the space formed between the hearth and the casing, and, on flowing round the hearth on their way to the grids, take up heat from it, and keep it at a moderate temperature.—H. B.

Gas producers; Impts. in suction ——. J. J. Bowmor, Newcastle-on-Tyne. Eng. Pat. 22,382, Nov. 2, 1905.

A SMALL boiler, round which the hot producer gases are drawn, is attached to one side of the producer, and is connected to a chamber in front of the fire-grate through a loaded valve. It is also provided with an escape valve loaded to a lower pressure than the latter valve, so that the steam generated passes off into the air unless drawn into the producer by the suction of the engine. An air pipe, which passes through the boiler flue, and supplies heated air to the producer, is likewise connected to the chamber in front of the fire-grate, the steam pipe and air pipe being controlled by a common loaded valve, so that steam and air in proper proportions only enter the chamber at each suction stroke.—H. B.

Gas generators; Impts. relating to ——. H. Goehtz, Hildesheim, Germany. Eng. Pat. 1331, Jan. 17, 1906. Under Int. Conv., Nov. 30, 1905.

THE generator is provided with an annular grate, arranged concentrically at the bottom of the combustion chamber, the grate consisting either of a ring of sheet iron of $\wedge$-shaped cross-section, or of a series of semicircular bars forming an annulus of $\cap$-shaped cross-section. The blast of steam and air is delivered into the annular grate through pipes, and either passes out beneath the lower edge of the annulus, or issues through the intervals between the bars. A roof-shaped deflecting plate, standing in the ash-pit beneath the grate, deflects the ashes descending through it to points convenient of access.—H. B.

Carburetting apparatus [for air-gas]; Impts. in ——. F. Hugershoff, Leipsic, Germany. Eng. Pat. 2440, Jan. 31, 1906.

THE carburetter proper, consisting of a zig-zag pipe of rectangular cross-section, is arranged within a casing filled with water, which serves as an attemperating liquid. Air is delivered by means of a meter drum at the lower end of the carburetter, and in passing upwards constitutes a downwardly flowing stream of the carburetting liquid, which is admitted in regulated doses at the top end of the carburetter. Within the casing is arranged a number of vertical pipes, through which atmospheric air may circulate, to assist in maintaining a uniform temperature, and a rotary stirring wheel, driven by the meter drum, to keep the attemperating water in motion. The carburetted air issues through a branch pipe at the upper end of the carburetter, and may be led off to a separate gas-holder, or into a bell, inverted over the casing, and adapted to serve as a gas-holder.—H. B.

Gases produced in the destructive distillation of coal or other carbonaceous material; Purification of ——, *and apparatus therefor.* G. Wilton, London. Eng. Pat. 2907, Feb. 6, 1906.

THE crude gas from, say, the hydraulic main is led directly, without the intervention of the usual condensing plant, through a scrubber in which it is caused to bubble through cooled gas liquor, preferably containing light tars in admixture. The liquor is caused to circulate from the scrubber through a cooling tower, so as to re-enter the scrubber always in a cold condition. The cooling and scrubbing thus effected may be preceded by treating the gas in the hydraulic main with cooled gas liquor, for the removal of heavy tars and naphthalene.—H. B.

Incandescent mantles; Treatment of the woven tubes or of the yarns used in the manufacture of ——. A. I. van Vriesland, Scheveningen, Holland. Eng. Pat. 24,680, Nov. 29, 1905.

SEE Fr. Pat. 359,945 of 1905; this J., 1906, 467.—T. F. B.

Arc lamp electrodes; Impts. in ——. The British Thomson-Houston Co., Ltd., London. From Allgem. Elektricitäts.-Ges., Berlin. Eng. Pat. 20,330, Oct. 9, 1905.

IN the manufacture of electrodes consisting essentially of metals, such as iron or manganese, or of metallic oxides, or of titanium carbide, finely powdered silicon carbide is mixed with the material of the electrode. The silicon carbide, it is stated, does not fuse when the arc is formed, and thus steadies the arc.—H. B.

UNITED STATES PATENTS.

Coke oven. W. Klönne, Rath, Germany. U.S. Pat. 825,221, July 3, 1906.

SEE Fr. Pat. 358,624 of 1905; this J., 1906, 309.—T. F. B.

Smoke; Apparatus for purifying ——. W. Cline, Assignor to J. F. Brimmer and W. Fuhrman, Lancaster, Pa. U.S. Pat. 824,469, June 26, 1906.

THE smoke passing from the flue to the chimney is caused to traverse a chamber interposed between them. A liquid is sprayed into this chamber near the inlet end, and in the same direction in which the smoke is passing. The spray washes the smoke, and falls to the bottom of the chamber, and is then conducted by a pipe to a series of settling tanks, where the impurities are deposited, and from which the purified liquid is pumped back to the sprayer for use over again.—W. H. C.

FRENCH PATENTS.

Fuel; Manufacture of artificial ——. J. M. A. Stillesen. Fr. Pat. 362,901, Jan. 4, 1906.

SEE U.S. Pat. 809,998 of 1906; this J., 1906, 169.—T. F. B.

Motive fluid for internal combustion motors; Preparation of a ——. P. Winand. Fr. Pat. 363,021, Feb. 6, 1906. Under Int. Conv., Feb. 8, 1905.

SEE Eng. Pat. 3006 of 1906; this J., 1906, 582.—T. F. B.

Furnaces for vertical retorts. E. Derval. Fr. Pat. 362,501, Jan. 18, 1906.

THE retort setting is characterised by the arrangement of the producer and recuperators upon the same level as the retort chamber, the hot products of combustion from the latter being led into the recuperators at the top, and forcing down them in a direction opposite to that of the inflowing air. The retort chamber is divided by

three series of horizontal partitions, which cause the burning gases flowing round the retorts to change their direction four times before reaching the outlet; the quantity of heated air admitted with the producer gas is insufficient for its complete combustion, and a supplementary supply of air is admitted at the third change of direction, to ensure, by the renewed combustion, the adequate heating of the lowest sections of the retorts. Methods of building up the retorts, and devices for closing them, and for introducing steam, are described.—H. B.

Gas-producer. A. J. J. Adam. Fr. Pat. 362,312, Jan. 10, 1906.

The cover of the producer, which carries a charging hopper and fuel distributor, eccentrically disposed, is adapted to be rotated continuously in a horizontal plane, so that the fuel may be discharged over the entire fuel bed. The fuel distributor, which is arranged within the lower part of the hopper, consists of a conical body, rotating on a horizontal axis, and formed with a longitudinal V-shaped trough which alternately fills with, and discharges, the fuel. The cover is in the form of a shallow tray, and is kept filled with water to prevent over-heating. The fuel in the producer rests upon a plate, which is suspended from chains wound upon pulleys arranged round the lower part of the producer; the blast-pipe extends centrally upwards through the plate, which, by the gradual rotation of the pulleys, is caused to descend slowly as the fuel is consumed, thus keeping the top level of the fuel constant. When the plate has reached the base of the producer, bars are inserted through the furnace walls at a point above the cinders, so as to form a temporary grate, whereupon the cinders are raked out, and the plate wound up again to its highest level, descending again *de novo*.—H. B.

[*Locomobile*] *Gas-producer.* H. Hurlebusch. Fr. Pat. 362,425, Jan. 15, 1906.

The locomobile gas-producer consists of a small producer of any suitable kind, attached to a casing having the general aspect of the boiler of a locomobile, the top of the casing serving as the foundation of a gas engine. Within the casing is arranged the apparatus for purifying and cooling the gas on its way from the producer to the engine; it consists of a series of compartments and channels, provided with water-spray and beds of moist coke and sawdust. The entire apparatus is mounted on wheels.—H. B.

Gases; Apparatus for the analysis of ——. Monopol Betriebskontroll-Apparate, K. Steinbock. Second Addition, dated Dec. 4, 1905, to Fr. Pat. 359,352, Nov. 2, 1905. XXIII., page 778.

Filaments for incandescent lamps; Process for the formation of ——. Zirkon-Glühlampenwerk. Dr. Hollefreund and Co. Fr. Pat. 362,847, Jan. 30, 1906.

The filaments, either loosely or in bundles, are placed along with a piece of any suitable metal, alloy, mixture of metals, or carbon, in a tube of metal or porcelain, which is then sealed up hermetically. As complete a vacuum as possible is next produced in the tube, which is afterwards heated to such a temperature that the metal, &c., inside is volatilised, and deposited as a fine, adherent film upon the filaments. After cooling, the vessel is opened, and the filaments taken out to undergo any other desired treatment, or to be used as they are.—W. H. C.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 687.)

Hydrocarbons; Oxidation of —— *by ozone at low temperatures.* J. Drugman. Chem. Soc. Proc., 1906, 22, 163—164.

The mode of action of ozone on a saturated and an unsaturated hydrocarbon is very different. Ozone acts, at the ordinary temperature, very slowly on saturated hydrocarbons such as methane and ethane. The process is one of gradual hydroxylation. In the case of ethane, ethyl alcohol is the first product formed.

The reaction in the case of an unsaturated hydrocarbon such as ethylene is instantaneous, even at temperatures far below 0°C. A very explosive addition compound is first formed, which decomposes extremely readily, giving oxidation products containing only one carbon atom. The carbon chain is broken at the double bond. Comparison with the results of Harries' work makes it appear probable that the addition product is an ozonide, but the decomposition of this is more complex than that usually obtained with a liquid or solid ozonide. The following equations probably represent the process:—

(1) $C_2H_4 + O_3 = C_2H_4O_3 = \begin{cases} (a)\ CH_2O + HCO_2H \\ (b)\ CH_2O + CO + H_2O \end{cases}$

(2) $C_2H_4O_3 + H_2O = 2CH_2O + H_2O_2$.

ENGLISH PATENT.

Tar oils, phenols, and similar products; Emulsions of ——. W. Spalteholz, Amsterdam. Eng. Pat. 13,151, June 26, 1905.

See Fr. Pat. 355,342 of 1905; this J., 1905, 1166.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 687.)

α-Naphthol and benzophenone chloride; Condensation products of ——. A. G. Shrimpton. Chem. News, 1906, 94, 13—14.

Diphenyldi-α-naphtholmethane, $(C_6H_5)_2C(C_{10}H_6.OH)_2$, was formed by the condensation of α-naphthol with benzophenone chloride, according to the equation:—

$(C_6H_5)_2CCl_2 + 2C_{10}H_7OH = (C_6H_5)_2C(C_{10}H_6OH)_2 + 2HCl$.

It forms microscopic crystals melting at 208·2°—209·2° C., is soluble in benzene, carbon bisulphide, ether, acetone, and chloroform, less soluble in alcohol and petroleum spirit, and dissolves in alkalis, giving a madder-brown solution, which shows a blue fluorescence. By modifying the method adopted for the preparation of the above compound, a second condensation product was obtained, consisting of fine yellow microscopic crystals melting at 180·5 to 181° C., and possessing good dyeing properties.—D. B.

Trinitrobenzene derivatives with cyclic amines; Contribution to the knowledge of ——. E. O. Sommerhof. Z. Farben.-Ind., 1906, 5, 270—271.

The author cannot admit V. Georgievic's contention (this J., 1906, 530) that picric acid must exist in two modifications because it dyes wool different shades from a cold and from a boiling bath. In the cold, he states, the picric acid is merely fixed on the fibre in the form of a solid solution. On heating, a "loose" chemical combination is formed between the picric acid and the wool fibre, which is of a darker colour than the dyestuff itself. Similarly, picric acid and also trinitrobenzoic acid form compounds of different colour with aromatic amines. Thus on mixing equimolecular methyl alcoholic solutions of trinitrobenzoic acid and pseudo-cumidine in the cold, a colourless salt is obtained; on warming an isomeric coloured substance, a "loose" molecular addition product is formed.—H. L.

Phenylacetic acid ketone dyestuffs. Trihydroxydeoxybenzoin and derivatives thereof. E. Noelting and V. Kadiera. Ber., 1905, 38, 2056—2060.

The authors have condensed pyrogallol with phenylacetic acid, and obtained phenylgallacetophenone (trihydroxydeoxybenzoin) m.pt. 141°—142°, a homologue of trihydroxybenzophenone (Alizarin Yellow A) the condensation product of pyrogallol and benzoic acid. By treating the new substance with hydroxylamine the ketoxime, m.pt. 166° C., and with sodium nitrite or amyl nitrite the isonitrosoketone, m.pt. 144° C., respectively were

obtained. The di-isonitroso derivative, m.pt. 168° C., was prepared by treating the oxime with sodium nitrite, and this substance was converted into the corresponding diketone, trihydroxybenzil, m.pt. 143° C., by acids, the isonitroso groups being eliminated. These five new substances are mordant dyestuffs similar to gallacetophenone [Alizarin Yellow C) and trihydroxybenzophenone. Their dyeing properties are given in the following table :—

Dyestuff.	Cotton mordanted with :		Wool mordanted with chrome.
	Alumina.	Iron.	
Ketone	olive-orange	brownish-black	olive
Diketone	olive-orange	brownish-black	olive
Isonitrosoketone	olive-orange	brownish-black	olive
Oxime	a little greener and duller		greenish-olive
Di-oxime	the same as the monoxime		greenish-olive
Gallacetophenone	greenish-yellow	greyish-black	greenish-olive
Trihydroxybenzophenone	orange	brownish-black	reddish-olive

—H. L.

Triphenylmethane derivatives ; o-Hydroxylated ——. E. Noelting and P. Gerlinger. Ber., 1906, **39**, 2053—2056.

4¹.4².4³-Hexamethyltriamino-2³-hydroxytriphenylmethane $(CH_3)_2N.C_6H_3(OH).CH[C_6H_4.N(CH_3)_2]_2$ is prepared by condensing Michler's carbinol with dimethyl-*m*-aminophenol by means of concentrated hydrochloric acid and a little alcohol. Recrystallised from alcohol it forms fine white needles turning reddish on exposure to the air, and melting at 172°—174° C. with decomposition. It is easily soluble in organic solvents. Oxidation to a blue dyestuff is very incomplete owing probably to the presence of an *o*-hydroxyl group. On the other hand the acetyl compound obtained by treating the leuco body with hot acetic anhydride can be smoothly oxidised with lead peroxide, and yields a dyestuff which dyes the fibre blue with a violet tone.

4¹.4².4³-*Hexamethyltriamino-2¹.2³-dihydroxytriphenylmethane* $(CH_3)_2N.C_6H_3(OH).CH[C_6H_3(OH)N(CH_3)_2][C_6H_4.N(CH_3)_2]$ is prepared by condensing *p*-dimethylaminobenzaldehyde with 2 mols. of dimethyl-*m*-aminophenol. It crystallises from alcohol in white needles, melting at 175° C. with elimination of water, which gradually turn pinkish when exposed to the air. It is readily soluble in dilute aqueous alkalis, and in organic solvents. Oxidation with lead peroxide and glacial acetic acid produces only a poor yield of a violet-blue dyestuff. The di-acetyl compound of the leuco body is, however, readily oxidised to a dyestuff which produces fairly strong violet-blue shades. When the leuco body is dissolved in concentrated sulphuric acid and heated for six hours on the water-bath, a molecule of water is split off, and a very readily oxidisable dark bluish-red substance

$$O<\begin{matrix}C_6H_3.N(CH_3)_2\\C_6H_3.N(CH_3)_2\end{matrix}>CH.C_6H_4.N(CH_3)_2$$

is obtained. By heating this leuco product to 150° C. with concentrated sulphuric acid, it is oxidised to the corresponding dyestuff, which represents the dimethyl-*p*-amino derivative of Rosamine. It produces very bluish-red—almost violet—shades. The introduction of the same group into the Malachite Green molecule, it is pointed out, produces Crystal Violet. Here the change is much less marked. The introduction of one or two acetoxy groups in the *o*-position in the Crystal Violet molecule has, further, much more effect on the shade than the introduction of a pyrone oxygen atom.—H. L.

Malachite Green ; Influence of substitution in the benzene ring on the shade of ——. E. Noelting and P. Gerlinger. Ber., 1906, **39**, 2041—2053.

The influence of substitution in the unsubstituted benzene ring of Malachite Green,

$$C_6H_5.CH<\begin{matrix}C_6H_4.N(CH_3)_2Cl\\C_6H_4.N(CH_3)_2,\end{matrix}$$

as far as hitherto determined, is as follows. A nitro-group in the *p*-position makes the shade yellower (see E. and O. Fischer, Ber., 1879, 800 and 802, and O. Fischer, Ber., 1881, 2524 ; 1882, 632 ; and 1884, 1839), in the *o*-position much bluer, and in the *m*-position is without any effect on the shade. Methyl in the *p*-position produces a yellowish-green (see Hanzlik and Bianchi, Ber., 1899, 1287) ; chlorine in the *o*-position a greenish-blue known as Setocyanine (see Geigy, Ger. Pat. 94,129), in the *p*-position a yellowish-green according to the authors and not a bluish-green as described by Käswurm (see Ber., 1886, 742). A sulphonic acid group in the *o*-position produces a well-known blue fast to alkalis (see Geigy, Ger. Pats. 80,892 and 87,176). An *o*-carboxyl prevents the formation of a dyestuff ; the presence of an esterified *o*-carboxyl group makes the shade much bluer (see Haller and Guyot, Compt. rend., **119**, 206). Neither *o*-, *m*-, nor *p*-hydroxyl has much influence on the shade (see O. Fischer, Ber., 1881, 2522). The authors have filled in the gaps in the above series of substituted Malachite Greens by preparing the *o*- and *m*-methyl, *m*- and *p*-chloro, and *m*-sulpho derivatives and also the *o*-, *m*-, and *p*-methoxyl derivatives of Malachite Green substituted in all cases in the benzal nucleus. They find that, as already observed in the nitro bodies, substitution in the *o*-position makes the shade bluer, in the *p*-position yellower, and in the *m*-position is without influence.

—H. L.

Phenolphthaleïn and quinolphthaleïn ; Constitution of the salts of ——. A. G. Green and P. E. King. Ber., 1906, **39**, 2365—2371.

The view of Green and Perkin (this J., 1904, 319) that the coloured salts of phenol- and quinol-phthaleïns possess a quinonoid structure has been adversely criticised by Meyer and Spengler (Ber., 1905, **38**, 1318), who adhere to Meyer's conception of these salts as lactone derivatives, and accept Baeyer's theory of a carbonium valence (this J., 1905, 320) as an explanation of their colour. Meyer and Spengler in their communication specially emphasised the fact that notwithstanding numerous attempts, no coloured, quinonoid carboxylic esters of phenol- and quinol-phthaleïns have been prepared, similar to those obtained by Nietzki from Fluorescein. The authors have succeeded in preparing such coloured esters, which is further confirmation of their view that the coloured salts of phenol- and quinol-phthaleïns possess a similar quinonoid structure to that of the salts of fluorescein.

Methyl ester of phenolphthaleïn.—Phenolphthaleïn was dissolved in boiling methyl alcohol, the solution saturated hot with zinc chloride, and a current of hydrogen chloride led through. After standing overnight, the dark red solution was poured into ice-cold, faintly acidulated water. The voluminous scarlet precipitate which separated was rapidly filtered off, washed with ice-cold water, and dried between filter-paper. The analytical results and properties of the product confirmed the view that it was the quinonoid methyl ester of phenolphthaleïn :

$$\begin{matrix}(COOCH_3)C_6H_4\\(HO)C_6H_4\end{matrix}>C:C_6H_4:O.$$

The ester is very unstable, being completely decolorised by contact with water for 12 hours, or with alcohol for a few minutes.

Methyl ester of quinolphthaleïn.—A solution of the phthaleïn in five parts of methyl alcohol was subjected to the action of a current of hydrogen chloride for half an hour, and the solution allowed to stand overnight, when a dark red, crystalline precipitate separated. This was filtered off, and washed with alcoholic ether. It consisted of the chloride of the quinonoid methyl ester of quinolphthaleïn :—

$$(COOCH_3).C<\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}>O.Cl.$$

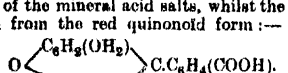
The chloride is stable when dry, but is slowly hydrolysed on boiling with water. It has not been found possible to isolate the free ester, owing to the ease with which it undergoes hydrolysis.—A. S.

Phthalein series; Salts formed with mineral acids in the ——. G. Heller. Z. Farben-Ind., 1906, 5, 265—269.

The author shows that Gallein, $C_{20}H_{12}O_7$, the phthalein of pyrogallol, is capable of forming stable well-crystallised salts with mineral acids, and this property may be utilised for the preparation of pure Gallein hydrate. Thus 1 part of commercial anhydrous Gallein is gently warmed with 10 parts of 96 per cent. alcohol and 1 part of concentrated hydrochloric acid. The nearly clear solution obtained is filtered, and the phthalein is precipitated with water. This product is then dissolved at the ordinary temperature in 4 parts of alcohol (or acetone), with the addition of 2 parts of alcoholic hydrochloric acid. Gallein alcoholate hydrochloride soon begins to crystallise out; it is filtered off and carefully added to concentrated sulphuric acid, in which it dissolves with an intense red colour. This solution is filtered through glass-wool, and on precipitation with water, pure Gallein hydrate, $C_{20}H_{12}O_7,H_2O$, is obtained.

Gallein alcoholate hydrochloride, $C_{20}H_{12}O_7,HCl,C_2H_5OH$ (prepared as described above), crystallises in fine brown needles. By dissolving Gallein in acetone or methyl alcohol, and adding concentrated hydrochloric acid to the solution, Gallein acetonate hydrochloride, $C_{20}H_{12}O_7,HCl$, C_3H_6O (blue-black needles), and Gallein methylalcoholate hydrochloride respectively are obtained. Gallein sulphate, $C_{20}H_{12}O_7,H_2SO_4$, and Gallein hydrobromide, $C_{20}H_{12}O_7,HBr$, are similarly prepared; both crystallise free from solvent. All these salts are decomposed by water. The author has further prepared the hydrochloride and sulphate of Gallein ethyl ester, the hydrochlorides of hydroxyquinolphthalein alcoholate, acetonate, and methyl alcoholate and hydroxyquinolphthalein sulphate, which are all crystallised substances decomposed by water. These salts are of theoretical interest in view of recent publications of Werner on partial valencies (Annalen, **332**, 296) and of Baeyer (Ber., **38**, 570) on the basic character of the carbon atom and on "carbonium" isomerism.

Pure Gallein hydrate is a stable reddish-brown crystalline substance, which may be dried at 100° without decomposition. It loses a molecule of water at 180° C., and begins to sinter at 240° C. When very finely ground and shaken with a small quantity of acetone or alcohol, it dissolves very readily with an intense violet coloration. On diluting or warming this solution, or allowing it to stand for some time, the coloration disappears, and a faintly red-tinted solution is obtained. This solution contains the Gallein in a different form, which must be the lactone form, the faint red coloration being due to the presence of small quantities of a red quinonoid form, which is isomeric with the violet modification. This red modification may be isolated as a dark red crystalline powder by adding a small quantity of chloroform to the acetone solution. By adding chloroform in gradually increasing quantity, practically all the dissolved dyestuff may be precipitated in this form. The violet modification is the basis of the mineral acid salts, whilst the alkali salts are derived from the red quinonoid form:—

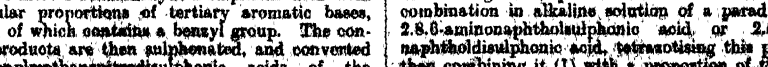


On acidifying alkaline solutions with acetic acid the red form is obtained, while with mineral acids the violet is precipitated owing to the secondary action of the mineral acid. There are thus in all four forms of Gallein, of which three have been isolated as definite compounds.—H. L.

English Patents.

Dyestuffs; Manufacture of green acid mordant ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 17,382, Aug. 28, 1905.

New green acid mordant dyestuffs are prepared by condensing 5-nitro-1-benzaldehyde-2-sulphonic acid with two molecular proportions of tertiary aromatic bases, one or both of which contains a benzyl group. The condensation products are then sulphonated, and converted into triphenylmethanenitrodisulphonic acids of the following general formula:—

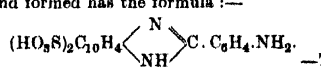


In this formula R^1, R^2, and R^3 represent a methyl, ethyl, or benzyl group. These nitrodisulphonic acids, which are in the form of leuco-compounds, are reduced to aminodisulphonic acids, diazotised, and combined with salicylic or cresotinic acid. The azo compound is converted into the finished dyestuff by oxidation with lead peroxide. Example, (*a*) 5-nitro-2-sulpho-1-benzaldehyde is prepared by boiling a solution of 185 kilos. of 5-nitro-2-chloro-1-benzaldehyde in 1000 litres of alcohol, with a solution of 140 kilos. of sodium sulphite in 500 litres of water, for 24 hours in a reflux apparatus. The solution is filtered and may then be directly used. (*b*) 422 kilos. of ethylbenzylaniline are introduced into this solution of 5-nitro-2-sulpho-1-benzaldehyde and then 100 kilos. of 96 per cent. sulphuric acid are added. The mixture is boiled for 24 hours, and the reaction product is precipitated with water, filtered, dried, and sulphonated on the water-bath by means of four parts of concentrated sulphuric acid. The sulphonated product is precipitated with water, filtered, and reduced in the usual way. (*c*) The *m*-amino-diethyldibenzyldiaminotriphenylmethanedisulphonic acid so prepared is diazotised, and combined in alkaline solution with salicylic acid, and the product is oxidised with lead peroxide. The dyestuff is obtained as a dark green powder readily soluble in water, which is said to dye wool, treated with chromium salts previously or subsequently to dyeing, in strong green shades fast to washing and padding.—H. L.

Colour bases; Products soluble in water, fats, and oils from the salts which higher fatty acids and acids of the oleic series form with ——. Meister, Lucius, und Brüning. Eng. Pat. 10,079, April 30, 1906. XIII*A*., page 768.

Phenyl-1.2-naphthimidazole or homologues or derivatives thereof; Manufacture of amidosulphonic acids of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 20,780, Oct. 13, 1905.

The *o*-amino-azo-compounds of the naphthalene series, obtained by combining diazotised *p*-phenylenediamine or acetyl-*p*-phenylenediamine with certain naphthylaminosulphonic acids (*e.g.*, 2.5.7-naphthylaminedisulphonic acid), are combined with a nitrobenzaldehyde or aminobenzaldehyde to form a triazine derivative; on reduction, *e.g.*, with iron and acetic acid, the nitro group or groups are reduced, and also the *p*-phenylenediamine residue is eliminated, whereby there is formed a phenylnaphthimidazolesulphonic acid derivative; thus, from the naphthylaminesulphonic acid referred to above, the compound formed has the formula:—



—T. F. B.

Colouring matter [Thio-indigo Red]; Manufacture of organic compounds containing sulphur, and of red —— *therefrom.* G. W. Johnson, London. From Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 22,736, Nov. 6, 1905.

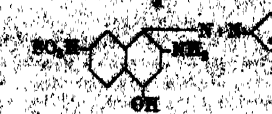
See Fr. Pat. 359,398 of 1905; this J., 1906, 424.—T. F. B.

Colouring matter [Thio-indigo Red]; Manufacture of red sulphur-containing ——. G. W. Johnson, London. From Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 23,316, Nov. 13, 1905.

See Fr. Pat. 359,399 of 1905; this J., 1906, 424.—T. F. B.

Azo colouring matter [Dyestuff]; Manufacture of ——. H. W. Lake, London. From the Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 6189, March 14, 1906.

New polyazo dyestuffs are claimed, which dye cotton directly in black shades stated to be of remarkable fastness to washing. The process consists in first preparing a combination in alkaline solution of a paradiamine with 2.8.6-aminonaphtholsulphonic acid, or 2.8.3.6-aminonaphtholdisulphonic acid, tetrazotising this product, and then combining it (1) with a proportion of the following aminomonoazo dyestuff,



and (2) with a meta-diamine of the benzene series. In place of the above aminoazo dyestuff the corresponding monoazo dyestuffs, containing a nitro or acetylamino group in place of the amino group, may be employed. In this case the nitro group is reduced, or the acetyl group is split off by hydrolysis, after combination is completed.

Example I.—7·5 parts of acetyl-*p*-phenylenediamine are diazotised and combined in alkaline solution with 11·95 parts of 2.8.6-aminonaphtholsulphonic acid. The product is hydrolysed with caustic soda to split off the acetyl group, tetrazotised, and then combined in alkaline solution with 24·1 parts of the above monoazo dyestuff. When the formation of this intermediate product is complete, 5·4 parts of *m*-phenylenediamine are added. After 12 hours the solution is warmed to 70° C., and the dyestuff is precipitated with salt. It dyes cotton in deep black shades.

Example II.—12·2 parts of dianisidine are tetrazotised, and combined in alkaline solution with 17·05 parts of 2.8.3.6-aminonaphtholdisulphonic acid. The intermediate product is then further diazotised, and allowed to run into an alkaline solution of the monoazo dyestuff obtained by combining acetyl-*p*-phenylenediamine-*o*-sulphonic acid with 11·95 parts of 2.5.7-aminonaphtholsulphonic acid in acid solution. When combination is complete the new body is further combined with 6·5 parts of *m*-toluylenediamine. The acetyl group is then split by boiling with aqueous caustic soda. The dyestuff dyes cotton in black shades.

The new products are said to equalise very well owing to the presence of the para amino group, which also increases the dyeing power, and deepens the shade.

—H. L.

Sulphinic acids of the aromatic series; Manufacture of ——. C. Dreyfus and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 7288, March 26, 1906.

Sulphinic acids of the aromatic series may be produced by diazotising primary aromatic amines, and treating the diazo solutions with finely-divided copper or other copper compounds in the presence of sulphurous acid. Nitrogen is evolved, and the original amino group is replaced by the sulphinic group, SO_2H. The patentees claim the use of cuprous sulphide, or a mixture of cuprous sulphide with finely-divided sulphur or other substances in place of the finely-divided copper or copper salts hitherto employed. The requisite mixture of cuprous sulphide and sulphur may be prepared by continued heating of an aqueous solution of a cupric salt and sodium thiosulphate, or by boiling with water the precipitate of sodium cuprous thiosulphate (obtained by mixing hot solutions of copper sulphate and sodium thiosulphate) until decomposition takes place. The material is best used moist and in a finely-divided condition, and during the evolution of nitrogen the temperature should not be allowed to exceed 5° C. Examples are given, describing the preparation of *o*-toluenesulphinic acid from *o*-toluidine, benzenecarboxylic-*o*-sulphinic acid, $C_6H_4(COOH)(SO_2H)$, from anthranilic acid; naphthalene-1-sulphonic-4-sulphinic acid from naphthionic acid; and a sulphinic acid of the following constitution:—

$$[N(CH_3)_2.C_6H_4]_2CH.C_6H_2(CH_3)(SO_2H)$$
$$[SO_2H:CH_3:CH=1:2:4]$$

from *p*-tetramethyldiaminodiphenyl-*p*-amino-*o*-tolylmethane.—H. L.

1.2-Diazonaphtholsulphonic acids; Manufacture of salts of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabr., Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,525, May 2, 1906.

The sulphonic acids of 1.2-aminonaphthol may it is claimed, be diazotised by treating the free acids with nitrites in the presence of common salt or other alkali or alkaline-earth salt. Example. A solution of 7 parts of sodium nitrite in 30 parts of water are allowed to flow rapidly, with good stirring, into a mixture of 24 parts of 1.2-aminonaphthol-4-sulphonic acid with a solution of 15 parts of common salt in 200 parts of water. Diazotisation is complete after about three-quarters of an hour, and a clear brownish-yellow solution is obtained. The diazo oxide of the sulphonic acid may be obtained, it is stated, by acidifying this solution with hydrochloric acid. (See also Eng. Pat. 25,034 of 1905; this J., 1906, 393.)

—H. L.

Colouring matters of the anthracene series [Anthracene dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 10,505, May 4, 1906.

The dyestuffs derived from 2.2′-dimethyl-1.1′-dianthraquinonyl or derivatives or homologues thereof (see Fr. Pat. 357,239 of 1905; this J., 1906, 68) are converted into new dyestuffs by chlorinating agents. The new products are similar in appearance to the unchlorinated dyestuffs, but produce redder shades. They may be converted into cherry-red vats, which produce bluish-red shades on cotton, changed into bright orange-red by washing.—H. L.

Anthracene series; Manufacture of compounds of the ——, *and of colouring matter [Sulphide dyestuffs] therefrom.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 13,057, June 6, 1906.

Dianthraquinonylamine, obtained as described in Fr. Pat. 357,138 of 1905 (this J., 1906, 66), is nitrated by treatment with nitric acid in presence of nitrobenzene; a nitro compound is formed, which appears to be dinitrodianthraquinonylamine; by melting this substance with alkali sulphide, a dyestuff is obtained which dyes cotton blue shades from an alkaline hydrosulphite vat.—T. F. B.

Dyestuffs; Manufacture of red vat dyeing ——. O. Imray, London. From Soc. of Chem. Ind., Basle. Eng. Pat. 10,405, May 3, 1906.

Red vat dyeing dyestuffs similar to thioindigo are said to be produced by heating a mixture of salicylthioacetic acid with isatin and an aromatic nitrohydrocarbon or acetic anhydride at a high temperature. The new dyestuffs crystallise in the form of brilliant yellowish-red to brownish-red needles, and dye cotton in yellowish-red shades much yellower than those produced by thioindigo.

—H. L.

Dyestuffs; Manufacture of red, violet, and blue vat dyeing ——. O. Imray, London. From Soc. of Chem. Ind., Basle. Eng. Pat. 11,760, May 19, 1906.

Red, violet, and blue vat dyeing dyestuffs are produced by heating a mixture of salicylthioacetic acid or thioindoxyl with the arylides of isatin, its homologues, or substitution products, in the presence of acetic anhydride or an aromatic nitrohydrocarbon or alcohol.

Example I.—Three parts of salicylthioacetic acid, 2·5 parts of *α*-isatinanilide, and 25—30 parts of acetic anhydride are boiled under a reflux condenser for 2—3 hours. After a short time the solution acquires a bluish-violet colour, and the dyestuff begins to separate. On cooling and filtering, it is obtained as lustrous bluish-violet felted needles, which dye cotton in violet-blue shades from an alkaline hydrosulphite vat.

Example II.—Two parts of thioindoxyl, 3 parts of *α*-isatinanilide, and 30 parts of acetic anhydride are boiled under a reflux condenser for 2—3 hours. The dyestuff which separates in violet-red crystals dyes cotton from an alkaline hydrosulphite vat in reddish-violet shades, stated to be of great fastness.

Two further examples are given. It is stated that the violet to blue dyestuffs obtained from *α*-isatinarylides contain the arylamine group in the molecule, whilst *β*-isatinarylides yield red dyestuffs probably identical with those prepared from isatin, the arylamine group being eliminated. (See preceding abstract.)—H. L.

FRENCH PATENTS.

1.2-Naphthylene-urea-hydroxysulphonic acids, and azo dyestuffs therefrom; Manufacture of ——. L. Cassella und Co. Fr. Pat. 361,335, April 6, 1905.

1.2-NAPHTHYLENE-UREA-HYDROXYSULPHONIC acids are produced by dissolving diaminonaphthalenehydroxysulphonic acids, *e.g.*, 1.2-diamino-5-hydroxynaphthalene-7-sulphonic acid, in water, and passing in a current of phosgene in the presence of sodium acetate. 1.2-Diamino-5-hydroxynaphthalene-7-sulphonic acid is prepared by reducing a monoazo dyestuff obtained by combining a diazo compound with 2.5-aminonaphthol-7-sulphonic acid in acid solution. The new urea separates out as sodium salt in brilliant colourless crystals of the following constitution :—

$$SO_3Na \atop OH > C_{10}H_4 < \overset{NH}{NH} > CO$$

It is readily soluble in hot, but sparingly soluble in cold water. The free acid is obtained as a colourless crystalline powder by the addition of mineral acids to solutions of the sodium salt, and is a not readily oxidisable substance, the alkaline solutions of which show an intense violet-blue fluorescence. It may be readily combined in alkaline solution with diazo compounds, and yields, it is stated, valuable monoazo- and polyazo dyestuffs distinguished by brilliant shade, fastness to acids, and strong affinity for cotton. The monoazo dyestuffs prepared from 1.2-naphthylene-urea-hydroxysulphonic acids and diazotised bases of the benzene series such as aniline and its homologues, acetyl-*p*-phenylenediamine, aminophenol ether, sulphanilic acid, &c., produce scarlet shades on cotton; *α*-naphthylamine and its sulphonic acids, aminoazobenzene and its sulphonic acids violet-red to violet shades, benzidine, tolidine, and dianisidine reddish-blue to blue shades. The dyestuffs prepared from *o*-aminophenol and its derivatives are said to yield wool colours, of excellent shade and fastness after chroming. One example is given, in which the combination of diazotised *o*-toluidine with 1.2-naphthylene-urea-5-hydroxy-7-sulphonic acid is described.—H. L.

Anthraquinone derivatives [*Arylaminoanthraquinones*]; *Production of* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 362,140, Jan. 3, 1906. Under Int. Conv., Jan. 9, 1905.

ARYLAMINOANTHRAQUINONES or their derivatives are produced by heating aminoanthraquinones with halogen derivatives of aromatic compounds, or their substitution derivatives, in the presence of copper or copper compounds, substances, such as chalk, sodium acetate, magnesia, &c., being, with advantage, also added to the mixtures employed, to combine with the halogen acids formed in the reactions. *p*-Nitrophenyl-*α*-aminoanthraquinone is, for example, obtained by acting at 200° C. with *p*-chloronitrobenzene (100 kilos.) on *α*-aminoanthraquinone (10 kilos.), in the presence of copper chloride (0·5 kilo.) and anhydrous sodium acetate (3 kilos.). A compound which is probably symmetrical 1.4-dichlorodiphenyldiaminoanthraquinone, is similarly prepared by heating under pressure at 200°—210° C., a mixture of *p*-dichlorobenzene, 1.4-diaminoanthraquinone, copper chloride, and sodium acetate. 1-Naphthylamino-4-hydroxyanthraquinone, again, is formed from a mixture of *α*-chloronaphthalene, the sodium salt of 1-amino-4-hydroxyanthraquinone, copper carbonate, and anhydrous sodium acetate. Numerous other examples of the application of the method are given in the original specification.—E. B.

1.2-Dichlorobenzenesulphonic acid; Separation of the isomeric acids formed in the nitration of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 362,574, Jan. 20, 1906.

1.2-DICHLOROBENZENE-4-SULPHONIC acid on nitration in the usual way is known to yield 1.2-dichloro-3-nitrobenzene-4-sulphonic acid, from which the corresponding amino compound has been obtained. The authors have isolated a new isomeric acid, which is simultaneously formed, and contains the nitro group in one of the ortho-positions to the chlorine atoms. The new 1.2-dichloro-3- or -6-nitrobenzenesulphonic acid yields an amino-acid on reduction. On diazotising this substance, and treating the solution with an alkali, one of the chlorine atoms is split off, and replaced by a hydroxyl group. The new nitro- and amino-1.2-dichloro-benzene-4-sulphonic acids and their sodium salts are all more soluble in water than their isomerides. Separation of the nitration products may thus be conveniently effected by crystallisation from water, either before or after reduction.—H. L.

Dyestuff derived from salicylthioacetic acid; Process for producing a red vat-dyeing —— [*Thio-indigo Red*] *similar to indigo.* Soc. pour l'Ind. Chimique à Bâle. Fr. Pat. 362,876, Jan. 31, 1906. Under Int. Conv., Oct. 30, and Nov. 4, 1905.

SEE Eng. Pat. 4687 of 1906; this J., 1906, 470.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 693.)

Banana bast from German East Africa; Examination of ——. A. Zimmermann. Der Pflanzer, 1906, 2, 77—79. Chem. Centr., 1906, 1, 1790.

SAMPLES of "hemp" from *Musa Holstii* and *M. ulugurensis* gave the following results when subjected to chemical examination :—

"Hemp" from	*Musa Holstii.*		*Musa ulugurensis.*
	I.	II.	
	Per cent.	Per cent.	Per cent.
Water	9·7	9·4	10·2
Ash	1·5	1·7	1·6
Loss on α-hydrolysis	10·3	13·0	22·9
Loss on β-hydrolysis	15·1	18·3	24·7
Loss on mercerisation	11·0	12·7	17·9
Loss on treatment with acid	0·8	3·7	6·5
Increase on nitration	36·5	26·3	33·[illegible]
Cellulose	78·1	74·5	[illegible]

—A. S.

Thioindigo Red. H. Alt. Färber-Zeit, 1906, 17, 169—171 and 185—189.

AFTER describing the preparation and properties of this new dyestuff (see this J., 1906, 367 and 424) the author discusses in detail its application in dyeing and printing. It is well adapted to the dyeing of woollen tissues from a fermentation or hydrosulphite vat, and as the leuco compound only oxidises slowly, shades of remarkable evenness are obtained. In cop-dyeing very useful effects are produced in combination with indigo, whilst by topping the red with other fast dyestuffs it is possible to obtain a great variety of shades, which are distinguished by their fastness. Equally good results are obtained in hank and loose wool dyeing. Unlike indigo, Thioindigo Red is characterised by its great resistance to oxidising agents and it is therefore well adapted for use as a bottom colour in combination with fast wool dyestuffs worked in a chrome bath, or chromed after dyeing. Cotton may be readily dyed from a hydrosulphite or iron sulphate vat, or in a sodium sulphide bath. The leuco body, however, possesses little affinity for the vegetable fibre, and in order to obtain heavy shades it is necessary to employ strongers vats containing from 15 to 20 grms. of dyestuff per litre. It is well adapted for mercerised cotton yarns and cloths, as it resists strong alkalis fairly well in the cold. For calico printing it may be used either as a direct colour or as a red discharge for direct cotton dyestuffs non-resistant to hydrosulphite.—D. B.

Dressing and thickening agents; Decomposition and solution of ——. G. and G. Tagliani. Z. Farben-Ind., 1906, 5, 241—257.

FROM an exhaustive series of experiments, it is concluded

that the best method of removing dressing and thickening agents from cotton threads and cloth is to soak the fabric for two hours in a 2—3 per cent. solution of "diastafor" (a preparation of native ferments, rich in diastase) at a temperature of 38° C. It is then squeezed, rinsed in water, and finally boiled with lye. *Diastafor* is stated to possess remarkable solvent properties not only for starch, but also for nitrogenous and proteid substances, such as gluten, gelatin, gum, and mucilage. Although the removal of thickening agents can be effected equally well by steeping the fabric at 100° C. in a solution of sodium carbonate or hydroxide containing a small quantity of glucose or glycerin, this plan is less expeditious and more expensive. For the treatment of printed goods the fabric is passed through water to remove gum, it is then squeezed, soaked for 30—60 minutes in a 3 per cent. solution of "diastafor" at 50°—60° C., and finally washed.—D. B.

English Patents.

Oils, fats, or the like; Manufacture of viscid or fluid emulsions of —— [*for lubrication of textile fibres*]. O. A. H. H. Koesters. Eng. Pat. 4688, Feb. 26, 1906. XII., page 767.

Cellulose articles; Direct production of coloured ——. F. and A. van den Bosch and O. Müller. Eng. Pat. 6042, March 22, 1906. XIX., page 775.

Silk; Manufacture of artificial ——, *from viscose.* Soc. Franç. de la Viscose, Paris. Eng. Pat. 8045, April 3, 1906. Under Int. Conv., April 3, 1905.

See Fr. Pat. 361,319 of 1905; following these.—T. F. B.

Viscose; Manufacture of lustrous threads, bands, strips, and the like of ——. M. Müller, Altdamm, Germany. Eng. Pat. 10,094, April 30, 1906. Under Int. Conv., May 1st, 1905.

In place of the usual precipitating bath employed for converting viscose solutions into lustrous threads, bands, films, and plates, which is stated to be composed of a solution of acids or ammonium sulphate, the author employs a bath containing 40 kilos. of sodium bisulphate, 7 kilos. of 66 per cent. sulphuric acid, and 60 litres of water. This bath is stated to produce a satisfactory result, and to be cheaper than one prepared from ammonium sulphate.—H. L.

Gassing machines for yarn or thread; Apparatus for supplying a uniform mixture of gas and air, chiefly intended for use with ——. H. B. Arundel and J. Higginson, jun., Stockport. Eng. Pat. 15,065, July 21, 1905.

The gas and air are raised separately, before mixing, to a uniformly maintained pressure, by independent but similar apparatus, each consisting of a pump or fan in combination with a regulating and relief chamber. The gas, for example, is delivered by a pump into a bell floating in a water tank, the bell being loaded so as to maintain the desired pressure. A vertical pipe, attached to the under side of the crown of the bell, and having openings at its upper end, slides within a vertical pipe communicating with the gas-supply pipe to the pump. The pump is run continuously at a uniform speed, whatever the rate of gas consumption; when the latter falls, the gas delivered to the bell simply returns down the vertical pipes to the pump, and a circulation of gas is maintained without affecting the speed of the pump.—H. B.

Fabrics, felts, yarns, slivers, and the like; Method of and machinery for treating —— *with liquids, emulsions, gases, vapours, or dusts.* R. Hardcastle, Mexborough-in-Wharfedale, Yorks. Eng. Pat. 13,356, June 28, 1906.

The method, which is applicable to dyeing and similar purposes, consists in forcing liquids through the material by pressure, as the latter is caused to travel before the orifices of a pressure chamber, from which such liquids are forced. The fabric is pressed against a flat, stationary slotted frame provided for the passage of the liquid with one or more slots of sufficient length to extend along the entire width of the material. The liquid is impelled through the material in a continuous and even stream, so that every part is subjected to an equal treatment, and after passing through the material it enters a receiving chamber. The material may also be pressed against a slotted plate forming the outlet of the pressure chamber by a suitable plate or backing frame slotted in the manner above mentioned. This latter plate may form the face of a receiving chamber. The material while under treatment is preferably immersed in a body of liquid contained in a vat.—D. B.

Dyeing; Processes of cold ——. C. Henry, Paris. Eng. Pat. 13,714, July 4, 1905.

See Fr. Pat. 355,391 of 1905; this J., 1905, 1227.—T.F.B.

Sponges; Method of dyeing ——. T. Asher, Duisberg, Germany. Eng. Pat. 14,866, July 19, 1905.

See Fr. Pat. 356,176 of 1905; this J., 1905, 1228.—T.F.B.

Dyeings; Production of stable ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,331, Nov. 1, 1905.

See Fr. Pat. 359,466 of 1905; this J., 1906, 373.—T.F.B.

Aniline Black; Dyeing wool or other animal fibres with ——. G. Bethmann, Leipzig, Germany. Eng. Pat. 26,962, Dec. 27, 1905.

The method consists in well washing and steeping the goods in alkali and water, then treating them with acid, and finally, after an eventual washing in water and a subsequent squeezing, impregnating them with an Aniline Black padding mixture containing only such a percentage of sodium chloride as is required for the purpose of developing the dyestuff. After steaming or ageing, the goods are treated with sodium bichromate in the usual manner. In this way wool can be dyed entirely without any preceding or simultaneous oxidation and injurious effects to its quality.—D. B.

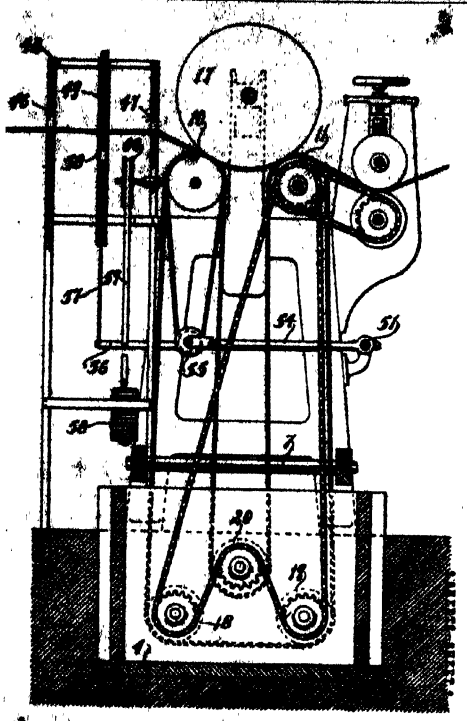
Aldehyde-hydrosulphite salts [*Discharges*]; *Manufacture of* ——. G. B. Ellis, London. From Chem. Fabr. von Heyden Akt.-Ges., Radebeul, Saxony. Eng. Pat. 25,602, Dec. 8, 1905.

See Fr. Pat. 360,306 of 1905; this J., 1906, 475.—T.F.B.

United States Patents.

Washing fabrics; Apparatus for ——. I. E. Palmer, Middletown, Conn. U.S. Pat. 816,179, March 27, 1906.

The fabric passes between the rollers, 10 and 17, into the cleansing tank, 4, under the roller, 20, between the rollers, 17 and 11, and under the rollers, 19 and 18. From the tank the fabric now passes between spacing bars, 7, which gradually feed it along the roller, 10, so that it makes several passages through the tank, receiving alternate washings and squeezings, before finally leaving the apparatus. About midway of the length of the rollers, 10 and 11, the fabric, instead of passing under the roller, 20, passes round a pulley, 55, and then upwards over the roller, 10, and along the same course as at the commencement. The pulley, 55, is mounted on an arm, 54, which is fixed to a rock-shaft, 51, the latter being also connected to an arm, 56, which actuates, by an arm, 57, the slide, 49, so that a change in tension on the fabric, acting on the arm, 54, raises or lowers the slide, 49. The fabric enters the apparatus through openings, 45 and 47, in the skeleton frame, 43, and passes also through an intermediate opening, 50, in the slide-bar, 49. The tension device is counterbalanced by a weight, 58, attached to the arm, 54, by a flexible connection, 59, the latter passing over a guide-pulley, 60. If the guide-bar, 49, is raised or lowered, the tension on the fabric is diminished



or increased, and this may be made automatic at any desired tension by adjusting the weight of the counter-balance, 58.—B. N.

Dyeing machine [for yarns]. J. Hussong, Camden, N.J. U.S. Pat. 822,844, June 5, 1906.

The yarns to be dyed are suspended in the form of hanks from sticks, carried by a frame, in a dye vat divided into two compartments by a vertical partition extending nearly to the top and bottom, and provided with a perforated false bottom, placed some distance above the bottom of the vat, a perforated false top mounted on the frame above the sticks to ensure the proper circulation of the liquor in the vat, and a screen between the sticks and the perforated partition to keep the hanks in position when the dye-liquor is caused to flow upwards through the hanks. The vat, when in use, is closed by a cover. Reversible mechanism, e.g., a turbine, is placed in one of the compartments to circulate, alternately in opposite directions, the liquor in the dye-vat.—E. B.

Warp-printing devices; Printing mechanism for ——. E. Schmidt, Oberschöneweide, Germany. U.S. Pat. 822,308, June 5, 1906.

Warp-yarns, spread upon a printing-drum, are printed by means of a number of sets of travelling "printing-rollers," to which colours are supplied from boxes suspended from a series of transverse bars carried by a pair of "suitably supported endless belts." The "rollers" press against the yarns "simultaneously and with a bodily-reciprocating movement parallel with the axis of the drum."—E. B.

French Patents.

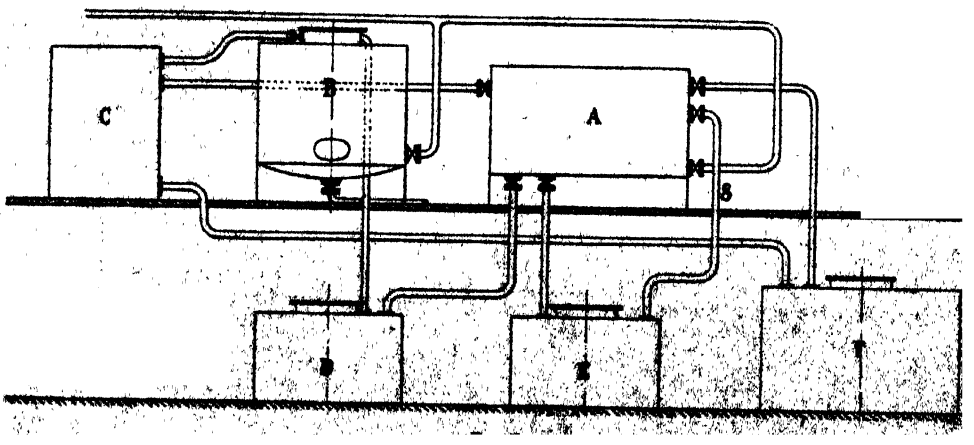
Viscose threads [Artificial silk]; Impts. in spinning ——. Soc. Franç. de la Viscose. Fr. Pat. 361,319, April 3, 1905.

With the object of preventing individual filaments of viscose from adhering to one another when a number of them are twisted together to produce threads suitable for weaving purposes, a mixture of an alkali (sodium or potassium) aluminate and an alkali silicate is either added to the solution from which the filaments are formed, or is employed, in place of the ferrous sulphate hitherto used for the same purpose, in a bath through which the filaments are passed immediately after their formation. The first of these methods is to be preferred. The threads obtained, it is stated, besides being silky in appearance and to the touch, dye very regularly.—E. B.

Ramie and analogous textile materials; Process and apparatus for decorticating and degumming ——. J. Bendel. First Addition, dated Dec. 14, 1905, to Fr. Pat. 338,752, April 15, 1903 (this J., 1904, 748).

Perforated or reticulated frames, made in parts hinged together, are employed to carry the strips of ramie during the treatment to which they are subjected for the purpose of degumming, &c. In softening and degumming the ramie, the frames are hung over rods fitted into two concentric supporting rings, connected together by cross-bars. The fibrous strips are thus immersed in the necessary baths contained in circular tanks. To decorticate the fibres, the frames with the strips upon them are passed through an apparatus from which fine jets of water are sprayed.—E. B.

Wool in the unmanufactured state and in the form of fabrics; Extracting —— with volatile solvents. H. Lecouflet. Fr. Pat. 362,220, Jan. 5, 1906.



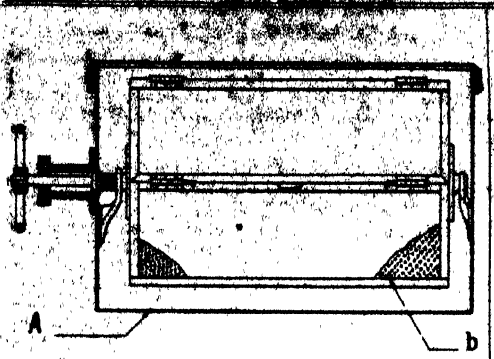


FIG. 2.

A PERFORATED, rotatable cylinder, *b*, (see figures), is filled with the greasy wool or woollen tissues, &c., to be extracted, and placed within a vessel, A, which is then closed by an air-tight lid. A grease solvent, *e.g.*, light petroleum, is then conveyed into the vessel, A, from a tank, F. After the cylinder has been revolved for a while in this, the solvent is withdrawn to a tank, E. A further quantity of "pure" solvent is thereupon introduced into the vessel, A, to complete the extraction of the fatty matters present in the wool. This also, after use, is run into the tank, E. The solvent retained by the wool is next expelled by means of steam, the vapours passing to a vessel, C, where they are condensed, the solvent thus recovered returning to the tank, F. The extracted wool is then removed from the cylinder, *b*, and replaced by a second charge of greasy wool, the latter being treated, first, with the impure solvent in the tank, E, which is then passed into a tank, D, and, afterwards, with "pure" solvent from the tank, F. Further lots of wool are treated in the same manner, the solvent being taken from the tank, D, to a still, B, and the purified solvent passing to the tank, F, while the extraction operations are proceeding.—E. B.

Indigo white preparations suitable for use in vats, particularly in fermentation vats; Process for obtaining ——. Farbw. vorm. Meister, Lucius, und Brüning. First Addition, dated April 6, 1905, to Fr. Pat. 352,695, March 6, 1905.

See Eng. Pat. 7390 of 1905; this J., 1906, 530.—H. L.

Bleaching and dyeing bobbins; Spindles for —— *in* ——. A. Rolls and Co. Fr. Pat. 362,318, Jan. 16, 1906.

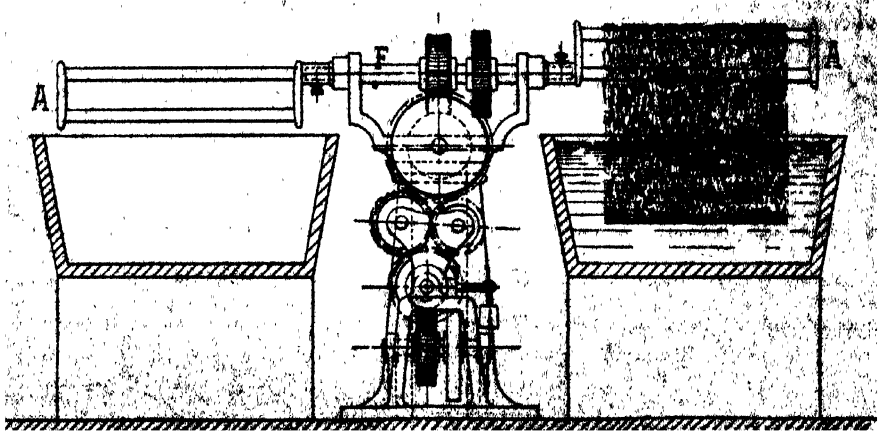
THE perforated spindles used in bleaching or dyeing cops or cheeses are provided with a grooved attachment against which the ends of the cop or cheese may be pressed. The object of the device is to prevent the liquor from finding a channel between the tube and the cop or cheese, and to ensure a thorough penetration of the material.—H. L.

Cotton on bobbins; Process and arrangement for the winding of —— *for dyeing or mercerising.* P. Fontaine. First Addition, dated Jan. 18, 1906, to Fr. Pat. 359,302 of Nov. 10, 1905.

SEVERAL bobbins with rigid perforated cores are mounted around the same spindle as an axis, alternate bobbins being of the same diameter. A core of smaller diameter is thus between two cores of greater diameter, and the smaller is able to penetrate into the larger when the whole is subjected to pressure from the screw at the end of the spindle. The cotton of the superposed bobbins then forms a continuous muff.—B. N.

Yarns in the form of hanks; Machine for boiling-off, charging, dyeing, and washing ——. See, C. Durand et Cie. Fr. Pat. 361,288, March 29, 1905.

THE yarns to be dyed, &c., are suspended in the form of hanks from reels, A (see Fig. 1), eccentrically fixed to rods, F, which are driven by suitable mechanism, so that neighbouring ones rotate in opposite directions, to the end that adjacent portions of the hanks shall ascend or descend together (see Fig. 2). This arrangement, it is claimed, while allowing the hanks to move in close proximity to one another, prevents them from becoming entangled. The reels, when required, are mechanically raised, to allow them to be removed and replaced, and the baths to be changed.—E. B.



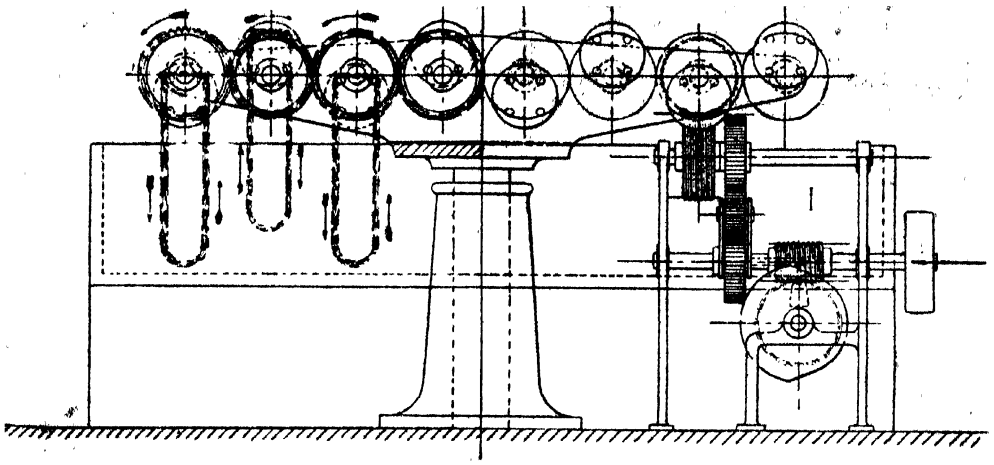


FIG. 2.

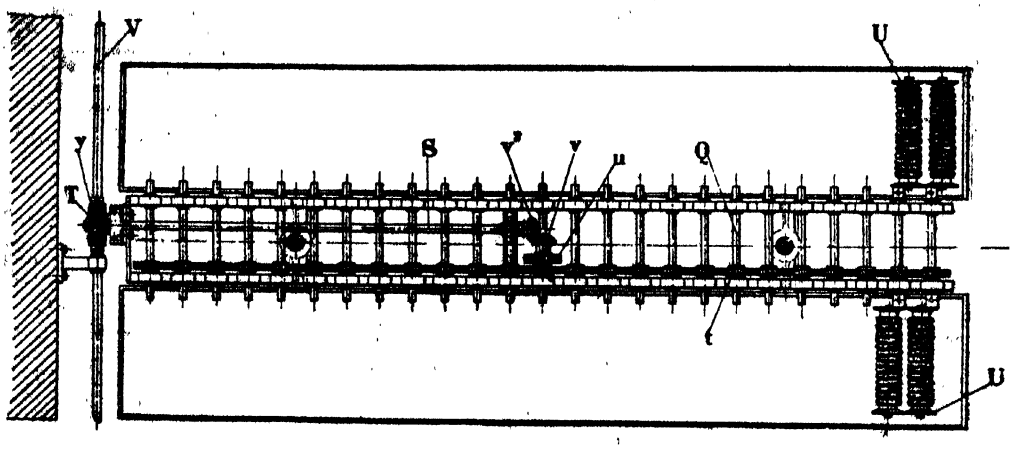
arms composed of silk, cotton, &c.; Machine for dyeing, in the form of hanks,——. J. Garel. Fr. Pat. 368,261, Jan. 6, 1906.

Two sets of reels, U (see figures), are eccentrically attached to the opposite ends of a number of short shafts, Q, mounted upon a supporting frame, and carrying wheels, *t*, gearing in line one with another. A shaft in the middle of the series has keyed upon it a second gear-wheel, *u*, by means of which motion is transmitted, through a transverse shaft, S, by the intermediary of the wheels, v^2, *v*, to the wheels, *t*, and thence to the reels, U. The reel-carrying frame is attached to an overhead carriage in such a manner that it can be raised and lowered by means of gearing, and, when raised, can be run sideways upon rails upon which it rests. To actuate the reels, the framework is lowered into position so that the worm-wheel, T, at one end of the shaft, S, comes into gear with an endless screw, *y*, keyed upon the main driving shaft, V. When the hanks to be dyed have to be treated in two or more baths, they are treated for a sufficient length of time in the first of those, and the framework bearing the hanks is then raised, and moved until it is directly above the tanks containing the second bath. It is thereupon lowered, the reels, &c., set in motion as before, and the hanks further treated as required. Much time and labour are thus saved.

—E. B.

GERMAN PATENT.

Cellulose threads and films; Process for preparing transparent, durable, and elastic ——. Vereinig. Glanzstoff-Fabr. A.-G. Ger. Pat. 169,567, Jan. 17, 1905. XIX., page 775.



VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page 693.*)

FRENCH PATENT.

Wood, metals, and other substances; Product adapted for the coloration and preservation of ——. Soc. Mass et Rose. Fr. Pat. 361,378, April 14, 1905.

THE process consists in treating or impregnating wood and other materials with a solution containing coal-tar dyestuffs, especially certain azo dyestuffs, alcohol, and commercial pyroligneite of iron—*e.g.*, aminoazobenzene sulphonic acid (Fast Yellow), 10 parts; alcohol, 85 parts;

and pyrolignite of iron, 30° B., 5 parts. It is claimed that pyrolignite of iron acts as a powerful antiseptic, besides fixing the dyestuffs. The process is stated to be of value for preserving and colouring metals, paper, linoleum, and in particular all kinds of wood.—H. L.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 697.)

Chromic acid; Action of —— on hydrogen iodide. K. Seubert and J. Carstens. Z. anorg. Chem., 1906, **50**, 53—66.

The speed of reaction between chromic acid and potassium iodide is proportional to the quantity of free mineral acid added, that is, to the number of hydrogen ions. The reaction is in its first stage a tri-molecular one, the components being hexavalent chromium, and iodine and hydrogen ions. The nature of the intermediate products after this first stage can at present only be surmised, but all the chromium is finally reduced to the chromic condition, and for every atom of chromium three atoms of iodine are liberated, as indicated by the simple equation :—$CrO_3 + 3HI = Cr(OH)_3 + 3I$.—F. Sodn.

Magnesium oxide; Physical properties of fused ——. H. M. Goodwin and R. D. Mailey. Trans. Amer. Electrochem. Soc., May 1, 1906. [Advance Proof.]

For the preparation of rods of the fused oxide an electrically heated graphite tube was employed, pure magnesium oxide being fed into the tube, which was protected on the outside by a jacket of powdered coke. Owing to a reaction between the carbon and magnesia at high temperature, it was impossible to obtain rods as large as the internal diameter of the tube. An arc furnace was subsequently employed, and from blocks of fused oxide thus obtained, rods were cut suitable for the tests which were carried out. The surface of the white fused oxide resembles glazed porcelain; the crystalline structure becomes more coarse the slower the cooling. The hardness is between that of apatite (transparent variety) and felspar (white cleavable variety). The specific gravity (mean of three samples) is 3·493 at 20° C. The melting point, estimated with an optical pyrometer, was found to be approximately 1920° C. The electrical conductivity was measured: below 1100° C. magnesium oxide is a much better insulator than porcelain, but above that temperature its large temperature coefficient indicates that it probably becomes a better conductor than porcelain. The coefficient of expansion, measured with an Abbe-Fizeau dilatometer, is not much greater than that of quartz crystal cut parallel to its optic axis, and is nearly equal to that of platinum, which fact will doubtless be of value in constructing apparatus for high temperature work. Chemically the fused oxide is very inert towards many neutral salts at high temperatures; the alkalis, however, attack it energetically.—R. S. H.

Ferric hydroxide and oxide; Pseudomorphs of —— after ferric sulphate. A. Vesterberg. Ber., 1906, **39**, 2270—2274.

Into a 250 c.c. flask are poured 50 c.c. of water and 50 c.c. of concentrated sulphuric acid, and 5 grms. of reduced iron are added. After the stormy evolution of gas has ceased, the flask is heated till the water is driven off, and the acid boiled till the iron is completely converted (about two days) into ferric sulphate. After cooling, the acid is poured off as far as possible, the magma of crystals poured into 100 c.c. of water, and then this is poured, with constant stirring, into 100 c.c. of strong solution (1:2) of sodium hydroxide. The resulting hydroxide is washed free from alkali by long heating on the water-bath with successive quantities of water. On drying in the air, it is seen under the microscope to consist of pseudomorphs of the ferric sulphate, and these pseudomorphs persist when the hydroxide is converted into oxide by ignition, though they are very friable and easily powdered.—J. T. D.

Potassium chlorate and nitrate; Isomorphism between ——. [Separation of isomorphous bodies.] J. Herbette. Compt. rend., 1906, **143**, 128—130.

Of the two forms in which potassium nitrate crystallises, one is isomorphous with potassium chlorate, but not the other, only one form of this latter salt being known. A similar relationship has been observed between the tartrates of potassium and thallium. These facts are capable of practical application in the separation of such isomorphous bodies. It has been found that if salts A and B have only one form in common, A may be isolated, quite free from B, by choosing conditions which render crystallisation in the common form impossible.—F. Sodn.

Borates; Potassium and sodium ——, [and determination of boric acid in alkali borates]. M. Dukelski. Z. anorg. Chem., 1906, **50**, 38—48.

The author has by a study of equilibrium in the system whose components are K_2O (or Na_2O), B_2O_3, H_2O, ascertained the formulæ of all the borates capable of stable existence in the solid phase at 30° C. They are :—$K_2O,B_2O_3,2{\cdot}5H_2O$; $K_2O,2B_2O_3,4H_2O$; $K_2O,5B_2O_3,8H_2O$; $Na_2O,B_2O_3,4H_2O$; $Na_2O,B_2O_3,8H_2O$; $Na_2O,2B_2O_3,10H_2O$; and $Na_2O,5B_2O_3,10H_2O$.

For the analyses, the mannitol method of estimating boric acid was found to give very accurate results when carried out as follows :—The alkali was first titrated with hydrochloric acid, using methyl orange as indicator. The solution was then boiled, under a reflux condenser, to expel all carbon dioxide, and the boric acid titrated with caustic soda and phenolphthalein in presence of mannitol. It is important that the mannitol be in sufficient quantity, and that the volume of liquid for titration be not too great.—F. Sodn.

Lead peroxide; New process for the manufacture of ——. L. Friderich, E. Mallet, and P. A. Guye. Monit. Scient., 1906, **20**, 514—518.

Normal or basic lead sulphate can be converted into lead peroxide with a nearly theoretical yield, by mixing it with magnesia, suspending the mixture in water, and passing in chlorine. In a trial with 5 kilos. of lead sulphate in a rotating barrel of 25 litres capacity, the operation was completed in about three hours, and required: Water, 13 litres; magnesia, 1·2 kilos.; and chlorine, 1·2 kilos. The crude reaction-product obtained contains at least 90 per cent. of lead peroxide, and by purification first with caustic soda, and then with acid, a product of 97 per cent. purity can be obtained, containing only traces of chlorine. The cost of production of 100 kilos. of lead peroxide is given as follows :—

		Francs.
36 kilos.	of magnesia at 7 francs per 100 kilos	2·50
33 „	„ chlorine at 15 „ „ „	4·95
146 „	„ lead sulphate at 23 „ „ „	33·58
Labour, &c.	.....	3·00
Total	.....	44·03

—A. S.

Mercuric iodide; Isomorphism of —— with zinc and cadmium iodides. A. Duboin. Compt. rend., 1906, **143**, 40—41.

From solutions of zinc and mercury iodides, or cadmium and mercury iodides, left to evaporate, successive crops of crystals are obtained containing progressively less mercury and more zinc or cadmium, the relative quantities of the two bearing no necessary relation to their atomic weights. Mercuric iodide thus appears to be completely isomorphous with zinc or cadmium iodide.—J. T. D.

Phosphorus trisulphide. R. Boulouch. Compt. rend. 1906, **143**, 41—44.

The author finds that when any substance containing phosphorus and sulphur in proportions between those corresponding to the formulæ P_2S_5 and P_2S_3, is fused, and suddenly cooled, and treated with carbon bisulphide,

an insoluble pulverulent portion remains, and a viscous portion dissolves. Continued repetition of this process, both in the pulverulent portion, and on the viscous portion recovered by evaporating the solvent, ultimately separates the substance completely into P_4S_3 and P_2S_5. The substance, P_3S_3, is thus not a definite compound. —J. T. D.

Phosphorus chloronitride. Besson and Rossett. Compt. rend., 1906, **143**, 37—40.

This substance is best produced by heating together phosphorus pentachloride and ammonium chloride, washing, drying, and redistilling the distillate. It has the molecular formula, $(PCl_2N)_3$, is a white solid substance resembling a carbon compound, and soluble in most organic solvents. Water slowly decomposes it, forming ammonia and hydrochloric and phosphoric acids. Sulphuric anhydride appears to form a compound with it, as does also nitrogen peroxide, but these compounds are exceedingly unstable, and their composition has not been established.—J. T. D.

Carbon; Solubility of —— in calcium carbide. H. M. Kahn. Compt. rend., 1906, **143**, 49—51.

At a high temperature, calcium carbide can dissolve carbon. Heated for 3½ minutes with currents rising from 400 to 600 ampères at 110 volts, the percentage of carbon dissolved, rose from 0·5 to nearly 4·0; with a constant current of 500—600 ampères, the percentage dissolved, increased with the time from 2½ in 3½ minutes to 5 in 6½ minutes.—J. T. D.

Vinasse; Treatment of —— at the Raab spirit factory. J. Ginsberg. XVII., page 771.

Vanadium salts; Electrolytic preparation and properties of ——. L. Marino. XIA., page 765.

Arsenic; Production of ——. Oil, Paint, and Drug Rep., July 16, 1906. [T.R.]

The annual report of the U.S. Geological Survey gives the following particulars of the production of arsenic:—

Production.—In 1905 there was produced in the United States 1,507,386 lb. of white arsenic (arsenious oxide), valued at $35,210, as compared with 72,413 lb., valued at $2185, in 1904. There are signs that the production of arsenic in this country will show marked expansion in the near future, and it is hoped that the chemical manufacturing industry utilising arsenic will progress also.

The following table shows the production of arsenic in the United States in the last five years:—

Year.	Lb.	Value.
		Dols.
1901	600,000	18,000
1902	2,706,000	81,180
1903	1,222,000	36,691
1904	72,413	2,185
1905	1,507,386	35,210

The peculiar feature of the domestic industry is the irregularity shown in production, which is unlike the status of the foreign industry as reported in recent years.

Imports.—The significance of the importation of arsenic and its compounds for the manufacturing industries of the United States may be appreciated from the statistics given in the following table for the period 1900 to 1905 inclusive:—

Year.	Lb.	Value.
		Dols.
1900	5,765,859	265,209
1901	6,989,588	313,782
1902	8,119,866	390,655
1903	8,557,961	394,602
1904	6,896,283	343,380
1905	7,675,962	256,540

World's production.—A noteworthy feature of the industry has been the growth in the production of Spain, which shipped to the United States in 1905 approximately 1750 short tons of white arsenic (99·8 per cent. of arsenious oxide). The largest producer of metallic arsenic and arsenious oxide in the world is Germany. Hopes are entertained that Canada may become an important producer with the development of its new deposits of mispickel in Ontario.

The following figures give the output of the principal producing countries during the last year for which statistics are available:—Canada (1905), 54 metric tons, value $5400; Germany (1904), 2,800 tons, value $244,917; Italy (1901), 6 tons, value $120; Japan (1903), 6 tons, value not given; Portugal (1904), 1370 tons, value $58,887; Spain (1903), 1088 tons, value $87,040; United Kingdom (1904), 992 tons, value $27,795; United States (1905), 684 tons, value $35,210.

English Patents.

Hydrochloric acid and gas-treating towers; Packing materials for ——. H. Hurlbutt, jun., Mold, and F. Hurlbutt, Queen's Ferry, Flintshire. Eng. Pat. 17,198, Aug. 25, 1905.

A series of raised bands or ribs are run horizontally round the surfaces, and preferably at right angles to the axes of the packing pieces for acid-treating towers, which ribs cause the acid flowing down to break up and spray over all round, as a fountain or waterfall. The packing pieces, of earthenware or other suitable material, are preferably formed in hollow lengths, of any desired cross-section; and the ribs may be formed of any convenient section, as semicircular or rectangular, and may be on either or both the exterior and interior surfaces.

(Reference is directed to Eng. Pats. 14,774 and 20,290 of 1896, and 23,052 of 1900; this J., 1896, 700; 1901, 897.)—E. S.

Nitric acid or nitric oxide; Processes for the production of —— from atmospheric air. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 7870, April 2, 1906.

In order to produce nitric oxide or nitric acid, air, or a mixture of air with oxygen, is heated to about 1200° C.; a portion of the products of the reaction is then withdrawn, cooled, and blown into the air under treatment, in order to cool the latter without causing it to be rarefied by the introduction of a foreign gas.—E. S.

Nitric acid; [Electrical] Production of pure —— [from air]. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 7871, April 2, 1906.

Air is subjected to the action of electrical discharges and water or aqueous vapour is added to the hot gases thus formed while they have a minimum temperature of 200° C., the quantity of such water or aqueous vapour being so proportioned as not to cool the gases below 100° C., so that the nitric vapours may remain gaseous. The gases are then passed through metallic pipes (in which, if desired, the mixture of the hot gases with water or steam may take place), and lastly, for condensation, into suitable clay apparatus. (See Fr. Pat. 323,760 of 1902; this J., 1903, 495.)—E. S.

Salt; Manufacture of ——. J. Hargreaves, Farnworth-in-Widnes, Lancs. Eng. Pat. 13,127, June 26, 1905.

Brine containing ferrous salts is treated with chlorine, or with sodium hypochlorite or the like, to convert the ferrous into ferric salts, the precipitation of which is facilitated by addition of "soda" or lime in excess. The heavy precipitate containing lime and magnesia thus formed carries down with it the finely-divided and suspended ferric hydroxide, and the brine, freed from the precipitate, yields, on crystallisation, salt of a "pure white colour."—E. S.

Common salt; Preparation of —— for domestic and other use. G. T. Holloway, London. Eng. Pat. 16,279, Aug. 10, 1905.

The coarser particles of common salt, freed from fine powder by screening, are agitated with about 1 per cent.

of their weight (in the case of kitchen salt) of finely powdered sodium carbonate. In some cases, the sodium carbonate so used is previously mixed with a portion of finely-powdered salt. The coarse salt thus becomes coated, and this coating serves the purpose of converting the deliquescent chlorides of magnesium and calcium present into non-deliquescent carbonates, at or near the surface of the granules.—E. S.

Acetates of copper and lime; Process for the manufacture of double ——. I. C. Ponthus, Lyons, France. Eng. Pat. 3536, Feb. 13, 1906. Under Int. Conv., Aug. 31, 1905.

See Fr. Pat. 357,414 of 1905; this J., 1906, 87.—T. F. B.

Sulphate of alumina and sulphate of potash; Separation of —— from solutions containing the same. A. Pezzolato and M. T. de Felice, Rome. Eng. Pat. 6122, March 13, 1906.

Solutions of crude potassium alum, such as are obtained by acting on alum stone or the like with alkali bisulphate or sulphuric acid, are treated with potassium sulphide solution to completely precipitate iron as sulphide, and aluminium as hydroxide, hydrogen sulphide being evolved. Potassium sulphate is crystallised out of the filtered solution. The precipitate is treated with sodium sulphide solution to obtain solution of sodium aluminate, which when cleared, is decomposed by hydrogen sulphide to precipitate aluminium hydroxide (subsequently converted into aluminium sulphate), and recover sodium sulphide. A portion of the potassium sulphate obtained as first described, is heated in a muffle furnace, and transformed into sulphide by causing hydrogen sulphide, evolved in preceding processes, to act upon it,

$$(K_2SO_4+4H_2S=K_2S+4S+4H_2O),$$

"thereby producing sulphur which is collected and utilised to prepare sulphuric acid."—E. S.

Alkali cyanides; Process for separating —— from their solutions in water. J. Tcherniac, London. Eng. Pat. 11,371, May 15, 1906.

Claim is made for separating alkali cyanides from their solutions, or for dehydrating a hydrated alkali cyanide, by adding solid caustic alkali. For example, a solution containing 30 per cent. of sodium cyanide is made by passing gases containing hydrogen cyanide into a solution of caustic soda containing a slight excess of alkali beyond the amount required, and a quantity of solid caustic soda, approximately equal to that originally contained in the solution, is added. The solution is now again nearly saturated with hydrogen cyanide, and a further quantity of solid caustic soda added, when about one-half of the sodium cyanide present separates in the form of a fine white powder. If the solution of sodium cyanide should become so concentrated that on cooling it sets to a mass of hydrated crystals, these can be converted into a sandy powder consisting of the anhydrous or less hydrated salt, by addition of solid caustic soda.—A. S.

Calcium hydride; Method of producing ——. Consortium für Elektrochem. Ind., Nurnberg, Germany. Eng. Pat. 11,767, May 19, 1906. Under Int. Conv., May 19, 1905.

Calcium is melted, preferably in an iron vessel, and hydrogen is conducted into the molten metal. The hydrogen is rapidly absorbed, and the product may be removed from the crucible in solid lumps, described as containing 84 per cent. of calcium hydride (CaH_2). Calcium hydride is stated to be well suited for producing hydrogen for aërial navigation. (See this J., 1906, 363.)—E. S.

United States Patents.

Ammonia from gases; Process of extracting ——. R. Brunck, Dortmund, Germany. U.S. Pat. 825,297, July 10, 1906.

See Fr. Pat. 356,889 of 1905; this J., 1906, 13.—T. F. B.

Tin; Producing oxygen compounds of ——. C. E. Acker, Niagara Falls, N.Y., Assignor to Acker Process Co., N.J. U.S. Pat. 824,898, June 26, 1906.

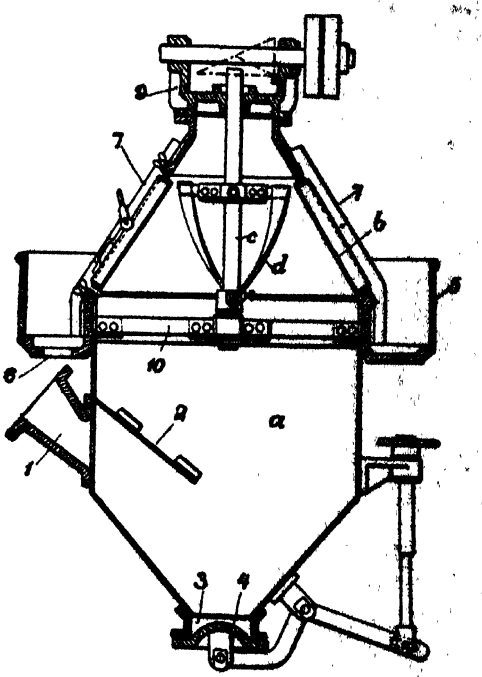
A hypochlorite, such as calcium hypochlorite, is caused to react in presence of water on a tin chloride (stannous or stannic chloride), and the hydrated tin oxide which separates is calcined. The chlorine set free by the reaction is withdrawn in such manner as to be recovered without substantial admixture of air. (Compare U.S. Pat. 810,897, of Jan. 30, 1906; this J., 1906, 218.)—E. S.

Peroxide of hydrogen; Stable solution of ——. W. Heinrici, Halle on the Saale, Germany. U.S. Pat. 825,883, July 10, 1906.

See Fr. Pat. 356,880 of 1905; this J., 1906, 19.—T. F. B.

French Patents.

Liquids which are not easily filtered, such as milk-of-lime, and diffusion juice [from beet sugar factories]; Apparatus for purifying ——. H. Kořán. Fr. Pat. 362,646, Jan. 23, 1906.



The milk-of-lime or other liquid to be purified enters the reservoir, *a*, by the pipe, 1, and is forced to take a downward direction by the partition, 2. The larger particles of impurities such as sand, coke, unslaked lime &c., settle to the bottom, and are drawn off from time to time through the opening, 3, which is provided with a valve, 4; the milk-of-lime rises in the vessel, *a*, and passes through the fine metallic sieves, *b*, which are held in position by the angle-irons, 7, into the trough, 5, from which it flows away through the opening, 6. Agitator blades, *d*, carried by the shaft, *c*, supported on the cross angle-irons, 10, and driven from above by the mechanism, 9, give a downward direction to the finer particles of impurities which have been carried upwards by the liquid, so that only a very pure liquid reaches the sieves, *b*. As the inflowing liquid has to pass over the solids deposited in the conical bottom of the vessel, *a*, the latter are completely exhausted.—W. H. C.

Salts of the oxyhalogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.G. Fr. Pat. 362,737, Jan. 10, 1906. XIA., page 766.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 698.)

ENGLISH PATENT.

Glass-melting and pouring apparatus. P. T. Sievert, Dresden, Germany. Eng. Pat. 5605, March 8, 1906. Under Int. Conv., March 11, 1905.

THE molten glass flows from the melting-bath into a device consisting of a movable carrier placed in a heating-chamber arranged in front of the furnace. This carrier is placed on a section of the wall of the closed heating-chamber, which section can be removed from the wall for the purpose of emptying the carrier, the latter being surrounded on all sides, and especially on the bottom, by hot gases. The movable section of the wall may either be carried on a vertically-moving carrier, or else the carrier or the section of the wall may be hinged, so that the carrier can be tipped about the joint or hinges, and emptied.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 698.)

Blast-furnace slag; Relation between the hydraulic properties and chemical composition of granulated ——. L. Jesser. Tonind. Zeit., 1906, 739; Chem.-Zeit., 1906, **30**, Rep. 225.

No perfect concordance can be traced between the hydraulic properties and chemical composition, the hardness of the cement being greatly influenced by the method of granulation in water, and the further treatment of the slag. The ratio of silica to alumina, however, has an undeniable effect on the hydraulic properties, though—the proportion of lime remaining constant—no regular decrease in strength can be detected between the ratios 1 : 0.5 and 1 : 0.3. The lime content also influences the hydraulic properties. The border line between good and inferior slags with a minimum content of lime may be expressed by the ratio silica 1:alumina 0.25:lime 1.4, the respective proportions by weight being: 1:0.76:0.32.
—C. S.

Cement; Researches on reinforced——, and the influence of the removal of stress. F. Schüle. Compt. rend., 1906, **143**, 28—30.

THE experiments were made on:—1. Two series of prisms or briquettes arranged for tensile stress. 2. Rectangular beams, armoured and unarmoured, 170 cm. long, loaded at two points 30 cm. apart. 3. Beams of T-section, 430 cm. long, loaded at seven points 50 cm. apart. In each case, starting with a certain load, the load was increased considerably, and after deformation or extension, the load was diminished to its original value. In the first set of experiments, a considerable permanent or residual deformation occurred; and, even after fissures appeared in the cement, the adhesion of cement to iron caused considerable residual stress, tension in the iron, compression in the cement. In the second set of experiments, the hypothesis of plane sections remaining planes after deformation was not realised; the actual tensions in the extended zone were always less than those calculated from the hypothesis, because of internal stresses due to the adhesion of metal and cement. The ratio of permanent to total deformation was found to be greatest when the load was just sufficient to produce the beginnings of fissure in the extended zone of the beams. In the third set there were two series of experiments; one with beams which had been made a year, the other with beams only six weeks old. The breaking stresses of the latter series were only two-thirds of those of the former; in both series the permanent deformation varied from 5 to 40 per cent. of the total deformation. The repeated application of a stress uniformly distributed over the length of the beam produced fissures not merely at the middle point, but over half the length of the one year old beams, and three-quarters of the length of the six weeks old beams. By this process, the adhesion of metal to cement was destroyed before the tension in the iron had reached half the elastic limit. Five of six one year old beams broke at the middle just after the elastic limit of the iron had been exceeded; the other gave way at the extremities under a smaller load. The six weeks old beams all gave way at the ends below the elastic limit of the iron.—J. T. D.

ENGLISH PATENTS.

Kilns for burning bricks, tiles, and the like; Impts. in ——. A. C. Brewerton, Reading. Eng. Pat. 13,036, June 23, 1905.

THE claim relates to improvements in kilns described in Eng. Pats. 3628 of 1876, and 15,659 of 1899. In addition to the usual chimney flue, the kilns are connected together in groups by one or more flues connected to the top of the kilns, and provided with suitable dampers. By manipulating these dampers, the hot gases coming from a kiln which has been burnt off can be sent to another kiln which has been recently charged. The gases pass down through the contents to the main flue, and serve to heat the bricks, &c., prior to the admission of the fire-gases which are to complete the burning. The hot gases may also be passed beneath a drying floor on which the bricks or tiles are stacked before being put into the kilns.—W. H. C.

Clays; Cleaning and separating ——, *and apparatus therefor.* M. Bohn, Nagy-Kikinda, Hungary. Eng. Pat. 1105, Jan. 15, 1906.

THE clay to be cleaned is advanced along the interior of a horizontal cylinder by means of a screw-conveyor placed therein. The lower part of the cylinder consists of a series of sieves of different sized meshes. As the screw-conveyor fits closely against these, it pushes the clay through the holes in the sieves, and keeps the latter clean at the same time, the clay thus being graded into its components according to their size. Any stones, &c., are pushed through to the end of the cylinder, and emerge by a suitably sized opening.—A. G. L.

UNITED STATES PATENT.

Marble and stone; Manufacture of artificial ——. T. M. Thom, Cheshunt. U.S. Pat. 825,068, July 3, 1906.

SEE Eng. Pat. 8804 of 1905; this J., 1906, 537.—T. F. B.

FRENCH PATENT.

Slag; Process for the manufacture of building stones, pipes, and briquettes from ——. Cöln-Müsener Bergwerks-Act.-Ver. Fr. Pat. 362,808, Jan. 29, 1906.

THE slag—for example, blast-furnace slag—is crushed or ground, mixed with water, with or without addition of lime, and then subjected in moulds to a pressure of several atmospheres of carbon dioxide or gases containing it.
—A. S.

X.—METALLURGY.

(*Continued from page* 700.)

Blast refrigeration; Different modes of ——, *and their power requirements.* J. E. Johnson, jun. Iron and Steel Inst., July, 1906. [Advance proof.]

THE author shows that the brine-circulation system of drying air by refrigeration used by Gayley (this J., 1904, 1148) is not the cheapest method with respect to power required and cost of attendance. The most economical method is that of direct expansion, the air being passed directly over the coils in which the ammonia is expanded,

instead of over coils in which cooled brine is circulated. In order to avoid the formation of much ice, the refrigeration is effected in two stages by the use of two ammonia compressor-cylinders, one working from a suction temperature of 36° F., and the other from a suction temperature of 15° F. Further economy is effected by cooling the incoming air by means of the outgoing cold air. It is claimed that by this regenerative, two-stage, direct expansion system, it is possible to dry the blast with less than half the first cost for plant, with much less attendance, and with one-third of the power required by the single-stage, non-regenerative, brine-circulation system. It is pointed out that from a commercial point of view there is no gain in cooling the air to too low a temperature, 32° F. being probably low enough in summer, and 22° F. in winter.—A. S.

Gas-engines; Application of large —— in the German iron and steel industries. K. Reinhardt. Iron and Steel Inst., July, 1906. [Advance proof.]

A REVIEW of (1) the extent of the application of gas-engines in iron-works and collieries in Germany; (2) the working results obtained, including the influence of purification on the gases; and (3) the present practice in the design of large gas-engines in Germany.

Coke; Comparison of Rhenish-Westphalian foundry and blast-furnace ——. F. Wüst and G. Ott. Stahl u. Eisen, 1906, **26**, 841—844.

THE authors have determined various chemical and physical constants of coke used in the Ruhr district for blast-furnace (36 samples) and foundry (26 samples) purposes, to ascertain whether the results would show differences which would account for the higher price of foundry coke. The minimum, maximum, and average figures extracted from the table of results are given below:—

	Blast furnace.			Foundry.		
	Min.	Max.	Aver.	Min.	Max.	Aver.
Ash ..... per cent.	6·74	14·30	9·48	7·30	13·07	9·85
Sulphur . ,,	0·77	1·52	1·10	0·73	1·58	1·08
Phosphorus ,,	0·013	0·047	0·022	0·013	0·047	0·022
Carbon .. ,,	81·94	89·66	87·35	83·35	90·19	86·64
Calorific value, grm.°C.	6621	7245	7058	6735	7288	7001
Sp. gr., apparent ..	0·77	1·00	0·90	0·69	1·02	0·89
,, real	1·72	2·09	1·87	1·85	2·02	1·92
Porosity, vol. per cent.	44·57	67·30	51·34	44·60	62·75	53·34
Crushing stress, kilos. per sq. cm.	85	200	127	61	194	113
Loss on heating in a stream of carbon dioxide	1·44	9·75	5·07	1·56	12·38	4·46

The results show that no difference can be thus established between foundry and blast-furnace coke; the only sensible difference shown is in the attack of the coke by carbon dioxide at a red-heat.—J. T. D.

Iron; Crystallography of ——. F. Osmond and G. Cartaud. Compt. rend., 1906, **142**, 1530—1532.

THE authors have previously found that the three varieties of iron all crystallise in the cubic system, and have now examined the effect of pressure on the crystal surfaces in producing slip or translation, and the position of macles. In α-iron, translation does not easily occur, but when it takes place, is parallel to the faces, a_1, of the octohedron; in β-iron there are no planes of translation; and in γ-iron translation parallel to the faces, a_1, occurs with ease. In α-iron, macling occurs as in fluorspar, but the plane of union is the face, a_2; no macles can be formed by reheating after deformation. In β-iron no macles are ever formed. In γ-iron, the macling is that of fluorspar, the plane of the macle and the plane of junction being the face, a_1, whether the macles be mechanical, or be made by reheating after deformation.

No crystallographic differences exist between the two allotropic forms of nickel.—J. T. D.

Iron; Crystallography of ——. F. Osmond and G. Cartaud. Compt. rend., 1906, **143**, 44—46.

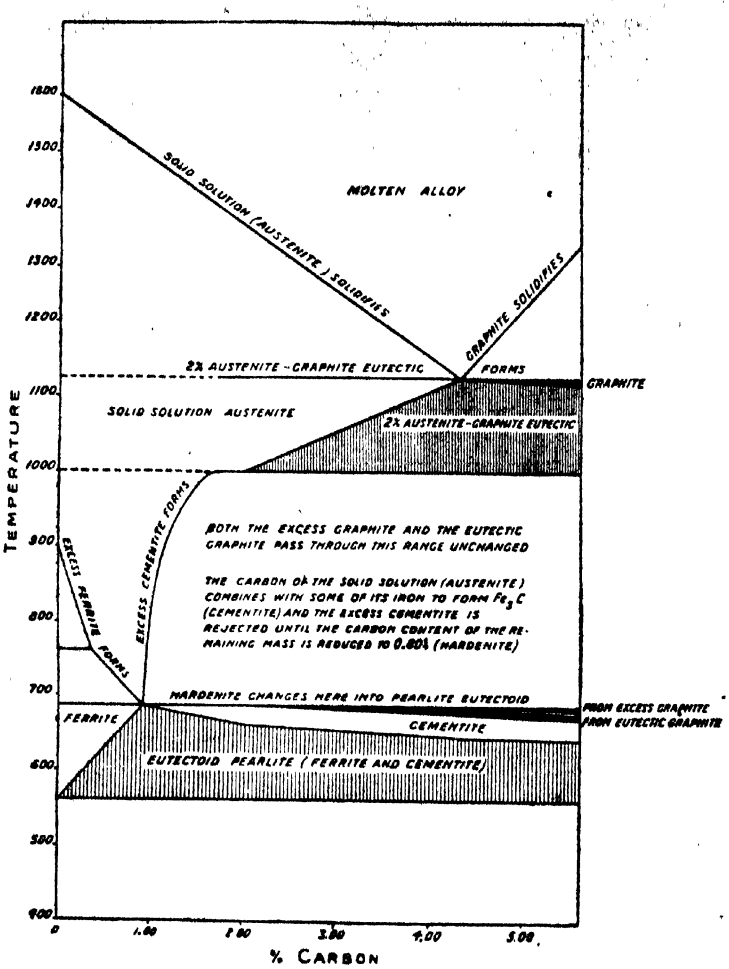
A WELL-CRYSTALLISED piece of manganese steel, chilled in cold water from a temperature of about 1100° C., shows under the microscope a number of macles, parallel to the four faces of the regular octohedron. An etched polished section shows needle-like lines, parallel in each granule to two, three, or four definite directions. This is the martensite structure; it is produced by the stresses set up through the rapid changes of volume produced by sudden cooling. It is a structure proper to γ-iron; but it may remain, even after careful annealing, when the whole of the iron has reverted to the α-form, as a kind of pseudomorph. When that is the case, the granules are cut into a number of fine lamellæ parallel to four different planes, and the natural cleavages, p, of α-iron are interrupted; hence the fragility is lessened. This is the cause of the improvement of the mechanical qualities of mild steels by tempering. The martensitic structure is, on a small scale, that of octohedral meteoric irons. Such a structure is not peculiar to iron, but is general in all cases where in the solid state an allotropic change accompanied by change of volume occurs, if the resulting mechanical stresses can produce mechanical macles.

—J. T. D.

Iron-carbon alloys; Constitution of ——. A. Sauveur. Iron and Steel Inst., July, 1906. [Advance proof.]

THE author discusses the Roberts-Austen Roozeboom diagram relating to iron-carbon alloys (this J., 1901, 1016); whilst agreeing with previous workers as to the nature of the alloys immediately after solidification, and the transformations experienced by alloys containing less than 2 per cent. of carbon, he is unable to agree that in the case of alloys containing more than 2 per cent. of carbon, graphite plays any part in the transformations which take place after solidification. It appears to have been generally accepted hitherto, that when the iron contains more than 2 per cent. of carbon, the cementite present in the slowly-cooled alloy has been produced not only by the breaking up of austenite, but also by the direct union of graphite with some of the iron of the austenite. According to this view any graphite present in an iron-carbon alloy is due to "lag," i.e., to absence of favourable conditions (slow cooling, &c.), for the reaction of the graphite and iron, and consequently all cast irons free from silicon and other disturbing elements should normally be white. The author's view, on the other hand, is that the graphite which forms during solidification plays no part in the further transformation of the alloys, but acts merely as an inert substance, passing through the critical range unaffected. In the accompanying figure the composition of iron-carbon alloys after solidification, and after slow cooling, is shown, in accordance with this view. One of the chief arguments in favour of this view is the well-known behaviour of graphite, which resists transformation by any known heat treatment short of melting. Further evidence pointing in the same direction was afforded by the following experiments:—Some electrolytic iron was melted in a graphite crucible "brasqued" with magnesia, together with an excess of sugar charcoal, and the crucible was then allowed to cool very slowly in the furnace. Under such conditions, exceptionally favourable to the production of a pure iron-carbon alloy in a state of stable equilibrium, the resulting alloy should contain relatively little graphite, if this constituent plays any part in the formation of cementite. The alloy was found to contain 4·354 per cent. of total carbon, and should therefore theoretically contain 2·40 per cent. of graphite, whereas actually the amount of graphite was 3·666 per cent., so that not only had any graphite failed to combine with iron at the critical temperature, but some of the cementite had decomposed into carbon (temper carbon) and iron during the very slow cooling. A piece of this alloy was next heated for five hours at the critical temperature (1000° C.), when instead of additional cementite being formed by the interaction of graphite and iron, a considerable quantity of that constituent was decomposed, 1·688 per cent. of temper carbon being produced.

The causes of the great variations in the percentage of



graphite in commercial cast iron are :—(1) The presence of impurities, and (2) the rate of cooling. In order to obtain the theoretical proportion of graphite in an iron-carbon alloy, two conditions are essential: (1) very slow cooling during solidification, and (2) absence of disturbing foreign elements. The production of malleable cast-iron castings by annealing for a long time is easily and logically explained if graphite be regarded as a normal constituent of cast iron. White cast-iron is in an unstable condition, the formation of graphite having been prevented through too sudden cooling, or because of the presence of disturbing elements. Re-heating to a relatively low temperature will allow of a partial or complete return of the metal to its stable condition, i.e., with a normal content of graphite, hence the production of malleable graphitic iron from white cast-iron by annealing.

The author further discusses the changes taking place at the thermal critical points of steels, with respect to the nature of the structural constituents, and concludes that the four constituents formed during the cooling of steel are :—(1) A solid solution of carbon in γ-iron (austenite); (2) a solid solution of carbon in β-iron (martensite); (3) a solid solution of carbon in α-iron (troostite); and (4) the iron-iron carbide eutectoid (pearlite).

A method of calculating from the proportion of total carbon the percentages of the various constituents which should normally be present in iron-carbon alloys is given in an appendix, and also a table showing the proximate and ultimate compositions of alloys containing between 0·1 and 5 per cent. of carbon, both after solidification and after slow cooling.—A. S.

Steels; Determination of transformation points of —— by the method of electrical resistance. P. Fournel. Compt. rend., 1906, **143**, 46—49.

By an examination of the forms of the curves showing the alteration of electric resistance with temperature, the author has determined the transformation points in five steels to be as follows :—

	Steel No.				
	1.	2.	3.	4.	5.
Carbon ..	0·08	0·11	0·22	0·87	1·05
Silicon ..	0·24	0·03	0·22	0·126	?
Manganese	0·45	0·86	0·57	0·47	0·23
A_1	—	670°	685°		
A_2	775°	750°	730°	730°—770°	730°—750°
A_3	880°	880°	780°		

The resistance was measured on a wire, 0·3 mm. diameter, rolled round a double sheet of mica, and heated *in vacuo* by an electric resistance furnace. The wire was arranged in series with an ohm-meter, and a current of a few hundredths of an ampère passed through. The temperature was ascertained by a Le Chatelier pyrometer, the junction of which was inserted between the folds of the mica. Care was taken that the rates of heating and of cooling were the same for each series of measurements. —J. T. D.

Silver ores; The Francke-Tina process for the reduction of ——. A. Fox, jun. Proc. Inst. Civil Eng., 1905—1906, **163**, Part I.

The process is in operation in parts of Peru and Bolivia, but is so expensive in working that it can only be applied to rich ores. The ores at Caylloma consist of galena, copper pyrites, and iron pyrites, together with polybasite, pyrargyrite, and argentite, with a little blende and manganese blende, in a gangue of rhodonite and quartz. A general analysis shows:—Copper, 0·4 per cent.; iron, 3·0; lead, 0·9; zinc, 0·6; sulphur, 4·0; manganese oxide, 18·0; insoluble, 58·0; and alumina, &c., 6·0 per cent. The ore is hand-sorted at the mines into three classes: the first, about 7 per cent. of the whole, is shipped to England; the second, about 45 per cent., is sent to the San Ignacio Mill on muleback for treatment; the third, about 48 per cent., is at present thrown on the dump. At the mill the ore is dry crushed in a stamp battery; each stamp weighs 700 lb., gives 100 blows per minute, and crushes 0·6 ton per 24 hours through a 12-mesh screen, 76 per cent. of the product being fine enough to pass a 40-mesh screen. The crushed ore is roasted in 1200-lb. charges with 5 per cent. of salt in a 3-hearth reverberatory furnace for about 2½ hours on each hearth, by which 70 per cent. of the silver is converted into chloride. The fuel employed is either taquia (dried llama and alpaca dung), yareta (a resinous plant), wood, or coal. After furnacing, the ore is stirred up with water in a wooden tub or "tina" having copper or bronze fittings, small quantities of copper sulphate, lime, cyanide, and mercury being added; and the whole boiled up with steam. From time to time the amalgam formed is withdrawn, and the mercury is distilled off for further use.

The action in the tina is supposed to be as follows:—The silver chloride formed by roasting is dissolved in the salt solution, reduced by the copper, and taken up by the mercury; the consumption of copper is equal to more than 40 per cent. of the silver produced, which is much in excess of the theoretical quantity required. The extraction of silver by this process is about 70 per cent., of the little gold present only 50 per cent. The costs are:—For crushing, 8s. per ton; roasting, 19s.; amalgamating, 10s.; general, 3s.; total, 40s. per ton. The defects of the process as there carried out are thus specified by the author:—"The wet ore from the mines has to be dried; dry crushing is very slow; the dust loss is heavy; fuel for roasting is scarce and dear; salt is dear; there is a large amount of labour required; the repairs to the machinery are heavy; and water power for driving the mill is only available for six months in the year. Experiments in wet crushing and concentrating over tables so as to obtain a product rich enough for export, and treatment of the tailings by cyanide, have been somewhat successful."—J. H. C.

Copper; Power of —— to form alloys with pure iron and iron-carbon alloys. V. O. Pfeiffer. Metallurgie, 1906, **3**, 281. Chem.-Zeit., 1906, **30**, Rep., 210.

The author employed electrolytic copper and Swedish nail iron, using an electric furnace as the source of heat, by which temperatures of 1700° C. could be obtained. The metals were melted together in a magnesia crucible in an atmosphere of nitrogen. An addition of 0·5 to 35 per cent. of copper caused no alteration in the solidifying point of the iron; on adding more copper the point of solidification of copper became more distinct. There is no evidence of copper being soluble in iron or iron in copper to any appreciable extent, and also no evidence of the formation of mixed crystals of copper with either α- or γ-iron. Microscopic examination showed that the copper is only present in suspension in the solidified melt. Similarly in alloys containing 4 per cent. of carbon no solution took place, the copper remaining suspended in the fusion mixture. On allowing the liquid melt to stand, the copper collected at the bottom of the crucible.—E. F. A.

Blast-furnace slag; Relation between the hydraulic properties and chemical composition of granulated ——. L. Jesser. IX., page 700.

Platinum metals; Analysis of ——, [Determination of osmium and palladium]. N. A. Orlow. XXIII., page 779.

Mineral production of Quebec. Eng. and Mining J., July 7, 1906. [T.R.]

The report of J. Obalski, chief of the Bureau of Mines of Quebec, gives the following statement of the production of the Province in 1905. The quantities are in short tons of 2000 lb., except where otherwise noted:—

	Quantities.	Value.
		Dols.
Bog iron ore	12,878	35,266
Chromic iron ore	8,528	104,565
Copper ore	28,644	128,850
Asbestos	48,960	1,476,450
Asbestic	19,220	31,100
Mica (pounds)	378,560	95,460
Calcined ochre	1,905	22,675
Phosphate	1,475	8,875
Slates (squares)	4,900	21,568
Flag-stones (sq. yds.)	2,930	2,490
Cement	254,833	408,000
Granite	—	120,000
Lime (bush.)	1,000,000	140,000
Bricks	120,000,000	625,000
Stone	—	580,000
Totals	—	3,750,800

There were 5,017 men employed during the year, the wages paid amounting to $1,634,363, and the period of employment from five to 12 months. Two men were killed and two injured, the average of each being 0·4 per 1000 employees.

English Patents.

Metals and alloys; Production of fused ——, from oxides and other compounds. C. Vautin, London. Eng. Pat. 10,881, May 24, 1905.

It has been proposed previously to obtain metals from their compounds by mixing and igniting the latter with finely-divided metallic aluminium (see Eng. Pats. 6506 of 1894, and 16,685 of 1896; this J., 1895, 582; 1897, 742). According to the present invention the metal oxide, *e.g.*, iron oxide, or a mixture of metal oxides, in a dry solid state, is mixed with silicide or boride of magnesium or aluminium, and the mixture is ignited. The silicide or boride is converted into silicate or borate, which forms a slag, and the metal, *e.g.*, iron, is produced in a fused state. Claim is also made for the application of the process to the welding of metals.—A. S.

Iron or steel; Uniting or coating —— with other metals or alloys. G. L. Davies and W. G. Clark, Wessels Nek, Natal. Eng. Pat. 15,675, July 31, 1905.

The invention relates to the method of uniting or coating iron or steel with other metals, described in Eng. Pat. 17,660 of 1904 (this J., 1905, 1309), and consists in improvements whereby a plate of iron or steel can be coated on both sides simultaneously with copper, gold, or silver, or with an alloy containing one or more of these metals. Two furnaces are employed, one having a magnesite or other basic lining, in which the coating metal or alloy is maintained in the molten condition, whilst the other, in which the plate of iron or steel is heated, contains "a bath of molten flux composed of approximately equal quantities of silica and an alkali or

alkaline-earth carbonate." The heated plate is transferred to a highly heated mould of magnesite, clay, or foundry loam, and the molten coating metal run in.—A. S.

Steel; Method of and apparatus for manufacturing ——. F. André, Haardt bei Neustadt, Germany. Eng. Pat. 1356, Jan. 18, 1906.

See Fr. Pat. 362,371 of 1906; this J., 1906, 700.—T. F. B.

Steel; Manufacture of —— by the pneumatic process. A. Tropenas, Montelimar, France. Eng. Pat. 6484, March 17, 1906.

The molten pig iron or mixture of pig iron and scrap is blown as usual in the converter, but as soon as, or a very short time after, the "carbon flame" appears, a small quantity of ferro-silicon or iron high in silicon (varying according to the composition of the charge) is added. It is stated that by working in this manner, the evolution or progression of the "carbon flame" is not altered in any way, and thus the characteristic signs of this flame can be used for the stopping of the operation at the precise moment when the fining is finished.—A. S.

Gold; Treatment of complex ores containing ——. R. W. E. McIvor, M. Fradd, and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 13,433, June 29, 1905.

The ores are roasted dead, ground, mixed in suitable proportions with a manganese ore containing manganese dioxide, and with magnesium chloride, and the mixture saturated with steam, whereby the gold is converted into chloride, and is afterwards recovered by known methods. —A. S.

Iridium; Art of producing metallic ——. H. H. Lake, London. From H. C. Parker, New York. Eng. Pat. 24,003, Nov. 21, 1905.

See U.S. Pat. 805,316 of 1905; this J., 1905, 1310.—T. F. B.

Tinned plates; The detinning of ——. K. Goldschmidt and J. Weber, Essen on Ruhr, Germany. Eng. Pat. 12,870, June 21, 1905.

See Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

United States Patents.

Precious metals; Process for recovering ——. J. A. Just, Pulaski, N.Y., Assignor to The Just Mining and Extraction Co., Syracuse, N.Y. U.S. Pat. 820,000, May 8, 1906.

The object of the invention is to extract gold and silver or other precious metals from ores, without previously chlorinating or roasting the latter. The claims are for the recovery of precious metals (gold and silver) from ores or material containing the same, by treatment with nitro-sulphonic acid, $HO.SO_2.NO_2$, to obtain the precious metals in solution, and precipitation of the metals in any suitable known manner. In practice, the best method of carrying out the invention is to treat the finely-ground ore with sulphuric acid along with sodium nitrate and atmospheric oxygen.—A. S.

[*Copper-nickel-manganese*] *Alloy* [*Electrical resistance*], W. B. Driver, East Orange, N.J. U.S. Pat. 824,103, June 26, 1906.

The alloy consists of copper, nickel (10—30 per cent.), and manganese (5—10 per cent.), practically free from iron or other foreign substances. One claim relates to an alloy containing 75 parts of copper, 20 parts of nickel, and 5 parts of manganese, for use as an electrical resistance material.—A. S.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 824,181, June 26, 1906.

The furnace consists of a number of superposed hearths, through which a vertical hollow shaft passes. Hollow arms project from the shaft, and extend into the several hearths. The shaft and arms are divided into intercommunicating sections, and a body of water is caused to circulate through the central section and the arms corresponding therewith. The steam generated from the water is caused to circulate through the sections (and also through the corresponding arms) on either side of the central section.—A. S.

Furnace; Ore-roasting ——. C. H. Rider, St. Louis, Mo. U.S. Pat. 824,263, June 26, 1906.

The roasting chamber of the furnace has inlet and outlet doors in its front wall, and communicates at its rear end with a stack. A cylindrical retort is mounted in an inclined position in the roasting chamber, and can be rotated. There is an opening in one end of the retort, normally closed by a plate, and registering in turn, as the retort is rotated, with the openings in the wall of the roasting chamber. A feed-hopper is mounted above the inlet opening, and a discharge shoot below the outlet opening. The gaseous products from the retort are discharged into a dust chamber, from which they pass through a pipe to a condenser, and thence through another pipe to the stack.—A. S.

Furnace; Smelting ——. J. D. Rivard, Los Angeles, Cal. U.S. Pat. 824,383, June 26, 1906.

The furnace comprises an inclined chamber communicating at its upper end with a combustion chamber below. Liquid hydrocarbon fuel is supplied to the combustion chamber through injection burners, and air is supplied on each side of a central baffle-wall of chequer-work in the rear portion of the chamber. At the lower end of the inclined chamber is a stack, at the bottom of which is a "directing-chamber" containing a covered crucible. There is a reheating chamber in the top wall of the inclined chamber, communicating with the latter by means of ports. Pipes are also provided connecting the reheating chamber with a blower, and the blower with the stack. The ore is fed in at the upper end of the inclined chamber, and during its passage through this chamber, is subjected to action of a number of hot blasts of gas directed downwards upon it. Between the ore-feed opening and the stack is an opening through which material capable of producing carbon monoxide is introduced into the inclined chamber. The molten material flows out at the lower end into the crucible, whilst the products of combustion pass over the crucible, down through passages between the walls of the crucible and the sides of the "directing-chamber," and through ports in the walls of the latter, near the bottom, into the stack.—A. S.

Furnace; Reverberatory —— for the production of steel. V. Defays, Brussels. U.S. Pat. 825,522, July 10, 1906.

See Fr. Pat. 337,589 of 1903; this J., 1904, 493.—T. F. B.

Slag-granulating apparatus. E. B. Clark, Chicago, Ill. U.S. Pat. 824,340, June 26, 1906.

The apparatus comprises a tank which communicates at its lower part with an adjacent chamber of about the same height, and has a filter-bed near the bottom. The mixture of slag and water is fed into the tank, and passes through the filter-bed into the adjacent chamber. Means are provided for preventing the water in the tank from falling below a certain level above the filter-bed, these means consisting of a number of discharge-pipes at different heights in the adjacent chamber, the lowest pipe being above the level of the filter-bed.—A. S.

Ores; Process for the reduction of [*sulphide*] ——. W. Koehler, Cleveland, Ohio. U.S. Pat. 824,663, June 26, 1906.

Sulphide ores are heated, and subjected to the action of a gaseous mixture containing a halogen-acid, such as "anhydrous hydrochloric acid," and an oxidising agent, such as "anhydrous" nitric acid.—A. S.

Nickel from nickel carbonyl; Apparatus for obtaining ——. C. Langer, Clydach, Assignor to The Mond Nickel Co., Ltd., London. U.S. Pat. 825,844, July 10, 1906.

See Eng. Pat. 13,350 of 1905; this J., 1905, 1070.—T. F. B.

French Patents.

Silicon combined with calcium or its compounds; Thermal process based on the action of ——. T. Goldschmidt. First Addition, dated Jan. 10, 1906, to Fr. Pat. 361,197 of Dec. 30, 1905.

Instead of forming a thermite by compounding silicon and calcium with certain oxides, as directed in the main patent (this J., 1906, 593), according to the present addition, the silicon therein used is replaced by aluminium, with or without the addition of other reducing or non-reducing metals. Good results are stated to be obtained, for example, by using with a mixture of equal weights of aluminium and calcium, mixtures of equivalent proportions of calcium and of ferric oxide and of aluminium and ferric oxide. The calcium in the "thermite" may be replaced, partially or entirely, by strontium or barium. —E. S.

Pyritic ores containing zinc; Treatment of ——. The Metals Extraction Corporation, Ltd. Fr. Pat. 362,677, Jan. 25, 1906.

Pyritic ores containing zinc are roasted at a low red heat to oxidise as much as possible of the zinc sulphide to sulphate; the product is then lixiviated, and the solution of zinc sulphate obtained is treated with calcium chloride. The zinc chloride, freed from the precipitated calcium sulphate, is heated in an autoclave with the roasted and lixiviated ore, containing zinc oxide, which is dissolved. The solution of zinc oxychloride thus obtained is precipitated by chalk or caustic soda to obtain zinc carbonate or hydroxide. Alternatively, the pyritic zinc ore may be roasted at a high temperature, and be then treated in an autoclave with zinc chloride solution, to dissolve out of it the zinc oxide formed. Ores thus freed from zinc may be smelted, and treated by known processes to recover any lead, copper, silver, or other metals they may contain.—E. S.

Zinc and other metals; Continuous process for refining ——. J. Callmann and R. Bormann. Fr. Pat. 362,802, Jan. 29, 1906. Under Int. Conv., March 20, 1905.

See Eng. Pat. 3252 of 1906; this J., 1906, 481.—T. F. B.

Metals; Processes of extracting —— from their minerals, or from waste containing them. A. Gutensohn. Fr. Pat. 363,011, Feb. 6, 1906.

See Eng. Pat. 2619 of 1905; this J., 1906, 319.—T. F. B.

Minerals; Treatment of complex sulphide —— after oxidation, and of oxidised minerals containing zinc. W. G. Rumbold and G. Patchin. Fr. Pat. 363,025, Feb. 6, 1906. Under Int. Conv., Feb. 8, 1905.

See Eng. Pat. 2532 of 1905; this J., 1906, 325.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 701.)

(*A.*)—ELECTRO-CHEMISTRY.

Carborundum; Measurement of temperature in the formation of ——. S. A. Tucker and A. Lampen. J. Amer. Chem. Soc., 1906, **28**, 853—858.

On taking down an electric carborundum furnace built on the lines of a technical furnace, it was found that there were fairly sharp lines of demarcation between the layers of graphite, carborundum (crystallised silicon carbide), and siloxicon (amorphous silicon carbide). By placing through the centre of the furnace a horizontal graphite tube, containing a plug of graphite which could be pushed to any desired section of the furnace, it was found possible to measure, by aid of a Wanner pyrometer, the temperature of formation of carborundum, and also that of its decomposition into graphite and silicon. The results obtained for the temperature of formation, *i.e.*, the point where the amorphous siloxicon changes into the crystalline carborundum, were not quite so concordant as those for the temperature of decomposition, but the average results may be taken as follows:—Temperature of formation of carborundum, 1950° C.; temperature of decomposition of carborundum into graphite and silicon, 2220° C. —A. S.

Conductors of loosely-packed small pieces for electrical heating resistances. J. Brown. Electrotechn. Zeits., 1906, **27**, 213.

The corollary of Ohm's law that the resistance of a conductor is independent of the shape of its cross-section is not quite applicable in the case of granulated charcoal, or of "kryptol," which, according to recent statements, consists of mixtures of charcoal, graphite, sand, clay and other silicates, carborundum, tungstates, &c. It was found that with such discontinuous conductors, the heating phase is characterised by a preliminary diminution of the resistance. As this preliminary phase is caused by the disengagement of occluded gases, its extent can be considerably diminished by reducing the E.M.F. of the current, by applying the current gradually, and by increasing the exposed surface of the conductor, whilst it can be increased by the introduction of gases, or by addition of substances capable of evolving vapours. In apparatus where high temperatures are required, the renewal of the resistance mass from time to time cannot be avoided, and in such cases, it is advisable to employ a material having, as far as possible, a simple and uniform composition; otherwise, the more readily oxidisable or combustible constituents are consumed, and the composition and electrical properties of the resistance mass become subject to considerable variations.—A. S.

Nickel oxide electrode in the Jungner-Edison accumulator; Chemical and physical behaviour of the ——. J. Zedner. Z. Elektrochem., 1906, **12**, 463—473.

In continuation of his previous work (this J., 1905, 1239), the author has been led to the following conclusions:—In the charged condition the active material of the electrode consists of the hydroxide, $Ni(OH)_3$, and in the discharged condition, of the hydrated lower hydroxide, $Ni(OH)_2.2H_2O$. Since by its action water is removed, the E.M.F. is higher in dilute than in concentrated solution. The E.M.F. of the combination, $Ni(OH)_3/KOH/H$, for concentration above 24 per cent. of potassium hydroxide, may be calculated from the formula $E=1{\cdot}323-0{\cdot}1\gamma$ (where γ = the number of molecules of potassium hydroxide per molecule of water). The chemical reactions occurring during discharge and charge may be represented by the equation:—

$$Ni(OH)_3+2H_2O\rightleftarrows Ni(OH)_2.2H_2O+OH'+\oplus,$$

the discharge reaction being read from left to right, the charge from right to left. A study of the discharge curves leads to the conclusion that the first stage is due to the hydroxide, $Ni(OH)_3$, a second, much less well marked, step in the curve being ascribed to the discharge of occluded oxygen.—R. S. H.

Vanadium salts; Electrolytic preparation and properties of ——. L. Marino. Z. anorg. Chem., 1906, **50**, 49—52.

In the electrolytic reduction of vanadic to vanadous compounds the substitution of a mercury cathode for one of platinum, as proposed by Rutter (Z. Elektrochem., 1906, **12**, 230), is unnecessary. But it is essential to prevent the solution from becoming warm, and to avoid large excess of acid, especially hydrochloric acid. A solution of vanadyl sulphate containing 5—60 per cent., and an E.M.F. of 4—5 volts are suitable.

Silver sulphate, suggested by Rutter, cannot be used as a test for vanadous salts, since it is reduced by vanadic compounds also.—F. Sodn.

Cyanogen; Action of a silent electric discharge upon —— H. Gaudechon. Compt. rend., 1906, **143**, 117—119.

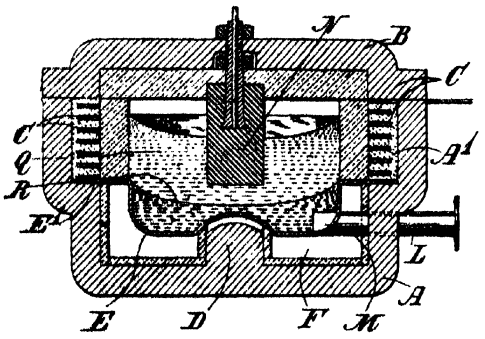
Pure, dry cyanogen, under the influence of the electric discharge, does not polymerise, but yields solid condensation products, with the elimination of nitrogen. They are brown soluble substances the composition of which varies with the conditions of formation.—F. Sodn.

Magnesium oxide; Physical properties of fused ——. H. M. Goodwin and R. D. Mailey. VII., page 757.

ENGLISH PATENTS.

Electrolytic cells [for fused substances]; Impts. in ——. E. A. Ashcroft, London. Eng. Pat. 5648, March 17, 1905.

THE outer casing, A, and lid, B, are of magnet steel, and within a recess, A^1, is arranged a coil, C, of heavy strip copper, this latter coil carrying the electric



current, and generating a magnetic field within the cell. The lines of magnetic force inside the cell spread in an axial or fan-like manner from the central pole, D, to the bottom of the lid, B, while outside the coil, C, they are conducted through the casing. In order that the magnetic effect of the coil may be varied, a commutator is connected with the several turns of the coil. A metal pan, E, forms the bottom of the cell, and is supported in the casing, A, by the flange, E^1, so that a flue space, F, is provided for the passage of furnace gases for heating purposes. L is an outlet and inlet pipe, divided into two parts by a partition, M. A fused electrode, R, is in contact with one terminal through the bottom of E, the flange, E^1, and the coil, C, the other electrode, N, of carbon, dipping into the fused electrolyte, Q. The lines of current flowing between N and R, are substantially axial or fan-like, and cut the lines of force approximately at right angles, thus causing the contents of the cell to swirl violently.—B. N.

Electrolytic solutions; Apparatus for agitating ——. F. J. Clarke, Birmingham. Eng. Pat. 17,152, Aug. 24, 1905.

THE apparatus consists of a system of pipes or passages arranged upon the bottom of the electrolytic vat, and provided at points above the floor level with discharge and "intake" perforations. An external pump is in connection with the perforated passages, but an intervening column or cushion of air completely isolates the pump from the electrolyte.—B. N.

Generator of electricity; Thermo-chemical ——. L. P. Basset, Epinay, France. Eng. Pat. 7375, March 27, 1906. Under Int. Conv., March 27, 1905.

THIS invention relates to a generator of electricity comprising two batteries in series, in one of which electric current is being generated by the solution of a metal, such as copper, in a suitable electrolyte, such as a solution of sulphuric acid and bromine. The second battery is traversed by the current generated, and also by the electrolyte. The latter when it leaves the generating battery contains the dissolved metal in solution, and a reducing agent such as sulphurous acid is then added. Copper is deposited on the cathodes of the second battery, as the electrolyte traverses the latter, until there is a sudden fall of E.M.F. in the first battery, whereupon the direction of the electrolyte is reversed through the two batteries. After the deposition of metal, the electrolyte consists of hydrobromic and sulphuric acids, but by passing it through an apparatus suitably heated, these acids may be made to interact so as to regenerate the bromine and sulphurous acid.—B. N.

Arc lamp electrodes; Impts. in ——. The British Thomson-Houston Co., Ltd. From Allgem. Elektricitäts Ges. Eng. Pat. 20,330, Oct. 9, 1905. II., page 747.

Nitric acid; [Electrical] Production of pure —— *[from air]*. H. Pauling. Eng. Pat. 7871, April 2, 1906. VII., page 758.

UNITED STATES PATENT.

[Copper-nickel-manganese] Alloy [Electrical resistance]. W. B. Driver. U.S. Pat. 824,103, June 26, 1906. X., page 764.

FRENCH PATENTS.

Accumulators; Manufacture of plates for ——. E. de Marçay. Fr. Pat. 362,909, Jan. 24, 1906.

A MIXTURE of aluminium chloride and litharge is made by mechanical means, a solution of sodium carbonate being then added, and the whole kneaded together. The mass is incorporated within a framework of lead, and left to solidify. The aluminium salt and sodium carbonate react, with formation of aluminium hydroxide and sodium chloride and disengagement of carbon dioxide. The salt is removed by washing with water, and the hydroxide is converted into aluminium sulphate by immersion in dilute sulphuric acid, the aluminium salt being afterwards removed by lixiviation. By the action of the electric current a skeleton of lead peroxide or of spongy lead may be obtained, solidly fixed to the framework, the plates having great surface, large capacity owing to the great porosity, and a great mechanical resistance to shocks. —B. N.

Sugar juice; [Electrolytic] Method of clarifying ——. R. J. Thomas and W. F. S. Howe. Addition, dated Jan. 5, 1906, to Fr. Pat. 353,568, April 20, 1905. XVI., page 771.

Salts of the oxy-halogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.-G. Fr. Pat. 362,737, Jan. 10, 1906.

SOLUBLE salts of vanadium, manganese, molybdenum, or uranium are added to the electrolyte employed for the production of the salts of the oxy-halogen acids with a view to suppressing the cathodic reduction and consequent loss of efficiency. Details of experimental results are given to show the effect of these several additions.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

Steel; Electrolytic corrosion of structural ——. M. Toch. Trans. Amer. Electrochem. Soc., May 1, 1906. Electrochem. and Metall. Ind., 1906, **4**, 215—216.

THE author has carried out experiments with strips of steel embedded in sand and cement moistened with salt solutions, and submitted to electrolysis. He concludes that electrolytic corrosion under these conditions is confined to the anode where it takes place with violence, the cathode being protected by the electric current. The impression that cement is a protector against corrosion is fallacious. If the steel be protected with a real insulating material corrosion can be entirely prevented.—R. S. H.

ENGLISH PATENT.

Shaft-furnaces; Impts. in electrically heated ——. Allmänna Svenska Elektriska Aktiebolaget, Westeras, Sweden. Eng. Pat. 7597, March 29, 1906. Under Int. Conv., March 30, 1905.

THE furnace is provided with a hearth forming an annular chamber of uniform or substantially uniform cross-section for taking up the melted material. In the hearth is a central hollow core of fireproof material, a hollow

extension of the core extending upwards through the centre of the shaft, thus producing an in-draught of cold air into the hollow core. In the latter is placed an iron core provided with a primary winding, and the e is thus produced in the melted mass a secondary current which heats the material.—B. N.

United States Patent.

Metal tubes; Electrolytic manufacture of ——. O. Dieffenbach, Darmstadt, Germany. U.S. Pat. 817,419, April 10, 1906.

"Comminuted kieselguhr" is mixed with a suitable electrolyte, and an electric current is passed through the mixture, whilst simultaneously a relative motion is produced between the electrolyte and the rotating cathode. The hydrogen bubbles are thus dislodged, and the metallic deposit is smoothed by the action of the kieselguhr.—B. N.

French Patents.

Metalliferous minerals; Electrolyser for treatment of — —. E. T. de Montrépeux. Fr. Pat. 362,680, Jan. 25, 1906.

A cylindrical wooden vat provided with mechanism for its rotation serves as the electrolysis vessel. The vat is provided internally with longitudinal rows of carbon electrodes, forming alternately anodes and cathodes. The heads of the electrodes pass through the walls of the vat, and on the outside are fixed to connectors, enabling them to be placed suitably in series. The current is collected from metallic strips which make contact with bands of metal forming the terminals.—R. S. H.

Electric furnace for the manufacture of steel. G. Gin. Fr. Pat. 362,734, Jan. 26, 1906. Under Int. Conv., May 3, 1905.

The furnace is divided into three compartments which communicate with one another in series, and serve respectively for the refining of the crude metal by oxidation, for the reduction of dissolved oxide, and for the carburisation, and finally for the adjustment of the composition of the finished metal. The electric current passes through vertical carbon electrodes dipping into the slag above the metal in the different compartments, and the connections are made so that whilst all the current passes in through the compartment reserved for refining, it passes out in parallel through the other two compartments. Means are provided for tilting the furnace in order to pour out the finished product (this J., 1905, 1115).—R. S. H.

Electrotypes, Process and apparatus for making copper ——. S. O. Cowper-Coles. Fr. Pat. 362,861, Jan. 30, 1906. Under Int. Conv., March 6, 1905.

See Eng. Pat. 4668 of 1905; this J., 1906, 322.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 702.)

Cholesterol. A. Windaus. XXIV., page 780.

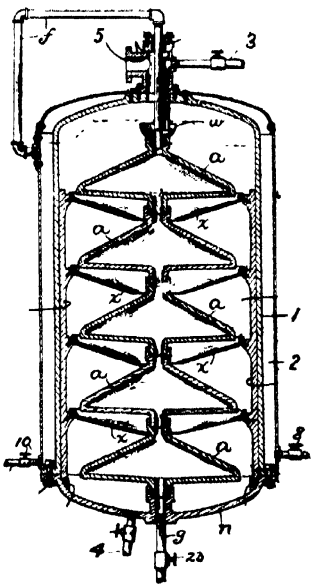
English Patent.

Oils, fats, or the like, Manufacture of viscid or fluid emulsions of — —*[for lubrication of textile fibres].* O. A. H. H. Kösters, Hemelingen, Germany. Eng. Pat. 4688, Feb. 26, 1906.

Emulsions containing any required proportion of water, and remaining stable at the boiling point of water, and also when mixed with glycerol, are obtained by adding the fat or oil, *e.g.*, heavy cylinder oil, to a mixture of water and an amide of a higher fatty acid or an acidyl derivative of an aromatic base, or both, together with the salt of a higher fatty acid. The emulsion may then be mixed with glycerol or other substance capable of raising the specific gravity of water, *e.g.*, for the preparation of lubricants for textile fibres.—C. A. M.

United States Patents.

Naphtha, &c.; Apparatus for separating ——, *from oil and other liquids.* E. R. Edson, Cleveland, Ohio. U.S. Pat. 824,104, June 26, 1906.



The apparatus consists of a casing, 1, (surrounded by a jacket, 2) containing a number of conical, communicating heating-drums, *a*, arranged one above the other. The liquid to be treated enters the apparatus by the pipe, 3, and flows into the cup, *w*, from which it overflows on to the upper surface of the topmost drum, *a*. From the edge of the lower surface of the latter, it flows into the funnel, *x*, and is conducted to the top of the cone of the next drum, and so on to the bottom, where the residual liquid from which the naphtha has now been expelled, collects in the basin, *n*, and is drawn off by the drain, 4. The vapours of naphtha, &c., given off pass away to a condenser by the elbow-pipe, 5. Steam enters the jacket by the pipe, 8, passes round, and leaves by the pipe, *f*, which conducts it to the interior of the uppermost heating drum, *a*, from which it passes down from drum to drum, the condensed water being drawn off through the pipe, *g*, and the valve, 23. Any water condensing in the jacket is drawn off through the valve, 10.—W. H. C.

Soap; Apparatus for making ——. T. W. Alexander and E. F. Holsteen, Burlington, Iowa. U.S. Pat. 824,167, June 26, 1906.

Claim is made for a mould-frame which can be locked upon a support by means of co-operating jointed rods, one joint of each of which passes through slots in the support, whilst the other joints interlock across the top of the frame. The soap mould may also be provided with a steaming jacket, the inner walls of which are perforated.—C. A. M.

German Patent

Fatty compounds; Process for preparing easily emulsified, stable ——. Ges. zur Verwerthung der Bolegschen wasserlöslichen Mineralöle und Kohlenwasserstoffe. Ger. Pat. 167,847, May 27, 1904.

Animal and vegetable oils, fats, and waxes are converted into stable, readily emulsified preparations, by treating

them, at a temperature between 60° and 80° C., with the water-soluble mineral oils produced according to Fr. Pat 332,324 of 1903 (this J., 1903, 1289).—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 704.)

(*A.*)—PIGMENTS, PAINTS.

Paints; Census of —— in the United States. Oil, Paint, and Drug Rep., July 9, 1906. [T.R.]

The Director of the Census has announced the result of the tabulation of the statistics of paints for the calendar year ending December 31, 1904. The statistics show that there has been a substantial increase in this industry in the United States, as compared with the statistics of 1900, which covered the fiscal year ending May 31.

Comparative figures for 1905 and 1900 are shown in the following summary:

		1905.	1900.	Per cent. of inc.
Number of establishments		449	419	7·2
Capital	dols.	55,783,259	42,501,782	31·2
Salaried officials, clerks, &c.				
Number		3,044	2,512	21·2
Salaries	dols.	3,654,289	3,077,318	18·8
Wage-earners—				
Average number		9,781	8,151	20·0
Wages	dols.	5,063,177	3,929,787	28·8
Miscellaneous expenses	dols.	6,055,367	3,430,061	76·5
Materials used:—				
Total cost	dols.	46,306,183	33,799,386	37·0
Limestone and cliff-stone	tons	13,520	18,234	—
Cost	dols.	24,841	50,368	—
Gums	lb.	4,612,360	*	—
Cost	dols.	624,463	354,660	—
Pig lead	tons	128,513	99,052	—
Cost	dols.	11,119,402	8,585,688	—
All other pigments†	lb.	410,617,498	*	—
Cost	dols.	10,295,631	8,758,499	—
Lime	bush.	3,538	33,007	—
Cost	dols.	1,072	6,098	—
Linseed oil	galls.	16,631,795	11,835,174	—
Cost	dols.	6,222,169	5,431,227	—
Grain alcohol	galls.	6,613	9,813	—
Cost	dols.	15,971	16,778	—
Wood alcohol	galls.	48,708	32,488	—
Cost	dols.	46,025	26,806	—
Sulphuric acid	tons	1,337	1,989	—
Cost	dols.	28,062	13,915	—
All other materials	dols.	17,928,547	10,555,347	—
Products:—				
Total value‡	dols.	67,277,910	50,874,995	32·2
White lead	lb.	278,439,291	116,102,316	—
Value	dols.	14,103,998	4,211,181	—
Oxides of lead	lb.	49,710,330	50,759,623	—
Value	dols.	2,590,472	2,550,340	—
Lamp and other blacks	lb.	757,244	1,065,000	—
Value	dols.	49,869	60,250	—
Fine colours	lb.	7,780,330	3,325,252	—
Value	dols.	1,076,853	736,796	—
Iron oxides and other earth colours	lbs.	47,322,913	33,153,896	—
Value	dols.	327,994	318,242	—
Dry colours	lb.	106,588,131	157,472,838	—
Value	dols.	3,812,716	4,066,147	—
Pulp colour sold moist	lb.	25,351,515	20,060,935	—
Value	dols.	915,383	861,531	—
Paints in oil, in paste	lb.	124,948,405	303,460,028	—
Value	dols.	8,298,483	17,405,822	—
Paints already mixed for use	galls.	21,822,755	16,591,745	—
Value	dols.	20,084,024	14,618,277	—
Oil and turpentine varnishes	galls.	2,236,024	1,373,603	—
Value	dols.	1,701,151	1,236,861	—
Alcohol varnishes	galls.	85,675	46,369	—
Value	dols.	134,221	71,707	—
Pyroxylin varnishes	galls.	3,892	16,291	—
Value	dols.	4,003	16,225	—
Liquid driers, japans, and lacquers	dols.	499,411	303,495	—
All other products	dols.	13,079,332	4,418,121	—

* Quantity not reported in 1900.
† Reported in 1900 as dry colours, and includes dry white lead, zinc white, and all other pigments.
‡ Exclusive of paint products, valued in 1905 at $908,920, made in establishments engaged primarily in the manufacture of other products.

English Patents.

Antimony and arsenic colours; Manufacture of ——. L. Brunet, Brioude, France. Eng. Pat. 16,490, Aug. 14, 1905. Under Int. Conv., April 15, 1905.

The process claimed consists in treating the sulphantimonates or sulpharsenates of alkalis or alkaline-earths dissolved in suitable solvents with the gas evolved when any suitable sulphide producing sulphurous gas is roasted, until the solution becomes acid. The advantages are stated to be cheapness and avoidance of the inconvenient yield of hydrogen sulphide in the ordinary process. Moreover the residue, instead of being valueless, is a solution of alkali thiosulphate, which can be used in the manufacture of vermilion of antimony.—C. A. M.

Lithopone; Rendering —— more stable against light. J. Ephraim, Berlin. Eng. Pat. 7819, March 31, 1906. Under Int. Conv., April 1, 1905.

The lithopone is treated with a non-acid salt capable of precipitating zinc from solutions of its salts. Sodium and potassium salts are particularly suitable for the purpose, and special claim is made for the addition of alkali phosphates. The salts may either be added, say, in the proportion of 1 to 3 per cent. to the lithopone, and the mixture used as a pigment, or they may be incorporated in the form of a solution, and the solvent evaporated, or they may be allowed to act for a certain time, and then separated by lixiviation with water.

—C. A. M.

Colour bases; Products soluble in water, fats, and oils from the salts which higher fatty acids and acids of the oleic series form with organic ——. Farbw. vorm. Meister, Lucius, und Bruning, Hoechst a/Main, Germany. Eng. Pat. 10,079, April 30, 1906. Under Int. Conv., May 19, 1905.

The salts of the higher fatty acids and acids of the oleic series with organic dyestuff bases are used for colouring fats and oils. They are insoluble in water. The present process is for the preparation of colours soluble in water as well as in fats and oils by mixing the above salts with an aqueous solution of an alkali salt of a benzylaniline-sulphonic acid or homologue thereof.—H. L.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Turpentine still. D. M. Ross and F. T. Edwards, Fletcher, Ga. U.S. Pat. 821,887, May 29, 1906.

The plant described consists of two kilns or stills, the outlet pipe of each leading into a common cylindrical drum, where the bulk of the creosote and tarry matters are separated from the volatile products. This drum is provided with an external water spray and an internal supply of water for washing the vapours. The latter then pass through a pipe into a purifier containing a baffle-plate, and from this purifier into a worm condenser. The outlet of the condenser is fitted with a trap, and any uncondensed gases are conducted back to the kilns, where they are consumed. Openings are provided at the bottoms of the various parts of the plant for the removal of the condensed matters.—W. P. S.

French Patent.

Tubes; Process for producing a protecting layer [varnish] on the interior surface of ——. Deutsch-Oesterreichische Mannesmannrohren-Werke. Fr. Pat. 362,886, Jan. 31, 1906.

The interior surface of the tube is covered with a thin coat of special varnish, about 0·1 mm. thick. The varnish is prepared by dissolving gum dammar in oil of turpentine, and adding 75 per cent. of linseed oil; the mixture is heated for some time to above 100° C., and then cooled, when it forms a varnish which is liquid at the ordinary temperature. The interior surface of the tube is coated with this mixture, and the coat at once dried by passing a current of air, heated to at least 140° C., through the tube. The drying takes from two to four hours, and owing to the speed of this drying, the layer of varnish has no time to run, but forms an even, thin, hard, adherent layer which is extremely resistant, and which does not melt below 260° C.—W. N. C.

(C.)—INDIA-RUBBER, &c.

Rubbers; Examination of some raw —— from East Africa. W. Schellmann. Der. Pflanzer, 1906, **2**, 1—6. Chem. Centr., 1906, **1**, 1911—1912.

In judging the value of raw rubber, the chief points are determinations of the loss on washing—that is, the proportion of substances which are removed by the ordinary technical washing process—and the ratio of pure caoutchouc to substances other than caoutchouc, especially resin, in the washed product. In six samples of rubber from East Africa the loss on washing varied between 20 and 40 per cent., and the percentage of pure caoutchouc between 47·32 and 65·90 per cent. The ratio of pure caoutchouc to resin ranged from 93·35 : 6·65 to 87·95 : 12·05. These samples of raw rubber were of good quality, in so far that they were capable of yielding technically useful rubber, but their commercial value was diminished by their content of substances other than caoutchouc and resin. The view is put forward that it would be advantageous to subject raw rubbers to mechanical purification before exporting them.—A. S.

Caoutchouc; Theory of the vulcanisation of ——, in the light of Harries' formula for caoutchouc. R. Ditmar. Gummi-Zeit., 1906, **20**, 1026—1028.

The author recapitulates the main facts regarding the vulcanisation of caoutchouc elucidated by Weber (this J., 1902, 712) and others, and shows how they can be made to agree with the dimethyl-octadiene formula of Harries (this J., 1905, 449).—W. A. C.

India rubber. Vulcanisation of —— in presence of resin. R. Ditmar. Gummi-Zeit., 1906, **20**, 999—1000.

Para rubber containing 3·28 per cent. of resin was mixed with 10 per cent. of sulphur and rising proportions of resin which had been extracted from fine black Upper Congo, and vulcanised for 45 minutes at 145° C. under 4—5 atmospheres pressure. With increasing proportions of resin, the breaking strains of the vulcanised specimens decreased very decidedly. The elongations increased slightly, but not in proportion to the elasticity of the specimens, since these showed a tendency to become soft, especially with 18 per cent. and upwards of added resin. It is proved experimentally that the higher the resin-content, the greater the proneness to atmospheric oxidation.—W. A. C.

Rubber production in Assam and Burma. Bd. of Trade J., July 26, 1906. [T.R.]

The following statement, showing the quantity of rubber extracted by the Forest Department from plantations of *Ficus Elastica* in Assam and of *Hevea Brazilensis* in Burma and the average prices obtained, is taken from the "India Trade Journal".

Year	Assam		Burma (Tenasserim).	
	Quantity lb.	Average price per lb	Quantity lb.	Average price per lb
		s d		s d
1903-04	9,387	3 8	864	4 9
1904-05	12,368	3 7	1,450	5 8
1905-06	14,010	4 0	Not stated	

Grants or leases of waste land not exceeding 1200 acres in area for the purpose of planting rubber trees may be made by the Deputy Commissioner, with the previous sanction of the Commissioner, in any district of the Tenasserim Division, and in any other district specially notified by the Local Government. When the area which it is proposed to grant or lease, exceeds 1200 acres, the application shall, with the recommendations of the Deputy Commissioner and Commissioner, be submitted to the Financial Commissioner for his orders.

United States Patents.

Gum [rubber]; Process of obtaining —— from vegetable matter. E. Heber, New York. U.S. Pat. 824,116, June 26, 1905.

The disintegrated wood or other material is heated in a suitable vessel at ordinary or increased pressure with a solution of soap, with or without the addition of suitable solvents, such as benzol, rosin oil, &c., until the gum (*e.g.* caoutchouc, gutta-percha, or chicle) is dissolved or emulsified. Other constituents can then be separated, and the gum precipitated.—C. A. M.

Rubber waste; Process for reclaiming vulcanised ——. A. Kittel, Vienna. U.S. Pat. 825,060, July 3, 1906.

See Fr. Pat. 344,734 of 1904; this J., 1904, 1226.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 705.)

Glue; Determination of the gelatinisation temperature and specific gravity of different solutions of ——. K. Wenkülblech. Z. angew. Chem., 1906, **19**, 1260—1262.

The best method of determining the melting point of a solution of glue ought to be that of stirring a large quantity of the jelly with the liquid part until it was liquefied, and noting the point at which a sudden rise of temperature occurred, but experiments with 10 per cent. solutions showed that the method was not practicable, the temperature rising before the end of the solid stage. On the other hand, serviceable results are obtained by determining the temperature of gelatinisation. For this purpose the weighed quantity of glue is allowed to soak overnight in cold water, and then dissolved in water at 40° to 50° C., and the solution made up to 500 c.c. at 40° C. It is advisable to use a large quantity of solution for the determination (about 400 c.c.), and the bulb of the thermometer should be about in the middle of the flask, which should be cooled with continual shaking and stirring. Gelatinisation occurs quite suddenly, but in the case of dilute solutions, *e.g.*, 2 per cent., care is necessary in observing the end-point, since such solutions may easily be cooled below the gelatinisation temperature. In the author's experiments the determinations of the specific gravity of the solutions were made with a hydrometer, and confirmed by weighing. The following comparative results were obtained with different samples of glue and with Merck's animal glutin:—

Solution of glue, &c.	Grms. per litre	Specific gravity at 50° C.	Specific gravity at 40° C.	Specific gravity at 30° C.	Specific gravity at 25° C.	Gelatinisation temperature. °C.	Sp. gr. at gelatinisation temperature.
Gelatin	160	1·031	1·036	1·040	1·041	24·5	1·041
Cologne I	,,	1·029	1·034	1·037	1·039	17·3	1·041
Cologne II	,,	1·030	1·034	1·038	1·040	16·2	1·042
Mulhouse	,,	1·037	1·040	1·044	1·045	13·2	1·048
Russian	,,	1·053	1·057	1·061	1·062	11·5	1·066
Gelatin	80	1·011	1·014	1·016	1·018	20·6	1·019
Joiners' glue	,,	1·011	1·013	1·016	1·017	11·0	1·026
Cologne I	,,	1·010	1·013	1·015	1·017	11·0	1·020
Cologne II.	,,	1·011	1·013	1·018	1·017	8·7	1·021
Mulhouse	,,	—	—	1·020	1·020	7·0	1·023
Russian	,,	1·023	1·025	1·027	1·027	4·0	1·030
Glutin	80	1·011	1·014	1·016	1·017	8·0	1·022
,,	40	1·003	1·008	1·008	1·009	3·0	1·012

Old solutions of gelatin kept in a cool room for several days (20 to 37) showed a marked decrease in the gelatinisation temperature without any pronounced change in the specific gravity. Partial purification of glue from soluble salts by extraction with cold water caused a considerable rise in the gelatinisation temperature, the effect of distilled water being much greater than that of tap water. As to the amount of colloid dissolved by the cold water, much more gelatin was taken up than in the case of joiners' glue, whilst remarkably little of the Russian glue passed into solution, this being attributed to the large amount of filling material. Large quantities of chemically indifferent substances, such as glycerol and cane sugar, can be present without interfering greatly with the gelatinisation temperature. The difference between the gelatinisation temperatures of solutions of equal strength of a glue and a good gelatin becomes greater on dilution in the case of impure glues, whilst with purer samples it remains approximately constant. The average differences observed were 7·5° C. for a good glue, 12·5° C. for Mulhouse glue, and 15° C. for Russian I. glue.
—C. A. M.

Gelatin; Action of alums and aluminium salts on ——. A. and L. Lumière. Brit. J. Phot., 1906, **53**, 573—574.

Besides aluminium sulphate and potassium and ammonium alums, it is found that alumina, and aluminium chloride, bromide, and nitrate all have a similar action in raising the solidifying point of a solution of gelatin. The alkali aluminates have no effect on the solidifying points. For the other compounds above mentioned, an increase in their amount raises the solidifying point of the gelatin solution, until a maximum is reached, corresponding in all cases, for a given strength of gelatin solution, to a definite weight of alumina: thus, 0·04 grm. of alumina or 1·6 grms. of aluminium chloride produces the maximum effect on 100 grms. of a 7·5 per cent. gelatin solution. The treatment of gelatin with solutions of aluminium salts appears to result, at first, in the absorption of the salt as such, the subsequent washing with water dissociating the salt into the acid and alumina, the latter remaining combined with the gelatin. The quantity of alumina combined with the gelatin increases with the weight of salt employed, until 3·6 per cent. of alumina is combined; beyond that point there is no increase.—T.F.B.

English Patents.

Leather; Process for producing artificial ——. H. Karle, Seckenheim, Germany. Eng. Pat. 26,517, Dec. 19, 1905.

See Addition of Nov. 17, 1905, to Fr. Pat. 342,622 of 1904; this J., 1906, 488.—T. F. B.

Catgut threads; Process of sterilising ——. H. Schmidt, Mannheim, Germany. Eng. Pat. 7825, March 31, 1906. Under Int. Conv., April 4, 1905.

The threads are immersed in an aqueous solution containing 1 per cent. each of iodine and potassium iodide, and from 0·4 to 0·5 per cent. of 40 per cent. formaldehyde solution, 1 per cent. of glycerol being also added, if desired. After being in this solution for eight days, the threads are ready for immediate use, or they may be dried, and kept in suitable sterilised envelopes.—W. P. S.

Casein compounds; Manufacture of films or sheets from ——. F. Thomas, Cologne, Germany. Eng. Pat. 18,328, Sept. 11, 1905.

Films or sheets prepared from solutions of casein in alkali are not impermeable to moisture; those prepared from solutions in dilute acid, however, are free from this defect. 100 grms. of casein may be dissolved by heating in a litre of water containing 8 grms. of 25 per cent. hydrochloric acid; 10 grms. of 40 per cent. formaldehyde solution and a small quantity of glycerin are added, and the solution is poured on glass plates to dry.—T. F. B.

French Patents.

Tannin extracts; Process for the decolorisation of ——. Soc. Badische Anilin und Soda Fabrik. Fr. Pat. 362,780, Jan. 27, 1906. Under Int. Conv., Jan. 5, 1906.

The extracts are decolorised by treatment with a formaldehyde-sulphoxylate, either pure, or mixed with a formaldehyde-bisulphite. For example, 1 litre of chestnut extract of 4° B. is treated with about 5 grms. of Rongalite C. (sodium-formaldehyde sulphoxylate of about 90 per cent. strength), and evaporated to dryness in a vacuum.
—A. S.

Hides and skins; Process and apparatus for tanning and depilating ——. C. J. Glasel. Fr. Pat. 362,663, Jan. 24, 1906.

The skins are treated with the tanning or depilating substance, meanwhile being alternately stretched and slackened, so as to expel spent material from the pores, and cause a fresh quantity to be taken up. The machine claimed for this purpose has a tank, preferably rotating, provided with means for causing the tanning or depilating substance to circulate, together with internal supports to which the skins can be attached, and means for making the skins become tight or slack intermittently.—C. A. M.

XV.—MANURES, &c.

(*Continued from page* 705.)

Nitrogen-assimilating bacteria; Researches on anaërobic ——. E. Haselhoff and G. Bredemann. Landw. Jahrb., 1906, **35**, 381; Chem.-Zeit., 1906, **30**, Rep., 223.

Anaërobic nitrogen-assimilating bacteria (*Clostridia*) are abundantly met with in soil and on the leaves of forest trees. The amount of nitrogen assimilated from the atmosphere by these organisms is approximately equal to that found by Wingogradsky in the case of *Clostridium Pasteurianum*, being 2·74 mgrms. per grm. of dextrose or mannitol, as compared with a maximum of 3 mgrms. found by that author.—C. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 707.)

Rhamnose; Alkylation of ——. T. Purdie and C. R. Young. Chem. Soc. Proc., 1906, **22**, 201.

By complete methylation with silver oxide and methyl iodide, acetone- and methyl-rhamnosides yield respectively *dimethylacetone-rhamnoside* and *trimethylmethyl-rhamnoside*, and by hydrolysing these compounds, *di-* and *tri-methylrhamnose* respectively are obtained. The rhamnose derivatives described are liquids, but all of them excepting dimethyl-rhamnose being volatile without decomposition, it was possible to isolate them by fractional distillation under reduced pressure.

Dimethyl- and trimethyl-rhamnose give crystalline phenylhydrazones, and display the ordinary properties of reducing sugars. Trimethyl-rhamnose is re-converted into trimethylmethyl-rhamnoside by condensation with methyl alcohol, and also by the silver oxide method of alkylation; the former process gives mainly the α-form of the aldoside, the latter a mixture composed largely of the β-form. The presence of the β-isomeride was recognised not only by its rotatory power, but also by the rapidity of its hydrolysis. The rotatory powers of the substances described fall into line with those of dextrose and its corresponding derivatives.

l-Arabinose; Alkylation of ——. T. Purdie and R. E. Rose. Chem. Soc. Proc., 1906, **22**, 201—202.

By methylating Fischer's α-methylarabinoside with silver oxide and methyl iodide, *trimethyl-α-methylarabinoside* is obtained in large, well-formed crystals (m. pt., 43°—45°), and by hydrolysing this with dilute hydrochloric acid, *trimethylarabinose* is produced. This substance is a liquid (b. pt., 148°—152° C. at 19 mm.), but otherwise it

exhibits the usual properties of a reducing sugar. It can be methylated by condensation with methyl alcohol, and also by treatment with methyl iodide and silver oxide, the product in both cases being a mixture of the isomeric trimethylmethylarabinosides. The condensation process yields the crystalline α-isomeride in large proportion, the silver oxide process mainly the β-isomeride. The latter substance is apparently a liquid, and it could not be isolated, but its presence in the mixture was recognised by its undergoing hydrolysis more rapidly than the isomeric α-form. In preparing Fischer's α-methylarabinoside, a small quantity of the *β-methylarabinoside* was obtained in crystalline prisms melting at 115°—117° C. With respect to rotatory power, the isomeric methylarabinosides and trimethylmethylarabinosides show relations similar to those of the corresponding derivatives of dextrose.

Starch; Behaviour of —— on hydrolysis with moderately strong sulphuric acid. B. Tollens. Z. Ver. deutsch. Zuckerind., 1906, 664—669.

Some mosses, such as reindeer moss, require to be heated for 10—12 hours with 6—7 per cent. sulphuric acid in order to ensure their complete hydrolysis. Others, such as Iceland moss, are readily hydrolysed when heated for 5—6 hours with 5—6 per cent. sulphuric acid. The former mosses on hydrolysis yield considerable quantities of *d*-mannose and *d*-galactose, besides a little dextrose. The latter mosses, on the other hand, furnish dextrose chiefly, and only small quantities of the other sugars. The author has investigated the question whether the mannose and galactose produced in the former case are actually hydrolytic decomposition products, or whether they are produced from originally formed dextrose by the prolonged hydrolysis with strong acid. 320 grms. of potato starch were made into a paste with some water, and the whole poured into a mixture of 2000 grms. of water and 160 grms. of pure, concentrated sulphuric acid. The mixture (containing 6—7 per cent. of sulphuric acid) was liquefied in a dish on the water-bath, and then heated in a boiling water-bath for 10 hours. The hydrolysed solution was found to contain a large quantity of dextrose and some by-products, chiefly of an amorphous nature, but no galactose, and at the most only traces of mannose. From these results the author concludes that the mannose and galactose, obtained by the hydrolysis of reindeer moss, originate, not from the conversion of dextrose during hydrolysis, but from the hydrolysis of the hemicelluloses, *i.e.*, mannan and galactan, contained in the moss.—L. E.

United States Patent.

Sugars; Process of converting cellulose of wood into fermentable ——. A. Classen, Aachen, Germany, Assignor to Classen-Lignum Co., New Jersey. U.S. Pat. 825,808, July 10, 1906.

See Ger. Pat. 161,644 of 1904; this J., 1905, 1078.—T.F.B.

French Patents.

Sugar juice; [Electrolytic] Method of clarifying ——. R. J. Thomas and W. F. S. Howe. Addition, dated Jan. 5, 1906, to Fr. Pat. 353,568, April 20, 1905 (this J., 1905, 1024).

The sugar juice is heated in a suitable vat or reservoir to near its boiling point, and is submitted to electrolysis, which produces rapid and almost complete clarification. —T. H. P.

Liquids which are not easily filtered, such as milk of lime, and diffusion juice [from beet sugar factories]; Apparatus for purifying ——. H. Korán. Fr. Pat. 362,646, Jan. 23, 1906. VII., page 750.

Diffusion process [for beetroot sugar works]. L. E. Rousseau, A. Guidet, and J. H. Sahut. Fr. Pat. 362,857, Jan. 30, 1906.

Each diffuser of a battery is provided with two pipes, one entering at the top of the apparatus and the other at the bottom. The former is in connection with an exhaust-pump, and when the pressure has been reduced to about 300 mm., steam is admitted through the lower pipe until the desired temperature in the diffuser has been attained. Taps fitted on both pipes are then turned off, and the diffusion allowed to proceed as usual.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 710.

Pediococcus viscosus, the cause of mucilage formation in "Weissbier." F. Schönfeld. Jahrb. Ver. Versuchs- u. Lehranstalt f. Brau., Berlin, 1905, 8, 90; Z. ges. Brauw., 1906, 29, 427—428.

Pediococcus viscosus causes mucilage formation most abundantly in wort which has not been heated above 75° C., to a less extent in boiled wort, and least in a boiled, hopped wort. Mucilage is formed more readily in wort from grain poor in albumin than in wort from grain rich in albumin; the reverse is the case with beer. A 10 per cent. solution of cane sugar containing 0·1—0·5 per cent. of asparagine or peptone, is rendered mucilaginous by the organism. A 50 per cent. sugar solution treated with 0·5 per cent. of peptone and with potassium or magnesium sulphate, forms mucilage with the *Pediococcus*. The degree of mucilage formation decreases with increasing sugar concentration. No relation exists between the development of the organism and the amount of mucilage produced. Cane sugar solution containing no nitrogenous organic matter does not become mucilaginous. The organism forms a mucilaginous deposit in ammoniacal sugar-yeast water; a similar deposit is obtained in solutions of dextrose, lævulose, invert sugar, maltose, lactose, dextrin, and potato and wheat starches (with addition of yeast water). The organism acts on pasteurised and on bottom-fermentation beer in the same way. Completely fermented beer is very resistant to the *Pediococcus*; mucilage is formed at once, however, if the beer is subjected to an after-fermentation by addition of sugar. Mucilage is generally produced most abundantly if much sugar and living yeast cells are present. Heating for one hour at 44° C. decomposes the mucilage, and kills the *Pediococcus*; in the first stage of growth, however, the organism is not killed by heating for two hours at 44° C., nor does it lose its power of forming mucilage. The organism lives for a very long time in beer. Development of the organism and mucilage formation are considerably retarded by vigorous aëration of the culture medium. The *Pediococcus* is incapable of causing fermentation with evolution of gas.

The formation of mucilage is probably due:—(*a*) to reversion of sugar, (*b*) to decomposition of albumin. Both processes, however, go on simultaneously, the production of mucilage being chiefly due to the former. —L. E.

Cider yeasts; Contribution to the knowledge of ——. A. Osterwalder. Wochensch. f. Brau., 1906, 23, 376.

The author has investigated a large number of yeasts isolated from cider and perry. Earlier work had shown that grape wine yeasts for the most part belong to the *S. ellipsoideus* group, whilst cider yeasts in the majority of cases are *S. pastorianus* varieties. Of twelve cider yeast cultures, two only were *S. ellipsoideus* yeasts, the remainder being *S. pastorianus* yeasts. In the sediment the elliptic cell-forms of the *pastorianus* yeasts exceeded the cylindrical cell-forms in number; the latter disappeared entirely or nearly so, on cultivation in Sicilian grape juice. A few of the yeasts formed spores on gypsum blocks in 15 hours; in the case of a few varieties, spores were formed in four days from 70—80 per cent. of the cells; some varieties did not sporulate.—L. E.

Vinasse; Treatment of —— at the Raab spirit factory. J. Ginsberg. Oesterr. Brenn.-Zeit., 1905, 187; Z. Spiritusind., 1906, 29, 255.

From 120 to 140 metric tons of molasses are treated daily, and yield about 2300 hl. of residue, which is concentrated, carbonised, and worked up into potash salts. The neutralised residue is passed through three evaporators: one with a heating surface of 180 sq. m., heated by steam,

whilst the other two are smaller, and are raised by waste heat to a temperature of 80°—90° C. and 60°—70° C. respectively, the evaporation being effected in a partial vacuum. On leaving these, the residue is concentrated from 20°—22° B. to 40° B. strength, and is next carbonised in two ovens, without any added fuel, the heat liberated being utilised for steam raising. From the ovens the mass is discharged into a shaft, where it is left to smoulder awhile in small trucks, which are emptied on to a floor where the heaped-up mass burns away to ash. The latter contains 0·5—5·4 per cent. of water, 56—58 per cent. of potassium carbonate, 10—12 per cent. of sodium carbonate, 8—10 per cent. of potassium sulphate, 0·3—0·4 per cent. of sodium sulphate, 6—7 per cent. of potassium chloride, 0·4—0·6 per cent. of potassium phosphate, 10—11 per cent. of insoluble matter, and 1·0—1·5 per cent. of organic substances. It is reduced to powder in ball-mills, and then lixiviated with hot dilute lye. The resulting solution is concentrated to 46°—47° B. strength in a vacuum pan, the potassium sulphate crystallising out in the warm, and the potassium chloride on cooling the mother liquor to 25°—30° C. The residual liquor is further concentrated to 50°—53° B., and throws down a double carbonate of sodium and potassium, from which the potassium salt is dissolved by treatment with soda lye. On further cooling, the mother liquor deposits in succession impure potassium chloride and another crop of the double salt, which latter is treated as before; and on repeated concentration and cooling, furnishes a 95 per cent. potash. —C. S.

German Customs Union; Trade in the —— in 1905. Z. Spiritusind., 1906, **29**, 257.

	Imports.		Exports.	
	100 kilos.	1000 Mk	100 kilos.	1000 Mk.
Dextrin	2,336	117	94,207	3,093
Potato starch ..	9,076	254	144,460	3,513
Rice starch	286	10	65,840	2,386
Starch sugar (syrup)	814	26	10,432	313
Do. do. (crystallised)	145	4	2,891	80
Beer	766,348	9,107	1,312,756	25,618
Raw spirit	86,534	2,198	60,525	2,018
Spirits (cognac, &c.) in casks	48,374	6,644	26,696	3,033
Brandy in bottle	2,894	588	107,764	5,158
Yeast, other than wine yeast ..	777	81	14,284	884
Vinegar and acetic acid ..	2,736	70	28,527	1,084
Wine and must, in cask	817,447	43,731	163,031	11,751
Wine for blending	133,898	3,421	nil.	—
Wine for cognac	14,979	441	nil.	—
Sparkling wines	28,587	6,232	25,695	3,429
Alcoholic or ethereal essences	1,791	687	2,471	777
Wood spirit ...	47,769	2,866	20,323	1,524
Malt	1,047,086	24,585	164,036	4,100

The unit prices (per 100 kilos.) of imported potato and rice starch and crystallised starch sugar; also those of the last named, potato starch, and vinegar, for export, were estimated on the same basis as in 1904. On the other hand, a reduction in price occurred in dextrin, starch, spirits, acetic acid, wines, and wood spirit for importation; and in spirits, yeast, vinegar, and wood spirit for export. In all others an increase is recorded.—C. S.

Spirit trade; Russian export ——. Weschtsch. Finanzow. Z. Spiritusind., 1906, **29**, 255.

The exports of 40 per cent. spirit increased from 1,647,000 wedro (of 12·3 litres) in 1902 to 2,303,000 wedro in 1903, these figures being 2·1 and 3 per cent. respectively of the total production of spirit in the country. The largest proportion of the exports, namely, 1,674,000 wedro, went to Turkey, the trade with that country being an increasing one, and showing a growth of 437,000 wedro for the year. The second largest foreign consumer is Germany, which took 142,000 wedro, against 91,000 the previous year. Port Arthur received 611,000 wedro and Dalny 20,000 wedro. On the other hand, the consumption by Greece declined from 12,000 to 2,000 wedro.

Exports of rectified spirit are increasing in proportion to raw spirit, the percentage of the former having grown from 22 per cent. of the total in 1894 to 96 per cent. in the year under report. The chief exporting centres are the provinces of Wolhynia, Kiew, and Kurek, the first and last of these, together with Estland, exporting rectified spirit exclusively, whereas Minsk, Warsaw, and Piotskow export only raw spirit. In addition to the general bounty of 5·5 per cent. on exported spirit, an additional premium of 1·5 per cent. is given in the case of rectified spirit.—C. S.

Glycerol in wine; New methods for the determination of ——. C. Billon. XXIII., page 779.

Alcohol; Denatured —— in Canada. Oil, Paint, and Drug Rep., July 9, 1906. [T.R.]

For over ten years Canada has had in force legislation whereby grain alcohol, denatured and known as methylated spirits, can be had for use in the arts free from revenue spirit tax at a price which bears a small profit to the department for supervision, over the cost of the grain spirit and the denaturants. So well has this arrangement worked that the agents of foreign countries, and particularly of the United States, have visited Ottawa, and based their methods of denaturing and control of the privileges upon the manner in which the Canadian government handles and controls their methylated or denaturing department.

Some years ago the government allowed denatured alcohol to be supplied by a concern which was allowed to buy grain alcohol "in bond free," mix it with 10 per cent. of wood alcohol, and sell it to the public, until it was discovered that an enormous amount of revenue was being lost to the government through the abuse of the mixing privilege, since the grain alcohol was being taken secretly and converted into whiskey and high wines instead of methylated spirits as intended.

After due consideration the government decided to assume complete control under its inland revenue department of the entire denaturing business, buying the grain alcohol and the denaturants, and adding only to the cost of each a profit to cover the expense of supervision and inspection.

Manufacturers who give a bond to the government that this methylated spirit shall not be purchased for re-sale, but will be destroyed in their own productions, are granted a purer spirit at a much lower price than the ordinary person buying for use other than manufacturing. Also soapmakers and perfumers who use very large quantities can, by having the methylated spirits stored in bond, and destroyed in their productions under the supervision of an officer, whose time they pay for, secure a still lower price and purer spirit from the department.

Alcohol: Industrial ——, in Australia. Pharm. J., July 7, 1906. [T.R.]

The first report of the Commonwealth Tariff Commission, appointed by the Federal Parliament last year, has just been issued. The recommendations are prefaced by a summary of the nature and methods of producing industrial alcohol. In view of the bounty paid in Germany on exported methylated spirit, amounting to about 5d. per liquid gallon, the Commission does not recommend the free import of this article into the Commonwealth. It was thought that a duty sufficient to counteract the German export bounty would be sufficient to protect local distilleries. A recommendation was therefore made that, in lieu of the present import duty of 1s. per gallon, there be imposed a duty of 6d. per gallon on methylated spirit of not less than 65 per cent. over proof, methylated in a manner satisfactory to a Commonwealth analyst. Other recommendations issued by the Commission are as follows:—

That spirit of not less than 65 per cent. over proof produced within the Commonwealth when methylated in bond be free; and that methylated spirit of less than

85 per cent. over proof shall not be manufactured within the Commonwealth.

That approved methylic alcohol and all approved methylating or denaturing agents shall be free for use in bond or on the premises of licensed methylators, subject to such regulations as may be prescribed.

That a registration fee of 1d. per gallon be payable upon all locally manufactured methylated spirit, such fee to be paid by means of adhesive revenue stamps affixed to all vessels in such manner as may be prescribed.

That methylated spirit be of three classes :—

(*a*) "Industrial" spirit, for use in the arts or manufactures (except of food, drinks, scents, essences, or tinctures), to be completely denatured by a general agent, *i.e.*, 2 per cent. of wood naphtha, with ½ per cent. of pyridine spirit.

(*b*) "Mineralised" spirit, for domestic lighting and heating, and for power purposes, to be completely denatured by the addition of 1 per cent. of wood naphtha, ½ per cent. of "pyridine," and from 2 to 20 per cent. of benzine and ½ per cent. of aniline violet or blue dye.

(*c*) Spirit for special manufacture may be denatured upon the premises where it is to be used, or upon the premises of a licensed methylator, by such special denaturing agents as may be prescribed by regulations to be approved of by Parliament.

That regulations be prescribed relative to the minimum strength below which it shall be unlawful to sell "industrial" or "mineralised" spirit, and the licensing of all dealers, provision being made that "industrial" spirit shall not be sold other than by a distiller or a licensed methylator; and as to the quantity which may be stored and sold by wholesale and retail dealers respectively. It is further recommended that spirits specially denatured shall only be allowed for the manufacture of fine chemicals and pharmaceutical products where such manufacture is kept entirely separate from the manufacture of tinctures and other preparations in which spirit remains as spirit in the finished product.

English Patents.

Kilns for drying malt and hops; Impts. in ——. E. G. Shew, Ledbury, Herefordshire, and W. Jones, Stourbridge, Worcestershire. Eng. Pat. 15,139, July 24, 1905.

The furnace of the kiln is provided with a dome or cover surrounded by a chamber, in which the air for drying the malt is heated before passing into the kiln. The air enters by passages at the bottom of the kiln, is heated in the chamber, and then escapes into the space below the drying floor. The products of combustion from the furnace pass through a number of zig-zag flues situated in the space below the drying floor, these pipes entering a central flue which pierces the floor, and reaches to the top of the kiln. The gases may be deflected into the space immediately above the malt, or pass up to the top of the flue, in either case causing a good draught through the kiln. During the removal of the dry malt or hops the gases pass off through a side flue fitted to the central flue just below the drying floor.—W. P. S.

Yeast; Process for the production of distillers' —— *from the raw materials, products, by-products, and residues of the manufacture of tapioca, sago, arrowroot, flour, and like materials.* O. E. Nycander, London. Eng. Pat. 18,393, Sept. 12, 1905.

A mash is prepared by mixing about 15 cwt. of the pith of plants which are used for the manufacture of arrowroot, sago, and tapioca, or of the by-products obtained in the manufacture of the flours, with 5 cwt. of malt and 6000 galls. of water, and heating the mixture to a temperature of 63° C. for one hour. The brew is then passed through a filter-press, and the clear filtrate mixed with about 10 cwt. of malt culms. After standing for three hours, the liquid is drawn off into a fermenting vat, where a sufficient quantity of yeast is added, and fermentation allowed to proceed in the usual way. The yeast developed during the fermentation is then separated and washed.—W. P. S.

Beer and the like; Production of non-deposit ——. L. Chew and H. J. West and Co., Ltd., London. Eng. Pat. 20,246, Oct. 6, 1905.

An apparatus is described by means of which small quantities (at a time) of beer can be cooled and carbonated. For this purpose three closed, cylindrical vessels communicating with each other and with a reservoir of carbon dioxide are employed. The communications are made through suitable pipes and two-way taps at the top of the vessels, and similar pipes and taps are provided at the bottoms of the vessels for filling and emptying the latter. All three vessels are surrounded by a cooling liquid, and by a suitable manipulation of the taps, the carbonating process may be made continuous; while beer is being pumped into one vessel, that in the second is being carbonated, and the contents of the third, fully cooled and carbonated, are forced out into the filter and bottling machine.—W. P. S.

Alcohol: Process for the recovery of vapours of ——, *pure or mixed with air, gases, moisture, or other volatile solvents.* Soc. Jules Jean et Cie., and G. Raverat, Paris. Eng. Pat. 13,602, July 1, 1905. Under Int. Conv., July 25, 1904.

See Fr. Pat. 345,138 of 1904; this J., 1904, 1231.—T. F. B.

French Patents.

Alcoholic fermentations in which malt is employed; Process for obtaining increased purity in ——. C. J. Somlo, First Addition, dated Jan. 12, 1906, to Fr. Pat. 331,578, April 29, 1903.

Before germination, the grain is treated in a grain-washing machine, mash-tun, or analogous apparatus, with tepid or hot water or steam, or with hot and cold water alternately, or with steam and cold water alternately.—T. H. P.

Distillery by-products; Apparatus and process for treating ——. L. Rivière. Fr. Pat. 362,654, Jan. 23, 1906.

The apparatus and process described are for the treatment of distillery residues, such as those which are freed from the greater part of their potash by precipitation on leaving the stills, and returned, with as small a loss of heat as possible, either to the diffusors or to the mash-tuns, or, after utilising the heat, to the drains. The apparatus also allows of the distillation under pressure and in presence of lime (with or without sodium hydroxide) of the ammonium compounds, which are condensed under a variable pressure, and afterwards transformed into ammonium compounds by means of acids. This elimination of the ammoniacal compounds may be followed by evaporation of the residue so as to allow of the extraction of the glycerin. This treatment may also be applied to the vinasses which have been used several times in the mash-tuns, and contain proportions of mineral and organic matters injurious to fermentation. It may also be extended to fermented liquids or wines, after these have been distilled to get rid of potash; these liquids are distilled to remove alcohol, and the residue transferred to the autoclaves for the extraction of ammoniacal nitrogen, either before or after passing through the diffusors or mash-tuns.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 711.)

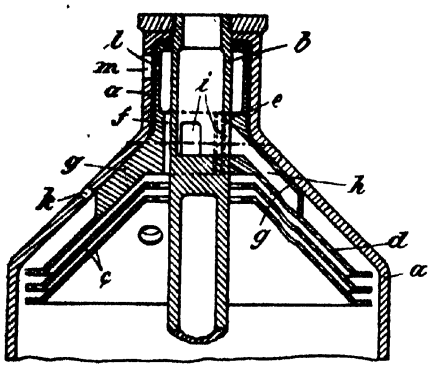
(*A.*)—FOODS.

Boric acid [in foods, &c.]: the detection and determination in large or small amounts. W. H. Low. XXIII., page 779.

Casein in cheese; Determination of ——. A. Gautier and Santon. XXIII., page 780.

ENGLISH PATENTS.

Centrifugal separators for liquids [*Milk, &c.*]. B. Ljungström, Stockholm. Eng. Pat. 5072, March 10, 1905.



THE invention relates to feed devices for separators, the milk being fed into the top of the liner or division contrivance instead of at the bottom, as usual. For this purpose the feed-pipe is placed centrally, and contiguous to it is provided an enlargement with passages for conveying the milk to the liner. Referring to the figure, which is a vertical section of the top portion of the bowl or drum, *a* is the drum, *b*, the feed-pipe, and, *c*, is the liner, the upper plate, *d*, thereof extending into the neck of the drum. This upper plate carries a flange, *e*, which bears tightly against the feed-pipe, holes, *f*, being provided for the passage of the separated cream to the exit. The plate, *d*, is also furnished with a circular projection, *g*, in which channels, *h*, are provided for the passage of the whole milk. The flange, *e*, and the projection, *g*, constitute the enlargement aforesaid. The upper ends of the channels, *h*, coincide with openings, *i*, in the wall of the feed-pipe, whilst the lower ends are opposite a series of holes in the plates, *c*, of the liner. The outlet, *k*, for the skimmed milk, and the cream outlets, *l*, and, *m*, are disposed in the ordinary manner.

Another modification of the apparatus is described in which the flange, *e*, is formed at the outside of, and in one with, the feed-pipe, and presses against the interior of the plate, *d*, on which the projection, *g*, is provided as before. The enlargement is, consequently, partly on the feed-pipe and partly on the upper plate. The projection, *g*, may be interrupted, or take the form of detached projections, sections, or humps. In separators where the discharge pipes for the skimmed milk are situated in the neck of the drum, the plate, *d*, need not extend into the neck of the drum. To prevent the skimmed milk from mixing with the separated cream, a ring is interposed between the plate, *d*, and the drum, orifices being made in it for the discharge pipes. The feed pipe and the upper plate, *d*, may be also made in one piece, the point where they emerge together being enlarged to form the flange, *e*, wherein the cream passages are placed. In this case the feed-pipe, *b*, and the casing forming the bearing for the driving shaft are preferably separate.—W. P. S.

[*Milk*] *Separators; Imps. in liners for centrifugal* ——. A. L. Christenson, Stockholm, Sweden. Eng. Pat. 23,991, Nov. 21, 1905. Under Int. Conv., Nov. 26, 1904.

INSTEAD of the recess usually formed on the inner edges of the superposed conical liners, the latter are provided with one or more ridges, formed on the upper surface of the conical plates, and extending in a direction oblique with regard to the radius of the liner. The object is to cause a retardation in the outflow of the whole milk from the central feeding pipe.—W. H. C.

Organic substances [*Foods*]; *Method of preserving* ——. R. Krause, Berlin, and R. Lenk, Vienna. Eng. Pat. 12,642, June 19, 1905.

THE substances to be preserved, such as meats, eggs, &c., are frozen, and the moisture removed by subjecting them to the action of cooled and dried air. The frozen articles of food may be also dried in closed chambers, the moisture being absorbed by suitable agents, such as calcium chloride, sulphuric acid, and the like, or removed from the chamber by means of an exhaust pump. The temperature to which the substances are cooled varies from 0° to —20° C.—W. P. S.

Fruit; Process for preserving ——. D. F. Sherman, New Castle, Cal., U.S.A. Eng. Pat. 13,245, June 27, 1905.

SEE U.S. Pats. 793,614 and 793,615 of 1905; this J., 1905, 853.—T. F. B.

UNITED STATES PATENT.

Food extract from cornstalks. A. G. Manns, Assignor to The Food and Fibre Products Co., Chicago, Ill. U.S. Pat. 820,806, May 15, 1906.

CORNSTALKS, either with or without the leaves, husks, &c., are boiled with water in an open vessel for three to five hours, or treated with superheated steam in a closed vessel for a shorter time. After separating the pulp, the liquid portion is concentrated under reduced pressure, and the residue granulated or powdered. The product is soluble in water, and contains on the average:—Moisture, 10 per cent.; ash, 14·3; proteids, 9·8; sucrose 9·2; and dextrose, 45·8 per cent. When the stalks have been stripped, less proteid is present in the food.—W. P. S.

FRENCH PATENTS.

Trypsin-zymogen; Preparation of ——. W. Hopmann. Fr. Pat. 362,615, Jan. 23, 1906.

CLAIM is made for a method of preparing trypsin-zymogen, an enzyme which causes the initiation or increase of the action of trypsin. The enzyme is obtained from intestinal mucus, spleen, human or animal intestinal secretions, or blood from the organs of animals previously treated with enzymes to precipitate the albuminoid matter, by breaking up or powdering the raw material, or by extracting by means of suitable liquids, or by precipitating these extracts by means of albumin and enzymes.—T. H. P.

Malt food; Process for making a ——. S. Felix. Fr. Pat. 362,773, Jan. 27, 1906.

AN infusion of kilned malt is prepared at a temperature of about 40° C., the infusion being then allowed to act on other foods, such as milk, meat, vegetables, &c., at a temperature of from 65° to 70° C. The residue obtained by the preparation of the infusion is also added, and the whole mixture finally dried under reduced pressure, and powdered or kept in the solid state.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

ENGLISH PATENT.

Screening, straining, or filtering fluids [*water or sewage*]; *Apparatus for* ——. J. T. Briscoe, Enfield. Eng. Pat. 27,155, Dec. 29, 1905.

A CYLINDRICAL or spherical perforated vessel is mounted on a shaft so that it can rotate, and the shaft is supported at either end by uprights connected above by a cross-bar. If it is desired to use any filtering medium, the shaft is provided with a sleeve fitting loosely round it, and the filtering medium is packed between the sleeve and the casing. The apparatus is lowered into a vertical conduit, up which the sewage or other liquid to be purified is flowing, and is of such a size and shape that while it can freely rotate, it nearly fills the conduit, so that the liquid is compelled to pass through the cylinder from side to side. If some of the perforations get blocked, the pressure from below becomes unequal, and the cylinder rotates

and facilitates the clearing away of the obstructions, whilst when it gets too much blocked up to work, the filter and frame can be lifted bodily out and cleaned. —W. H. C.

FRENCH PATENT.

Water; Apparatus for the purification of ——. C. Schmidt. Fr. Pat. 362,993, Feb. 5, 1906.

SEE Eng. Pat. 1158 of 1906; this J., 1906, 440.—T. F. B.

(C.)—DISINFECTANTS.

Phenols combined with acids, and in admixtures with soap; Study of —— from the chemical and bacteriological standpoint. H. Schneider. Z. Hyg., 1906, **53**, 116—138. Chem. Centr., 1906, **1**, 1897—1898.

IT is known that in the case of phenol, if a hydrogen atom in the benzene ring, in the ortho or meta position with respect to the hydroxyl group, be replaced by a sulphonic group, the disinfecting power is increased, the effect being greatest when the substitution takes place in the ortho position. The author finds that an exactly similar action occurs in the case of the cresols. *p*-Cresol-*o*-sulphonic acid has a greater disinfecting power than phenol-*o*-sulphonic acid. By allowing cold concentrated sulphuric acid to act on cresol for 1—2 days, sulphuric acid esters of cresol are obtained, which are superior disinfectants to the corresponding cresol-sulphonic acids. The most efficient cresol disinfectants, however, are aqueous solutions of cresol containing free hydrochloric or sulphuric acid. In preparing these mixtures, the acid is added to an aqueous suspension of the cresol.

The view put forward by Fehrs (Centr.-Bl. f. Bakter. u. Parasitenk, **37** [1], 730) that in commercial cresol soaps containing equal proportions of cresol, the chief factor governing the disinfecting power is the composition of the crude cresol, *i.e.*, the proportions of ortho-, meta-, and para-compounds, is stated to be not altogether correct. The free alkali usually present in these soaps must also play an important part, experiments having shown that an addition of alkali hydroxide diminishes considerably the disinfecting power of cresol soaps, owing to the formation of less active alkali compounds. The nature of the fatty acid also has a considerable influence on the disinfecting power, soaps prepared with linseed oil being more active than those prepared with rape oil.—A. S.

ENGLISH PATENT.

Disinfectants, deodorisers, and moth and insect preventives. T. Smith and W. F. Davis, London. Eng. Pat. 6676, March 20, 1906.

SPENT gas lime is heated to a temperature of from 150° to 200° C. in the presence of a good supply of air. When cooled, 5 per cent. of its weight of chloride of lime is added, and the mixture obtained is employed as the base of the disinfectant compounds claimed, which consist of this base with varying quantities of phenol, cresol, camphor, naphthalene, pyridine, quinoline, or acridine, &c., or mixtures of the same. The compounds may be made up in the form of tablets, or prepared as a fluid by heating them with ammonia solution to a temperature of 90° F., and filtering.—W. P. S.

UNITED STATES PATENT.

Insecticide fertiliser. R. and M. Jenkner and J. Pleyl, Floridsdorf, Austria-Hungary. U.S. Pat. 824,791, July 3, 1906.

SEE Eng. Pat. 19,068 of 1904; this J., 1904, 1109.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 712.)

ENGLISH PATENTS.

Papermaking machines; Smoothing apparatus for ——. C. Tittel, Gratwein, Austria. Eng. Pat. 2795, Feb. 5, 1906. Under Int. Conv., March 4, 1905.

PROVISION is made for keeping the web of paper "closed" and smooth during the drying operation, by passing it between polished smoothing-rolls, a pair of which is placed behind each of the drying cylinders of the first group. The "opening" of the web during drying is caused by the expulsion of the moisture in the form of steam, and, according to this invention, this "opening" effect is corrected by the rolls immediately after it has been produced on the drying cylinder.—J. F. B.

Cellulose articles: Direct production of coloured ——. F. and A. van den Bosch, Goch, and O. Müller, Cologne, Germany. Eng. Pat. 6942, March 22, 1906. Under Int. Conv., April 1, 1905.

CELLULOSE articles, such as threads, films, &c., prepared by dissolving the cellulose of cotton-seed hulls by the ordinary solvents of cellulose (Eng. Pat. 3211 of 1906) can be produced in a range of colours varying from red to pale yellow, by leaving in the cellulose a certain proportion of the natural colouring matter of the hulls. Darker shades can be obtained by adding to the cellulose the desired proportion of the coloured alkaline liquor obtained in the first stage of the treatment of the cotton-seed hulls. The coloured solutions of cellulose are formed into solid articles by precipitation in solutions with an acid reaction.—J. F. B.

Viscose; Manufacture of lustrous threads, bands, strips, and the like of ——. M. Müller. Eng. Pat. 10,094, April 30, 1906. V., page 753.

FRENCH PATENTS.

Drawings, documents, &c.; Process and apparatus for rendering —— transparent and waterproof. C. L. Crabb. Fr. Pat. 362,122, Jan. 2, 1906.

THE sheets of drawings, &c., to be rendered waterproof and transparent, are conveyed between two endless bands, the tension of which is adjustable, first through a bath of a substance suitable for the purpose, *e.g.*, paraffin wax ("about 12 parts") dissolved in alcohol ("1 part"), and then into a heated, closed chamber, where the bands are pressed between rollers. On emerging from the chamber, the bands are separated by a mechanical device, enabling the sheets to be withdrawn from between them and replaced by others. Pencil drawings on paper, thus treated, resemble in appearance, it is stated, drawings in ink on calico.—E. B.

Viscose threads [artificial silk]; Impts. in spinning ——. Soc. Française de la Viscose. Fr. Pat. 361,319, April 3, 1905. V., page 754.

GERMAN PATENTS.

Celluloid-like masses; Process of preparing ——. Rheinische Gummi- und Zelluloid-Fabrik. Ger. Pat. 168,497, July 22, 1903.

THE camphor in celluloid is replaced by sugar, starch, dextrin, &c., the sugar being first rendered soluble in alcohol by treatment with aldehydes. Five hundred grms. of cane sugar are heated for several hours, under a reflux condenser, with 125 grms. of 40 per cent. formaldehyde and 100 grms. of alcohol. The alcohol and the excess of formaldehyde are removed by heating on the water-bath, a current of air being passed through the product. A colourless, resinous mass, free from water, results, easily soluble in alcohol and ether.—T. F. B.

Cellulose threads and films; Process for preparing transparent, durable, and elastic ——. Verein. Glanzstoff-Fabriken A.-G. Ger. Pat. 169,567, Jan. 17, 1905.

CELLULOSE threads and films, prepared by coagulating cellulose-cuprammonium in sulphuric acid, are wound on cylinders, which are then rotated in concentrated caustic soda solution, washed with water or dilute acid, and dried under tension.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 714.)

Berberine reactions. C. Reichard. Pharm. Centralh., 1906, **47**, 473; Chem.-Zeit., 1906, **30**, Rep. 211.

BERBERINE possesses an intense yellow colour, and is one of the few vegetable bases forming a carbonate, $(C_{20}H_{17}NO_4)_2CO_3$. A characteristic black coloration is produced on adding concentrated sulphuric acid to a powdered mixture of berberine and ammonium persulphate. A mixture of chromic and sulphuric acids gives a blackish-green to black coloration with berberine. Berberine hydrochloride, when warmed with a concentrated solution of cobalt nitrate, shows a violet-brown to violet-red coloration.—E. F. A.

Cade oil [Empyreumatic oil of Juniperus oxycedrus wood]: its preparation and distinctive characters. C. Pépin. J. Pharm. Chim., 1906, **24**, 49—58.

Preparation.—Cade oil is distilled in the neighbourhood of Saint-Sauveur, Alpes Maritimes, and in the departments of Var and Gard. It is produced from the wood of wild *Juniperus oxycedrus*, this species being distinguished from other kinds of *Juniperus* by its bright orange-red fruits of the size of a hazel-nut. The wood is cut into billets, and packed in an iron pot, which is then inverted and luted over a concave stone; the centre of the concavity is pierced by an aperture to which the delivery tube is fitted. In some larger distilleries, the billets are laid in a pile on such a large hollow stone, and a kiln is constructed round them with bricks. In either case the plant is surrounded with fuel, consisting of the worthless wood of the juniper, and distillation is conducted *per descensum*. The tarry distillate is collected, and set aside for some weeks, when it separates into three layers, consisting of a thick tarry deposit, an intermediate aqueous stratum, and a floating layer of oil. The latter is cade oil. It is clear, lighter than water, fluid, and has a red-brown colour, and a distinctive smoky odour.

Test for genuine oil.—One c.c. of the oil is agitated with 15 c.c. of light petroleum spirit, and filtered. Ten c.c. of the filtrate are then shaken well with an equal volume of 5 per cent. neutral cupric acetate solution, and the mixture is allowed to separate. Five c.c. of the ethereal layer are withdrawn, mixed with 10 c.c. of ether, and filtered. The filtrate should be coloured brownish-yellow. In the presence of pine tar, it will have an intense green colour; by this reaction the admixture of 10 per cent. of pine tar may be readily detected. The test is virtually that of Hirschsohn, but with the important difference that that author considered the green colour to be characteristic of genuine cade oil.

A specimen of so-called cade oil, distilled by a manufacturer of repute, was found not to respond to the above characters and test. It was then ascertained that it was not the product of the wood of *Juniperus oxycedrus* alone, but had been prepared from three distinct species of *Juniperus*.—J. O. B.

Rue; Essential oil of Algerian ——. H. Carette. J. Pharm. Chim., 1906, **24**, 58—62.

Two kinds of rue oil are distilled in Algeria, one in the summer, the other in the winter. The former, known as "essence de rue d'été" is the produce of *Ruta montana*. Its chief constituent is methyl-nonyl ketone. It readily congeals in winter, its solidifying point being 5°—8° C. In this respect it resembles oil of *R. graveolens*, which congeals at 8°—10° C. The oil distilled in winter, "essence de rue d'hiver," is derived from *R. bracteosa*, and consists chiefly of methyl-heptyl ketone; it does not solidify in winter, and requires exposure to a temperature of −18° C. before congealing; it melts again at −10° C. It is evident therefore that the mere determination of the congealing point is insufficient to establish the purity of rue oil, since this character varies with the species of *Ruta* employed as a source of the oil. All the rue oils examined were soluble, in the proportions 1:2 or 1:3 in 70 per cent. alcohol, so that any admixture of petroleum or of turpentine oil would be detected by this test.

In order to avoid confusion, it is suggested that the oil should be dealt with commercially under the names of the botanical sources, thus, "Oil of *Ruta bracteosa*," "Oil of *Ruta montana*," and "Oil of *Ruta graveolens*."
—J. O. B.

Camphor; Export of —— from Japan. For. Off. Ann. Series, No. 3675. [T.R.]

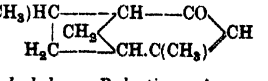
THE production of camphor in Formosa last year fell off considerably, and consequently the amount of camphor oil sent to the refineries in Kobe was also correspondingly less (49 per cent. of camphor is obtained from this oil). The output in Japan itself is limited, and cannot show much increase, at any rate till the distillation from the leaves gets beyond the experimental stage. The export from Japan therefore depends greatly upon supplies from Formosa, and at present these cannot meet the demand, though it is to be hoped that the workers in the Formosan camphor districts, with higher prices paid to them for their produce may be stimulated to further efforts.

The following table shows the shares taken by the principal countries in the export from Japan during the last three years:—

Year.	Value.					
	India.	France.	Germany.	United Kingdom.	United States.	Total Export.
	£	£	£	£	£	£
1905	53,000	58,000	12,000	26,000	100,000	262,000
1904	82,000	71,000	15,000	8,000	128,000	323,000
1903	61,000	37,000	68,000	50,000	117,000	361,154

Umbellulone; Constitution of ——. F. Tutin. Chem. Soc. Proc., 1906, **22**, 195—196.

THE ketone, umbellulone, was isolated from the essential oil of *Umbellularia Californica* by Power and Lees (Chem. Soc. Trans., 1904, **85**, 629; this J., 1904, 559), who showed it to possess the formula $C_{10}H_{14}O$. Umbellulone, on oxidation, yields a saturated keto-acid, $C_9H_{14}O_3$ (m.pt. 102°C.), called *umbellulonic acid*, which, on distillation under suitable conditions, is partially converted into an unsaturated lactone, $C_9H_{12}O_2$ (b.pt. 217°—220°C.). This lactone, on hydrolysis, yields umbellulonic acid, and is produced by the elimination of water from the enolic modification of the keto-acid. On oxidation, a polymethylene dicarboxylic acid, *umbellularic acid*, $C_8H_{12}O_4$ (m.pt. 120°—121° C.), is obtained, which is remarkably stable. By the bromination of umbellulone, and subsequent distillation of the products, *p*-cymene was obtained, together with substances containing bromine. It would therefore appear that the molecule of umbellulone has a structure capable of yielding this hydrocarbon without undergoing any profound change. The following formula is stated to offer the most satisfactory explanation of the behaviour of umbellulone on oxidation and on bromination:—



Unsaturated alcohols; Reduction of —— by metal-ammoniums. E. Chablay. Compt. rend., 1906, **143**, 123—126.

THE reduction of primary unsaturated alcohols by metal-ammoniums results in the formation of alcoholates, as obtained in former experiments on the saturated alcohols (this J., 1905, 634), but at the same time olefines are produced, instead of hydrogen being liberated. Using allyl alcohol the reaction is a very energetic one even at −40° C. It is only the alkali metal which is directly active, the ammonia being set free, and it has been found that when sodium alone acts on allyl alcohol, some propylene is formed, though mixed with hydrogen.—F. Sodn.

Cinnamic acid; Reduction of —— to cinnamene by [the ferments of] moulds. Oliviero. J. Pharm. Chim., 1906, **24**, 62—64.

THE ferments secreted by the moulds *Aspergillus niger* and *Penicillium glaucum* rapidly reduce cinnamic acid and its salts, with the formation of cinnamene, which is readily characterised by its powerful odour, resembling that of coal-gas. A filtrate from a culture of these organisms will at once reduce a solution of sodium cinnamate in this manner. The reaction suggests the employment of cinnamic acid for the detection of these moulds in dietetic preparations. The peculiar coal-gas odour often developed in the pharmaceutical syrup of balsam of Tolu is attributed to the occasional growth of the moulds therein.—J. O. B.

Ether; Duty on sulphuric —— in Switzerland. Bd. of Trade J., July 19, 1906. [T.R.]

A DECREE of the Swiss Federal Council, which came into force on the 5th inst., imposes a special duty on sulphuric ether (No. 1062 of the Tariff), in addition to the import duty proper, of 10 frs. per 100 kilos. (gross weight), to countervail the internal taxes levied on the alcohol employed in the domestic manufacture of that article.

Iodine; Division of —— between two solvents. Y. Osaka. Mem. Coll. Sc. and Eng. Kyoto Imper. Univ., **1**, 93—102; Z. Elektrochem, 1906. **12**, 473.

MEASUREMENTS have been made of the division of iodine between carbon bisulphide and mixtures of alcohol and water, the two solvents being practically immiscible. The following is a résumé of the results obtained:—Per cent. alcohol—30·5, 26·7, 22·9, 19·1, 15·3, 11·4, 7·6. Co-efficient (ratio of iodine in alcohol to iodine in carbon bisulphide)—0·0129, 0·0076, 0·0049, 0·0034, 0·0028, 0·0023, 0·0020. The values are the mean of those obtained with widely different concentrations of iodine. (See also this J., 1906, 282).—R. S. H.

Bismuth salts; Action of hydrogen peroxide on ——. L. Moser. Z. anorg. Chem., 1906, **50**. 33—37.

WHEN a solution of bismuth nitrate is added to alkaline hydrogen peroxide solution, the basic hydroxide, BiO.OH is precipitated. This contains no peroxide, but a small quantity of basic nitrate, which accounts for the fact that some chlorine is liberated on treatment with hydrochloric acid.—F. SODN.

Morphine; Colorimetric determination of ——. L. Georges and Gascard. XXIII., page 779.

Cantharidin; Determination of —— in cantharides. K. Siegfried. XXIII., page 780.

ENGLISH PATENTS.

Ether vapours; Process for the recovery of ——. Soc. Jules Jean et Cie., and G. Raverat, Paris. Eng. Pat. 13,601, July 1, 1905. Under Int. Conv., July 13, 1904.

SEE Fr. Pat. 350,057 of 1904; this J., 1905, 1082.—T. F. B.

Δ_4-Cyclogeranic acid and derivatives thereof; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 15,515, July 28, 1905.

SEE U.S. Pat. 805,924 of 1905; this J., 1906, 39.—T. F. B.

Pyrimidine derivatives; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,582, Sept. 14, 1905.

DIALKYLBARBITURIC acids (2.4.6-trioxy-5-dialkylpyrimidines) are prepared by treating with acids the 2-thio-4-imino-5-dialkyl-6-oxypyrimidines obtained by condensing dialkylcyanoacetic esters with thiourea; by this process, the sulphur and imino groups are simultaneously replaced by oxygen.—T. F. B.

UNITED STATES PATENT.

Zinc perborate. O. Liebknecht, Frankfort on the Maine, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 824,798, July 3, 1906.

SEE Ger. Pat. 165,278 of 1904; this J., 1906, 443.—T. F. B.

FRENCH PATENT.

Camphor [from isoborneol]; Process of preparing ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 362,956, Feb. 2, 1906. Under Int. Conv., Nov. 4, 1905, and Jan. 27, 1906.

SEE Eng. Pat. 2520 of 1906; this J., 1906, 335.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 714.)

Ultra-violet rays; Absorption of —— by glass and apparatus used by photographers. A. J. Newton and A. J. Bull. Phot. J., 1906, **46**, 282—284.

THE spectrum of the iron arc, formed by a diffraction grating replica mounted on a concave surface, was photographed, and the absorption of the glass and other substances ascertained by exposing them in the path of the light. Photographs are given of the spectra obtained. All the lenses tried showed complete absorption of ultra-violet light up to 3170 A.U., most of them up to about 3,300. A Kahlbaum metal process-mirror reflected all the ultra-violet light recorded, without showing marked absorption; silver or glass mirrors gave marked but incomplete absorption between 2600 and 3300 A.U. A half-tone screen absorbed almost all the ultra-violet light up to 3300. The absorption of specimens of Jena glass 1 cm. thick, selected for their opacity to ultra-violet light, was in no case complete, whilst the yellow tint of the glass indicated some absorption of blue light. The importance of the ultra-violet light in process work, when an enclosed arc lamp is used, is shown by spectra of arc lights on a wet collodion plate, from one of which the ultra-violet was excluded by means of a solution of quinine sulphate; it is demonstrated that the greater portion of the effect of such light is attributable to the ultra-violet rays, and, when a pigment which absorbs these rays (*e.g.*, Chinese White) is used, the resulting negative is frequently faulty.—T. F. B.

Gelatinobromide; Action of alkali bromides in ——. B. Homolka. Phot. Korr., 1906, **43**, 216. Chem.-Zeit., 1906, **30**, Rep., 228.

THE author considers it probable that the production of "marginal fog" on negatives is due to the diffusion of the alkali bromide, in the emulsion, from the margin to the centre of the plate, under the influence of osmotic pressure. It is, therefore, stated that the alkali bromide of lowest molecular weight (*viz.*, lithium bromide) is the best to use for preparing plates as free from marginal fog as possible; it is shown that the greater the molecular weight of the alkali bromide used, the more complete and more rapid will be the diffusion of the bromide towards the centre of the plate.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 714.)

Dinitroglycerol. F. Volpert. Z. ges. Schiess.- u. Sprengstoffwesen, 1906, 169. Chem.-Zeit., 1906, **30**, Rep., 215.

THE author describes dinitroglycerol, an explosive introduced by Mikolajczak, as relatively safe and possessing the advantage that it does not solidify when exposed to a low temperature, such as would be met with in the arctic regions. It is more soluble in water than the tri-

nitrate; and can be mixed with ammonium nitrate to form explosives which keep well. It can be used as an ingredient of a "powder" which is good for shooting purposes, being non-corrosive and free from smoke.
—E. F. A.

"*Oxyliquit*" [*Liquid-air explosive*]. L. Sieder. Z. ges. Schiess.- u. Sprengstoffwesen, 1906, 1, 87—89. Chem. Centr., 1906, 1, 1915.

"Oxyliquit" consists of liquid air mixed with oxidisable substances, especially wood charcoal. The bursting effect of mixtures containing hydrocarbons, &c., depends upon the heat of combustion of the combustible substances. Petroleum carbon and cork charcoal have been used in place of kieselguhr as absorbing agents. The explosive acts well, but suffers from the disadvantage that its action is considerably diminished, especially in bore-holes of small diameter, by rapid evaporation of the liquid air. Liquid oxygen has recently been used in place of liquid air.—A. S.

Gunpowder and bullets, made about 1641, *recently discovered in Durham Castle.* O. Silberrad and W. S. Simpson. Chem. Soc. Proc., 1906, 22, 172—173.

The ammunition was found in a bucket which had been walled up in the roof of Durham Castle, probably having been placed there about 1641, when the Castle was armed against a Scottish raid. The bullets consisted of roughly moulded spheres of lead of two different sizes, some being 1·5 cm. and others 1·8 cm. in diameter. On analysis they were found to consist of 99·17 per cent. of lead, and to contain a small quantity of iron and silver, together with traces of bismuth, arsenic, and antimony. The gunpowder, on analysis, was found to approximate closely in composition to the black powder now used in this country. In appearance, however, it differed widely from powder manufactured at the present day, the ingredients having been merely ground and mixed together, no attempt at granulation having been made.

	Analysis of powder from Durham Castle.		Proportions used at present time in this country.
	On sample.	On dry material.	
Potassium nitrate	73·99	74·81	75
Carbon	14·71	14·87	15
Sulphur	9·98	10·09	10
Moisture	1·10		
	99·78		

These results are somewhat surprising, since the compositions used in this country during the seventeenth century all contained a much higher percentage of sulphur. It seems indeed probable that this powder was of Prussian origin, Prussian musket powder being the only explosive of this composition in use at that date.

The calorimetric value was determined by firing a charge at a density of loading, 0·48, in a closed vessel suspended in a calorimeter. The pressure recorded was 9·7 tons per sq. in., or 1478 atmospheres. The calorimetric value = 894 calories per grm. This is in close agreement with the figure given by ordinary black powder. The critical time of burning was determined at a density of loading of 0·230. The pressure recorded at this density was 4·51 tons per sq. in., 687 atmospheres; ordinary black powder fired at this density gives a pressure of 686 atmospheres (Sir Andrew Noble. Phil. Trans., 1905, 205, 15). The critical time of burning observed was 0·0030 second. This is more rapid than that of the granulated powders now in use.

Moisture: New method of determining ——, *with special application to moisture in cordite and other substances containing volatile matters other than water.* P. V. Dupré. XXIII., page 780.

English Patent.

Nitroglycerine-explosives; Manufacture of ——. H. W. Lake, London. From Dynamit A.-G. vorm. A. Nobel and Co., Hamburg, Germany. Eng. Pat. 6314, March 15, 1906.

Glycerol is converted into diglycerol by heating it under atmospheric pressure, and the product is either mixed with glycerin, and the mixture nitrated, or it is nitrated alone, and the tetranitrodiglycerol produced added to ordinary nitroglycerin, to obtain explosives of very low freezing point. It is stated that a nitroglycerin explosive obtained by nitrating glycerin containing 25 per cent. of diglycerol does not congeal when cooled to —18° C.
—A. S.

German Patent.

Nitroglycerin explosives; Process for the manufacture of gelatinous ——. Schachtebeck. Ger. Pat. 172,651, April 26, 1905.

The invention relates to the manufacture of gelatinous nitroglycerin explosives, in which wet collodion-cotton is used. The wet collodion-cotton is treated with glue, dextrin, starch, or similar substances for the purpose of absorbing the moisture. As an example an explosive of the following composition is given:—Nitroglycerin, 60·25; collodion-cotton containing 35 per cent. of water, 2·7; glue, 3·0; wood meal, 7·0; sodium nitrate, 24; and ammonium nitrate, 3 parts.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 717.)

APPARATUS, &c.

Calorimetric method; New ——. M. Casaubon. J. Gas Lighting, 1906, 95, 41—42.

This calorimetric method consists in measuring the proportion of air required for the complete combustion of the gas, instead of directly measuring its calorific value. It is stated that, despite the differences in the calorific values of the variable constituents of a gas, it can be shown by calculation that an accurate determination of the heating power can be made by observing the ratio of air to gas. Even in the case of coal gas enriched with benzene, the error is only something like 8 calories per cubic metre. In carrying out the method, the gas is burned in a Bunsen burner to which the air and gas are supplied from separate meters, the flame being maintained in a closed space provided only with an orifice at the top for the escape of the products of combustion. By observing the appearance of the flame while the air supply is increased or diminished, one can see the exact point at which complete combustion is occurring, but an easier method of ascertaining this point consists in surrounding the flame with a mantle of oxide of cerium, and noting when the colour of the mantle changes from red to white. It is stated that an infinitely small change in the supply of air is sufficient to change sharply the red colour, due to a reducing flame, to a white colour, due to an oxidising flame. A ceria mantle is easily obtained by soaking an ordinary mantle in a 30 per cent. solution of cerium nitrate.—H. B.

French Patent.

Gases; Apparatus for the analysis of ——. Monopol Betriebskontroll-Apparate K. Steinbock. Second Addition, dated Dec. 4, 1905 (under Int. Conv., May 11, 1905), to Fr. Pat. 359,352 of Nov. 2, 1905 (this J., 1906, 394, 529).

The apparatus described in the principal patent and first addition thereto is here further modified, with the object of obtaining an exact, automatic registration of the results of the analysis.—H. B.

INORGANIC—QUANTITATIVE.

Platinum metals; Analysis of ——. [*Determination of osmium and palladium*]. N. A. Orlow. Chem.-Zeit., 1906, **30**, 714—715.

(1) To separate osmium from platinum, iridium, ruthenium, and rhodium, the solution is first treated with zinc or magnesium, and then hydrogen peroxide is added to the black precipitate thus formed. Osmium dissolves, and can be subsequently obtained as the pure tetroxide, whereas the other metals are insoluble.

(2) Palladium may be separated from the other metals of the platinum group by adding freshly precipitated silver iodide to a solution of their chlorides. This, unlike potassium iodide, reacts only with palladium chloride, yielding the black insoluble iodide, and leaving the other metals in solution. The palladium may be extracted from the precipitate by the aid of potassium iodide or thiocyanate solutions, or by means of *aqua regia*.—F. Sodn.

Boric acid [*in foods, &c.*]; *its detection and determination in large or small amounts.* W. H. Low. J. Amer. Chem. Soc., 1906, **28**, 807—823.

The chief points brought out by the author are the following:—

Detection of boric acid.—There is no necessity to dry the turmeric paper at the temperature of the water-bath. By carrying out the test at the ordinary temperature in a vacuum desiccator, or at 40°—50° C., in an ordinary desiccator, small quantities of boric acid can be detected in the presence of large amounts of other salts, and in the presence of substances such as nitrates and phosphates, that interfere with the test made in the usual manner.

Determination of boric acid.—If a water-absorbing substance, such as dry calcium chloride, be added to the solution under examination, it is possible to distil over the whole of the boric acid, by means of methyl alcohol vapour, without evaporating to dryness. Details of the methods of carrying out the tests are given, and also the proportions of boric acid found in various salts used in meat-packing establishments.—A. S.

Borates; Potassium and sodium —— [*and determination of boric acid in alkali borates*]. M. Dukelski. VII., page 757.

ORGANIC—QUANTITATIVE.

Cade oil; preparation and distinctive characters. C. Pepin. XX., page 776.

Glycerol in wine; New methods for the determination of ——. C. Billon. Sixth Internat. Congr. Appl. Chem., Rome, 1906. Wochensch f. Brau., 1906, **23**, 350.

In the opinion of the author the old methods for the estimation of glycerol in wine are both intricate and inaccurate. Treatment with alcohol-ether gives a very impure extract; conversion of glycerol in wine into other easily estimated substances is difficult and uncertain. The author has worked out the following methods:—

A. *Determination of glycerol in dry wines.*—Fifty c.c. of the wine are evaporated to 15 c.c. on the water-bath, treated with a slight excess of milk of lime, and then evaporated to dryness. The residue is triturated with a glass spatula, and mixed with 5 c.c. of strongest alcohol, again triturated, and treated with a further quantity of 5 c.c. of alcohol. The whole is poured into a 100 c.c. flask, and the dish rinsed into the flask twice, each time with 5 c.c. of alcohol. Ethyl acetate is then added in small quantities at a time until the flask is filled up to the mark, the whole being shaken after each addition. Owing to their insolubility in ethyl acetate, foreign substances are thus precipitated. The flask is shaken thoroughly for 1—2 minutes, and its contents filtered. Eighty c.c. of the filtrate (= 40 c.c. wine) are evaporated to a syrupy consistence on the water-bath at a temperature below 80° C. The residue is dried for an hour in an oven at 60°—70° C., and the pure, dry glycerol remaining is weighed. The author has shown by experiment that the results are satisfactory.

B. *Determination of glycerol in sweet wines.*—If the wine contain more than 10 per cent. of sugar, the glycerol obtained by the above method is somewhat contaminated with sugar. In such cases the method is modified as follows:—Fifty c.c. of the wine are concentrated to 15 c.c.; a quantity of lime, equal to the weight of sugar in the 50 c.c. of wine, is added, and the whole is evaporated to a syrup. The residue is treated with 10—15 c.c. of alcohol, and then heated to boiling. The alcohol is decanted into a 100 c.c. flask, and the alcoholic extraction repeated six or seven times. The alcoholic extract is cooled, made up to 100 c.c. with alcohol, shaken, and filtered. An aliquot part of the filtrate is evaporated to a syrup on the water-bath; the residue is taken up with 10 c.c. of alcohol, and then made up to a volume of 50 c.c. with ethyl acetate. The mixture is filtered, and an aliquot part of the filtrate evaporated to dryness, and the residue heated for an hour at 60°—70° C., and weighed.—L. E.

Casein in cheese; Determination of ——. A. Trillat and Sauton. Compt. rend., 1906, **143**, 61—63.

A method is described for the determination of the unchanged proteids in cheese, and is based on the precipitation of the casein in the presence of formaldehyde and acetic acid (see this J., 1906, 395). Two grms. of the cheese are rubbed down with 10 c.c. of hot water, a further 50 c.c. of water being added gradually. In the case of hard cheese, slightly ammoniacal water is used. The liquid obtained, is boiled for five minutes, 0·5 c.c. of 40 per cent. formaldehyde solution are added, and the heating continued for three minutes. After the addition of five drops of acetic acid, the precipitated proteids are collected on a weighed filter, extracted with acetone to remove fat, then dried at a temperature of 75°—80° C., and weighed. The method is particularly suitable for following the changes which take place during the ripening of the cheese, as will be seen from the following results obtained by the examination of a Roquefort cheese:—

Freshly-made cheese		19·48	per cent. of casein.
The same cheese, 8 days old		18·12	,, ,,
,, ,, 15	,, ,,	11·65	,, ,,
,, ,, 30	,, ,,	8·00	,, ,,
,, ,, 60	,, ,,	7·10	,, ,,

The products of the digestion of casein are not rendered insoluble by formaldehyde, as is proved by experiments on casein itself, and also on various samples of peptone and albumose.—W. P. S.

Morphine; Colorimetric determination of ——. L. Georges and Gascard. J. Pharm. Chim., 1906, **23**, 513—515.

The method depends on measuring the colour produced by iodic acid in solutions of morphine, either alone, or in the presence of a slight excess of ammonia. For purposes of comparison a standard solution containing 1·256 grms. of morphine hydrochloride is prepared; each c.c. of this contains 0·001 grm. of mono-hydrated morphine. A known volume of the neutral solution of morphine of unknown strength is treated with 5 c.c. of 5 per cent. solution of iodic acid, and is matched in the usual manner, with the colorimeter, against the standard morphine solution treated in a similar manner. The tint developed by iodic acid alone reaches its maximum in about 30 seconds; after about 15 minutes it begins to diminish. The colour produced by iodic acid and ammonia is not fully developed for two or three minutes. The method is useful as confirmatory of gravimetric results.—J. O. B.

Cantharidin; Determination of —— in cantharides. K. Siegfried. Schweiz. Woch. Chem. Pharm., 1906, 44, 342—345.

Fifteen grms. of the powdered drug are covered with 150 grms. of chloroform, 1 c.c. of hydrochloric acid is added, and the mixture is thoroughly agitated for several minutes; it is then set aside for 24 hours with occasional agitation. One hundred grms. of the chloroformic extract are then filtered into another flask, and the solvent is removed by distillation at the lowest possible temperature, the flask being well immersed in the water-bath. The residual cantharidin is then washed, and transferred to a small tared filter by means of 10 c.c. of light petroleum spirit, any adherent crystals being removed with a little more of the solvent. The filter and contents are finally dried to constant weight at 50° C. The yield of cantharidin should be at least 0·8 per cent.—J. O. B.

Moisture; New method of determining ——, with special application to moisture in cordite and other substances containing volatile matters other than water. P. V. Dupré. Analyst, 1906, 31, 213—218.

Water is estimated by measuring the amount of acetylene given off when it is allowed to act on calcium carbide. From 1 to 2·5 grms. of cordite, ground as for analysis, is weighed out in a tube of about 1 cm. diameter and about 12 cm. long. It is covered with a layer of sand, and calcium carbide filled in to a depth of about 5 cm., the sand being used to prevent the cordite from coming into contact with the calcium carbide. The tube is then connected with a nitrometer containing a saturated solution of common salt, and the apparatus adjusted to zero with the tube brought to a known temperature by immersion in cold water. It is next immersed in a water-bath at a temperature of 100° C. to a depth of 7—8 cm., and the heating continued until no further evolution of gas is observed. The tube is then brought back to its original temperature, and the volume of acetylene measured, and corrected for temperature and pressure. Owing to the fact that the lime which is formed retains a certain amount of moisture at 100° C., it was found that 1 c.c. of acetylene corresponds to 0·001725 grm. of water instead of 0·00162 grm. as given by calculation.—B. J. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES

(*Continued from page* 717.)

Cholesterol. A. Windaus. Ber., 1906, 39, 2249—2262.

Mauthner and Suida (Monatsh. Chem., 1896, 579) described three neutral products, *viz.*, α-hydroxycholestenol, hydroxycholestenone, and hydroxycholestendiol, obtained by oxidising cholesterol with chromic acid. The first of these, $C_{27}H_{42}O_2$, is probably an unsaturated secondary alcohol, whilst hydroxycholestenone, $C_{27}H_{40}O_2$, is the corresponding ketone, and hydroxycholestendiol, $C_{27}H_{42}O_3$, probably a saturated compound containing 1 mol. of water more than hydroxycholestenone. In the author's experiments 20 grms. of cholesterol were oxidised by means of chromic acid in acetic acid, and the products separated into neutral and acid compounds. The former, about 70 per cent., were purified, and finally yielded 5 to 6 grms. of pure hydroxycholestenone. The acid products, on treatment with acetone, yielded from 3 to 4 per cent. (calculated on the cholesterol) of an acid melting at 290° C., and having the formula, $C_{27}H_{44}O_4$. An acid with the same composition and properties has been obtained from cholesterol by Diels and Abderhalden (Ber., 1903, 3177; 1904, 3092).

Hydroxycholestenone.—The fact that an ethyl ester can be formed, indicates the presence of a hydroxyl group, but as the hydroxyl was not replaced by hydrogen when the compound was heated in a tube with zinc dust, it was not, according to Semmler, a tertiary hydroxyl group. A quantitative conversion of hydroxycholestenone into cholestandione was effected by boiling it for four hours under a reflux condenser with dilute acetic acid and zinc dust. From this the author concludes that since the double bond is so readily reduced, it must stand in the α, β-position with regard to at least one of the ketonic groups. The close relationship between hydroxycholestenone and cholestandione is also shown by the fact that both yield the same dibromide, melting at about 165° C.

Action of hydrazine on cholestandione.—About 70 per cent. of six-sided plates melting at about 188° C. and having the formula, $C_{27}H_{42}N_2$, were obtained. Here 1 mol. of the diketone reacted with 1 mol. of hydrazine, with the liberation of 1 mol. of water. This reaction is usually regarded as characteristic of β- and γ-diketones (in one isolated instance it has been observed with an α-diketone); and since cholestandione is not an α- or β-diketone, there remains only the 1 : 4 position for the two ketonic groups.

Action of hydrazine on hydroxycholestenone.—There was formed only a monohydrazone, $C_{27}H_{42}ON_2$, melting, after recrystallisation, at 160°—161° C.

Other derivatives of hydroxycholestenone.—When fused with *o*-phenylenediamine, and the product crystallised from hot ethyl acetate, hydroxycholestenone yielded a compound, $C_{33}H_{46}ON_2$, melting at 158°—159° C. This substance, which was readily soluble in chloroform, ether, and benzene, but only slightly soluble in alcohol and ethyl acetate, contained one more molecule of water than a quinoxaline derivative. It yielded an acetyl derivative melting at 148° C., and dissolved in concentrated sulphuric acid or alcoholic hydrochloric acid to form solutions of a beautiful purple colour. Compounds of hydroxycholestenone with acetic anhydride and sulphuric acid, and with aniline and sulphuric acid, are also described.—C. A. M.

Trade Report.

Government Laboratory; Report of the ——.

The report of the Government Laboratory shows that during the twelve months ended March 31, 1906, 2054 samples of "drugs, medicinal and toilet preparations," 1506 samples of "flavouring essences, essential oils, and perfumery," and 1112 samples of chemicals were tested at the Government Laboratory for liability to spirit duty. 320 samples of mineral acids, chemicals, drugs, vinegar, and the like were tested for the presence of arsenic.

The export of medicinal tinctures, flavouring essences, and perfumes under the special drawback regulations continues to increase. In the course of the twelve months under review 14,269 samples, representing 143,255 galls. of proof spirit, were tested, and there were few occasions for complaint with respect to inaccuracies in the traders' declarations. The total quantity of methylated spirit made shows a marked increase, amounting to over 3,821,000 galls., as against about 3,666,000 in each of the three previous years. Of this amount, 2,139,000 galls. represent the ordinary unmineralised or manufacturing spirit, and 1,688,000 galls. the mineralised methylated spirit chiefly sold by retail to the general public. The increase has been wholly in the mineralised spirit, which shows an excess of 177,195 galls., or more than 11 per cent., over the quantity made in the year ended March 31, 1905. The unmineralised or manufacturing spirit shows a slight decrease, being 23,108 galls. less than in the year ended March 31, 1905. This does not imply any lessened use of alcohol in manufacturing operations. During the year a considerable quantity of unmineralised methylated spirit has been replaced by alcohol denatured otherwise than with wood naphtha, and there has also been further use of more efficient recovery apparatus.

Seventy-four samples of special "petroleum ether," representing 2391 galls., for addition to the methylated spirit used in certain manufacturing operations, were also examined, and all were approved. The use of specially denatured alcohol for manufacturing purposes has been sanctioned in several additional cases, and the quantity of spirit of this kind used in manufacturing operations has increased during the year to 351,615 proof galls., as compared with 267,706 proof galls. last year, and 206,452 proof galls. in the year ended March 31, 1904. The total quantity of denatured alcohol of all kinds used for industrial purposes last year shows an increase of 207,000 galls. over 1905, and 262,000 galls. over 1904. A large number of samples of spirits recovered in various manufacturing operations, and of various special denaturing agents—camphor, toluene, animal oil, &c.—have been examined. No illegal use of methylated spirit has been detected at any manufacturing premises where its use has been sanctioned. In the great majority of the sheep dips examined, the chemical constituents have been found to be substantially what they had been stated to be. The total number of analyses and examinations made for the Revenue and other departments of the State was 106,799

SPAIN; NEW CUSTOMS TARIFF OF ——. [Cd. 3066]. Price 5½*d*.

This is a translation of the new Spanish Customs tariff which came into force on the 1st July, with comparison of the duties leviable under the tariff which was in force prior to that date. The new tariff rates quoted in this Return are the minimum rates, these being applicable to the merchandise of the United Kingdom, which is entitled to most-favoured-nation treatment. Special attention is directed to Schedule III. in the Return, containing particulars of the *entrepôt* surtaxes leviable on products of extra-European origin transhipped in a European port; also to Appendix I., containing explanatory notes relating to various items of the tariff; and to Appendix II., containing the provisions of the new tariff relating to the dutiable weight of merchandise and the Customs treatment of packings and coverings.

Chemicals; United States Census of ——. Oil, Paint, and Drug Rep., July 9, 1906.

THE Director of the Census has announced the result of the tabulation of the statistics of chemicals, including wood distillation products and sulphuric, nitric, and mixed acids, for the calendar year ending December 31, 1904, forming a part of the census of manufactures of 1906. The statistics indicate that there has been a substantial increase in this industry in the United States, as compared with the statistics of 1900, which covered the fiscal year ending May 31. The products cover only the chemicals manufactured and sold as such. They do not include products which are made and consumed in the establishment where produced.

Comparative figures for 1905 and 1900 are shown in the following summary:—

		1905.	1900.
Number of establishments		448	459
Capital	dols.	119,890,193	89,091,430
Salaried officials, clerks, &c.—			
Number		3,387	2,123
Salaries	dols.	4,901,523	2,923,038
Wage-earners—			
Average number		24,523	19,054
Wages	dols.	13,253,692	9,401,467
Miscellaneous expenses	dols.	8,937,242	4,363,868
Materials used, cost	dols.	51,883,219	34,564,137
Products, total	dols.	*92,088,378	63,676,730
Oleum	tons	13,268	‡
Value	dols.	361,018	—
Sulphuric acid, 66° B.	*tons	325,382	373,410
Value	dols.	4,757,046	5,895,886
Sulphuric acid, 60° B.	*tons	30,658	16,629
Value	dols.	375,883	239,836
Sulphuric acid, 50° B.	*tons	216,015	97,858
Value	dols.	1,741,814	487,893
Nitric acid	*lb.	41,254,419	28,704,789
Value	dols.	2,026,893	1,404,743
Mixed acid	*lb.	57,756,350	42,368,819
Value	dols.	1,707,385	1,112,158
Tartaric acid	lb.	2,684,000	2,677,604
Value	dols.	680,280	781,503
Acetic acid	lb.	27,001,322	24,945,558
Value	dols.	537,542	396,323
Soda ash	tons	518,954	336,361
Value	dols.	8,204,545	4,766,365
Sal soda	tons	56,870	53,231
Value	dols.	792,248	779,166
Bicarbonate of soda	tons	68,867	68,185
Value	dols.	1,135,610	1,324,843
Caustic soda	tons	80,173	78,779
Value	dols.	2,924,850	2,917,955
Borax	tons	20,882	5,637
Value	dols.	2,122,808	503,480
Potashes	lb.	5,520,106	3,784,606
Value	dols.	644,768	174,476
Alums	lb.	202,106,650	152,520,259
Value	dols.	2,352,746	2,013,607
Coal tar distilling products—			
Chlorides made from coal tar	dols.	340,641	809,850
Distilling products, value	dols.	504,176	518,264
Crude wood alcohol	galls.	6,684,871	4,191,879
Value	dols.	2,101,813	1,660,041
Refined wood alcohol	galls.	4,343,346	3,088,140
Value	dols.	2,329,486	2,206,895
Acetate of lime	tons	53,571	43,413
Value	dols.	1,474,982	981,290
Charcoal	bus.	25,869,055	17,154,302
Value	dols.	1,197,973	726,672
All other wood distillates	dols.	364,329	9,584
Hypochlorites and other bleaching agents, value	dols.	752,275	492,086
Calcium carbide	†lb.	31,642,000	—
Value	dols.	1,088,420	—
Carbon disulphide	†lb.	1,447,565	—
Value	dols.	57,071	—
Phosphorus	†lb.	709,618	—
Value	dols.	204,441	—
Sodium	†lb.	1,320,000	—
Value	dols.	170,000	—
All other electro-chemical products, value	dols.	4,626,347	—
Pyroxylin plastics, value	dols.	2,857,093	1,970,337
All other plastics, value	dols.	1,898,668	129,013
Anhydrous ammonia, value	dols.	1,173,184	443,157
Carbon dioxide, value	dols.	1,343,966	606,164
All other compressed and liquefied gases, value	dols.	274,209	70,690
Alkaloids	oz.	4,949,525	3,257,532
Value	dols.	2,925,789	1,745,264
Gold salts	oz.	59,969	8,594
Value	dols.	449,864	90,145
Silver salts	oz.	1,743,882	1,252,604
Value	dols.	683,761	499,245
Platinum salts	oz.	19,068	7,212
Value	dols.	175,682	54,600
Chloroform	lb.	616,670	396,540
Value	dols.	165,604	98,070
Ether	lb.	871,394	363,238
Value	dols.	440,340	139,678
Acetone	lb.	1,300,395	1,638,715
Value	dols.	161,320	178,666
All other fine chemicals, value	dols.	4,162,137	1,426,373
Glycerine	lb.	18,791,997	15,383,798
Value	dols.	2,345,205	2,012,686
Cream of tartar	lb.	11,553,660	10,620,000
Value	dols.	2,263,872	2,061,500
Epsom salts	lb.	15,935,837	6,075,399
Value	dols.	145,801	45,966
Copperas	lb.	8,896,875	14,097,905
Value	dols.	28,647	58,581
Phosphate of soda	lb.	12,018,815	3,478,380
Value	dols.	248,822	104,554
Tin salts	lb.	10,676,941	4,677,471
Value	dols.	1,092,980	470,159
All other products	dols.	23,808,089	18,836,488

* Exclusive of chemical products valued in 1905 at $2,747,434, made in establishments engaged primarily in the manufacture of other products. The principal items covered by this amount were sulphuric acid, 50° B., 21,903 tons, valued at $194,478; nitro acid, 5,009,662 lb., valued at $224,046; crude wood alcohol, 129,357 galls., valued at $40,148; refined wood alcohol, 1,459,807 galls., valued at $808,639; acetate of lime, 5,242,696 lb., valued at $52,751; charcoal, 6,045,157 bushels, valued at $290,192; coal tar distilling products, valued at $288,645, and soda products, valued at $247,800.

† The total value, $1,905,368, only was reported for this group in 1900 under the heading "Electro-Chemical Products."

‡ Not separately reported in 1900.

New Book.

ANNUAL REPORT OF H.M. INSPECTOR OF EXPLOSIVES. Home Office. [Cd. 3044.] Price 2s. 2d.

THIS publication deals with the manufacture, storage, packing, conveyance, importation, and Government inspection of explosives. Details are given of the accidents by fire or explosion of which the Home Office had cognisance during 1904. These show a total of 341, causing 50 deaths, and injuring 348 people. Special chapters are devoted to petroleum and to carbide of calcium and acetylene.

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XVI.	Sugar, Starch, Gum, &c.	[illegible]
XVII.	Brewing, Wines, Spirits, &c.	[illegible]
XVIII.	Foods; Sanitation; Water Purification and Disinfectants	[illegible]
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XXI.	Photographic Materials and Processes	[illegible]
XXII.	Explosives, Matches, &c.	[illegible]
XXIII.	Analytical Chemistry	[illegible]
XXIV.	Scientific and Technical Notes	[illegible]

Patent Specifications may be obtained by post by remitting as follows :—

English.—9d. each to the Comptroller of the Patent Office, C. H. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 55, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

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DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 580 pages, was published in 1898; a few copies of this are still left, price 25s. A second volume, embracing the period 1896—1905, is in course of preparation, and will be ready for printing in [illegible] section both a subject matter and authors' [illegible] each will be a volume of about 900 pages, [illegible] the Journal. As the success of [illegible]

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Zimmele, Harry B., 200, Bellfield Avenue, Pittsburg, Pa., U.S.A. July 9.

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 17,253. Vandor. Process for sharpening tools by chemical means. July 31.
„ 17,362. Lorenz. Means for connecting the end of an india-rubber tube with the mouthpiece of an air pump.* Aug. 2.
„ 17,612. Aitken and Mackie. Apparatus for separating liquids from vapours. Aug. 4.
„ 17,813. Breh and Kahnert. Washing process and apparatus.* Aug. 8.
17,832. Mackenzie and Gibson. Packings for Glover and other towers, funnels, &c., used in processes for concentrating liquids and absorbing gases.* Aug. 8.
17,999. Meyer and Hastert. Apparatus for cooling and purifying gases. Aug. 10.
18,003. Ingram. Hydraulic separators particularly for precious stones and metals. Aug. 10.
18,014. Meyer and Hastert. Apparatus for cooling gases. Aug. 10.
18,029. Adams. Apparatus for the discharge of liquids. Aug. 11.
] 11,206 (1905). Johnson (Feld). Apparatus for subjecting gases or vapours to the action of liquids. Aug. 9.
16,035 (1905). Hargreaves. Heating and evaporating solutions and apparatus therefor. Aug. 9.
19,212 (1905). Fitz-Patrick, Lord Armstrong. Manufacture of briquettes. Aug. 15.
1804 (1906). Haigh, Wheeler, and Appleyard. Means for rendering certain substances non-conductive of electricity, waterproof and acid-proof. Aug. 15.
4079 (1906). James. Receptacle or container for viscous, semi-fluid, or like substances. Aug. 15.
4818 (1906). Claus. Expansion and closing apparatus for casks employed for pasteurising or like purposes. Aug. 15.
5348 (1906). Soddy. Means or apparatus for use in heating matter in high vacua to high temperatures in glass vessels. Aug. 9.
6363 (1906). Ekenberg. Filter-presses. Aug. 15.
7421 (1906). Mazza. Apparatus for separating the constituent elements of gaseous mixtures. Aug. 9.
8053 (1906). James. Receptacles or containers for semi-fluid or other like substances. Aug. 15.
13,358 (1906). Meek. Boxes or vessels for holding viscous fluids. Aug. 15.

II.—FUEL, GAS, AND LIGHT.

17,176. Dunn and Berriman. Liquid for controlling the evolution of gas from calcium carbide. July 30.
[A.] 17,194. Potter. Regenerative gas producers for water and other gases. July 31.
„ 17,214. Thompson. Gas producing plants for water and other gases. July 31.
„ 17,294. Lynde. Apparatus and appliances for producing gas from petrol and other hydrocarbons for lighting, heating, &c. Aug. 1.
„ 17,296. Hipkins and Pendlebury. Construction of gas producers and method of working them. Aug. 1.
„ 17,322. Woods. Manufacture of incandescent mantles. Aug. 1.
„ 17,347. Parker. Production of fuel. Aug. 1.
„ 17,622. Hooton, and The Ashton Gas Co. Producing or enriching gas for lighting or heating. Aug. 4.
„ 17,766. Sensenschmidt. Apparatus for burning off incandescing bodies. [Ger. Appl., Aug. 7, 1905.]* Aug. 7.
„ 17,910. Lemon and Freel. Apparatus for the generation and purification of acetylene gas.* Aug. 9.
„ 17,996. Wise (Solvay und Co.). Coke ovens.* Aug. 10.
„ 18,081. Becker and Greener. Gas producers. Aug. 11.
[C.S.] 16,226 (1905). Robeson and Bettington. Furnaces for burning pulverulent fuel and for treating pulverulent ores. Aug. 15.
„ 21,644 (1905). Thompson (Englo and Cahill). Artificial fuel and method of making it. Aug. 15.
„ 24,433 (1905). Marconnet. Gas generators or apparatus producing combustible gases. Aug. 9.
„ 968 (1906). Wielandt, and Torfkoks Ges. Method of and apparatus for producing coke from fuel containing a large proportion of water, such as peat and lignite. Aug. 9.
„ 2244 (1906). Justice (Phönix Elektrotechnische Ges.). Production of electric arc light and apparatus therefor. Aug. 9.
„ 3145 (1906). Streubel. Incandescent mantles. Aug. 9.
„ 8030 (1906). Rothberg. Coke ovens. Aug. 9.
„ 9800 (1906). Becigneul. *See under* VII.
„ 9988 (1906). Fairweather (G. Seyfarth und Sohn). Gas producers. Aug. 9.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 17,162. Kalle und Co., A.-G. Manufacture of red colouring matter. [Ger. Appl., Nov. 13, 1905.]* July 30.
„ 17,164. Johnson (Kalle und Co., A.-G.). Manufacture and production of reduction products of ortho-nitro-phenylglycollic acid and of isatine. July 30.
„ 17,558. Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of colouring matters containing sulphur. Aug. 3.
„ 17,559. Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of compounds containing sulphur. Aug. 3.
„ 17,611. Read Holliday and Sons, Turner, and Dean. Direct blue cotton dyestuffs. Aug. 4.
„ 17,743. Newton (F. Bayer und Co.). Manufacture and production of new azo colouring matters. Aug. 7.
[C.S.] 2622 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of yellow azo dyestuffs. Aug. 15.
„ 7287A (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of certain naphthalene derivatives. Aug. 9.
„ 14,057 (1906). Kalle und Co., A.-G. Manufacture of a sulphur containing red colouring matter from thio-indoxylcarboxylic acid and from thio-indoxyl. Aug. 9.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 17,163. Kalle und Co., A.-G. Dyeing and printing red on textile fibre. [Ger. Appl., Nov. 13, 1905.]* July 30.

[A.] 17,239. Remington. Process for strengthening felts and woollen fabrics.* July 31.
,, 17,487. Giehler. Process for the production of transparent patterns on tissues.* Aug. 3.
,, 17,660. Schmidt and Handschin. Dyeing apparatus.* Aug. 4.
,, 17,772. Vaysse. Composition for removing the grease from wool and stains from linen and fabric. Aug. 7.
[C.S.] 16,902 (1905). Brossard. Apparatus for dyeing, cleaning, washing, &c. Aug. 9.
,, 2830 (1906). Simon and Weckerlin. Process of and apparatus for steaming fibres and fabrics. Aug. 15.
,, 7520 (1906). Vereinigte Kunstseidefabriken, A.-G. Process or method for the manufacture of artificial hemp-bast and the like. Aug. 9.
,, 14,087 (1906). Vittenet. *See under* XIX.
,, 16,078 (1906). Thiele. *See under* XIX.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

[A.] 17,554. Cowper-Coles. Process for ornamenting metallic surfaces. Aug. 3.
,, 17,643. Gardner. Printing on tin-plate to obtain dead or dull impressions. Aug. 4.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 17,175. Ogle. Decomposition of metallic sulphates. July 30.
,, 17,461. Morton, and United Alkali Co., Ltd. Furnaces for burning pyrites, &c. Aug 2.
,, 17,559. Johnson (Badische Anilin und Soda Fabrik). *See under* IV.
,, 17,864. Bambridge. Production of sulphurous anhydride. Aug. 9.
,, 17,865. Bambridge. Production of sulphur. Aug. 9.
,, 17,905 Read. *See under* XIIIA.
[C.S.] 24,226 (1905). Bacon. Manufacture of crystallised sodium monosilicate. Aug. 9.
,, 24,330 (1905). Jaubert. Preparation of oxygen by decomposition of oxygenated salts. Aug. 15.
,, 24,849 (1905). Harris. Apparatus for the generation of ozone. Aug 15.
,, 26,380 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of stable dry hydrosulphites. Aug. 9.
,, 9800 (1906). Becigneul. Treatment of spent gas purifying materials for the extraction of sulphur and apparatus therefor. Aug. 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 17,520. Boult. (Marsden). Manufacture of building material.* Aug. 3.
,, 17,534. Wolman. Solutions for preserving wood and other fibrous material.* Aug. 3.
,, 17,569. Apperley and Hullinghorst. Manufacture of artificial stones and other plastic articles.* Aug. 3.
,, 17,646. Ford. Manufacture of artificial stone or sand-lime bricks. Aug. 4.
,, 17,748. Ohlsson. Impregnating wood, &c., in closed vessels. [Swedish Appl., Aug. 7, 1905.]* Aug. 7.
,, 17,761. Kelly. Composition for making or surfacing roads, paths and floors.* Aug. 7.
[C.S.] 19,180 (1905). Peters. Manufacture of Portland cement. Aug. 15.
,, 22,787 (1905). Watson. Manufacture of bricks from clinker and lime. Aug. 15.
,, 26,993 (1905). Hoettger. Preservation of wood. Aug. 15.

X.—METALLURGY.

[A.] 17,131. Moore and Heskett. Direct process of manufacturing iron and steel.* July 30.
,, 17,242. Massenez and Richards. Manufacture of steel. July 31.
,, 17,441. Ellis (Les Produits Chimiques de Croissy). Extraction of copper and other metals from pyrites.* Aug. 2.
[A.] 17,587. Jarvis. Manufacture of steel. Aug. 4.
,, 17,592. Ciantar. Extracting gold from sea-water. Aug. 4.
,, 17,615. Roechling and Rodenhausen. Means for obtaining thin liquid dross in electric furnaces for metallurgical purposes. Aug. 4.
,, 17,672. Cowper-Coles. Process for removal of scale and oxide from metallic surfaces. Aug. 7.
,, 17,758. Centralstelle für Wissenschaftlich-Technische Untersuchungen Ges. Manufacture of brass. [Ger. Appl., Aug. 21, 1905.]* Aug. 7.
,, 17,913. Harden, and Amalgahne, Ltd. Jointing of aluminium and flux therefor. Aug. 9.
,, 17,915. Smith, Harden, and Amalgahne, Ltd. Jointing of sheet lead, tin, zinc, &c., and flux therefor. Aug. 9.
,, 17,932. Marks. (Soc. Anon. G. Ansaldo Armstrong and Co.) Process for manufacturing armour plates and other steel objects or objects made from alloys of steel.* Aug. 9.
,, 17,933. Marks. (Soc. Anon. G. Ansaldo Armstrong and Co.) Process for manufacturing armour plates and other objects made of steel or alloys of steel.* Aug. 9.
,, 17,935. Marks (Soc. Anon. G. Ansaldo Armstrong and Co.). Manufacture of armour plates and other steel objects.* Aug. 9.
[C.S.] 16,226 (1905). Robeson and Bettington. *See under* II
,, 15,423 (1905). Churchward. Hardening and toughening of iron and steel. Aug. 9.
,, 16,374 (1905). Kingsley. Treatment of sulphide and other ores. Aug. 9.
,, 17,310 (1905). Hobson. Selective solvents for silver. Aug 15.
,, 2988 (1906). Newton (Westman Process Co.). Process for reducing iron ore. Aug. 15.
,, 6426 (1906). Hadfield. Treatment of magnetic materials. Aug. 9.
,, 13,186 (1906). Birmingham. Alloys. Aug. 15.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 17,617. Cowper-Coles. Process for the rapid production of electrotypes. Aug. 4.
,, 17,768. Bridge. Electrically treating air and other gases.* Aug. 7.
,, 17,981. Wetter (Schuckert und Co.). Apparatus for the electrolytic production and separate collection of gases. Aug 10.
,, 18,079. Bradley and Sahs-Schwabe. Electro-deposition of metals or alloys upon metallic and other surfaces. Aug. 11.
,, 18,080. Ramen. Method of precipitating metals electrolytically.* Aug. 11.
[C.S.] 14,995 (1905). Johnson (Badische Anilin und Soda Fabrik). Means for the production of long stable electric arcs. Aug. 15.
,, 1926 (1906). Edison. Process of making metallic films or flakes for use with active materials in alkaline storage batteries. Aug. 15.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 17,154. Imbert. Process for producing oxy-fatty acids.* July 30.
,, 17,656. Breda. Process for extracting fats.
[C.S.] 16,132 (1905). Spies. Candles. Aug 15.
,, 22,242 (1905). Haddan (Edson Reduction Machinery Co.). Process for converting into a marketable product vegetable or animal matter from which oily or greasy matter has been extracted. Aug. 9.
,, 25,204 (1905). Kessler Soaps, ointments, and the like. Aug. 15.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS; PAINTS.

[A.] 17,772. Vaysse. Composition for removing or renovating paint and varnish. Aug. 7.
,, 17,904. Read. Manufacture of barium sulphate or permanent white. Aug. 9.

[A.] 17,905. Read. Treatment of minerals or compounds of the alkaline-earth metals for the recovery of useful products. Aug. 9.

(*B.*)—RESINS, VARNISHES.

[A.] 17,245. Castle. Manufacture of floorcloths, linoleums, patent leathers, feltings, body belts, &c. July 31.

(*C.*)—INDIA-RUBBER.

[A.] 17,773. Rouxeville. Process for the manufacture of a substance having somewhat similar properties to gutta-percha, obtained by the transformation of a certain hydrocarbon. [French Appl., Aug. 7, 1905.]* Aug. 7

„ 17,775. Foelsing. Process for production of pure caoutchouc * Aug 7.

[C.S.] 3116 (1906). Hood. Method of and machine for purifying crude or reclaimed rubber, but applicable as well to gutta-percha and similar materials Aug. 15.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 17,129. Inrig. Treatment of waste leather, raw hides or skins, hoofs, horns, and bones. July 30.

„ 17,295. Forbes. Mineral substitute for glue and process for making same. Aug. 1.

„ 17,772. Vaysse. Composition for removing fat from leathers and skins. Aug. 7.

„ 18,002. Osborne and Schupp Process of converting catechin into catechutannic acid. [Ger. Appl., Aug. 14, 1905.]* Aug 10.

[C.S.] 1787 (1906) Bryan. Process for hardening leather. Aug. 9.

XV.—MANURES, &c.

[A.] 17,512 Neech. Discharging apparatus for superphosphate pits. Aug 3.

„ 17,878. Macdonald. Process for making manures very dry and acid-free without mechanical heat. Aug. 9.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 17,665. Hill and Hill. Brewing of fermented liquors.* Aug. 4.

„ 17,909. Ozonair, Ltd., and Rogerson. Brewing beer or other liquors. Aug. 9.

„ 18,045 Van Rijn. Continuous fermentation of liquids.* Aug. 11.

[C.S.] 22,709 (1905). Classen. Process for facilitating the fermentation of sugar solutions obtained from wood that contains tannin. Aug. 15.

„ 2584 (1906). Felix. Process of manufacturing malt preparations. Aug. 15.

„ 8601 (1906). Varga and Kölgyesi. Device for conducting the gases of fermentation from barrels into the open air. Aug. 9.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS

[A.] 17,116. Williams. Preparation of proteids from ground nuts.* July 30.

„ 17,649. Galbraith and Ross. Table waters. Aug. 4.

„ 17,825. Deutschmann. Method of obtaining animal serum.* Aug. 8.

[C.S.] 15,597 (1905). Zündel-Donati. Process for drying foodstuffs of vegetable origin. Aug. 9.

„ 19,521 (1905). Holgate and Jessop. Process of treating milk to produce artificial human milk. Aug. 15.

„ 22,640 (1905). Hunter. Preservation (*in vacuo*) of cooked meats or other edibles in glass or other receptacles. Aug. 15.

„ 26,794 (1905). Clarke. Manufacture of an alimentary product. Aug. 15.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 17,267. Bridge. Purifying and sterilising water by ozonised air and apparatus therefor.* July 31.

[A.] 17,342. Felters, and Guilleaume-Lahmeyer-werke A.-G. Electrical sterilising apparatus. [Ger Appl., Aug. 1, 1905.]* Aug. 1.

„ 17,757. O'Brien. Earth closets and deodoriser and disinfectant for use therein.* Aug. 7.

„ 17,948. Ellis and Slade. Process for forming and filling bacteria beds and tanks for purification of sewage, &c. Aug. 10.

„ 17,997. Evans-Jackson (Oesterreichischer Verein für Cellulose fabrikation). Process and apparatus for purifying the water used in factories. Aug. 10.

[C.S.] 16,177A (1905). Clark (American Water Purifying Co.). Method and apparatus for purifying water by distillation. Aug. 9.

„ 10,206 (1906). Decloreq. Water purifying apparatus. Aug. 15.

(*C.*)—DISINFECTANTS.

[C.S.] 18,839 (1905). Power. Solid deodorisers or disinfectants. Aug. 9.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 17,701. Liddle (Roonitz Exploiting Co.). Apparatus for making cellulose vessels or receptacles.* Aug 7.

„ 17,777. Linfoot. Manifold paper and process of producing it Aug 7

„ 18,030. Schloesser and Schloesser. Steaming paper and the like. Aug. 11.

[C.S.] 8960 (1905). Mather. Manufacture of cellulose from vegetable fibres. Aug 9.

„ 15,417 (1905). Lockett and Baker. Means for applying size to paper during manufacture. Aug. 9.

„ 19,330 (1905). Miles. Cellulose derivatives and process of making them. Aug 9.

„ 3211 (1906). Van den Bosch and Müller. Cellulose substitute. Aug. 9.

„ 6123 (1906). Sachsenroeder. Manufacture of parchment-paper. Aug. 15.

„ 14,087 (1906). Vittenet. Apparatus for manufacture of artificial silk. Aug. 9.

„ 16,078 (1906). Thiele. Apparatus for manufacture of artificial silk. Aug. 15.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 17,167. Imray (Basle Chem. Works). Manufacture of carbamic acid esters of the pyrogallol-1-3-dialkyl-ethers.* July 30.

„ 17,169. Busch. Process of manufacturing new compounds of albuminoids or proteids with bismuth iodide or mercuric iodide. July 30.

„ 17,324. Gretsch and Henning. Stopper for ethyl chloride and other volatile fluids. Aug. 1.

„ 17,573. Goldsmith, and British Xylonite Co., Ltd. Manufacture of camphor. Aug. 3.

„ 18,065. Goldsmith, and British Xylonite Co., Ltd. Manufacture of camphene. Aug. 11.

[C.S.] 3222 (1906). Imray (Farbwerke vorm. Meister, Lucius, und Brüning). Manufacture of formaldehyde sulphoxylates. Aug. 9.

„ 16,429 (1906). Badische Anilin und Soda Fabrik. Manufacture of camphene. Aug. 15.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 17,955. Herbert. Photographic films. Aug. 10.

[C.S.] 16,104 (1905). Davidson. Colour photography. Aug. 15.

„ 2057 (1906). Hoffsümmer. Process for making photographic papers. Aug. 9.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 17,414. Reschke. Manufacture of safety explosives.* Aug. 2.

„ 17,891. Westfälisch-Anhaltische Sprengstoff, A.-G. Nitroglycerine explosives. [Ger. Appl., Oct. 21, 1905.]* Aug. 9.

[C.S.] 5259 (1906). Bichel. Explosives. Aug. 9.

Official Notices.

JUBILEE OF THE COAL-TAR COLOUR INDUSTRY.

Presentations to Sir William Perkin.

The meeting in connection with the international celebration of the 50th anniversary of the discovery by William Henry Perkin of the dyestuff "mauve," took place on July 26th at the Royal Institution in London, and was largely attended, among those present being Lady Perkin, Miss Perkin, Prof. W. H. Perkin, F.R.S., Mr. A. G. Perkin, F.R.S., and Dr. F. M. Perkin. Telegrams of congratulation were received from a large number of scientific societies and distinguished chemists in different parts of the world. Prof. Meldola, F.R.S., Chairman of the International Committee, presided.

Prof. Meldola opened the proceedings by offering the hearty congratulations of the meeting to the founder of the coal-tar industry, on having lived to witness the consummation of his labours. In offering him their best congratulations they hoped that he might yet be spared for many years to continue those brilliant researches with which his name had become associated during the later period of his life. It was also a matter of congratulation that they were able to refer to the recent mark of distinction which Sir William Perkin had received from the hands of the King. No more appropriate meeting place could possibly be found anywhere in the British Islands than that hall, the classical home in which, in 1825, Michael Faraday first discovered benzene, which was there on the table before them. The meeting which was held last February at the Mansion House had three objects in view. The first was the painting of a portrait of Sir William Perkin, the second the execution of a bust, and the third the presentation of the remainder of the fund for the endowment of chemical research in the name of Sir William Perkin. Those objects had been fulfilled, and it was in the first place his pleasing duty, on behalf of the subscribers, to present the portrait which had been painted by Mr. Cope (The chairman then unveiled the portrait, which represents Sir William Perkin in his laboratory with a skein of mauve-dyed silk in his hands.) The portrait, which was ultimately to become the property of the nation, would, they sincerely hoped, remain in the possession of Sir William Perkin for many years to come. Then there was the bust by Mr. Pomeroy, of which the original would be placed in the library of the Chemical Society, where it would act, as they hoped, as a reminder of the long association of Sir William Perkin with their society, and an incentive to all original chemical workers in this country.

Prof. Dr. Emil Fischer offered to Sir William Perkin for his acceptance the Hofmann medal, which has been awarded to him by the Deutsche Chemische Gesellschaft.' Speaking in German, he said that for two decades the Deutsche Chemische Gesellschaft had been proud to have inscribed upon its list of honorary members the name of Perkin. As the present president of the Society he rejoiced to give expression to the heartfelt sympathy which was entertained for Sir William Perkin in the wide circle of German chemists, and to say how highly they prized his achievements in advancing their science, and in creating a new branch of chemical industry. It was indeed a bold undertaking half a century ago for the 18-year-old youth to develop into a manufacture a happy scientific observation of the practical value of which he had correctly gauged the true importance, and thereby to create a new and special art, the flourishing children of which should soon awaken both the surprise and the delight of all who took an interest in colour. But his fellow-workers had a still greater cause for astonishment when, after 20 years of earnest and successful technical work, Sir William Perkin had returned to pure science, and presented them with those fruitful methods which had their root in that was well known to every organic chemist as "Perkin's reaction." Sir William Perkin had also turned his attention to the little explored boundary between chemistry and physics, and given to the world a new and valuable means of assistance for the solution of the problems of chemical structure. For all those distinguished achievements in the field of organic chemistry the committee of their society had resolved to award him the highest mark of distinction in its power to offer, and he was entrusted with the duty of handing to him the Hofmann medal, which commemorated the founder of the society.

Sir William Perkin expressed his indebtedness to the German Chemical Society for the honour which had been conferred upon him. Dr. Hofmann when in London was constantly at the meetings of the Chemical Society, and when he left England he realised the want of such a society in his own country. The first volume of the Journal of the German Chemical Society was very small, but its contents were exceedingly interesting to the coal-tar colour industry, as it contained Graebe and Liebermann's paper on the synthesis of alizarine from anthracene, a colouring matter which was now manufactured in enormous quantities and had superseded the madder root, the original source of alizarine. Again, the first paper in the volume was Baeyer's paper on the reduction of indigo blue, and the continuation of these researches eventually resulted in the artificial formation of that colouring matter also, and from the insight into its nature thus obtained, indigo was now being made in very large quantities and taking the place of the naturally produced dye. He realised the kindness which Germans had always shown to him and his family. At the tercentenary celebration of the University of Würzburg, a good many years ago, he received the honorary degree of Doctor of Philosophy, and again, only this week, he had received a similar degree from the ancient University of Heidelberg, given him in connection with this jubilee celebration. He valued greatly the Hofmann medal, established in memory of the great man under whom he studied chemistry, and from whom he learnt so much, Dr. Hofmann, by his enthusiasm and force of character, stimulated his natural desire for research, and helped to establish him in a course which he had pursued for more than 50 years. He also greatly appreciated the action of the German Chemical Society in sending that medal by their president, one of Germany's greatest chemists, from whose hands he felt it an honour to receive that distinction. Before resuming his seat Sir William Perkin returned hearty thanks to all connected with that jubilee celebration for the honour which they were paying to him. He could not say how much he valued the gift of his portrait painted by so distinguished an artist as Mr. A. S. Cope, and he felt sure it would also be greatly prized by his family and friends, and would add much interest to his home. They were all proud to know that it was eventually to become the property of the nation. He looked upon that portrait as a very special part which his countrymen had taken in reference to the jubilee of the coal-tar colour industry. That was by no means the first time his fellow-countrymen had conferred honours upon him. Some of the Universities and learned societies had on previous occasions done this in recognition of his scientific and technical work, but that gift was certainly the crowning one, and he thanked them all most sincerely for the kindly and generous feeling of which that portrait was the evidence.

Prof. A. Haller presented the Lavoisier medal to Sir William Perkin, together with an address from the Société Chimique de Paris. Speaking in French, he said he regretted that the president of the society was not able himself to bring these tributes of respect, but he had charged him with the agreeable mission of presenting them. The Lavoisier medal was offered in recognition of the fine work which for half a century Sir William Perkin had done both in pure and applied chemistry, and in witness of the fact that he was one of the first and most illustrious of those who had applied chemistry to industry in modern times.

Sir William Perkin, in reply, said that his chemical education was to some extent influenced by French

chemists, among whom were Prof. Cahours, Prof. St. Claire-Deville, Pasteur, Berthelot, and Prof. A. Wurtz. When mauve was first introduced the silk dyers took to it readily, but the cotton dyers and calico printers in this country did not seem at all keen about it. The French realised at once the value of the dye for general purposes, and immediately applied it to calico printing, with the result that when the patterns came into the market all the other calico printers quickly followed suit. As early as 1859 the Société Industrielle de Mulhouse awarded him a silver, and later in the year a gold, medal. This recognition of the importance of mauve was a great encouragement to him, and he had always greatly prized those two medals. He was proud to add to them the beautiful Lavoisier medal, and felt doubly honoured by receiving it from the hands of so illustrious a chemist as Prof. Haller.

Dr. LEO BAEKELAND presented a congratulatory address from American chemists, Prof. Dr. PAUL FRIEDLANDER one on behalf of the scientific and technical chemists of Austria, Prof. P. VAN ROMBURGH one from the chemists of Holland, and Prof. Dr. H. RUPE one from the chemists of Switzerland.

Prof. Dr. C. DUISBERG and Prof. Dr. MAX DELBRÜCK presented a congratulatory address from the Verein Deutscher Chemiker. Dr. Duisberg said that, as manager of one of the largest German colour works, he was personally pleased to present the good wishes of the "Verein," seeing that he and his German colleagues were now the gardeners in the large and extensive garden laid out by William Henry Perkin, 50 years ago, and as it was their lot to assist in cultivating the young plant planted by him when he invented the first aniline dye, mauve: and furthermore because they in Germany were now gathering the fruits from the large orchard, full of strong and mighty trees, which had grown up to full maturity within the past five decades from the then small and delicate plant. As heirs to the experiments made by Sir William Perkin in the year 1856, they regarded it as their sacred duty to be present in the English metropolis, most cordially to shake the hand of the esteemed and honoured forerunner in that particular scientific and technical branch, and to express to him their heartiest thanks for his great fundamental achievement. He presented a copy bound in mauve-dyed leather of a "lecture" delivered last June at the general meeting of the Verein held in Nuremberg by the distinguished *doyen* of German scientific chemistry, Adolf von Baeyer, "On Aniline Dyestuffs." After referring to the important work of W. H. Perkins' fellow-countryman, W. Noel Hartley, in measuring the absorption of the ultra-violet light in the case of numerous chemical compounds, and the valuable deductions made as regards the absorption phenomena of organic compounds, especially dyestuffs, and their bearing upon constitution in connection with the development of colour, Adolf von Baeyer concluded his lecture with these words. "The key to the knowledge of the nature of aniline colours lies in the basic properties of the carbon atom. The aniline colours which delight the eye have thus attained much more importance to science. Their rays are the torch which enlightens the path of the explorer in the dark regions of the interior of the molecule, and the man who has lit the torch is William Henry Perkin." Prof. Duisberg added that about 3500 German chemists, the members of their Verein, were present that day in spirit celebrating with them that unique festival. They sincerely wished the whole coal-tar colour industry, and especially the English organic chemical industry, prosperity and success.

Prof. HALLER then presented, on behalf of the Société Industrielle de Mulhouse, a medal and an address, stating, at the same time, that the Society had elected Sir William Perkin an honorary corresponding member.

Sir WILLIAM PERKIN, in thanking Prof. Haller, said that the first medal he had received was from the same Society.

Dr. CARO, on behalf of the Society of German Chemical Manufacturers, Prof. Gustav Schultz, on behalf of the Munich Chemical Society, Lord KELVIN, on behalf of the Royal Society, and Prof. MELDOLA, on behalf of the Chemical Society of London, also presented addresses of congratulation.

Sir WILLIAM PERKIN replied to each, and in reference to the address of the Chemical Society of London, said that the proposal of placing his bust, executed by the eminent sculptor, Mr. F. W. Pomeroy, in the rooms of the Chemical Society, was an honour which touched him deeply, as he had always taken keen interest in that Society, of which he had been a Fellow for 50 years. For 17 years he was Secretary and for two years President. It was to that Society that he had contributed nearly all his own researches, and he looked upon it as a kind of scientific home.

Dr. E. DIVERS, in presenting the address from the Society of Chemical Industry, said that the President, Mr. Eustace Carey, of Liverpool, who was, to his profound regret, unavoidably absent, had asked him, as being his immediate predecessor in office, to present to Sir William Perkin the address from that Society. Dr. Divers then referred to the fact that Sir William Perkin and himself, who were of the same age, had been boys together at the same school, the City of London School, where they had been each inspired with the desire to become a chemist by their master, Thomas Hall, a pupil of A. W. Hofmann. They had both been examined in chemistry by the late Sir Frederick Abel, and later on sent to the Royal College of Chemistry to study under Hofmann, Hall having, in both cases, persuaded their parents to let them follow their bent and devote themselves to chemistry. One difference between them had been that, in the City of London School, Sir William Perkin was already Hall's assistant behind the lecture table, when he himself, a year junior in school rank, was but one of the juvenile audience. Another difference was that his own stay in the Royal College of Chemistry was during the session when Hofmann gave his last course (1851—2) in the lecture hall of the College in Oxford Street, whereas Sir William Perkin attended a year later Hofmann's lectures at the Royal School of Mines in Jermyn Street, with which the College of Chemistry had just been incorporated. Thus it was that they lost sight of one another, on leaving the City of London School, until his own return from Japan. They had both been President of the Chemical Section of the British Association, and President of the Society of Chemical Industry. These facts must obviously have great significance to himself when he had at that moment the great happiness to present that address, fifty-five years after they had taken their first steps in chemistry together. The following is the text of the address:—

"SIR WILLIAM HENRY PERKIN, KT., LL.D., D.Sc., PH.D., F.R.S.

"The Society of Chemical Industry offers to you its warmest congratulations on the occasion of the Fiftieth Anniversary of that great event, momentous both in chemical science and in the industrial arts, your epoch-making discovery of the first coal-tar dyestuff.

"As a consequence of that discovery, you were left free, at an unusually early age, to follow any course your inclination might suggest, and in that freedom you have, to your honour be it said, unswervingly devoted your whole life to the prosecution of chemical research. In that career, your achievements have been so splendid that, even had it been possible to forget your discovery of the first coal-tar colour, these achievements alone would have gained for you that eminent position which you hold among chemists.

"Happy in the results of your own researches, you have the additional happiness of your sons following you with distinguished success, in the work of extending the boundaries of the science of chemistry.

"The Society remembers with pleasure that at its foundation you were chosen one of its Vice-Presidents, and that, three years afterwards, you became its President. It cherishes the recollection of the services you then rendered it and recalls with satisfaction that the Society early

awarded its medal to you as a further mark of its profound appreciation of your work in chemical technology.

"There only remains to the Society, to-day, at this international celebration of the Jubilee of the foundation of the coal-tar colours industry, to do homage to your great attainments and high character, and to wish you many happy years of health and activity."

EUSTACE CAREY,
President.

July, 1906.

Prof. PERCY FRANKLAND presented a congratulatory address from the Institute of Chemistry, Sir THOMAS WARDLE one from the Society of Dyers and Colourists, Prof. SMITHELLS one from the University of Leeds, and Mr. J. W. HELPS one from the Institute of Gas Engineers.

Prof. Dr. SCHULTZ presented Sir William Perkin with the doctor's diploma of the Technical Hochschule at Munich.

Scientific addresses were also given by Prof. Dr. A. BERNTHSEN, Director of the Badische Anilin und Sodafabrik, and by Prof. Dr. C. LIEBERMANN.

Sir WILLIAM PERKIN, in reply to all the congratulations received during the day, then said:—I am glad that this meeting is taking place in this institution, which I first visited 54 years ago, and for several successive Saturday afternoons sat up in that gallery an eager listener to some lectures which were being delivered. I was a schoolboy of 14 then, and my old schoolmaster at the City of London School, Mr. Thomas Hall, to whom I owe very much, who was interested in me on account of my great liking for science, induced me to write to that great and good man, Michael Faraday, who was about to give a series of lectures on electricity, telling him how much I should like to be allowed to attend them, and he very graciously sent me an order—written in his own hand—admitting me to the course. I little thought then that, in four years' time, I should be the fortunate discoverer of the mauve dye, a product which in an indirect way is related to Faraday's scientific work, for it was in 1825 that Faraday discovered benzene, which, as is well known, has been the initial product for the production of aniline from the commencement of the coal-tar colour industry, and, of course, for the mauve. This fact also connects the industry with the Royal Institution, because it was in this building that Faraday by his researches discovered benzene. And further, I little thought that in a few years' time—May, 1866—Faraday himself would come to the Chemical Society, as he did, to hear me give a lecture on "Colouring Matter Derived from Coal Tar," and then encouraged me by his remarks. These were all things that naturally never entered the mind. How much less could I have dreamed that 50 years after I had obtained the mauve I should be here at a golden jubilee celebration of the discovery of this dye? And, moreover, who could have formed any idea of the wonderful development of the coal-tar colour industry that exists to-day, started from such small beginnings, but which through the researches of an army of scientific men is now of such colossal magnitude? When this year opened, I received a New Year's card from my old friend Dr. Caro, whom I am delighted to see here to-day, in which he referred to this year as being the golden jubilee of this industry, and I thought it very kind indeed of him to have remembered it; but I little thought that I should hear any more about the matter, and not until a short time before the meeting which took place at the Mansion House was I privately told that something was going to be done, and to-day is the consummation of this "something." I feel, too, the very great honour which is being done me; but what I appreciate most deeply is that this jubilee celebration is an international one, in which nations on both sides of the globe are taking part. I do indeed feel greatly honoured by the gifts I have received and by the very numerous addresses from the learned and other societies, and also by the very kind congratulatory speeches that have been delivered by so many and such eminent men, and I do not know how to express myself adequately, and regret that time has prevented me from referring to them more fully. But, ladies and gentlemen, I feel that I cannot take all this honour to myself. There are others who deserve much of it, but are no longer with us. I refer to my late father and brother. They joined me when this industry was first started, the firm being known as Perkin and Sons. My father, who was a builder, was much disappointed when I took to chemistry, as he wished me to be an architect, but nevertheless, when I obtained the mauve, he risked most of the capital he had accumulated by a life of great industry in building and started the works at Greenford Green, evidently having great confidence in me. This was indeed a very noble act on his part, for which I have always felt very grateful, for, had it not been for this, I probably should not have been able to start this industry, as few would have been inclined to undertake the risks connected with the manufacture of such a new and untried product as the mauve dye then was. My father lived about nine years afterwards, and fortunately was rewarded by seeing the undertaking a success. My brother, Mr. T. D. Perkin, who was expected to follow my father's business, helped me in my first small manufacturing operations before the works were commenced. He afterwards conducted the commercial part of the undertaking with great assiduity, and also took a practical part in the works with great success, and we worked together harmoniously for 17 years, until the works were sold in 1873. Therefore it will be seen what a great extent the collaboration of my father and brother had to do with the early success of this industry, and consequently I feel that much of the honour so lavishly given me to-day should be accorded to them. It is certainly a very interesting coincidence that the president of the Chemical Society should this year be Prof. Meldola, one who has had so much practical experience in connection with the coal-tar colour industry, and has enriched it by his own discoveries of colouring matters, as well as by his researches, which have yielded much valuable information in connection with the scientific side of the industry. He has taken, I know, a most laborious and active part in connection with this jubilee, and I thank him most heartily for all his kindness, as well as that of all others who have assisted in this matter. There is one matter connected with this industry and its great development which is of interest, and that is the immense amount of employment it has created for men of all classes, and, of course, especially for the working classes. When one considers its ramifications and its influence on other industries, it is difficult to gauge this, but it is often a very pleasant thought to me, and I am also very glad to know that the comfort and well-being of the *employés* of some of the largest works abroad are studied by the principals, and suitable dwellings provided for them. And, of course, the end result of all our work should be the benefit of mankind. But when I look upon all the great results that have been obtained chiefly by the accumulated labours of scientific men, both inside and outside the works, and the skill of those who have assisted to carry out their discoveries, while I am thankful that I had to do with the beginning of this industry, yet I cannot but feel how humble a part I have taken in this matter, and how generous and kind all are in connection with this celebration in recognising my early labours and struggles. I might say much more, but I feel I must conclude. This manifestation of the honour you wish to do me, of the kindness and friendly feeling you have shown me, this gathering together of friends from far and near, some of them very old friends, is very gratifying to me at this period of life, when the sun is declining in the west and the evening is approaching; and I cannot but again reiterate how deeply I feel all that has been done, and again I thank you most heartily. At the same time, when I look back on my life and consider all the way I have been led, above all I thank God, to Whom I owe everything, for all His goodness to me, and ascribe to Him all the praise and honour.

Prof. GREEN proposed a vote of thanks to the Chairman and Managers of the Royal Institution, for the use of the theatre—the workshop of Davy, Faraday, and Tyndall, and the place where Hofmann often lectured. It was

appropriate that that celebration should take place there.

This was heartily accorded, and the proceedings ended.

In the evening a complimentary dinner was given to Sir William Perkin at the Hotel Metropole.

On Friday, July 27th, the Greenford Green Works, now empty and tenantless, were visited. This was followed by a garden party, given by Sir William and Lady Perkin at their residence at Sudbury, during which the visitors had an opportunity to inspect Sir William Perkin's private laboratory.

A soirée at the Leathersellers' Hall, St. Helens' Place, E.C., completed the international celebration.

INDUSTRIAL ALCOHOL AND METHYLATED SPIRITS.

New Excise Regulations.

The Commissioners of Inland Revenue, in pursuance of the powers vested in them, hereby prescribe the following regulations which are to be observed from and after the 1st day of October, 1906:—

Part I.—*As to spirits other than methylated spirits.*

1. In taking account of the quantity of spirits in the spirit store of a distiller the officer must carry to the debit side of the account the quantity of spirits computed at proof, which shall be from time to time duly conveyed into the store from the spirit receiver in the distillery, and must carry to the credit side of the account the quantity so computed, which shall have been sent out under permit.

2. There must be legibly cut, branded, or painted with oil colour upon the head of every cask in warehouse containing racked or blended spirits, in addition to the other marks required to be thereon, the word "Racked" or the letter "R" in the case of racked spirits, and the word "Blended" in the case of blended spirits.

3. The manner in which a permit or certificate is to be cancelled is to be by writing in large letters in ink across the same the word "Received" and the day and the hour of the receipt, or by drawing lines in ink across the permit or certificate, so as to prevent it from being again used for the removal of spirits.

Part II.—*As to spirits received for use in the arts and manufactures under section 8 of the Finance Act*, 1902.

4. The allowance payable under section 1, subsection 1, of the Revenue Act, 1906, in respect of spirits received for use under section 8 of the Finance Act, 1902, shall be paid to the person authorised to receive the spirits on production by him to the Collector of Inland Revenue for the collection within which the spirits are authorised to be received for use, of a certificate signed by the officer who shall have taken account of the spirits on receipt, and countersigned by the supervisor of the district, setting forth the quantity of spirits at proof which shall have been so received.

Part III.—*As to methylated spirits.*

5. All spirits to be used for methylation must be conveyed under bond to the premises where the methylation is to take place, and must there remain without alteration or change in the cask or package in which the same are delivered until an account of the spirits has been taken by the proper officer of Inland Revenue.

6. An authorised methylator must at the time of methylation mix with and dissolve in all spirits then methylated other than industrial methylated spirits as defined by the Revenue Act, 1906, in addition to the matter prescribed by section 128 of the Spirits Act, 1880, a quantity not less than three-eighths of 1 per cent. by volume of mineral naphtha of a specific gravity of not less than 0·800, and the mineral naphtha shall before the mixing thereof be examined and approved by the Principal of the Government Laboratory, or other officer appointed in that behalf.

7. The account to be kept by an authorised methylator of any industrial methylated spirits and any mineralised methylated spirits prepared or received by him, and of the sale or delivery thereof, shall be in the forms prescribed in the first and second parts, respectively, of the first schedule hereto annexed. The methylator shall enter in the appropriate account daily, and at any time when required by an officer, the quantity of methylated spirits made or received, and the separate quantities sent out, both in bulk and at proof, and he must keep the accounts at all times open for inspection by any officer of Inland Revenue.

8. Essential oil or other flavouring matter must not without the express sanction of the Commissioners of Inland Revenue be added to or mixed with methylated spirits.

9. Methylated spirits may be removed by a maker of methylated spirits from the place of methylation for exportation under the following regulations, *viz.*:—

(*a*) The methylator must give the proper officer 12 hours' written notice of his intention to export, and state in the notice the number of gallons to be exported and the time at which the officer's attendance will be required, which must be between the hours of 8 a.m. and 2 p.m.

(*b*) The quantity exported at any one time must not be less than 10 gallons.

(*c*) The spirits may be exported in casks or other vessels, each containing not less than 10 bulk gallons, or they may be exported in smaller vessels containing any number of complete gallons, provided the vessels are packed in cases or packages containing not less than 10 bulk gallons each.

(*d*) The casks or vessels must be marked and numbered in the prescribed manner, and be accompanied on removal by a permit written by the methylator and endorsed by the officer.

10. A retailer of methylated spirits must not sell or have in his possession for sale any methylated spirits other than mineralised methylated spirits, nor any methylated spirits containing any essential oil or other flavouring matter; but this regulation shall not prevent a retailer of methylated spirits, if duly authorised by the Commissioners, receiving or having in his possession industrial methylated spirits for use in an art or manufacture carried on by him.

11. A retailer of methylated spirits—

(*a*) Must not receive or have in his possession at any one time a greater quantity of methylated spirits for sale than 200 gallons;

(*b*) Must not receive methylated spirits from a retailer of methylated spirits in a quantity exceeding four gallons at a time; and

(*c*) Must not sell to or for the use of any one person more than four gallons of methylated spirits at a time.

12. The account to be kept by a retailer of methylated spirits shall be in the form given in the second schedule hereto annexed. The account is to be at all times open to inspection by any officer of Inland Revenue.

13. A retailer of methylated spirits must not use methylated spirits in any art or manufacture carried on by him unless he has been authorised by the Commissioners of Inland Revenue to do so.

14. A person who has been authorised to receive methylated spirits for use in any art or manufacture carried on by him, whether he holds or does not hold a licence as a retailer of methylated spirits, must obtain all methylated spirits received by him from an authorised methylator, and in the manner directed by subsection 4 of section 124 of the Spirits Act, 1880.

15. A retailer of methylated spirits, and a person authorised to receive methylated spirits, must on receiving any methylated spirits accompanied by a permit, or a document in the nature of a permit, keep the permit or document and deliver it to the officer of Inland Revenue who first inspects his premises after the receipt thereof.

16. The allowance payable under section 1, subsection 1, of the Revenue Act, 1906, shall, as regards spirits used in making industrial methylated spirits, be paid to the authorised methylator, on production by him to the Collector of Inland Revenue of the collection in which the methylating premises are situate, of a certificate signed by the supervisor and the officer who shall have witnessed the methylation, setting forth the quantity of spirits at proof which have been used for that purpose.

17. The regulations of June 15th, 1891, relating to the manufacture and sale of spirits, and that of November 17th, 1900, relating to permits are hereby annulled as from September 30th, 1906.

Dated this 11th day of August, 1906.

Signed by order of the Commissioners of Inland Revenue.

J. B. MEENS, Secretary.

ALCOHOL FOR INDUSTRIAL PURPOSES.

The Revenue Bill, which includes facilities for the use, without payment of duty, of spirits in arts and manufactures (this J., 1905, 397—426; *ib.* 706) has received the Royal assent. After having been considered in Committee, the report stage passed the House of Commons without discussion on July 27, and the Bill was read a first time in the House of Lords on the same date. The second reading was carried without dissent on July 31, and the third reading took place on the same afternoon. Rules and regulations for the use of duty-free spirit will be issued on October 1st next.

First Schedule.

First Part.

FORM OF STOCK ACCOUNT OF INDUSTRIAL METHYLATED SPIRITS TO BE KEPT BY AN AUTHORISED METHYLATOR.

M———, *Authorised Methylator.*

Industrial Methylated Spirits Made or Received into Stock.				Industrial Methylated Spirits Sent Out of Stock accompanied by a Permit.						
Date of Receipt or Mixing.	Bulk Gallons.	Strength O.P.	Gallons at Proof	Date of Sending Out or Delivery.	No. of Permit.	Name of Person to whom Sent or Delivered.	Of What Place.	Bulk Gallons.	Strength O.P.	Gallons at Proof.

Second Part.

FORM OF STOCK ACCOUNT OF MINERALISED METHYLATED SPIRITS TO BE KEPT BY AN AUTHORISED METHYLATOR.

M———, *Authorised Methylator.*

Mineralised Methylated Spirits Made or Received into Stock.				Mineralised Methylated Spirits Sent Out of Stock accompanied by a Permit.						
Date of Receipt or Mixing.	Bulk Gallons.	Strength O.P.	Gallons at Proof.	Date of Sending Out or Delivery.	No. of Permit.	Name of Person to whom Sent or Delivered.	Of What Place.	Bulk Gallons.	Strength O.P.	Gallons at Proof.

Second Schedule.

FORM OF STOCK ACCOUNT TO BE KEPT BY A RETAILER OF METHYLATED SPIRITS.

Requisition.			Permit.				Account of Sales.				
Date.	No. of.	Gallons Requisitioned	Date.	From What Methylator Received.	Of What Place.	Gallons.	Date.	Full Name of Person to whom Sold	Of What Place and Address.	Trade or Occupation.	Gallons and Parts of a Gallon Sold.

London Section.

Meeting held at Burlington House, on Monday, June 11, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

STUDIES OF BASIC CARBONATES.

I. Magnesium Carbonates.*

BY W. A. DAVIS, B.SC.

The investigation of which an account is now given was undertaken primarily with the object of explaining the difficulty, which not unfrequently occurs in softening waters, that when the amount of sodium carbonate (or hydroxide) is added which should suffice to remove the whole of the magnesium as carbonate, practically none of the "hardness" is destroyed, no magnesium carbonate being precipitable at ordinary temperatures.

At the same time, the hope was entertained of gaining information that would throw light on the formation of dolomite, $MgCO_3,CaCO_3$. This is a problem of which a solution has long been desired; and now that it has been shown, by the examination of the core obtained, under the auspices of the Royal Society of London, by boring into the coral reef in the island of Funafuti, that dolomitisation has taken place to very different extents at different depths ("The Atoll of Funafuti," Harrison and Sons, London), it is more than ever desirable to discover the conditions under which calcium carbonate may be converted into the double carbonate.

At an early stage in the inquiry, it was necessary to take into consideration the basic carbonates of magnesium; the results obtained were such that it became probable that the opinions which have long been held as to the nature of the basic carbonates generally, not merely those of magnesium, are erroneous in no slight degree. In the interest of the analyst, as well as of the student of qualitative analysis—to whom the formation of "basic" precipitates is the source of much tribulation—it is desirable that clearer views should prevail than those which are now stated in the text-books; this subject will be dealt with somewhat fully in the following pages.

The formation of a normal carbonate is almost confined to the alkaline-earth metals—calcium, strontium, and barium. In all other cases a so-called "basic carbonate" is obtained. The production of such a substance is usually regarded as the consequence of the hydrolysis of the normal carbonate. Mendeléeff, for instance, in his "Principles of Chemistry" (1897 Edn., I. p. 601), speaking of the basic carbonates of magnesium, states that "their formation shows the power of water to decompose the normal salt." The universal acceptance of such a view is apparently to be traced to Heinrich Rose, by whom it was advocated in a series of papers, published in 1851 and 1852 ("Ueber den Einfluss des Wassers bei chemischen Zersetzungen," Pogg. Annalen, **83**, 132, 417, 597; **84**, 52, 461, 547; **85**, 107, 304, 312; **86**, 99, 279). Rose considered that water, acting as a "weak acid," was able to decompose more or less completely the salts of the "weak" acid, carbonic acid.

There has been a tendency hitherto to regard all the "basic carbonates," formed from any one metal under different conditions, as definite compounds; indeed, no less than 15 distinct basic carbonates of magnesium, eight basic carbonates of copper, and seven of zinc are described and formulated in Dammer's Handbuch.

Great uncertainty has existed, however, with regard to the basic carbonates of magnesium. The *magnesia alba* of pharmacy is a substance of a very indefinite and varying character. In Dammer's Handbuch the formula assigned to it is $4MgCO_3,Mg(OH)_2,4H_2O$; in Moissan's "Traité de Chimie Minérale" it is represented as $3MgCO_3,Mg(OH)_2,3H_2O$; in the British Pharmacopœia (1898) it figures as $3MgCO_3,Mg(OH)_2,4H_2O$; Roscoe and Schorlemmer (II., 247) are more explicit, and write $[OH.Mg.CO_3.Mg.CO_3.Mg.CO_3.Mg.OH]$ *plus* two or three molecules of water of crystallisation. Brill (Zeit. anorg. Chem., 1905, **45**, 275) has stated quite recently that when magnesium carbonate is heated between the temperatures of 230° and 510°, no less than seven distinct basic carbonates are formed; and he not only assigns definite formulæ to the several products, but ascribes to each a definite dissociation temperature. Anderson (Chem. Soc. Trans., 1905, **87**, 261), after showing that the analyses of commercial varieties of magnesium carbonate cannot be reconciled with the simple formulæ which are given in the text-books, concludes that the "basic carbonates are substances of high molecular weight," and assigns to the materials which he analysed complex formulæ such as $20MgCO_3,21Mg(OH)_2,02H_2O$.

The possibility that most, if not all, of the basic carbonates are mixtures of several substances does not seem to have occurred to anyone hitherto. The only hint to be found in the literature that such is the case would appear to be the description given in the British Pharmacopœia of *magnesia alba* as consisting of "amorphous particles with numerous slender prisms intermixed."

Not only, moreover, have the "basic carbonates" of magnesium been regarded as definite substances, but special hypotheses have been brought forward to explain their formation; thus Bodländer (Zeit. phys. Chem., 1900, **35**, 31), in order to account for the abnormal properties of a solution of magnesium bicarbonate, as compared with those of solutions of calcium bicarbonate and barium bicarbonate, goes so far as to assume that the complex ion $(MgCO_3)_n.MgOH'$, can exist, considering this to be proved by the formation of a "basic carbonate" when the solution is warmed.

General Survey of Results.

Decomposition of magnesium hydrogen carbonate in solution.—From the results obtained by Treadwell and Reuter (Zeit. anorg. Chem., 1898, **17**, 170), it appears that whilst a solution of calcium hydrogen carbonate, $Ca(CO_3H)_2$, is stable at ordinary temperatures, a solution of magnesium hydrogen carbonate is only stable in presence of an excess of carbon dioxide; when the pressure of the carbon dioxide in the atmosphere above the solution falls sufficiently, decomposition sets in and crystals are deposited of a compound which has long been regarded as a trihydrate of magnesium carbonate, $MgCO_3.3H_2O$. When equilibrium is established, each litre of the solution is found to contain at 15° C., 1·954 grms., $Mg(CO_3H)_2$, and 0·6410 grm., $MgCO_3$.

The conclusion arrived at, in the present paper, is that the acid carbonate is not at first simply resolved into normal carbonate and acid, but that in solution, at ordinary temperatures, it undergoes hydrolysis in the sense of the equation—

$$Mg(CO_3H)_2 + H_2O = Mg(OH)(CO_3H) + H_2CO_3,$$

a *hydroxide-carbonate* being formed which may be regarded as a true basic carbonate. With the possible exception of the mineral hydromagnesite, this apparently is the only basic carbonate of magnesium which there is any reason to regard as a definite substance. As the temperature is raised, however, the acid carbonate appears to undergo alteration in other ways than that which is here contemplated (comp. p. 794).

Magnesium hydroxide-carbonate dihydrate.—The conclusion that the compound which has hitherto been regarded as the trihydrated carbonate, $MgCO_3.3H_2O$, is in reality a dihydrated hydroxide-carbonate, is based on the fact that this salt loses only two-thirds of its water, either when heated in a dry state at 100° in a current of air or when boiled with a liquid such as xylene (b.p., 137°), the remaining third being expelled only at a much higher temperature and always together with some carbon dioxide.

The hydroxide-carbonate dihydrate is formed as sole product when solutions of hydrogen magnesium carbonate are heated at temperatures not exceeding 80°. It is also

* Taken as read.

produced when the ordinary "basic" precipitate, which is formed on adding an alkaline carbonate to a solution of magnesium salt, is left in contact with a solution of carbon dioxide or of potassium hydrogen carbonate, and, therefore, when the precipitate is merely left in contact with its mother liquor or when moist precipitated magnesium hydroxide is exposed to carbon dioxide.

The substance obtained by these methods must be supposed to be a hydrated polymeride of the compound, $Mg(OH)CO_3H$, as it is but very sparingly soluble in water (to an extent equivalent to only about 0·8 grm. $MgCO_3$ per litre), whereas solutions can be obtained containing about 3 grms. of dissolved $HO.Mg.CO_3H$ per litre (and therefore supersaturated with respect to the ordinary form), either by the careful decomposition of the bicarbonate or by the action of water on the curious variety of the normal carbonate discovered by Engel.

Magnesium carbonate, $(MgCO_3)_n$.—At least two such substances are known, natural magnesite and the carbonate obtained by Engel by heating magnesium ammonium carbonate at 130°—140° in a stream of dry air (Compt. rend., 1899, **129**, 598); this latter is remarkable on account of the readiness with which it becomes hydrated, "slaking" as easily as lime and being converted ultimately into the dihydrated hydroxide-carbonate. It dissolves in water more readily than the latter substance, giving a solution containing about 2 grms. of $MgCO_3$ per litre; but the solution is not stable, and after a short time deposits crystals of the dihydrated hydroxide-carbonate. Magnesite, on the other hand, is insoluble in water and is not affected to an appreciable extent by boiling with water or with aqueous alkaline carbonates.

It cannot be supposed that either variety of the normal carbonate represents the fundamental molecule, $MgCO_3$; at present, unfortunately, no method is known of determining the degree of polymerisation attained to in such salts.

Magnesite, calcite, and dolomite, being isomorphous, are probably polymeric forms of the general type, $(M''CO_3)n$, in all of which n has the same value. Magnesite and dolomite should, therefore, be as resistant to the action of water as is calcium carbonate; this is found actually to be the case, no change whatever taking place on boiling them either with water alone or together with alkali.

Mixed magnesium carbonates.—The so-called "double salts," represented by formulæ such as—

$$MgCO_3,K_2CO_3,4H_2O$$
$$MgCO_3,KHCO_3,4H_2O$$
$$MgCO_3,Na_2CO_3,$$

which were first obtained by Deville (Ann. Ch. Ph., 1851, iii., **33**, 86) by the action of potassium hydrogen or sodium hydrogen carbonate on precipitated magnesium carbonate, are to be regarded as, respectively, normal or acid salts of magnesium hydrogen carbonate; they may be represented by such formulæ as—

$$Mg\begin{Bmatrix}CO_3K\\CO_3K\end{Bmatrix} \qquad Mg\begin{Bmatrix}CO_3H\\CO_3K\end{Bmatrix}$$

Reynolds (Chem. Soc. Trans., 1898, **73**, 262) has shown that a large number of such normal mixed salts can be prepared by precipitating a concentrated solution of potassium carbonate with the appropriate metallic acetate; well-defined, crystalline, mixed salts of potassium with the metals, bismuth, calcium, cobalt, copper, iron, magnesium, manganese, nickel, and silver, have been prepared in this manner. Reynolds appears to have been the first to recognise the existence of such mixed carbonates. Arnold has also recently pointed out (Ber., 1905, **38**, 1173) that nearly all precipitated carbonates are soluble in an excess of the alkali carbonate used as precipitant.

Mixed salts, having a considerable degree of solubility, are formed on adding a caustic alkali to a solution of magnesium bicarbonate, thus:—

$$Mg(CO_3H)_2+NaOH=Mg(CO_3H).CO_3Na+H_2O.$$
$$Mg(CO_3H)_2+2NaOH=Mg(CO_3Na)_2+2H_2O.$$

No solid is separated until the solution is heated to a temperature sufficiently high to cause decomposition of the mixed salt; such decomposition may give rise to very different products, according to the conditions. The acid salt,

$$Mg\begin{Bmatrix}CO_3H\\CO_3Na,\end{Bmatrix}$$

gives rise initially to magnesium hydroxide-carbonate dihydrate,

$$Mg\begin{Bmatrix}CO_3H\\CO_3Na\end{Bmatrix}+3H_2O=Mg\begin{Bmatrix}CO_3H\\OH\end{Bmatrix},2H_2O+NaHCO_3;$$

whilst the disodium salt decomposes in two ways:—

$$Mg\begin{Bmatrix}CO_3Na\\CO_3Na\end{Bmatrix}+H_2O=Mg\begin{Bmatrix}OH\\CO_3H\end{Bmatrix}+Na_2CO_3$$
$$Mg\begin{Bmatrix}CO_3Na\\CO_3Na\end{Bmatrix}+2H_2O=Mg(OH)_2+2NaHCO_3,$$

giving magnesium hydroxide-carbonate (or its dihydrate) and magnesium hydroxide, the proportions depending on the conditions. By heating it in boiling water or a solution of sodium hydroxide, the hydrated hydroxide-carbonate is further changed, giving a mixture of magnesium hydroxide and magnesium hydroxide-carbonate.

Decomposition of magnesium hydroxide-carbonate dihydrate by water.—When crystalline magnesium hydroxide-carbonate dihydrate is heated with boiling water, two actions take place simultaneously, the product consisting of a mixture of anhydrous magnesium hydroxide carbonate, $OH.Mg.CO_3H$, and magnesium hydroxide; if the boiling be continued during but a short period, some of the original material remains undecomposed in the mixture:—

$$Mg\begin{Bmatrix}OH\\CO_3H\end{Bmatrix},2H_2O=Mg\begin{Bmatrix}OH\\CO_3H\end{Bmatrix}+2H_2O$$
$$Mg\begin{Bmatrix}OH\\CO_3H\end{Bmatrix}+H_2O=Mg(OH)_2+H_2O+CO_2.$$

After boiling during about half an hour, the change goes on very slowly, as a coating of magnesium hydroxide is formed which protects the crystals. When a solution of magnesium hydrogen carbonate is boiled, at first a precipitate of crystals of the hydrated hydroxide-carbonate, $Mg(OH)CO_3H,2H_2O$, is produced; since this undergoes decomposition as the boiling is continued, the ultimate product is similar to that formed on heating crystals of the compound with boiling water, namely, a mixture of unchanged substance with anhydrous magnesium hydroxide-carbonate, $Mg(OH).CO_3H$, and magnesium hydroxide. The mixed character of the product is shown by its appearance under the microscope.

Basic carbonates of magnesium.—The substance obtained, at the end of an hour, on boiling a solution of magnesium hydrogen carbonate, having a concentration equivalent to 11·1 grms. $MgCO_3$ per litre, is represented by the expression $0{\cdot}319MgCO_3,Mg(OH)_2,1{\cdot}2H_2O$, or, roughly, $3MgCO_3,Mg(OH)_2,3{\cdot}5H_2O$. Judging from their appearance under the microscope, such substances, and indeed all varieties of the basic carbonate, are not definite salts but mixtures, in all cases, of the three compounds, $HO.MgCO_3H$, $HO.Mg.CO_3H,2H_2O$, and $Mg(OH)_2$ in varying proportions.

The extent to which *magnesia alba* differs in composition, according to the manner in which it is prepared, is not sufficiently recognised. Thus, its composition may approximate to that represented by the expression $3—4MgCO_3,Mg(OH)_2,3—6H_2O$; or the ratio, $MgCO_3:Mg(OH)_2$ may be nearly that of unity—for example, $20MgCO_3,21Mg(OH)_2,62H_2O$ (compare the analyses made by Anderson, *loc. cit.*, of commercial varieties of magnesium carbonate). When prepared with cold solutions of sodium carbonate and magnesium sulphate, the air-dried product has the composition $4MgCO_3.Mg(OH)_2.11H_2O$ (Rose). That this substance consists almost entirely of a mixture of the dihydrated hydroxide-carbonate with hydroxide in the proportions $4(OH.MgCO_3H.2H_2O)$; $Mg(OH)_2$ is shown, however, by its behaviour when dried at 100°, the product being then of the composition, $4MgCO_3,Mg(OH)_2,4H_2O$, that is to say, a mixture of $4(OH.Mg.CO_3H)$ with $Mg(OH)_2$, as would be anticipated from the fact that, when dried at 100°, the compound, $OH.Mg.CO_3H,2H_2O$ is converted into the anhydrous hydroxide-carbonate.

The so-called "basic magnesium carbonates" can be obtained by two methods: (*a*) by boiling a solution of magnesium bicarbonate during a prolonged period or by heating magnesium hydroxide-carbonate dihydrate with boiling water; (*b*) by precipitating a solution of a magnesium salt with an alkaline carbonate. When the latter method is used, a basic carbonate may be formed even at ordinary temperatures. In such a case it cannot be supposed that the water acts on a simple magnesium carbonate which is formed initially, converting it into a basic product, if the important fact be borne in mind, which was first elicited by Fritzsche in 1836 (*Pogg. Ann.*, 1836, **37**, 314), and afterwards confirmed by Favre (*Ann. Ch. Phys.*, 1844 [iii.], **10**, 483; Jacquelain, *ibid*, 1851 [iii.], **32**, 195) and Rose (*Pogg. Ann.*, 1851, **84**, 465), that if the basic precipitate which is formed on mixing solutions of magnesium sulphate and sodium carbonate be left in contact with its mother liquor during several days, it changes completely into the crystalline dihydrated magnesium hydroxide-carbonate, $OH.Mg.CO_3H,2H_2O$. In other words, instead of the normal carbonate or hydroxide-carbonate being decomposed by water at the ordinary temperature and converted into a basic carbonate, the so-called basic carbonate can take up carbon dioxide from the solution—which contains alkali hydrogen carbonate—forming a substance of the empirical composition of a normal carbonate, ($MgCO_3,3H_2O$), the product so formed being affected only with extreme slowness, if at all, by water.

When an alkaline carbonate is added to a solution of a magnesium salt, the first product is a mixed carbonate, formed according to the equation,—

$$2NaCO_3Na + MgSO_4 = Mg(CO_3Na)_2 + Na_2SO_4;$$

but, except in the most concentrated solutions, this at once undergoes more or less complete hydrolysis into hydroxide-carbonate and hydroxide. The so-called basic carbonate which is formed is therefore a mixture of these substances in proportions, which vary within wide limits as the conditions are varied. Every alteration in the conditions tends to modify the composition of the product: thus, Rose obtained products to which he assigned the following formulæ:—

1. $4MgCO_3,Mg(OH)_2,11H_2O$;
2. $4MgCO_3,Mg(OH)_2,6H_2O$;
3. $3MgCO_3,Mg(OH)_2,5H_2O$;
4. $2MgCO_3,Mg(OH)_2;2H_2O$.

The first was prepared by mixing equivalent quantities of magnesium sulphate and sodium carbonate dissolved in three parts of cold water; the second, by using the solutions hot and boiling the liquid; the third, by substituting potassium for sodium carbonate, and boiling; the fourth, by using more dilute solutions than in the third case.

Judging from the great variation in their composition, it is probable that the basic carbonates of metals generally, not only those of magnesium, are in most cases mixtures.

Evidence supporting the foregoing explanation.—Various observations which were formerly inexplicable may be interpreted without difficulty in the light of the explanation which has been given of the manner in which basic carbonates are formed.

1. The fact that it is possible to obtain either a normal or a basic carbonate without varying either temperature or concentration, as shown by Fritzsche, Favre, &c. (comp. above).

2. The fact that solutions of magnesium sulphate and potassium carbonate of suitable concentration can be mixed in equimolecular proportions without giving rise to a precipitate (Rose, *Pogg. Ann.*, **83**, 435). This is clearly because a soluble mixed carbonate is formed, according to the equation $MgSO_4 + 2K_2CO_3 = Mg(CO_3K)_2 + K_2SO_4$, and is proof that the first interaction is not that expressed by the equation—

$$MgSO_4 + K_2CO_3 = MgCO_3 + K_2SO_4.$$

As the proportions used are in the ratio, $MgSO_4:K_2CO_3$, half of the magnesium sulphate is unaffected. From the time of Black onwards, (*Magnesia alba*, 1755) it has been frequently observed that on precipitating a magnesium salt by alkaline carbonate a considerable proportion of the magnesium remains in solution, and is only removed by continual boiling. The explanation of this fact is now obvious.

3. In many cases, it has been shown that the precipitate which is at first formed, on adding an alkaline carbonate to a solution of a metallic salt, contains more or less admixed alkaline carbonate.

(*a*) *Magnesium.*—Thus, H. Rose has stated (*Pogg. Ann.*, 1851, **84**, 461) that when magnesium sulphate dissolved in ten parts of water is mixed with 2 mol. proportions of potassium carbonate, dissolved in a similar quantity of water, and the precipitate is separated after 24 hours, but not thoroughly washed, a product is obtained containing 11·6 per cent. of potassium oxide. The substance prepared by Rose must therefore have consisted, to a considerable extent, of the mixed carbonate $Mg(CO_3K)_2,4H_2O$ previously isolated by Deville.

(*b*) *Copper.*—On adding an alkaline carbonate to a solution of a copper salt, basic carbonates are precipitated which vary widely in composition, according to the conditions under which they are prepared: ultimately, copper hydroxide or copper oxide is obtained. Rose's analysis (*Pogg. Ann.*, 1851, **84**, 466) shows that the blue precipitate, which is at first formed on adding a solution of potassium carbonate, owes its blue colour to the presence of a considerable proportion of the blue mixed carbonate, $Cu(CO_3K)_2$, or hydrates thereof (compare Reynolds, *loc. cit.*). When the blue precipitate is stirred up with or washed with water, it at once loses its blue colour, becoming green, until, under favourable circumstances, the so-called green basic carbonate, $CuCO_3,Cu(OH)_2$, approximating in composition to malachite, is obtained. Whether this substance is a true basic carbonate remains to be determined. On adding an excess of alkali carbonate, the precipitate again becomes blue and dissolves, giving a solution of the blue mixed carbonate.

Considerable difficulty is experienced in quantitative analysis in washing many precipitated carbonates (for example, zinc carbonate) free from adhering (in reality combined) alkali. It is clear that the alkali will only be removed on washing at a suitable temperature, and with sufficient water to decompose the mixed carbonate present in the precipitate. The significance of this fact will be appreciated on reading Rose's papers.

4. If the conditions be such as to prevent the formation of a mixed salt with an alkaline carbonate, a normal carbonate is formed in the case of metals which ordinarily give rise to basic carbonates; lead salts, for instance, give more or less basic carbonates when precipitated with alkaline carbonates, but when a current of carbon dioxide is passed into a solution of lead acetate, nearly pure lead carbonate, $PbCO_3$, is obtained, whatever may be the proportion of water (Rose, *Pogg. Ann.*, 1851, **84**, 66). Obviously, the basic carbonate of lead cannot be formed by the decomposition of the normal carbonate by water.

Practical applications.—Two important cases in which the foregoing views receive a practical application may be referred to:—

1. *Softening of magnesian waters.*—When caustic soda is added to a very dilute solution of magnesium bicarbonate containing 5—250 parts "$MgCO_3$" per 100,000, only a soluble salt is formed, either $Mg(CO_3H)CO_3Na$ or $Mg(CO_3Na)_2$, according to the proportions used. The solution remains clear until heated sufficiently to decompose the soluble mixed salt, when a mixture of magnesium hydroxide and hydroxide-carbonate is precipitated. If the original solution contains less than 50 parts "$MgCO_3$" per 100,000, no precipitate is formed until the temperature is raised to 90°. Indeed, it is impossible to completely soften magnesian waters containing small quantities of magnesium sulphate, chloride, or bicarbonate by means of either sodium hydroxide or carbonate, unless the temperature be above 90°. The difficulty that is often experienced in practice in softening such waters is undoubtedly a consequence of the formation of soluble mixed alkali carbonates of magnesium. When the equivalent quantity of caustic soda is added to a solution of magnesium bicarbonate containing about 50 parts of "$MgCO_3$" per 100,000 and the mixture is

heated at 90° during five minutes, the amount of magnesium carbonate remaining in solution does not exceed 3 parts per 100,000.

2. *Solvay method of manufacturing potassium carbonate with the aid of magnesia.*—In this process the careful regulation of temperature is essential. In order that the mixed carbonate may be formed according to the equation $[3MgCO_3,3H_2O+2KCl+CO_2=MgCl_2+2(MgCO_3,KHCO_3,4H_2O)]$, it is necessary to prevent a reversal of the action by keeping the temperature below 24° by artificial cooling, and also to maintain carbon dioxide in excess. (See Salzberg Werke Neu-Stassfurt., D.R.P., 1900, 143,408, 143,409; 1901, 143,595, Zeit. angew. Chem., 1903, **16**, 730.) In decomposing the mixed carbonate, it is either gently heated with an excess of water, or it is mixed with magnesium oxide, which seems to combine with the carbon dioxide of the potassium hydrogen carbonate at a temperature not exceeding 20° (Deutsche Solvay Werke, D.R.P., 1901, 135,329; 1903, 157,354). In either case, potassium carbonate is obtained together with magnesium hydroxide-carbonate dihydrate. If a low temperature be maintained, all the magnesium is separated from the mixed carbonate as hydroxide-carbonate; if the temperature rise, a "basic" carbonate is produced.

Formation of normal carbonates and exceptional conditions giving rise to basic sulphates.—It would appear that the production of a normal carbonate is associated with a predominating tendency on the part of the simple molecule to undergo polymerisation. Thus the sulphates of the three metals, barium, strontium, calcium, are the least soluble sulphates, a fact doubtless to be attributed to polymerisation. Most sulphates are easily soluble in water and probably possess—at least in solution—a simple structure; the sparingly soluble calcium sulphate (anhydrite), strontium sulphate, and barium sulphate are probably polymerised sulphates of the type $(M''SO_4)n$. The tendency to polymerise so clearly shown in the sulphates extends to the carbonates. It is still uncertain (compare Arzfuni, Physikalische Chemie der Krystalle) what are the conditions determining the formation of calcite and aragonite on precipitating a calcium salt with an alkaline carbonate; it is clear, however, that the two substances can only differ in the complexity of their molecules. Such a view would help to explain the peculiar, indefinite stages which are usually manifest during the precipitation of calcium carbonate, a more or less gelatinous, colloidal form being first produced which only becomes crystalline after a time or when boiled with water.

Magnesium hydroxide carbonate is soluble not only in solutions of alkali carbonates, but to some extent in solutions of magnesium sulphate. In this case it is probable that a mixed salt, *e.g.*, $Mg<^{SO_4}_{CO_3}>Mg$, is formed in solution.

Such an assumption is not improbable considering the extraordinary tendency of magnesium to give mixed salts, such, for example, as kainite, $MgSO_4,KCl,3H_2O$ (perhaps $ClMg,SO_4K,3H_2O$). A mixed salt of this type might be decomposed by water in several ways, giving:—

(1) $OH.MgCO_3H+MgSO_4$;
(2) $Mg(OH)_2+MgSO_4+CO_2$;
(3) A true basic sulphate, thus:—

$$Mg<^{SO_4}_{CO_3}>Mg \rightarrow CO_2+H_2O+HO.MgSO_4.MgOH;$$
$$OHH \quad HOH.$$

(4) A basic carbonate-sulphate

$$Mg<^{SO_4}_{CO_3}>Mg+H_2O \rightarrow \begin{matrix} HCO_3.MgSO_4.MgOH; \\ \text{or} \\ SO_4H.Mg.CO_3.MgOH. \end{matrix}$$

or a mixture of these. Compounds of the type 3 and 4 have not been isolated in the case of magnesium, but Rose (*loc. cit.*), under certain conditions, obtained by the action of alkali carbonates on a solution of copper sulphate, (*a*) a basic copper sulphate; (*b*) a basic sulphate carbonate.

Magnesium carbonate is soluble also to a slight extent in solutions of potassium sulphate, potassium nitrate and potassium chloride. In the light of the preceding results, it may be suggested that a small proportion of the mixed salts, $KSO_4.Mg.CO_3K$, $NO_3.Mg.CO_3K$, $ClMgCO_3K$, is formed, owing to occurrence of reversible interactions, such as—

$$MgSO_4+K_2CO_3 \rightleftharpoons KSO_4.Mg.CO_3K \rightleftharpoons OH.MgCO_3H.+K_2SO_4.$$

It is probable that the salt, $KSO_4Mg.CO_3K$, is formed in addition to the salt, $Mg(CO_3K)_2$, when potassium carbonate is added to an excess of magnesium sulphate in a solution containing much potassium sulphate. Such a salt might give rise, according to the conditions, to magnesium hydroxide carbonate, magnesium hydroxide, basic magnesium sulphate, or basic magnesium potassium sulphate, $OH.MgSO_4K$, or to a mixture of these substances.

Experimental.

Four series of experiments are described in the following account. The first relates to the decomposition of magnesium hydrogen carbonate in solution; the second to the behaviour of the magnesium carbonates with water and dilute alkalis; the third to the nature of the so-called basic carbonates of magnesium; and the fourth to the decomposition by water and alkali of the magnesium sodium carbonates.

I.—Decomposition of Magnesium Hydrogen Carbonate in Solution.

Preparation of the solution.—At the outset of the inquiry, traces of alkali were found to cause a wide variation in the results; special precautions were therefore taken in preparing the solution of the bicarbonate. Ordinary magnesium carbonate contains sodium carbonate, which cannot be removed even by repeated extraction with boiling water. The following method, however, ultimately gives a solution of magnesium bicarbonate which does not colour a Bunsen flame yellow. Commercial purified "crystal" magnesium carbonate is boiled with successive large quantities of water in a two-litre Jena flask, each time during about a quarter of an hour; it is then converted into bicarbonate by passing carbon dioxide (purified by passage through powdered potassium carbonate, cotton wool, and two or three washing flasks) into about 7 litres of water, in which about 150 grms. of the solid is suspended, contained in a large hard glass bottle; the rate of dissolution may be increased by passing in the gas under pressure. When nearly all the solid is dissolved, the solution is filtered and then decomposed by boiling; the liquid, containing practically all the alkali, having been decanted from the precipitate, a fresh quantity of water is added, and the solid again converted into bicarbonate; if necessary the treatment may be repeated.

Decomposition experiments, between 25° and 65° C.—The solution of magnesium bicarbonate which was used contained 11·07 grms. $MgCO_3$ per litre (= 19·21 grms. $Mg(CO_3H)_2$ per litre); usually, carbon dioxide in excess of that required to form the bicarbonate was present to the extent of 2 or 3 per cent. The amount in the stock solution was never allowed to fall below that corresponding with the presence of the whole of the magnesium as bicarbonate.

The object aimed at was to ascertain the actual amount, at different temperatures, of magnesium bicarbonate and magnesium carbonate in solution, at the moment when crystals of the empirical composition, $MgCO_3.3H_2O$, began to separate from a solution containing originally only bicarbonate. All the experiments were made in the same way, so as to be comparable. In order to exclude alkali, flasks of Jena glass were used throughout. About 55 c.c of the solution of magnesium hydrogen carbonate was introduced into a long-necked, round-bottomed flask, capable of containing 100 c.c., and heated as quickly as possible, over a small flame, to the temperature required to effect the decomposition. The temperature was observed by means of a thermometer reading to ½°, the bulb of which was kept immersed during the whole period of heating. During the decomposition, the liquid

the evolution of gas. As the manner of shaking is an important factor in regulating the decomposition, special care was taken to ensure uniformity in this respect. The temperature was maintained constant to within $\frac{1}{4}^{\circ}$. Directly the first sign of a crystalline precipitate became visible, the time during which heating had been effected having been noted, the solution was rapidly cooled under the tap, in order to prevent further precipitation, and filtered. By means of a standard pipette 25 c.c. was measured into the apparatus in which the total carbon dioxide was estimated, and another 25 c.c. was titrated with standard acid (1·065 *N*/10 HCl), using methyl orange as indicator. The operations were carried out as quickly as possible.

Method of estimating carbon dioxide.—In order to ensure complete expulsion of carbon dioxide from the portion of the liquid used for the analysis, the following method was adopted:—The 25 c.c. of the solution of bicarbonate was measured into the round-bottomed, 100 c.c., flask, A, connected, as shown, with the small distilling flask, B, and the U-tubes, C and D. C contained calcium chloride, and D was filled half with calcium chloride and half with pumice impregnated with anhydrous copper sulphate. Into A, was introduced 0·1 grm. of thin * aluminium

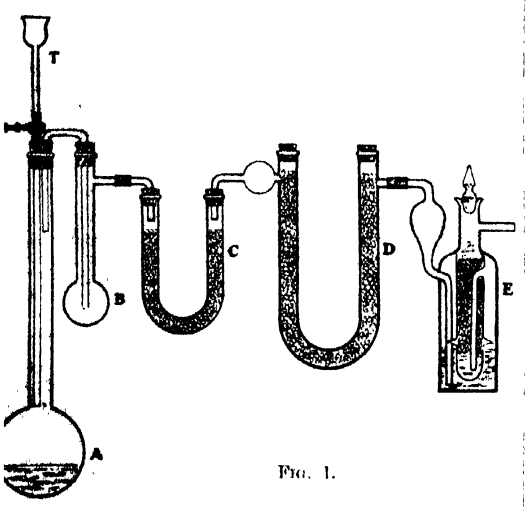


FIG. 1.

urnings; the rubber stopper was replaced and chlorhydric acid (3 c.c. of acid, 1·2, diluted with 2 c.c. of water) was added, gradually and as required, from the thistle funnel, T—a screw clip, S, serving to regulate the addition of acid. The carbon dioxide was absorbed in a potash bulb, E, of the remarkably efficient type, described by Wetzel (Ber., 1903, **36**. 161). A guard-tube containing soda-lime was attached to E. Care was taken to regulate the addition of acid, so that the carbon dioxide was evolved slowly. When all the acid was added, the liquid was gradually warmed, to cause the aluminium to dissolve in the acid. The hydrogen thus generated not only drives forward the carbon dioxide, but expels the greater part of that dissolved in the water. Finally, the liquid was gradually raised to the boiling point and kept in ebullition during about 15—30 seconds. After boiling, a U-tube containing soda-lime was put in place of the thistle funnel, and air aspirated through the whole apparatus. The flask, B, served as a condenser to prevent steam passing into the calcium chloride tube, C; for it may be substituted a piece of thin-walled glass tube, about 2 ins. long, sloping upwards, and drawn out at one end, so as to pass through the stopper of flask, A, and connected at the other with tube, C, by means of a rubber stopper and a piece of glass tube. To boil the liquid once is usually sufficient; but for safety the boiling and aspiration of air should be repeated. The aluminium serves two purposes: (1) it ensures the rapid expulsion of carbon dioxide dissolved in flask, A: if it be not used the liquid has to be boiled several times; and (2) it causes the liquid to boil regularly. Several tests made with pure calcite, to ascertain the degree of accuracy, showed that, using 25 c.c. of liquid in A, and weighing 0·25—0·30 grm. carbon dioxide (as in the experiments in Table I.), the probable error in the carbon dioxide weighed does not much exceed 1 part in 1000.

Results of experiments.—Table I. summarises the results* obtained at different temperatures on decomposing a solution of magnesium hydrogen carbonate, containing 11·07 grms. $MgCO_3$ per litre.

Note.—25 c.c. of the original solution = 61·5 c.c. of acid (1·065 *N*/10).

* The turnings must not be so thin as to dissolve rapidly at the ordinary temperature. Aluminium powder cannot be used.

* Example of an actual experiment showing method of calculation:—

Temp. = 29°. Time until first sign of precipitation was observed = 58 mins.

25 c.c. of filtered decomposed solution required 61·20 c.c. of 1·065 *N*/10 acid and gave 0·2700 grm carbon dioxide.

61·20 c.c. of acid = 61·20 × 1·065 × 0·0022 = 0·1434 grm. carbon dioxide.

"Half-bound" carbon dioxide = 0·2700 − 0·1434 = 0·1266 grm. carbon dioxide.

∴ In 25 c.c. of solution, $Mg(CO_3H)_2 = 2 \times 0{\cdot}1266 \times \frac{146{\cdot}4}{88{\cdot}0} = 0{\cdot}4212$ grm.

In 25 c.c. of solution, $MgCO_3 = (0{\cdot}2700 - 0{\cdot}2532)\ \frac{84{\cdot}36}{44} = 0{\cdot}0322$ grm.

Correction for $OH.Mg.CO_3H$, $2H_2O$ separated (calculated as $MgCO_3$):—

25 c.c. of the original solution, before decomposition, neutralised 61·5 c.c. acid.

∴ $MgCO_3$ equivalent to 61·5 − 61·2 = 0·3 c.c. of acid has been precipitated,

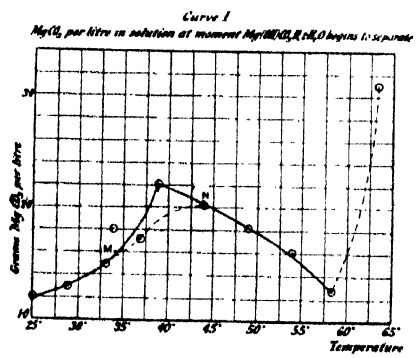
i.e. = 0·3 × 1·065 × 0·004218 = 0·00135 grm $MgCO_3$.

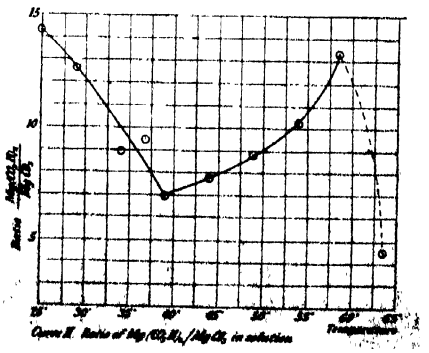
Whence $MgCO_3$ in solution when crystallisation began = 0·0322 + 0·0013 grm.

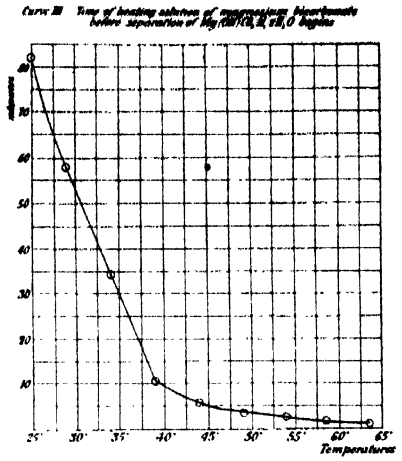
$Mg(CO_3H)_2$ per litre = 0·4212 × 40 = 16·85.

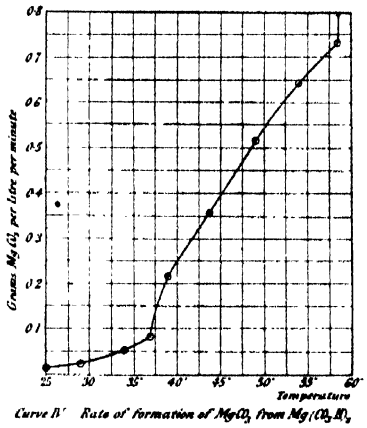
$MgCO_3$ " = 0·0335 × 40 = 1·34.

$$\frac{Mg(CO_3H)_2}{MgCO_3} = \frac{16{\cdot}85}{1{\cdot}34} = 12{\cdot}6.$$









Curve IV Rate of formation of $MgCO_3$ from $Mg(C_2H_5O_3)_2$

TABLE II.

Rate of formation of $MgCO_3$ from $Mg(HCO_3)_2$.

Temp. ° C.	$MgCO_3$ per litre.	Time in mins.	Rate in grms. $MgCO_3$ per litre per min.
25·0	1·20	82·0	0·015
29·0	1·34	58·0	0·023
*34·0	1·80	34·0	0·053
*37·0	1·71	21·0	0·081
*39·0	2·21	10·3	0·215
44·0	2·02	5·75	0·351
49·0	1·82	2·5	0·680
54·0	1·60	2·5	0·640
58·5	1·27	1·75	0·726
*63·5	3·09	1·25	2·47

* Average of three experiments.

Table II. shows the rate at which magnesium hydroxide carbonate (calculated as $MgCO_3$) is formed from magnesium bicarbonate at different temperatures.

Example at 25° C.—Time before separation began = 82 minutes. Total $MgCO_3$ formed = 1·20 grms. per litre.

Rate of formation $= \frac{1{\cdot}20}{82} = 0{\cdot}015$ grm. $MgCO_3$ per min. per litre.

The results given in the tables are plotted in four curves.

Curve I. shows the amount of $OH.Mg.CO_3H$ in solution (calculated as $MgCO_3$) when $OH.Mg.CO_3H,2H_2O$ (the so-called trihydrate, $MgCO_3,3H_2O$) begins to separate. The curve thus represents the apparent solubility at the various temperatures of $OH.Mg.CO_3H,2H_2O$ in presence of the bicarbonate.

Curve II. gives the ratio, $\frac{Mg(CO_3H)_2}{MgCO_3}$, at the same instant for different temperatures.

Curve III. shows the time of heating required before crystals of $OH.Mg.CO_3H,2H_2O$ begin to separate from the bicarbonate solution at different temperatures.

Curve IV. shows the rate of formation of $OH.Mg.CO_3H$ from the bicarbonate.

Interpretation of results.—The crystalline products separating at all temperatures between 25° and 70° is the hydroxide carbonate dihydrate, $OH.Mg.CO_3H,2H_2O$, which is perfectly homogeneous under the microscope (Photograph I.) and never contains "basic" carbonate.

TABLE I.

Relation existing between $MgCO_3$ and $Mg(HCO_3)_2$, at commencement of separation of $MgCO_3,3H_2O$.

Time in minutes.	Temp. ° C.	c.c. of 1·065 N/10 acid	Carb. diox. weighed.	$MgCO_3$ per litre of solution.	$MgCO_3$ per litre separated.	Total $MgCO_3$	$Mg(HCO_3)_2$ in 1 litre.	$\frac{Mg(HCO_3)_2}{MgCO_3}$	
82	25	61·4	0·2726	1·18	0·018	1·20	17·12	14·3	
58	29	61·2	0·2700	1·29	0·053	1·34	16·85	12·6	
34	34	61·2	0·2644	1·716	0·053	1·77	16·10	9·09	Average $MgCO_3$ = 1·80
36	34	60·85	0·2638	1·67	0·116	1·79	16·12	9·06	$Mg(HCO_3)_2$ = 16·04
33	34	60·7	0·2618	1·75	0·116	1·86	15·91	8·55	Ratio = 8·90
									Time = 34 min.
22	37	61·0	0·2630	1·76	0·090	1·85	15·97	8·64	Average $MgCO_3$ = 1·71
18	37	61·3	0·2668	1·56	0·036	1·60	16·4	10·25	$Mg(HCO_3)_2$ = 16·25
22	37	60·9	0·2650	1·58	0·106	1·69	16·3	9·65	Ratio = 9·50
									Time = 21 min.
10½	39	60·4	0·2558	2·10	0·20	2·30	15·20	6·60	Average $MgCO_3$ = 2·21
10½	39	60·75	0·2587	2·09	0·135	2·13	15·5	7·25	$Mg(HCO_3)_2$ = 15·3
10½	39	61·3	0·2588	2·17	0·036	2·21	15·3	6·94	Ratio = 6·9
5½	44	61·4	0·2619	2·00	0·018	2·02	15·65	7·74	
3½	49	61·10	0·2636	1·75	0·072	1·82	16·02	8·80	
2½	54	61·25	0·2670	1·53	0·045	1·58	16·44	10·40	Average $MgCO_3$ = 1·60
2½	54	60·6	0·2652	1·46	0·16	1·62	16·40	10·12	$Mg(HCO_3)_2$ = 16·42
									Ratio = 10·25
1½	58·5	60·75	0·2700	1·14	0·135	1·275	16·98	13·32	
1½	63·5	61·3	0·2486	2·96	0·036	3·00	14·0	4·66	Average $MgCO_3$ = 3·00
1½	63·5	60·9	0·2484	2·85	0·108	2·96	14·1	4·75	$Mg(HCO_3)_2$ = 13·9
1½	63·5	61·6	0·2440	3·20	0·098	3·30	13·8	4·1	Ratio = 4·5
									Time = 1½ min.

Analyses.

Separated at	Found	Ratio
I. 25°.	MgO, 29·76, CO_2, 32·71,	$\frac{CO_2}{MgO}=1·098$
II. 70°.	MgO, 29·43, CO_2, 32·46,	$\frac{CO_2}{MgO}=1·102$
III. 75°.	MgO, 29·58, CO_2, 32·07,	$=1·085$

$OH.MgCO_3,2H_2O$ requires $MgO=29·16$, $CO_2=31·79$, $H_2O=39·05$. $\frac{CO_2}{MgO}=1·090$

All three products contain slightly more MgO and CO_2 than correspond with the formula, $OH.Mg.CO_3H$, but the constancy of the ratio $\frac{CO_2}{MgO}$ shows that this is due to a slight loss of water. Von Knorre (Zeit. anorg. Chem., **1903, 34,** 260) has also observed that the finely divided "trihydrate," $MgCO_3,3H_2O$, loses a little of its water at the ordinary temperature. That actually the same crystalline variety of the salt, $OH.Mg.CO_3H,2H_2O$, separates at 70° as at 25° is apparent on examining the crystals under the microscope, both in ordinary and in polarised light. The peculiar changes in the "apparent solubility" of the carbonate seen from Curve I. to occur in the neighbourhood of 39° and 59° cannot, therefore, be attributed to the formation of different hydrates or crystalline varieties of the salt. Curve IV., on the other hand, shows that in the interval from 25° to 60°, three distinct stages can be traced in the decomposition of the bicarbonate. They are, as follows:—

Region I. 25°—37°.—The Curve I. of "apparent" solubility is in reality a curve of supersolubility; all the points on the curve represent amounts of $MgCO_3$ in solution (1·2 to 3·1 grms. per litre) far exceeding those corresponding with the solubility of the so-called trihydrate, $MgCO_3,3H_2O$, which separates. According to Auerbach (Zeit. Electrochemie, 1904, **10**, 161) the solubility of $MgCO_3,3H_2O$, expressed as $MgCO_3$, is about 0·73 grm. per litre at 25°, and diminishes as temperature rises.

It would appear that between 25° and 39° two changes are taking place, *viz.*, the following:—

$$Mg<\begin{matrix}CO_3H\\CO_3H\end{matrix}+H_2O=Mg<\begin{matrix}OH\\CO_3H\end{matrix}+H_2CO_3\ldots.\alpha^*$$

in which a comparatively soluble and, perhaps, simple hydroxide-carbonate is produced, and a second, in which the hydroxide carbonate undergoes polymerisation:

$$nMg<\begin{matrix}OH\\CO_3H\end{matrix}+Aq\rightarrow(MgOH.CO_3H,2H_2O)\ldots\beta$$

At all points, when separation begins, the solution may be regarded as saturated with $(OH.Mg.CO_3H,2H_2O)$, but not saturated with the simpler, less complex form, $OH.Mg.CO_3H$, which is being produced directly from the bicarbonate. The variation shown in Curve I. as regards the amount of $MgCO_3$ in solution at different temperatures, may be regarded as due to there being different amounts of the simple form, $OH.Mg.CO_3H$, in solution at the moment when crystals of $OH.Mg.CO_3H,2H_2O$ begin to separate. The fact that up to 37° the amount of $MgCO_3$ in solution at the moment of separation of crystals increases with temperature, may be interpreted by assuming that rise of temperature accelerates the change, α, more than it does β. Both changes occur comparatively slowly between 25° and 37°, so that the bicarbonate solution has to be heated during intervals varying from 82 to 21 mins. (see Table II.) before solid begins to separate. The gentle slope of Curve IV., between 25° and 37°, shows that in this interval the actual rate of decomposition of the bicarbonate is only slightly influenced by temperature.

Region II. 37°—58·5°.—At about 37°, a sudden change in the direction of Curve IV. occurs, showing that a new kind of decomposition of the bicarbonate is setting in; the slope is steeper, indicating an increased rate of decomposition. Curve I. shows at the same time a gradually decreasing amount of $OH.Mg.CO_3H$ in solution at the moment when crystals of $OH.Mg.CO_3H,2H_2O$ begin to separate. It would appear that the decomposition, γ, of the bicarbonate, which sets in at about 38°, produces, not the soluble form $OH.Mg.CO_3H$, but the probably more polymerised form $(OH.Mg.CO_3H,2H_2O)_n$ directly. It is difficult to realise how this occurs, but probably several molecules of the bicarbonate take part simultaneously in the action, thus:—

$$nMg(CO_3H)_2+nH_2O\rightarrow(Mg<\begin{matrix}OH\\CO_3H\end{matrix})_n,2nH_2O\ldots\gamma.$$

The low solubility of the crystals having the composition, $OH.Mg.CO_3H,2H_2O$ (*viz.*, about 0·7 grm. per litre) would point to a considerable degree of polymerisation. Between 37° and 58·5°, the three changes, α, β, and γ, are probably occurring simultaneously; the slope of the Curve IV. and the constant diminution of the amount of $MgCO_3$ in solution at the moment when crystals begin to separate (Curve I.) would, however, indicate that the change, γ, more and more predominates as the temperature is raised. A "lag" may occur in the beginning of the change, γ; this would account for the values obtained between 34° and 39° on the Curve I. If such a "lag" could be prevented, the Curve I. would probably follow the course marked by the dotted line, MN.

Region III. Above 60°.—Between 58·5° and 63·5°, another and, as it were, explosive decomposition of magnesium hydrogen carbonate sets in; the result of this seems to be the direct formation of the soluble hydroxide-carbonate, $OH.Mg.CO_3H$, for the amount of $MgCO_3$ in solution, at the moment crystals begin to separate, increases from 1·275 grm. per litre at 58·5° to 3·09 grms. per litre at 63·5°. There is an enormous increase in the rate of decomposition of the bicarbonate, Curve IV. becoming almost vertical. The velocity of the change, β, at 63·5° is sufficiently great to cause a separation of crystals of $OH.Mg.CO_3H,2H_2O$ in 1½ minutes. The changes occurring between 58·5° and 63·5° are probably—

$$Mg<\begin{matrix}CO_2.OH\\CO_3H\end{matrix}\rightarrow Mg<\begin{matrix}OH\\CO_3H\end{matrix}+CO_2\ldots\ldots\ldots\delta$$

$$nMg<\begin{matrix}OH\\CO_3H\end{matrix}+Aq\rightarrow(OH.Mg.CO_3H,2H_2O)_n\ldots\beta$$

Above 63°.—The hydrolyses, α and γ, are negligible in comparison with the decomposition δ.

Magnesium hydroxide-carbonate, $OH.Mg.CO_3H$.—The foregoing results show that the action of water on magnesium bicarbonate is initially one of partial hydrolysis, giving rise to $MgOH.CO_3H$; the actual product being the dihydrate, $OH.Mg.CO_3H,2H_2O$. This substance does not lose water when boiled with absolute alcohol (b.p., 78°) during 1½ hours; at 95° the rate of loss begins to be appreciable, and at 100° the product, $OH.Mg.CO_3H$, is obtained on heating until the weight becomes constant. Even at 110°—115° water is lost comparatively slowly; 2 grms. of $OH.Mg.CO_3H,2H_2O$ losing 25·43 per cent. (constant) of its weight in 18 hours when heated in a crucible at 110°—115°. At 125° the loss of weight occurs more rapidly, but does not (unless the heating is very prolonged*) exceed that required for the formation of $Mg(OH).CO_3H$.

At 125°, 2·000 grms. lost 26·45 per cent. (constant) in 4½ hours. Theory for loss of $2H_2O=26·04$ per cent.

Magnesium hydroxide carbonate can also be obtained from the dihydrated salt, $Mg(OH).CO_3H,2H_2O$, by boiling the latter with xylene (b.p., 136°—138°) and distilling off

* An analogy may be traced between such a hydrolysis of magnesium bicarbonate and the decomposition by water of the etherates of magnesium bromide and iodide (Menschutkin, Bull. St. Petersburg, Polyt. Inst., 1905, 4. See Abstr. Chem. Soc., 1906, i, 132); for example:

$MgI_2.2Et_2O+H_2O \rightarrow MgI.OH,2Et_2O+HI$,

$Mg(CO_2H)_2,Aq+H_2O \rightarrow Mg(OH).OO_2H,Aq+H_2CO_3$.

* Prolonged heating of $OH.Mg.CO_3H$ at 125° during several days, causes slight decomposition, accompanied by loss of water and carbon dioxide.

the water as fast as it is liberated.* For this purpose the hydrated salt (3 grms.) is boiled with purified dry xylene (450 grms.), and the latter gradually distilled from the solid, until it no longer carries water with it; the distillation is so regulated as to be continuous during 2½ hours, the amount of xylene then remaining undistilled being about 75 c.c. The last 100 c.c. of xylene passing over should be perfectly limpid and free from water. The crystals remaining, after being heated during 15 minutes in a stream of air at 130° to remove traces of xylene, gave $MgO = 39{\cdot}97$, $CO_2 = 42{\cdot}36$, $H_2O = 17{\cdot}67$ per cent.; calculated for $Mg(OH).CO_3H$, $MgO = 39{\cdot}39$, $CO_2 = 43{\cdot}06$, $H_2O = 17{\cdot}58$. The product has lost a little carbon dioxide, probably owing to slight decomposition by water; the analysis corresponds with a mixture $Mg(OH).CO_3H + 0{\cdot}030Mg(OH)_2$. Calculated: $MgO = 39{\cdot}92$, $CO_2 = 42{\cdot}27$, $H_2O = 17{\cdot}82$ per cent.

It is remarkable that the hydroxide-carbonate retains the external crystalline form of the dihydrate $OH.Mg.CO_3H.2H_2O$, from which it is prepared, either by heating in the dry state or with xylene. When examined under the microscope, however, it is seen to differ from the dihydrated salt (Photographs I. and II.) by showing striations running lengthwise along the faces and small "blowholes" from which steam was probably emitted (see Photographs III. and IV.). The hydroxide-carbonate would thus appear to be pseudomorphous with its dihydrate, but it is to be observed that the optical properties of the latter do not appear to be destroyed; the crystals of $Mg(OH).CO_3H$, when examined between crossed Nicols, appear bright against a black ground (Photograph V.); Photograph VI. shows a crystal of the dihydrate, $OH.Mg.CO_3H.2H_2O$, under similar conditions. The extinction is in both substances straight. It would appear that we are dealing with one of those cases in which loss of water exercises little influence on crystalline shape; as, for instance, in passing from $Na_2CrO_4.10H_2O$ to $Na_2CrO_4.4H_2O$ (Arzruni, Physik. Chemie der Krystall, p. 270).

II. Magnesium Carbonates.

For the peculiar properties of Engel's variety of $MgCO_3$, see Compt. rend., 1899, **129**. 598. It is easily convertible by water into $OH.Mg.CO_3H$, and therefore can be decomposed by boiling with water giving magnesium hydroxide.

Magnesite, $(MgCO_3)n$, either crystalline or massive, is not changed when boiled in a state of fine powder with water or alkaline carbonates.

Crystalline.—Original substance contained $MgO = 47{\cdot}50$ per cent. Boiled two hours with water, $MgO = 47{\cdot}31$.

Massive. Original substance contained $MgO = 49{\cdot}3$ per cent. After boiling two hours with water, $MgO = 48{\cdot}9$.

Crystalline.—Boiled two hours with $N/10$ potassium carbonate, $MgO = 47{\cdot}4$ per cent.

III. The So-called "Basic" Magnesium Carbonates.

Brill (Zeit. anorg. Chem., 1905, **45**, 275) considers that a series of seven distinct basic carbonates are formed, between the temperatures of 230° and 510°, when magnesium carbonate is heated, and attributes to each a definite dissociation temperature. The fact that he worked with a "hygroscopic" magnesium carbonate, having the composition, $MgCO_3.\frac{1}{2}H_2O$, however, deprives his results of real significance as examples of the "dissociation" of magnesium carbonate; the presence of water profoundly modifies the decomposition of magnesium carbonate. Brill's material began (owing to the presence of water) to "dissociate" at 230°. Magnesite does not lose water until 405° (Anderson), but magnesium hydroxide carbonate is known to decompose, losing carbon dioxide, considerably below 300°.

Method of analysis of the so-called basic carbonates.—The method adopted was to heat about 0·3—0·5 grm. of the carbonate, contained in a platinum boat, very gradually by means of a Ramsay burner, in a Jena glass combustion tube, 9 ins. by ½ in., through which a current of air was slowly passed. The water and carbon dioxide formed were absorbed, respectively, in a weighed calcium chloride tube and Wetzel potash bulb, as in an ordinary combustion. The decomposition was usually complete within 20—40 minutes; during the last 10 minutes, the largest possible flame obtainable with the Ramsay burner was used, and the decomposition was considered to be at an end when, on stopping the current of air, a bubble of gas did not pass forward into the bulbs during about 30 seconds. The percentage of magnesium oxide was ascertained by igniting, to constant weight, in a muffle furnace, about 0·5 grm. of the carbonate. A check on the accuracy of the analyses was obtained by ascertaining whether the sum of the percentages amounted to 100. If the substance analysed was at all hygroscopic and, therefore, increased in weight whilst being weighed in an open boat, the method was slightly modified. The substance was weighed from a small corked glass tube, about ¼ in. diameter, directly into the combustion tube, being poured against a plug of asbestos placed about 1½ in. from the end connected with the weighed calcium chloride tube; the combustion tube was then gently shaken so as to distribute the powder evenly and ensure that the whole of it got heated. Before each analysis, it is, of course, necessary to pass dry air through the heated tube to expel all moisture.

Formation of the salt, $Mg.OH.CO_3H.2H_2O$, *by the action of sodium carbonate on magnesium sulphate.*—Cold solutions of equivalent quantities of sodium carbonate and magnesium sulphate, each dissolved in 15 parts of water, were mixed, and the "basic" precipitate first formed left with the mother liquor. After four days, the precipitate was entirely crystalline, and contained $MgO = 29{\cdot}73$ per cent. (air dried.) The mother liquor after standing for three months gave a further crop of needles, which on analysis gave $MgO = 29{\cdot}25$. Calculated for $Mg(OH).CO_3H.2H_2O$, $MgO = 29{\cdot}16$. The experiment clearly shows that a "basic carbonate" cannot be produced by the decomposition of the hydroxide-carbonate by water at the ordinary temperature; the crystals separated from the mother liquor were in contact with water containing a slight excess of alkaline carbonate during three months, and yet contained magnesia and carbon dioxide in the ratio corresponding with a normal carbonate.

The following experiment shows that pure water, free from alkali, is practically without action on magnesium hydroxide-carbonate dihydrate at the ordinary temperature. About 1 grm. of the specially purified material was left at 18° for three weeks with 150 c.c. of distilled water in a well-stoppered Jena flask; at the end of this time the solution was perfectly clear and the crystals transparent and unchanged. After about one month, however, the crystals began to stick to the glass and to show change where they were in contact with it; a thin film of hydroxide began to form over them. The decomposition in contact with the glass is perhaps caused by the glass itself.

Effect of boiling the salt, $OH.Mg.CO_3H.2H_2O$, *with water.*—5 grms. of the crystalline salt, consisting of white needles, was boiled with 325 c.c. of water in a Jena flask during 15 minutes, about a third of the product being then separated, dried in the air, and analysed,=Product I. The remainder of the solid was then boiled with the same liquid during another 15 minutes, and half of it separated and dried,=Product II. The remaining portion of the solid was boiled with liquid during 30 minutes, the volume being kept fairly constant by adding water as required,=Product III. Product I. represents the effect of boiling $OH.MgCO_3H.2H_2O$ with water during 15 minutes, Product II. of boiling during 30 minutes, and Product III. the result of boiling with water during one hour. The following table summarises the results. All the substances were air dried.

* If the water is not removed in this way, it attacks the hydroxide-carbonate and gives rise to a product containing much magnesium hydroxide, similar in composition to that obtained by boiling the hydrated salt with a large quantity of water.

TABLE III.

Product.	Time in mins.	Concentrated $MgCO_3$ per litre expressed as $MgCO_3$	Composition per cent. MgO	CO_2	H_2O	Formula.	Mixture of.	$\frac{H_2O}{CO_2}$ found.	$\frac{H_2O}{CO_2}$ calculated.
I.	15	5·5	39·76	35·16	25·12	$MgCO_3$, 0·234 $Mg(OH)_2$, 1·51H_2O	* 1·1 $Mg(OH)CO_3H$, $2H_2O$; 3·16 $Mg(OH).CO_3H$; 1·0 $Mg(OH)_2$	8·38	8·32
II.	30	3·7	41·17	35·28	23·62	$MgCO_3$, 0·270 $Mg(OH)_2$, 1·365 H_2O	† 0·70 $Mg(OH)CO_3H$, $2H_2O$; 3·0 $Mg(OH)CO_3H$; 1·0 $Mg(OH)_2$	8·06	8·00
III.	60	1·8	41·45	35·40	23·18	$MgCO_3$, 0·276 $Mg(OH)_2$, 1·323 H_2O	‡ 0·58 $Mg(OH).CO_3H.2H_2O$; 3·05 $Mg(OH).CO_3H$; $Mg(OH)_2$	8·07	8·10

* Calculated: MgO = 39·74 CO_2 = 35·08 H_2O – 25.18.
† Calculated: MgO = 41.03 CO_2 = 35.20 H_2O – 23.76.
‡ Calculated: MgO = 41.43 CO_2 = 35.42 H_2O = 23.15.

The products, when examined under the microscope, were seen to be mixtures (compare Photographs VII. and VIII.). They may be considered as formed by the two following actions:

A. $Mg(OH)CO_3H,2H_2O \rightarrow Mg(OH)CO_3H + 2H_2O$ *Dehydration.*

B. $Mg(OH)CO_3H + H_2O \rightarrow Mg(OH)_2 + H_2CO_3$ *Hydrolysis.*

An easy calculation shows that the nature of the products I. II., and III. can be explained in a simple manner by such a hypothesis.

In the original substance $OH.MgCO_3H,2H_2O$,

	CO_2	H_2O
1 grm. MgO is associated with	1·0902 grm.	and 1·3390

In Product I.,

1 grm. MgO is associated with	0·8841 grm.	and 0·6317
	0·2061	0·7073

Thus, in the formation of the "basic carbonate" I. from the original substance,

1 grm. MgO loses 0·2061 grm. CO_2 and 0·7073 grm. H_2O.

Ratio of loss of water to loss of carbon dioxide $= \frac{0·7073}{0·2061} = 3·43$.

Mol ratio, $\frac{\text{loss of } H_2O}{\text{loss } CO_2} = 3·43 \times \frac{44}{18·02} = 8·38$.

Thus, in forming the Product I. from the original material 8·38 mols. of water are lost for every 1 mol. of CO_2 expelled.

Similarly, in forming Products II. and III. from the same substance the ratio of $\frac{\text{loss of } H_2O}{\text{loss of } CO_2}$ is found to be 8·06 and 8·07 respectively (see table).

It is only necessary to assume that the action, A (dehydration), takes place about 8¼ times as rapidly as change B (hydrolysis), to explain the approximately constant character of the ratio of the loss of water to loss of carbon dioxide. The change, B, takes place more slowly than change, A, owing to the comparatively small solubility of the original material.

The composition of substances, I., II., and III., is shown in the eighth column to agree with this view; Product I. can easily be calculated to be a mixture of 1·1 mols. $OH.Mg.CO_3H,2H_2O$ (unchanged material), 3·16 mols. $Mg(OH).CO_3H$, and 1·0 mol. $Mg(OH)_2$, and similarly the composition of II. and III. agrees with that of the mixtures given in the table. If in the case of I., it be supposed that 5·26 mols. of $Mg(OH).CO_3H,2H_2O$ are started with, and 4·16 of these undergo change according to A, 1·00 mols. of the hydroxide-carbonate formed undergoing change in the sense of B, we obtain a theoretical ratio of $\frac{\text{loss of water}}{\text{loss of } CO_2} = \frac{8·32}{1} = 8·32$

The values calculated for the Products II., and III., assuming them to be mixtures formed in a similar manner, in the last column of the table, agree closely with those calculated from the composition given in column 8.

Progressive decomposition of magnesium hydrogen carbonate in solution, between temperatures of 80° and 100°.—1200 c.c. of a solution of magnesium hydrogen carbonate (free from alkali, and containing 11·07 grms. $MgCO_3$ per litre) was gradually heated to a temperature of 78°. During the heating between 65° and 78° a crystalline precipitate separated in quantity. The times of heating were seven minutes to raise from 65° to 70°, five minutes to raise from 70° to 78°; then left to cool to 70°; time of cooling from 78° to 70° = 18 minutes.

Precipitate = α, weight, air dried, = 11·0 grms.; under microscope, entirely crystalline (see Photograph 1.).

The mother liquor (containing about 6·7 grms. $MgCO_3$ per litre) was then heated during 20 minutes at 85°—90°. Precipitate = β, weight, air dried, = 2·5 grms. a light powder, only partly crystalline under microscope (see Photographs VII. and VIII.).

Mother liquor from β (containing, roughly, 3·0 grms. $MgCO_3$ per litre) boiled at 100° during 15 minutes. Precipitate = γ, weight 3·1 grms. – somewhat more compact than β, and only very slightly crystalline.

Mother liquor from γ, containing, as shown by a titration, 0·26 grm. $MgCO_3$ per litre, boiled 65 minutes. Precipitate = δ, formed only slowly, gelatinous when wet, horny when dry, and resembling magnesium hydroxide. Dried in air only very slowly. Weight, dry, 0·15 grm.

The following table gives a summary of the result and indicates the nature of the precipitates:—

TABLE IV.

Precipitate.	$MgCO_3$ per litre in solution	Temp. of heating	Time of heating.	Composition, expressed by formula.*	Mixture of	Found Mol ratio, $\frac{\text{loss } H_2O}{\text{loss } CO_2}$	Mol. ratio, $\frac{\text{loss } H_2O}{\text{loss } CO_2}$ calculated for mixture.
α	11·1	65°–78°	30 min	$MgCO_3,3H_2O$			
β	5·5	85°–90°	20 „	$MgCO_3,0·208\ Mg(OH)_2,1·04H_2O$	1·50 mols $Mg(OH)CO_3H$, $2H_2O$; 3·30 mols. $Mg(OH)CO_3H$; 1·00 mols $Mg(OH)_2$	8·55	8·60
γ	3·0	100°	15 „	$MgCO_3,0·246\ Mg(OH)_2,1·44\ H_2O$	0·90 $Mg(OH)CO_3H$, $2H_2O$; 3·10 $Mg(OH)CO_3H$; 1·00 $Mg(OH)_2$	8·33	8·20
δ	0·26	100°	60 „	$Mg(OH)_2,0·143\ MgCO_3,0·81\ H_2O$			

* The absorption or imbibition of benzene by magnesium hydroxide is very striking; it makes the density of the latter determined in benzene appear considerably greater than that determined in water, which is not absorbed by the dried hydroxide.
Relative density of magnesium hydroxide at 25° (25°, determined by displacement of water = 2·35.
Relative density, referred to water at 25°/25°, determined by displacement of benzene = 2·58.

* *Analyses.*—α. $MgO = 29.20$; $CO_2 = 46.40$; $H_2O = 24.40$; total 100·26; calculated for mixture given:—$MgO = 29.16$; $CO_2 = 46.70$; $H_2O = 24.40$.

β. $MgO = 38.77$; $CO_2 = 34.99$; $H_2O = 26.50$; total 100·26; calculated for mixture:—$MgO = 38.74$; $CO_2 = 34.97$; $H_2O = 26.26$.

γ. $MgO = 40.29$; $CO_2 = 35.21$; $H_2O = 24.39$; total 100·08; calculated for mixture given:—$MgO = 40.35$; $CO_2 = 35.15$; $H_2O = 24.50$.

δ. $MgO = 60.75$; $CO_2 = 8.27$.

Photographs VII. and VIII. of the precipitate, β, show plainly that it is a mixture; in Photograph VII. β is mounted in glycerin jelly, and in Photograph VIII. (more highly magnified) in Canada balsam. The large crystals consist of the unchanged salt, $OH.MgCO_3H,2H_2O$, or of the hydroxide carbonate, $OH.MgCO_3H$; the opaque masses in Photograph VIII. consist of amorphous magnesium hydroxide adhering to and encrusting crystals of the hydroxide-carbonate. On adding benzene to the Canada balsam the magnesium hydroxide absorbs it and becomes transparent * and the crystals of the hydroxide-carbonate are thus rendered plainly visible. Glycerin jelly serves the same purpose to some extent, but does not render the hydroxide so transparent.

The decomposition of *magnesium bicarbonate* by water, between 65° and 78°, gives the salt, $Mg(OH)CO_3H,2H_2O$, (*a*)' alone. The products, β and γ, are formed by the decomposition by water of crystalline hydroxide-carbonate dihydrate, $Mg(OH).CO_2H,2H_2O$, initially precipitated; that this is so and that the decomposition proceeds in the manner explained on p. 796, is shown by the identity of the number expressing the mol. ratio, $\frac{\text{loss } H_2O}{\text{loss } CO_2}$, calculated for the formation of β and γ from this salt, with the constant found for the decomposition of the crystalline $OH.MgCO_3H,2H_2O$. The following table shows this:—

TABLE V.

Decomposition of magnesium hydrogen carbonate.		Decomposition of solid $Mg(OH).CO_3H,2H_2O$.	
$MgCO_3$ per litre of water.	Ratio found for loss H_2O/loss CO_2.	$MgCO_3$ per litre of water.	Ratio found for loss H_2O/loss CO_2.
5·5	8·55	5·5	8·38
3·0	8·33	3·7	8·06
		1·8	8·07

The values found with the solid $Mg(OH)CO_3H,2H_2O$ are slightly lower than with the bicarbonate solution at corresponding concentrations; this is perhaps due to the presence, in the latter case, of carbon dioxide in solution retarding the change,—

$$Mg(OH)CO_3H + H_2O = Mg(OH)_2 + H_2CO_3$$

according to the law of mass action. In both cases, the value of the ratio diminishes as the concentration of the carbonate diminishes, that is, as the proportion of water *increases*; an increase of dilution favouring hydrolysis and loss of carbon dioxide at the expense of the decomposition by dehydration.

The product, δ, probably consists of magnesium hydroxide which has taken up a little carbon dioxide from the air during the long exposure required for the gelatinous precipitate to dry; its appearance and the following experiments support this view. Magnesium hydroxide-precipitated from magnesium sulphate solution by potassium hydroxide, after draining on biscuit ware and drying rapidly at 120°—130°, was found to contain 68·44 per cent. magnesia, and to be practically free from carbon dioxide ($Mg(OH)_2$ requires $MgO = 69.1$ per cent.). When allowed to dry in the air the product contained $MgO = 67.75$, $CO_2 = 8.51$ per cent. The amount of carbon dioxide taken up agrees closely with that present in δ. The solution from which α was formed, did not contain sufficient magnesium carbonate for either of the compounds of either series, $Mg(OH)CO_3H$ or $Mg(OH)CO_3H,2H_2O$, to separate in the ordinary course of the latter's formation (about 0·20 grm. $MgCO_3$ per litre at 100°); and from precipitates that can therefore be formed on heating a magnesium hydroxide formed according to the equation,—

$$Mg(OH)CO_3H + H_2O = Mg(OH)_2 + H_2O + CO_2$$

In the experiments made by boiling the crystalline salt, $OHMgCO_3H,2H_2O$, with water, it might appear, at first sight, from the similarity of Products II. and III. (Table III.), that a definite basic carbonate was being formed. During the first 15 minutes' heating with water, the salt undergoes much more decomposition than occurs during the next 15 minutes (Product II.), whilst there is very little change at all during the next 30 minutes (Product III.). An explanation of the apparent equilibrium set up is at once given by considering Photograph VIII. A film of magnesium hydroxide is deposited on the crystals of the original salt and of the derived salt, $OHMgCO_3H$, during the earlier heating, and thus arrests the action by preventing contact with water. The mixed character of the basic carbonates of magnesium precludes, as already explained on pp. 789, 790, the acceptance of the existence of definite basic salts.

The exact composition of the product obtained after boiling a solution of magnesium bicarbonate depends entirely on the conditions, such as the original concentration and rate of heating, which determine the fineness of the initially precipitated $OH.Mg.CO_3H,2H_2O$. Thus, whilst in the foregoing experiment γ, with an original concentration of the bicarbonate solution of 3·3 grms. $MgCO_3$ per litre, a precipitate having the composition $MgCO_3,0·246Mg(OH)_2.1·44H_2O$, was obtained, a solution of the bicarbonate, containing 11·2 grms. $MgCO_3$ per litre, gave, after boiling (see p. 798) for one hour, a product, $MgCO_3.0·319Mg(OH)_2.1·20H_2O$. In the former case the ratio, $MgCO_3 : Mg(OH)_2$, is nearly 4 : 1; in the second case, approximately 3 : 1. The approximation in composition to simple formulæ is in such cases deceptive.

IV.—Decomposition of Magnesium Acidium Carbonates in Aqueous Solution at 100°.

Decomposition of the salt, $Mg(CO_3H)CO_3Na$, by water at 100°.—To 100 c.c. of a solution of magnesium bicarbonate containing 11·07 grms. $MgCO_3$ per litre, 121 c.c. of a decinormal solution of sodium hydroxide and 100 c.c. of water was added. No precipitate was formed, and the solution contained 3·3 grms. $MgCO_3$ in the form of $Mg(CO_3H)CO_3Na$ per litre. On warming to 60°, minute well-defined crystals of the salt, $Mg(OH)CO_3H,2H_2O$, began to separate. The liquid was raised to the boiling-point, kept in active ebullition for one hour, the product filtered, dried in a vacuum desiccator and analysed. Two separate preparations gave—

(*a*) $MgO = 43·58$ $CO_2 = 35·75$ $H_2O = 21·04$. Total, 100·37.

(*b*) $MgO = 42·83$ $CO_2 = 35·73$ $H_2O = 21·43$. Total, 99·99.

Mean, $MgO = 43·20$ $CO_2 = 35·74$ $H_2O = 21·24$,

corresponding with the composition,—

$$MgCO_3,0·319\ Mg(OH)_2,1·13H_2O.$$

The product is identical in composition with that formed on boiling a solution of magnesium bicarbonate with water for the same time, with similar precautions (see p. 798). It has been formed, no doubt, by the decomposing action of water on the salt, $OH.Mg.CO_3H,2H_2O$, initially precipitated, the magnesium hydrogen carbonate present in solution exercising no influence.

Behaviour of the disodium salt, $Mg(CO_3Na)_2$, when boiled with water.—To 100 c.c. of the same solution of magnesium bicarbonate was added 27·1 c.c. of N/10 sodium hydroxide (*i.e.*, 2 mols., NaOH); no precipitate was at first formed, but after 25 c.c. of the alkali had been added a faint opalescence appeared; on standing, a slight flocculent precipitate began to separate. The liquid was boiled for one hour. The product was gelatinous, resembling precipitated magnesium hydroxide. It was obtained on a tile in a vacuum over

left for four days in a vacuum desiccator.

Analysis. $MgO = 29.16$, $CO_2 = 35.38$, $H_2O = 22.79$. Total, 100·33. This agrees with the formula $Mg(OH)_2,0{\cdot}33MgCO_3,0{\cdot}75H_2O$, and indicates that the decomposition of magnesium bicarbonate; this decomposition of the salt $Mg(OCO_2Na)_2$ with water at 100° gives, therefore, about 2 mols. of $Mg(OH)_2$ for every molecule of $OH.Mg.CO_3H$ produced.

Decomposition of magnesium hydrogen carbonate by excess of sodium hydroxide.—To 58 c.c. of a solution of magnesium hydrogen carbonate, containing 20·1 grms., $MgCO_3$ per litre, 410 c.c. of *N*/10 sodium hydroxide solution (*i.e.*, $2NaOH$) was added; the amount present was, therefore, 2·8 grms. $MgCO_3$ per litre of liquid, *i.e.*, nearly the same as in the two previous experiments. The liquid was boiled for one hour. The product was slightly gelatinous and difficult to filter; it was drained on a tile and after drying as in the preceding experiment in a vacuum desiccator, analysed:—Found, $MgO = 42{\cdot}42$, $CO_2 = 5{\cdot}75$, $H_2O = 27{\cdot}00$. Total, 100·06. Composition = $Mg(OH)_2,0{\cdot}08MgCO_3$.

The product here is almost entirely magnesium hydroxide. An excess of alkali thus favours the hydrolysis, $Mg(CO_3Na)_2 + 2HOH = Mg(OH)_2 + 2NaHCO_3$, at the expense of the decomposition giving hydroxide-carbonate.

Decomposition of magnesium bicarbonate by water, free from traces of alkali.—The product obtained when magnesium bicarbonate is boiled with water (Product γ, Table IV.) is so similar in composition to that formed by decomposing (p. 797) the same substance in presence of ½ mol. of sodium hydroxide, that the question arises whether the formation of magnesium hydroxide from the bicarbonate or the salt $OH.Mg.CO_3H,2H_2O$ is not due to the intermediate production of the salt $Mg(CO_3H)CO_3Na$, owing to the presence of traces of alkali removed from the glass or present in the original solution. A solution of magnesium bicarbonate prepared from ordinary pure magnesium carbonate, which has been repeatedly boiled with large quantities of water, always shows an intense sodium flame when heated on a platinum wire. By alternately dissolving the carbonate, however, in water containing carbon dioxide and decomposing the solution so obtained, as explained on page 791, a solution of the bicarbonate may be ultimately obtained which is absolutely free from alkali. A large platinum bottle having a capacity of 2 litres was used throughout the preparation, and the water prepared by the aid of a Bousfield still, having a conductivity of 2·0 gemmhos at 25°. The bicarbonate, ultimately obtained, contained 19·7 grms. of $MgCO_3$ per litre and did not show a sodium flame when heated on a platinum wire. Fifty-seven c.c. of this solution diluted with 43 c.c. of the conductivity water, giving a concentration of 11·2 grms. $MgCO_3$ per litre, was boiled in a platinum flask of a capacity of 300 c.c., fitted with a platinum condenser-tube, round which steam circulated in a jacket. The product was collected, dried for several days in a vacuum desiccator, and analysed:—

$MgO = 29{\cdot}33$, $CO_2 = 35{\cdot}38$, $H_2O = 22{\cdot}02$. Total, 100·23. Composition = $Mg(OH)_2,0{\cdot}31MgCO_3,1{\cdot}20H_2O$.

The product is almost identical in composition with that obtained in the experiment when $1NaOH$ was present ($MgO = 29{\cdot}20$, $CO_2 = 35{\cdot}74$, $H_2O = 21{\cdot}24$). There can be no doubt, therefore, that water at 100° will of itself decompose the salt, $OH.Mg.CO_3H,2H_2O$, and that in both cases the product is formed by the decomposition of this salt by water.

In conclusion, I take great pleasure in acknowledging my indebtedness to Prof. Armstrong for much valuable criticism, to Mr. Geo. Matthey, F.R.S., for the loan of platinum apparatus, and to Mr. R. Whymper for his assistance in preparing the magnesium hydroxide.

[illegible]

[illegible] 16, 1898.

PROF. A. G. GREEN IN THE CHAIR.

A METHOD FOR THE EXAMINATION OF MARINE OILS.—PART I.

Contribution from the Leather Industries Laboratory of the University of Leeds.

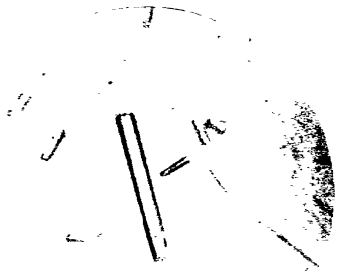
BY H. R. PROCTER AND H. G. BENNETT.

It is well known that the investigation and analysis of oils is attended with considerable difficulty on account of their being mixtures of substances which are chemically very similar. The oil chemist is therefore compelled to fall back upon the determination of various "values" and constants, often of an empirical nature, and obtained by following analytical processes under certain definite conditions. One of the most important of these is the iodine value, which, being the percentage of iodine absorbed by the oil, gives some knowledge of its unsaturated constituents, and is practically a measure of the number of "double-bonds" present. This, however, yields little information as to the nature of these compounds, and we have no means of telling, for example, whether the iodine value is due to the presence of a fairly large quantity of the glyceride of an acid with one double-bond, or is accounted for by a comparatively small quantity of the glyceride of an acid with several double-bonds. Various attempts have been made to gain further information in this direction, notably by Hehner and Mitchell ("Analyst," 1898, 313) whose "hexabromide test" is based upon the differences in solubility of the bromination glycerides in ether, and of the brominated fatty acids in acetic acid, those compounds with the higher percentage of bromine being much more insoluble. Quantitative determinations of the yield of "hexabromides" from various oils have also been attempted, and the work was supplemented to some extent by Farnsteiner, who investigated more closely the "tetrabromides" of vegetable oils.

The present work is an application of this principle of different solubility to the marine oils—information as to these being most needed in the institution from which the research comes. It is well known that these oils are often adulterated by admixture with other marine oils of inferior quality and price, and that, unfortunately, it is usually quite impossible to tell by any known test whether this has been done, and to what extent. Hence, one of the principal hopes of the authors was that in the investigation of the more highly unsaturated glycerides of these oils such striking differences might be observed in the quantity, as revealed by the percentage yield of "hexabromides," as would serve not only for their identification but also for the detection of adulteration.

This hope was encouraged by the results already obtained, a summary of which is given in table on p. 79[illegible]

As far as the glycerides are concerned, the method of Hehner and Mitchell as it stands, is open to several objections, not the least obvious being their method of adding bromine until a permanent coloration is first obtained, and then allowing it to stand three hours. Evidently if there is to be complete bromination, it will be necessary to add enough bromine to leave some unabsorbed at the end of three hours. Moreover, as a test in which to do a quantitative bromination, ether is a peculiar choice. Its hygroscopic nature, its [illegible]



I.—OH $Mg\,CO_3H_2H_2O$.



II.—OH $Mg\,CO_3H_2H_2O$
Mono-hydrous magnesium

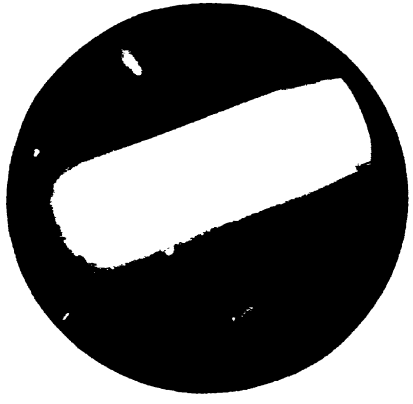


III.—OH $Mg\,CO_3H_2H_2O$ crystallized from boiling
aqueous solution at 125°

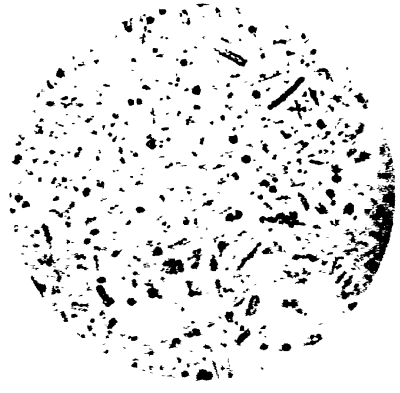
IV.—OH $Mg\,CO_3H$ decomposed by boiling pro-
longed in water with Xylene



OH $Mg\,CO_3H$ between crossed Nicols.



VI.—OH $Mg\,CO_3H_2H_2O$ between



VII.—Same specimen as



VIII.—Same dry in Canada Balsam

sufficient phenol was added to cause the disappearance of the colour due to the excess of bromine. The results were fairly satisfactory, being as follows:—

*Möller's Cod Liver Oil.**

1 .. 38·9 2 .. 38·2

Brown cod oil.		*Bromine percentage.*
1. 58·3	.....	59·1
2. 60·5	.....	57·7
3. 59·1	.....	58·7
4. 59·1	.....	58·3

It seemed of interest now to investigate somewhat the nature of the precipitate and to find the amount of bromine it contained. A standard solution of bromine in carbon tetrachloride was made, and a definite quantity—insufficient for complete bromination—was added to a carbon tetrachloride solution of cod oil, and after the disappearance of the bromide, the bromides were hydrolysed on the water-bath by the action of alcoholic potash for three hours. This not only saponifies the glyceride, but removes the bromine as potassium bromide, leaving the alkali salts of the hydroxy fatty acids. The products were now washed into a calibrated flask, made distinctly acid by formic acid, the excess of it neutralised by the addition of some magnesium oxide, and the solution made up to the mark with distilled water. The insoluble portions were filtered off, their volume being inappreciable, and the amount of potassium bromide estimated in aliquot portions of the filtrate, by means of N/10-silver nitrate solution, using three drops of 10 per cent. potassium chromate solution as indicator. This method was found to be accurate, and hence was applied to the precipitates obtained from the brown cod oil, above. The results are given in the column adjoining the yield of bromine.

Accepting the statement of Dieterich that the mean molecular weight of the acids of cod oil is approximately 275, the "hexabromide" of a triglyceride would have 62·5 per cent. of bromine, a "tetrabromide" 52·5 per cent. of bromide, and a "dibromide" 35·8 per cent., and hence it will be seen that the above precipitates must either be the bromide of a mixed glyceride, or a hexabromide precipitate with lower bromides mixed with it, or both, the variations noticed making the last two explanations the more probable. It will be noticed, too, that where the yield of bromides is greatest, the bromine percentage is least, and *vice versâ*. This bears out the idea that we are dealing with mixtures of bromides, those containing the most bromine being the most insoluble.

An experiment was now made, using a larger quantity of oil, brominating in carbon tetrachloride as usual, and removing the excess of bromine by phenol, and then precipitating the bromides gradually by alcohol, filtering off each fraction separately, washing, drying, weighing, and estimating the bromine in each fraction.

9·853 grms. of brown cod oil were dissolved in 200 c.c. of carbon tetrachloride. After the bromination, the solution was slightly turbid, but nothing could be filtered off.

50 c.c. of alcohol were added—again the filter retained nothing. 50 c.c. of alcohol were added again—large precipitate. (Fraction 1.)

To the filtrate from (1) 100 c.c. more alcohol were added, but nothing could be filtered; 25 c.c. more alcohol however, precipitated an oil which was filtered off with difficulty. (Fraction 2.)

To the filtrate, 75 c.c. more alcohol were added and more oil was precipitated. (Fraction 3.) 100 c.c. of alcohol added to the filtrate precipitated still more oil. (Fraction 4.) No further precipitate was obtained. The total yield was 133·6 per cent., and the weights of each fraction and its percentage of bromine are given as follows:—

	grms.	per cent. bromine.
(1)	9·6974	containing 60·3
(2)	1·3883	containing 53·7
(3)	0·6449	containing 54·6
(4)	1·2125	containing 33·1

* It will be noticed, perhaps, as curious that Möller's cod—which is supposed to be unoxidised—should give a lower result than an ordinary brown cod. This fact was also confirmed by the method as modified later, but the authors do not as yet attempt to explain it.

Keeping still to the assumption of 275 as a mean molecular weight for the acids, and excluding the possibility of mixed glycerides, we see that, roughly speaking, (1) is a "hexabromide" mixed with some tetrabromide, (2) and (3) are tetrabromides mixed with some hexabromide, and (4) is dibromide mixed with some saturated oil. It may be mentioned that part of (1) was dissolved in carbon tetrachloride and fractionated further, and two fractions were obtained which gave over 70 per cent. of bromine; *i.e.*, were "octabromides"—corresponding to the triglycerides of an acid with four double-bonds.

It seemed evident from this experiment that it would be better in the quantitative work to add less alcohol, and so exclude more tetrabromide (which is shown above to be an oil), and thus render the filtration more easily workable. This conclusion was strongly confirmed by a quantitative experiment, in which the precipitate was left 18 hours before filtration, and was then found to be very oily, difficult to filter, and to give a bromide yield of 79·6 per cent., thus showing the tetrabromide to be really insoluble in the mixture of one volume of carbon tetrachloride and two volumes alcohol, though only very gradually precipitated.

The method of drying in air was also dispensed with, for the simple reason that it was necessary to weigh the precipitate and paper under the same conditions of atmospheric humidity as when the paper was tared, and this was not always possible. As heat has been shown to decompose the precipitate, it is necessary to have an arbitrarily fixed time for heating, and as it may be necessary to estimate the bromine in the precipitate, this time should obviously be at a minimum, so that the precipitate may be as little decomposed as possible. Henceforth, therefore, the precipitates were dried in air, and then heated for a quarter of an hour in the steam oven, which was quite sufficient to get atmospheric moisture out of the filter paper.

Again, in view of the expense of both absolute alcohol and carbon tetrachloride, and from the standpoint of quick working, it seemed desirable to make some reduction in the quantities used. Hence, the method was modified as follows:—

Cod oil =0·4 grm. (approximately), is weighed out into a small tared flask, and 10 c.c. carbon tetrachloride added, and 12 drops of bromine, the mixture being kept cool for three hours in running water. Remove the excess of bromine by adding 10 c.c. of carbon tetrachloride containing 0·075 grm. of phenol, and add 20 c.c. of absolute alcohol gradually, with constant stirring. Filter, and allow to drain, wash with 50 c.c. absolute alcohol,* dry in air, place in a weighing bottle which has been first tared along with the paper, and heat in steam oven for a quarter of an hour, cool in a desiccator, and weigh. The bromine should be dropped from a tap funnel at a rate convenient for counting, and, with duplicate experiments, should drop at the same rate. It was proved, by dropping into excess of potassium iodide, and titrating with thiosulphate, that this gives very approximately the same quantity of bromine. For any given oil it is necessary to keep the weight taken very nearly the same, for, if too little be taken, more bromine will be left over than will be debrominated by the small quantity of phenol added, and, if too much be taken, there may be no bromine left in excess at the end of the three hours. With these precautions and some care, results varying within 1 per cent. can easily be obtained. This percentage yield of bromides is called the "*Bromide value.*"

E.g., *Brown cod oil.* (Iodine value, 150·7.)

Bromide value.		Bromine percentage.
1. 60·9	.....	65·7
2. 60·0	.....	63·3
3. 60·4	.....	63·5
4. 60·8	.....	63·7

As the quantities of liquids and the amount of bromine and phenol which are added are made definite according to the above method, in applying the process to other oils, it will be obviously necessary to take quantities which will

* This absolute alcohol after standing overnight with potassium hydrate and distilling twice over potash, can be used again for the same purpose.

give in solution about the same amount of unsaturation, and hence leave about the same amount of bromine unabsorbed. These quantities will evidently be obtained by making them inversely proportional to the iodine value of the oil.

These precipitates do not always filter off very well at first, and it is necessary then to pass the liquor through until it filters quite clearly. Usually this occurs before the liquor has been passed through once, and it is only in the case of those oils which give a very small yield that the filtration is really difficult. It will be noticed, too, that in these cases of awkward filtration not only is the yield small, but also the amount of bromine in the precipitate is lower than usual, indicating that the difficulty is partly due to the presence of greater quantities of the lower bromides. In all cases it is desirable from the point of view both of accuracy and rapidity of work to keep the filter paper full, when once the filtration is started.

The method was now applied to various vegetable and animal oils.

Castor oil was turbid slightly before the addition of bromine, rather more so after bromination, but this disappeared on the addition of alcohol. Olive oil, sesamé oil, and cotton-seed oil gave no precipitate. Rape oil gave a very small precipitate, and lard oil a trace of precipitate. This confirms to some extent the observations of Farnsteiner.

The method was also applied to the fatty acids obtained from a brown cod oil. The bromination produced a dark brown precipitate which was apparently little changed in quantity by the addition of alcohol. Bromide value—10·4.

This shows that, although the free acids do not give the same results as the glyceride, they do give a precipitate, and hence we can conclude that an oil of high acid value will not have its bromide value seriously affected. The method was now applied in duplicate to the various marine oils, and the results are given in the table below.

It will be noticed that where the yield was small, it was sometimes necessary to add together the precipitates obtained in the duplicate experiments in order to estimate the bromine. The iodine value of each oil is given, and as this is the percentage of iodine absorbed by the oil, one can get, by a simple calculation, the "bromine value" of each oil. From this figure and the weight of oil taken in the experiment, the total amount of bromine absorbed by this amount of oil is easily obtained, and as the weight of bromine in the precipitate is determined during the estimation of its percentage in the precipitate, one can thus see how much of the total bromine is absorbed by the glycerides which give the precipitate, and how much by those which do not. This distribution is best expressed in the percentage of the total bromine absorbed, and is given as such in the table below.

Example: 0·4138 grm. of cod oil gave 0·2502 grm. of precipitate containing 0·1591 grm. of bromine. From the bromine value we see that 0·4138 grm. of oil absorbs 0·3927 grm. of bromine. Hence the percentage of total bromine absorbed, which is taken up by the glycerides giving precipitates,

$$= \frac{0{\cdot}1591 \times 100}{0{\cdot}3927} = 40{\cdot}5$$

Assuming that the formation of these bromides is due merely to the addition of bromine to the unsaturated linkages in the oils, it is clear that by subtracting the weight of bromine found in the precipitate, from the weight of the precipitate taken we get the weight of the glycerides which gave the precipitate, and hence it is simple to calculate the bromine value of these glycerides, and by the use of the factor 127/80 to obtain also, therefore, the iodine value of the more highly unsaturated portions of the oil. If these portions are the most readily oxidisable, this figure may be of even more value than the iodine value of the oil for indicating its quality and its state of oxidation. This is illustrated by the first two oils in the table.

It will be next necessary to make investigations of the constants of a series of oils in which the range of variation of the bromide value is observed, especially in relation to the iodine value, for it is clear that unless this range is determined the method will be of no great practical use in the detection of adulteration. It may be observed, however, that the figures for seal oil and the fish oils seem promising, the bromide values being much lower, and it is the hope of the authors that, although the iodine value of an oil is "adjusted," it will be impossible to adjust, at the same time, the bromide value, and the distribution of the total bromine absorbed.

The process is empiric, but the oil chemist is forced to rely at present upon such processes. That this is undesirable, all will admit, but nothing perfectly satisfactory can be obtained until oil chemists know what they are analysing. This can only be realised by patient investigation as to the exact chemical nature of the glycerides and fatty acids in particular oils. The authors believe that the above work is, at any rate, one step in this direction.

Oil.	Iodine value.	Bromine value (by calculation).	Bromide value.	Percentage of bromine in precipitate.	Percentage of the total bromine absorbed, which is taken up by the glycerides giving the precipitate.	Mean iodine value of glycerides giving precipitate.
Brown cod	150·7	94·9	60·4	63·5	40·5	277*
			60·8	63·7	40·8	
			60·0	63·3	40·1	
Newfoundland cod	141·1	88·8	49·5	52·4	29·1	185
			48·6	55·3	30·3	
Möller's cod	163·2	102·8	41·6	60·9	24·2	267
			42·7	62·6	26·1	
Möller's cod (blown 24 hours)	147·0	92·60	30·2	58·8	19·2	243
			28·7	62·0	19·1	
			24·8			
Linseed	158·7	100·0	25·0	61·5	15·5	253
			24·5			
Menhaden (marked "4")	154·2	97·1	52·7	62·4	33·9	258
			54·7	61·7	34·5	
			52·6	52·2	28·3	
Menhaden (marked "5")	157·3	99·1	60·5	58·8	36·9	245
			59·4	62·4	37·3	
Pale seal.....	102·5	64·5	13·2	51·3	11·2	147
			15·0			
Dark seal	90·6	57·0	13·4	60·0	13·7	238
			14·5			
Pale whale	120·7	76·0	27·5	58·4	21·1	242
			27·2	62·1	22·2	
Dark whale (marked B) ..	114·2	71·9	37·0	59·6	28·0	239
			37·8	60·3	31·4	
Shark liver.....	109·7	69·1	15·4	55·4	14·1	205
			17·6	56·3	14·3	
Sperm	81·8	51·5	6·5	45·7	5·6	134
			6·2			
Coal fish	130·7	82·3	29·9	58·9	21·4	216
			29·6	56·2	20·5	
Fresh herring	136·4	85·9	44·8	47·7	24·9	180
			44·7	55·5	27·2	

* The glycerides giving the "octabromides" recorded in the fractionation experiments, have an iodine value of 280 approximately.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

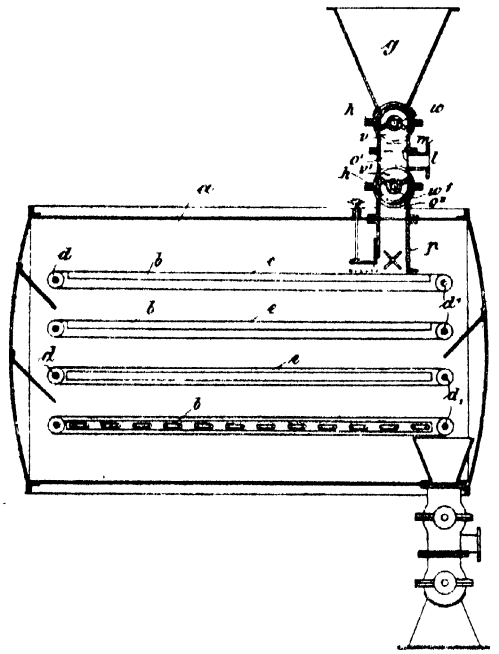
(*Continued from page* 745.)

ENGLISH PATENTS.

Straining or filtering water and other liquids; Apparatus for ——. E. Gobbi, Paris. Eng. Pat. 83, Jan. 1, 1906. Under Int. Conv., Jan. 11, 1905.

A NUMBER of pairs of dished plates of "non-permeable" material are arranged in a vertical series upon a central tube, the plates of each pair being placed with their concave surfaces facing one another, and the whole series being kept pressed together by a spiral spring at the top of the tube. The pile of plates is placed in a vessel, and the water to be strained, is forced into the latter, and passes between the edges of the plates, through the central tube into a chamber, from which it is drawn off. The plates are cleansed from deposit by reversing the direction of flow of the water.—W. H. C.

Drying pulverised, granular, and like material in vacuo; Apparatus for ——. E. Passburg, Berlin. Eng. Pat. 3432, Feb. 12, 1906.



THE material to be dried is fed into the vacuum chamber, *a*, from the hopper, *g*, by the rollers, *w*, and w^1, which are provided with cavities, *v*, and v_1, and are rotated, air-tight, in the casing, *h*, by suitable external mechanism. A vacuum is maintained in the space, o^1, by an auxiliary air-pump, connected to the pipe, *l*, the inner end of which is protected by a wire gauze screen, *m*. The material passes into the drying-chamber, *a*, by the passage, o^2, and is distributed by the arms, *p*, on to the travelling bands, *c*, which pass round the rollers, *d*, and d^1, and over the heating plates, *b*. The rollers, d^1, pass through the casing, *a*, being rotated by external gearing, and the material passes from band to band, and is finally expelled from the bottom of the casing by an apparatus similar to that by which it was introduced. The material is subjected to progressively decreasing temperatures by varying the distance between the bands, *c*, and the heaters, *b*, which touch the upper bands but are at some little distance from the lower ones. The same result may be attained by keeping the bands in contact with the plates, and heating the upper plates by steam and the lower ones by hot water.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 748.)

Moss; White —— for fuel in Sweden. T. Palmberg, Teknisk Tidskrift, Stockholm, 1905, General section, 283—284. Proc. Inst. Civil Eng., 1905—1906, **163**, 63—64.

IN the Midlands of Sweden there are large tracts of white moss ("sphagnum"). By passing the wet material between rollers, its water content can be reduced to 50 per cent., and experiments have shown that a mixture containing as much as 70 per cent. of the coarse powder thus obtained, together with 30 per cent. of air-dried peat, can be burnt in a Talin's so-called "combined gas-generator and half gas-fired furnace," without impairing the working of the latter, or reducing the steam-pressure of 6 kilos. per sq. cm. (85 lb. per sq. in.). Trials in a tube-welding furnace showed that 616 kilos. of air-dried white moss, cut into pieces, and containing a little over 38 per cent. of water, gave out as much heat as 356 kilos. of steam-coal. The calorific value of white moss is 4300—4700 heat units, so that the pressed powder containing 50 per cent. of water would be equal to 31—33 per cent. of its weight of good steam-coal, or probably more, if used in a furnace suitable for burning the water-gas formed by its combustion.—A. S.

Gas-engine exhaust gases; Resistance of metals to corrosion by ——. J. Pintsch. Gasmotorentechnik, 1906, **6**, 51—54. Science Abstracts, 1906, **9B**, 293.

SHEETS of various metals were exposed in the exhaust vessel (at 370° C.) of a gas-engine supplied with producer gas of low calorific value (800—900 kilo.-cals. per cb. m.), and the loss or gain in weight was noted after five months in one set of tests, and after 5½ months in another. Bronzes containing tin were attacked most by the gases; copper also was considerably corroded. The metals least acted upon were nickel and brass, the latter being more resistant the higher its content of zinc. Nickel steel was not corroded so much as cast iron, and was better the higher its content of nickel. The outer crust on cast iron exerted a strong protective influence, but even machined cast iron was not strongly attacked.—A. S.

Gases; Optical analysis of industrial ——. F. Haber. Z. Elektrochem., 1906, **12**, 519—520.

THE refractive power of a gas, or mixture of gases, can be determined with great accuracy, by observing the displacement of image which occurs on looking with a telescope at a distant object through a glass prism into which the gas is led. In applying this method to the analysis of gases, the author uses an apparatus (made by Zeiss of Jena) consisting of a prism telescope, a glass prism for the gas or air, and a mirror. The observer looks, not at a distant object, but at a luminous spot situated in the telescope itself. On looking into the instrument, one sees a dark shadow, which falls upon a scale in a position corresponding to the composition of the gas in the prism. The method is simple, and has the advantage that the refractive index of a sample of gas (as compared with air) remains the same, provided any changes of temperature and pressure, affect equally the

sample, and the air under comparison. If chimney gases be led through the prism, an increase of 0·9 per cent. in the carbon dioxide causes the shadow to be displaced one division on the scale. The instrument can be adapted for photographic registration, instead of for direct reading, or the image of the shadow can be made visible at a distance. The apparatus is sensitive to 0·0000003 in the refractive index, corresponding to a change of 0·2—0·25 per cent. of carbon dioxide in chimney gases. Methane, hydrogen, hydrochloric acid, and hydrocyanic acid, can be determined in air with the same delicacy. In the case of acetylene or sulphuretted hydrogen, the exactitude is twice as great; for sulphur dioxide, 2½ times as great; and for pentane and benzene vapour, nearly ten times as great.—H. B.

Incandescent black bodies; Brightness of ——, and a simple pyrometer. W. Nernst. Physik. Zeits., 1906, **7**, 380—383. Chem. Centr., 1906, **2**, 294.

Previous determinations of the quantity of light (in Hefner candles) emitted by 1 sq. mm. surface of a black body at different temperatures, have yielded the following results, the temperatures being given in absolute degrees:—At 1449°, 0·0042 candle; at 1597°, 0·012; and at 1707°, 0·064 candle. In the author's experiments, a Wanner pyrometer, graduated optically (Ber. deutsch. phys. Ges., **4**, 146), was used for measuring the temperatures, and the light emitted by a cylinder blackened with manganese dioxide, when heated in an electric furnace, was measured. As a standard, the melting point of gold was taken as 1064°C. + 273° = 1337° absolute, whilst the radiation constant was taken as 14,600. The radiation of the black body was ascertained by comparison with incandescent electrodes photo-standardised for different current-strengths. The values given above were confirmed, and the following additional values were determined:—0·06 Hefner candle at 2027° absolute, 1·80 at 2182°, and 2·72 Hefner candles at 2290° absolute. The values obtained, agree well with Planck's equation: $\log_{10}$ Hefner candles $= -\frac{A}{T} + B$, where T is the absolute temperature, and A and B are constants (A = 11,230, B = 5·367), and temperatures may be ascertained in this way by determining the quantity of light emitted by a black body (carbon, osmium, tantalum, or a Nernst electrode). A photo-standardised incandescent electrode is thus by itself a fairly accurate pyrometer. For higher temperatures 1-ampère electrodes from Nernst lamps are especially suitable; after being used for some time at normal E.M.F., they give concordant results with a lower E.M.F. At the melting point of platinum, 1 sq. mm. surface of a black body emits 0·634 Hefner candle, and at the melting point of iridium (2348°), 12·1 candles. In practice the Hefner candles would be replaced as standards by standardised electric lamps. One sq. mm. surface of a black body at 1819° yields one candle, and gives light which is not so red as that of the Hefner candle.—A. S.

Nernst lamp; Temperature of the ——. L. W. Hartmann. Physical Rev., 1906, **22**, 351. Electrician, 1906, **57**, 579—580.

As other authors have indicated, measurements of the temperature of the Nernst glower based on its radiating power or photometric qualities, give values which are much too high. This is due to the fact that the glower emits selective radiation, and consequently departs from the simple laws which hold for the "black body."

The author has applied the method of using a series of thermo-junctions with wires of gradually decreasing thickness and extrapolating, to find the value of the temperature corresponding to a couple of zero cross-section, thus eliminating the conduction of the wires. The values obtained with six different glowers, some with direct, others with alternating current, and with the junctions placed very differently in the single cases, vary from 1505° C. to 1535° C. In comparison with this the author's measurements by radiation methods indicate a temperature of about 2090° C.

These values are of importance in considering the relative efficiency of the Nernst glower. If the high temperature, as indicated by the radiation measurements, be correct, the watts lost per centimetre, are very low (1 to 5 watts), or 5 to 7 per cent., compared with a "black body" of the same temperature; but, considering the temperature indicated by the thermo-element, 42 watts are lost per centimetre, which is a percentage of 70·5.

—R. S. H.

English Patents.

Gas producers; Impts. in suction ——. E. W. Anderson, Solihull, Warwick, and Kynoch, Ltd., Witton, Staffs. Eng. Pat. 14,098, July 8, 1905.

The producer is provided with a perforated water-supply pipe, which may be swung beneath the fire-grate as soon as the fire is lit, on starting the producer. Water is thus squirted up into the fire, supplying the latter with steam, and generating good gas, until the vaporiser is hot enough to generate steam in the normal working manner, whereupon the perforated pipe is withdrawn.—H. B.

Coal gas and producer gas; Manufacture of ——. J. Parry and H. J. Pillinger, Newport, Mon. Eng. Pat. 15,226, July 25, 1905.

One or more inclined or vertical retorts are arranged within a producer having the form of a blast furnace. The retorts are charged with a mixture of coal and lime, and after the illuminating gas has been driven off completely from the coal, the residual mixture is discharged and fed into the top of the producer. The heat generated in the latter is controlled by regulating the blast of air (hot or cold) admitted by the tuyères, and ordinary producer gas is led off from the upper portion of the furnace. Owing to the addition of lime to the fuel, the ash becomes fused and is drawn off in the molten condition through a tap hole at the base of the furnace.—H. B.

Gas and dense coke from coal dust; Manufacture of lighting ——. A. Pistorius, Schloss Waldenburg, Germany. Eng. Pat. 3870, Feb. 16, 1906.

Dry coal dust is mixed intimately with finely ground lime (say, 3—4 per cent.) and finely ground pitch (say, 5—6 per cent.), the mixture is compressed into briquettes under high pressure, and the briquettes are carbonised in gas retorts in the usual manner.—H. B.

Power-gas producers; Impts. in ——. F. Müller, Darmstadt, Germany. Eng. Pat. 4077, Feb. 19, 1906.

In order to allow of the use of fine, granular, and brittle fuel in a tall producer, and to avoid the blocking or choking effect due to the weight of the charge, one or more rows of hollow bridges with an inverted V-shaped top, and open bottom, are built across the producer. These help to support the fuel, and also serve for the introduction of air and for the extraction of gas, for which purpose some of them may be perforated.—W. H. C.

Filaments [Vanadium carbide] for electric incandescent lamps; Impts. in ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co. of Schenectady, N.Y., U.S.A. Eng. Pat. 19,264, Sept. 23, 1905.

Vanadium oxide, 100 parts, is mixed intimately with Acheson graphite, 47 parts, and with enough coal-tar to make a stiff dough. The dough, formed into balls, is baked in a gas furnace and then heated in an electric arc furnace until reduction, with formation of vanadium carbide, is complete. The carbide is formed into lamp filaments by mixing it with a small quantity of ceresin, extruding the mixture into threads, and firing the latter, packed in graphite, in a vacuum furnace at a high temperature. Filaments of carbide may also be obtained by heating wires of metallic vanadium to a high temperature in contact with powdered carbon or a gaseous hydrocarbon.—H. B.

United States Patents.

Combustion; Process of regulating ——. P. Larsen, Copenhagen, Denmark. U.S. Pat. 824,728, July 3, 1906.

The combustion is regulated by changing the relative positions of the openings through which the air and fuel are separately introduced into the furnace, and also by moving the point of their introduction further into or out of the furnace.—W. H. C.

Furnaces; Process of combusting coal mixtures in ——. G. Mielenhausen, New York, N.Y. U.S. Pat. 825,066, July 3, 1906.

The coal on the grate is surrounded on three sides by a semi-tubular mantle of steam under pressure, introduced through a jet. The pressure is highest in the centre above the fuel, and lowest at the sides near the bars. The light, completely burnt products of combustion escape to the flues through the steam mantle at its highest point, whilst the particles of coal-dust and the heavy partially-burnt gases are kept in contact with the heated bed of fuel by the sides of the mantle until they are completely burnt.—W. H. C.

Gas-producer. J. Reuleaux, Wilkinsburg, Pa. U.S. Pat. 824,883, July 3, 1906.

The producer is a vertical chamber built of refractory material, and is provided with two systems of air-inlet openings. One is a vertical pipe which passes up through the water-seal ash-pit into the lower part of the producer, and the other consists of a number of air-inlets which project into the producer from an annular air-chamber built into the brickwork of the producer just above the lower conical part and at the same level as the central inlet. Both systems of air-inlets are connected by pipes provided with cylindrical dampers.—W. H. C.

Gas-analysis apparatus. J. M. Morehead. U.S. Pat. 824,999. July 3, 1906. XXIII., page 828.

Calcium carbide; Producing ——. J. M. Morehead. U.S. Pat. 825,234, July 3, 1906. XI*A*., page 817.

French Patents.

Gas-producer; "Hydroxydric" ——. E. Bardot. Fr. Pat. 362,994, Feb. 5, 1906.

The producer, which is intended more particularly for use with gas engines of 8 h.p. or less, is fed with oxygen instead of air, so that the mixed water-gas generated may contain but little nitrogen. The oxygen may be obtained from an ordinary cylinder of that gas, a floating bell-holder being interposed between the cylinder and the engine, or it may be generated by causing the hot gases from the producer to flow, on their way to the engine, round vessels containing barium peroxide, the oxygen liberated being drawn into the producer. Instead of barium peroxide, a mixture of manganese dioxide and caustic soda may be employed, and in this case part of the steam generated in the vaporiser of the producer is led into the mixture.—H. B.

Carburetter for the production of [*air*] *gas for lighting or heating.* Soc. Le Radiogaz. Fr. Pat. 363,057, Feb. 7, 1906.

The apparatus consists of two gasholders and a carburetter. The bell of the first gasholder (which serves to draw in air and deliver it under pressure to the second gasholder) is caused to rise by a hydraulic piston, working in an upright cylinder attached to the bottom of the bell tank, and fed with water from the mains. As the bell rises, it draws in air through a pipe fitted with a non-return valve; it also raises a vertical rod, fitted with catches which bear upon a weighted, tipping-arm device. When the bell reaches a certain point, the tipping arm is thrown over, thereby shutting off the water supply to the hydraulic piston. The air in the holder, now under a pressure corresponding to the weight of the bell, is forced through a non-return valve into the second holder; and when the bell reaches a certain point in its descent, the tipping arm is thrown back, thereby reversing the valves, and again admitting water to the hydraulic piston. From the second holder the air passes through the carburetter, composed of a vertical casing having superposed horizontal trays, over which benzol or the like trickles. The apparatus works automatically in accordance with the consumption of the compressed air.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 748.)

Paraffin wax; Determination of the solidification point of ——. T. Fischer. Z. angew. Chem., 1906, **19**, 1323—1326.

With the object of obtaining concordant results the Verein für Mineralölindustrie at Halle devised the so-called Halle method, which has recently been modified as follows:—A beaker is filled to the brim with water, and a thermometer suspended so that its bulb is completely immersed. The water is heated about 5° C. or 6° C. above the melting point of the paraffin, and a piece of the wax about 7 mm. in size is taken from the middle of the sample, and placed on the surface of the water, care being taken not to touch it with the fingers. The water is allowed to cool slowly, and a note taken of the temperature at which an opaque film forms over the surface of the drop of paraffin. The author finds that if a fragment of paraffin solidifying at about 58° C. be placed on water at about 63°—64° C., a film begins to appear at the edges of the oily layer at about 59° C., and at about 58° C. the filming is complete, *i.e.*, when the determination is made as in the original method in a space protected by glass plates on all sides. In the later modification, however, there is frequently a complete filming over of the paraffin between 59° C. and 61° C., the film disappearing again in a few minutes. This is due to the influence of the colder air of the surrounding room, and with the other observations made, affords some explanation of the variation in the results (not infrequently 1·5° C. to 2° C.) recorded by different observers for the same sample. Hence the author has devised the following combined method with which such great differences are not possible:—About 120 grms. of the paraffin wax are melted and poured into a flask of about 125 c.c. capacity, which is thus filled nearly to the neck. The flask is then closed with a cork through which passes a thermometer graduated in $\frac{1}{5}$° C., and is placed in a wooden box closed with a lid in which is an opening for the thermometer. Periodical readings of the time and of the thermometer are now taken, and it will be found that the times between equal intervals of temperature increase shortly before the solidification point, until finally the thermometer records the same temperature for at least 10 minutes, this being taken as the solidification point of the paraffin wax. Considerable differences in the temperature of the room do not materially affect the results, and readings agreeing within $\frac{1}{10}$° C. can be obtained in duplicate determinations. In experiments with different samples of paraffin the author obtained by this method results from 1·1° C. to 2·4° C. lower than by the original Halle method, the differences increasing with the rise in the melting points of the paraffins. In the case of a mixture of paraffin waxes of widely divergent solidification points (*e.g.*, 60° C., 53° C., and 44° C. respectively) the thermometer does not keep constant for 10 minutes, but the author points out that such a mixture is useless for most practical purposes, and can hardly be regarded as a commercial product of paraffin wax factories.—C. A. M.

English Patents.

Gases obtained from the dry distillation or gasification of fuels; Treatment of ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 16,386, Aug. 11, 1905.

The crude gas is cooled to about 40°—45° C., whereby much of the water and about half of the ammonia are

condensed; it is next passed through a tar separator; then heated, by using it as a cooling medium in the coolers through which the hot crude gas flows; and finally scrubbed with sulphuric acid to remove the remainder of the ammonia. Owing to the heating of the gas prior to its entering the scrubber, no dilution of the liquor, due to condensation of water, occurs. The ammoniacal liquor obtained on cooling the crude gas is treated with lime in a distilling column, and the hot ammonia vapour is led into the same acid scrubber. The acid in the scrubber is kept at about 80° C., to minimise the condensation and dilution. The waste liquors from the distillation apparatus are discharged into the atmosphere by spraying them into hot chimney gases.—H. B.

Sulphate of ammonia; Apparatus for making ——. S. H. B. Langlands and H. O'Connor. Eng. Pat. 17,267, Aug. 26, 1905. VII., page 811.

UNITED STATES PATENTS.

Wood; Apparatus for distilling ——. E. G. Jewett, Bellingham, Wash. U.S. Pat. 824,872, July 3, 1906.

THE distillation is carried on in vertical cylindrical retorts set in brickwork with a furnace between each pair of retorts. The wood is lowered into the retorts in crates, formed of radial bars connected by annular bars, and having conical bottoms. Water-spraying pipes are attached to the crates.—W. H. C.

Wood-alcohol; Process of making ——. H. O. Chute. U.S. Pat. 824,906, July 3, 1906. XVII., page 824.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page 752.*)

Aromatic nitro compounds; Introduction of amino groups into the nucleus of ——. J. Meisenheimer and E. Patzig. Ber., 1906, **39**, 2533—2542.

THE compound obtained by the action of hydroxylamine on *m*-dinitrobenzene in alcoholic alkali hydroxide solution was found to consist of 2.4-dinitroaniline and *m*-dinitro-*m*-phenylenediamine. The latter is obtained in almost theoretical quantity by dissolving the sodium salt resulting from the above reaction in a small amount of water, and strongly cooling the solution. It crystallises from alcohol in orange-yellow needles melting at 253°—254° C. Under similar conditions 1.3.5-trinitrobenzene yields a sodium salt, which when acidified forms picramide in fairly large quantity together with some trinitrophenylenediamine. From these results it is inferred that *m*-dinitro compounds are not reduced by means of hydroxylamine, but form substitution products.—D. B.

Nitro compounds; Reduction of ——, *by tin halides.* H. Goldschmidt and E. Sunde. Z. physik. Chem., 1906, **56**, 1—42.

IT has been previously shown (Z. physik. Chem., 1904, **48**, 435) that in the reduction of nitro compounds by stannous chloride and hydrochloric acid or by stannous bromide and hydrobromic acid, if the concentration of the acid be kept constant, the reaction is one of the second order. If the concentration of the acid be varied, the reaction velocity alters also, and approximately in proportion to the change in the concentration of the acid. Stannous bromide and hydrobromic acid effect the reduction of a nitro compound about eight times as rapidly as stannous chloride and hydrochloric acid of the same concentration. The results previously obtained indicated that the reduction is effected not by stannous ions, as has been generally accepted, but either by complex compounds, $SnCl_3H$ or $SnBr_3H$, or by the ions, $SnCl_3'$ or $SnBr_3'$. Further experiments with *m*- and *o*-nitrophenol and *m*-nitrobenzaldehyde have confirmed these results. In the case of *o*- and *p*-nitrobenzenesulphonic acids and *o*-nitrobenzaldehyde, also, the reaction velocity increases with the concentration of the acid, but to a greater extent than is required by theory. *o*-Nitrobenzaldehy reacts not with three molecules of stannous chloride, other nitro compounds do, but only with two, anthra being formed:—

$$C_6H_4(NO_2)CHO + 4H = C_6H_4<\begin{matrix}N\\CH\end{matrix}>O + 2H_2O.$$

In experiments with *m*-nitrobenzenesulphonic acid a *o*-nitrobenzaldehyde, it was found that a portion of t hydrochloric acid could be replaced by sodium chloride barium chloride, without any noticeable effect on t reaction velocity. This fact may be found useful practice in cases where a large excess of acid is injurio The behaviour of metal chlorides as substitutes for hydr chloric acid proves that it is not the complex compour $SnCl_3H$, but the ion, $SnCl_3'$, which is the actual reduci agent. It is pointed out that the results in gene obtained by the authors confirm the correctness of Habe view that the reduction of nitro compounds in ac solution proceeds according to the scheme:—

$$R.NO_2 \rightarrow R.NO \rightarrow R.NHOH \rightarrow R.NH_2.$$

—A. S.

Azoxy compounds. A. Angeli and G. Marchetti. Atti Accad. dei Lincei Roma, 1906, **15**, [5], 480—48 Chem. Centr., 1906, **2**, 325—326.

ANILINE and nitrobenzene on treatment with metall sodium yield a compound, of the probable formul $C_6H_5N(OONa)N(Na)C_6H_5$, which ignites spontaneous in the air, and is readily hydrolysed by water, a notat quantity of azoxybenzene being among the decompositic products. *α*-Naphthylamine and *α*-nitronaphthale yield *α*-azoxynaphthalene in an analogous manne Aniline and *α*-nitronaphthalene on the one hand, a nitrobenzene and *α*-naphthylamine on the other, yie two isomeric compounds, probably: $C_6H_5N:N(:O)C_{10}$ and $C_6H_5N(:O):NC_{10}H_7$. The condensation of amin with nitro-derivatives in presence of sodium thus appea to be a general reaction. The following cases have be examined by the authors:—

$$(OH)NH_2 + NO_2C_6H_5 = OH(N_2O)C_6H_5 + H_2O;$$
$$(OH)NH_2 + NO_2OC_2H_5 = OH(N_2O)OH + C_2H_6O;$$
$$C_6H_5NH_2 + NO_2OC_2H_5 = C_6H_5(N_2O)OH + C_2H_6O;$$
$$C_6H_5NH_2 + NO_2C_6H_5 = C_6H_5(N_2O)C_6H_5 + H_2O.$$

—A. S.

Azo dyestuffs; Decomposition of —— *by sodium hydr sulphite.* E. Grandmougin. Ber., 1906, **39**, 2494—249

THE decomposition of azo dyestuffs by sodium hydr sulphite (hyposulphite) affords a ready means of dete mining their constitution, and is, in many cases, superi to the well-known method with stannous chlorid The aqueous or alcoholic solution of the dyestu is heated to boiling, and decolorised by means a concentrated solution of sodium hydrosulphit the reaction-products being subsequently isolated in an suitable manner. A boiling aqueous solution of Orange I decolorised with sodium hydrosulphite, and then filtered yielded, on cooling, glistening colourless needles of fre aminonaphthol, the yield being the same as by the stannou chloride process (Ber., 1892, **25**, 981). Benzeneazo-*β* naphthol when treated in alcoholic solution with sodiur hydrosulphite yielded aniline and amino-*β*-naphtho From 2-benzeneazo-*α*-naphthol, treated in a simila manner, 2-amino-1-naphthol was obtained. The latte was converted quantitatively into a diacetyl derivativ (m.pt. 116° C.) by boiling for from 1 to 2 hours with a equal weight of fused sodium acetate and six times it weight of acetic anhydride. By partial saponificatio of the diacetyl compound, the N-acetyl derivative $C_6H_3(OH).NH.COCH_3$, is produced, m.pt. 128°—129° C This substance combines with diazonium compounds, bu the resulting dyestuffs are of no technical value. *α*-Nitroso *β*-naphthol yields amino-*β*-naphtholsulphonic acid o reduction with sodium hydrosulphite, whilst azobenzen is converted almost quantitatively into hydrazobenzene

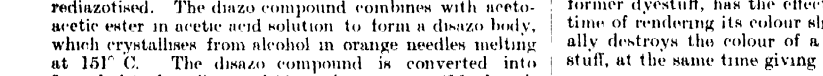
—A. S.

Disazo compounds of p-phenylenediamine; Fatty-aromatic mixed —— with heterocyclic side chains. C. Bülow and F. Busse. Ber., 1906, **39**, 2459—2466.

DIAZOTISED *p*-amino-acetanilide may be readily combined with benzoylacetone in acetic acid solution to form acetyl-*p*-aminobenzene-azo-benzoylacetone

$$CH_3CO.NH.C_6H_4.N:N.CH(CO.CH_3).CO.C_6H_5,$$

m.pt. 171° C., which crystallises from alcohol in golden yellow needles, and is sparingly soluble in water. On treating this substance with hydroxylamine a practically quantitative yield of the corresponding isoxazole [acetyl-*p*-aminobenzeneazo-4]-3-methyl-5-phenylisoxazole is obtained. This product, m.pt. 228° C., crystallises from alcohol in yellow needles, practically insoluble in water. It may be hydrolysed with dilute caustic soda, and then rediazotised. The diazo compound combines with aceto-acetic ester in acetic acid solution to form a disazo body, which crystallises from alcohol in orange needles melting at 151° C. The disazo compound is converted into 3-methyl-5-phenylisoxazole[1-azo-benzene-azo-4]-1-phenyl-3-methyl-5-pyrazalone,



if treated with phenylhydrazine in glacial acetic acid solution. The new substance is insoluble in water, but may be obtained from nitrobenzene in light red needles m.pt. 205°—206° C. The same product is obtained by reversing the above procedure and combining [*p*-amino-benzene-azo-4]-1-phenyl-3-methyl-5-pyrazolone with benzoylacetone, and subsequently treating the product of the reaction with hydroxylamine.—H. L.

Trinitromethane and triphenylmethane. A. Hantzsch Ber., 1906, **39**, 2478—2486.

THE author attempted to prepare hexanitroethane by treating the silver salt of nitroform $(NO_2)_3CAg$ with iodine in ethereal solution, but obtained instead iodotrinitromethane $(NO_2)_3CI$, m.pt. 58° C. This substance is formed immediately even at a temperature of —75° C. It reacts readily with silver nitrite to form tetranitromethane, but is quite indifferent to the very reactive silver salt of nitroform. The author points out that hexa-nitroethane is thus evidently a substance of abnormal reactivity or instability, and is probably not capable of existence. He argues from analogy that Gomberg's very reactive "triphenylmethyl," which is dimolecular, is probably hexaphenylethane. The analogy between trinitro- and triphenylmethane derivatives is supported by the stability of both tetranitro- and tetraphenylmethane. —H. L.

Dyestuff-ammonium bases; A physiological contribution to the question of the constitution of ——. H. Führer. Ber., 1906, **39**, 2437—2438.

METHYLATED-ammonium compounds in general show a characteristic physiological curara reaction. This reaction is obtained with Methyl Green, but not with Auramine, Malachite Green, Crystal Violet, and Methylene Blue. According to the views of Hantzsch, Auramine, Malachite Green, and Crystal Violet in the free state are pseudo-bases, whilst Methyl Green and Methylene Blue are true ammonium bases. The two latter substances should therefore behave physiologically as other methylated ammonium compounds. Methylene Blue is thus anomalous in this respect, and the fact is regarded by the author as a support for Kehrmann's *o*-quinonoid azthionium formula for this dyestuff. (See this J., 1906, 173.)—H. L.

Methylene Green. E. Grandmougin and E. Walder. Z. Farben.-Ind., 1906, **5**, 285—286.

BY a method of quantitative reduction, Gnehm and Walder (this J., 1906, 368) have recently proved that Methylene Green, which is prepared by the action of nitrous acid on Methylene Blue (this J., 1887, 508) is a nitro compound. The dyestuff in question may be obtained, as Noelting has shown, by the action of nitric acid on a sulphuric acid solution of Methylene Blue. The authors find that it may also be produced by the action of nitric acid on a solution of the same dyestuff in acetic acid. To this end, a solution of Methylene Blue (32 grms.), free from zinc, in acetic acid (150 grms. of a 40 per cent. solution), to which nitric acid (14·3 grms. at 36° B.) is added, is heated to from 80° to 82° C., at which temperature the reaction takes place. When this is completed, water (200 c.c. of hot, followed by 300 c.c. of cold) is added, and then common salt (50 grms.) and zinc chloride (25 grms. of a solution at 40° B.). The zinc chloride double salt thus obtained, is purified by reprecipitation from a solution containing hydrochloric acid.

The presence of Methylene Blue in admixture with Methylene Green, which is difficult to observe with the spectroscope, may be detected by means of ammonia. This reagent, when added to an aqueous solution of the former dyestuff, has the effect, after the lapse of a little time of rendering its colour slightly paler, while it gradually destroys the colour of a solution of the green dyestuff, at the same time giving a brown precipitate.—E. B.

Hydroxylamine, Decomposition of ——, in presence of hydroferrocyanic acid. Formation of crystallised ferricyanogen-violet and nitroprusside. K. A. Hofmann and H. Arnoldi. Ber., 1906, **39**, 2204—2208.

ON boiling an aqueous solution containing equal weights of potassium ferrocyanide and hydroxylamine hydrochloride, ammonium chloride and a nitroprusside are formed, nitrogen and hydrocyanic acid are evolved, and a deep blue crystalline powder with a purple lustre is precipitated. A filtered solution of 30 grms. of hydroxylamine hydrochloride was mixed with a solution of 30 grms. of potassium ferrocyanide, and the whole heated on the water-bath till neither ferri- nor ferrocyanide could be detected in a portion of the filtered solution. The solution was then decanted off, and the residual blue powder washed with a hot 15 per cent. solution of hydroxylamine hydrochloride, and afterwards with water. The blue compound forms microscopic cubes with a brilliant purple lustre. When treated with a strong solution of alkali in the absence of air, it yields ferric hydroxide and potassium ferrocyanide. It is not acted upon by boiling potassium nitrite solution, nor by ferric chloride solution. It is not dissolved by water, dilute mineral acids, oxalic acid, acetic acid, or a solution of Rochelle salt; it is attacked slowly by 4 per cent. ammonia solution at the ordinary temperature, with formation of ferric hydroxide, but is not acted upon by hydrogen sulphide. It thus corresponds with respect to properties and colour with Williamson's violet (this J., 1905, 1221), and it must therefore be regarded as a ferric-ammonium ferrocyanide of the following constitution:—

$$NH_4(FeCy_6)\ Fe'''_2(FeCy_6)NH_4.$$

The compound is quite anhydrous, and this affords another objection against the view that the intense colour of the blue iron-cyanogen compounds is due to the presence of combined water. The true cause of the colour is the simultaneous presence of ferric and ferrous iron in the molecule (see this J., 1905, 1221). The new violet compound can be obtained perfectly pure in a crystallised condition, whereas Williamson's violet is amorphous, and usually impure. The same violet compound is obtained if ferricyanide be used instead of ferrocyanide, indicating that the ferrocyanide is in the first place oxidised by the hydroxylamine. In the reaction, one-half of the ferrocyanide is converted into the violet compound, and the other half into nitroprusside; the quantity of hydrocyanic acid evolved is equivalent to one-fourth of the ferrocyanide used. (See also this J., 1904, 1209.)—A. S.

ENGLISH PATENT.

Dyestuff; Manufacture of a black —— [from coal or lignite], with by-products, including a tanning agent or a second black dyestuff. D. Lerman, B. B. D. Schwartz, and P. Pikos, Pozega, Hungary. Eng. Pat. 3107, Feb. 8, 1906.

COAL or lignite is pulverised, and heated to 90°—110° C. in an open vessel or under pressure, with 0·5 to 15 per cent.

of an aqueous solution of an alkali hydroxide or carbonate or other "solvent," varying according to the nature of the material used; heating is continued till the bituminous constituents are dissolved and the residue carbonised. The latter is separated, washed, and distilled, the distillate consisting of gases, which may be used for illuminating purposes, and also of tar and other oils; the residue, when pulverised, is said to be a valuable black dyestuff. The aqueous solution of bituminous substances is precipitated by addition of acid, the precipitate being of value as a tanning material, it is stated; the precipitate may, however, be converted into a black dyestuff similar to that first obtained by distillation, as above.—T. F. B.

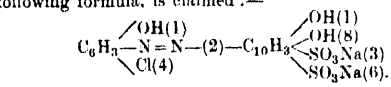
UNITED STATES PATENTS.

Dyestuff; Ortho-oxyazo ——. K. Schirmacher and F. Schmidt, Assignors to Farkwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 826,279, July 17, 1906.

SEE Ger. Pat. 167,333 of 1905; this J., 1906, 471.—T.F.B.

Dyestuff; Ortho-oxymonoazo ——. K. Schirmacher and F. Schmidt, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 826,280, July 17, 1906.

THE *o*-hydroxyazo dyestuff, having as a sodium salt the following formula, is claimed:—



Its aqueous solution is bluish-red, becoming bluish-violet on addition of sodium carbonate. It dyes wool red from acid baths, and chromed wool blue. (See also Ger. Pat. 167,333 of 1905; this J., 1906, 471.)—T. F. B.

Dyestuff; Ortho-oxymonoazo ——. F. Schmidt and K. Schirmacher, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pats. 826,281 and 826,282, July 17, 1906.

THE dyestuff claimed is analogous with that described in U.S. Pat. 826,280 (see preceding abstract), the chlorine in the latter being replaced by the methyl group. It dyes wool blue-red from acid baths, the dyeings of the chrome lake being blue.—T. F. B.

Alizarinsulphonic acid and process of making same. M. Iljinskij, Crefeld, Assignor to R. Wedekind und Co., Uerdingen, Germany. U.S. Pat. 826,509, July 17, 1906.

A NEW alizarinmonosulphonic acid is obtained by the action of fuming sulphuric acid on alizarin in presence of mercury. Its potassium salt, which is carmine-coloured, gives a deep red solution in potassium chloride solution, which gelatinises on cooling. Its aqueous solution gives a purple coloration on addition of copper sulphate.—T. F. B.

Anthraflavindisulphonic acid and process of making same. M. Iljinskij, Crefeld, Assignor to R. Wedekind and Co., Uerdingen, Germany. U.S. Pat. 826,510, July 17, 1906.

ANTHRAFLAVIN, when treated with fuming sulphuric acid in presence of mercury, is converted into a new disulphonic acid, which forms yellow microscopical rectangular prisms, not pointed; it is soluble in hot water, giving a red solution, which is converted to deep red-brown on addition of copper sulphate.—T. F. B.

FRENCH PATENT.

Organic or inorganic compounds; Process for the reduction of ——. S. Kapff. Fr. Pat. 362,985, Feb. 3, 1906. VII., page 811.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 756.)

ENGLISH PATENTS.

Waterproofing composition, applicable also as a vehicle for pigments. T. L. Leishman. Eng. Pat. 4533, Feb. 24, 1906. XIII*B*., page 821.

Dyed or naturally coloured material; Removal of colouring matter from ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,517, May 29, 1906.

THE alkali salts of formaldehyde-sulphoxylic acid, either alone, or in conjunction with formaldehyde-bisulphites, possess only feeble reducing properties in neutral solution, even when boiling; in acid solutions, however, the reducing properties are much increased, but decomposition also occurs, with precipitation of sulphur in the fibre. This objection is not apparent, if the sparingly soluble basic zinc salt of formaldehyde-sulphoxylic acid (described in the second Addition to Fr. Pat. 350,607 of 1905; this J., 1905, 1299 and 1300) is used in acid solution, no decomposition taking place; acetic acid, sulphuric acid, and especially formic acid, may be used. The discharging bath may contain, for example, three parts of the basic zinc salt, and three to five parts of formic acid to every 100 parts of the material to be treated; the materials are heated slowly to boiling, and boiled for about 10 minutes, or until a portion of the bath does not reduce Indigo Carmine solution.—T. F. B.

Oiling of cotton and other vegetable fibres; Process for the ——. J. C. Fell, London. From E. Korndörfer, Asch, Bohemia. Eng. Pat. 13,580, July 1, 1905.

THE persistent emulsions obtained from vegetable or animal fat with mineral oils and ammonia, do not appreciably improve the appearance of cotton yarn, especially that dyed with sulphide blacks; excellent results are stated to be obtained, however, by the addition of alkaline-earth salts, preferably chlorides, to the emulsions. 100 kilos. of cotton yarn dyed with a sulphide black are passed for half an hour through a hot bath containing 1000 grms. of 80 per cent. Turkey red oil, 800 grms. of olive oil or cocoa-nut fat, 800 grms. of "best refined" paraffin oil, 200 grms. of ammonia (sp. gr., 0·91) and 700 grms. of crystallised magnesium chloride; the liquid is removed from the material without rinsing; in the case of other black dyestuffs, the emulsion of oil as above is added to the dyebath.—T. F. B.

Drying yarn or other textile materials in hanks; Machines for ——. A. N. Marr, Thorner, Yorks. Eng. Pat. 15,133, July 24, 1905.

THE machine consists of a drying chamber open at both ends, and provided with a perforated floor and ceiling, which communicate with air spaces above and below the drying chamber; circulating air spaces, arranged at either end of the drying chamber, are divided into two sections, one of which contains a suitable apparatus for heating the air, and both of which contain a fan or fans for circulating the air through the air spaces, and thence, through the perforations, to the hanks of yarn, which are carried on a travelling web within the drying chamber. It is stated that the drying is performed quite evenly by this machine.—T. F. B.

UNITED STATES PATENT.

Printing indigo colouring matter; Process of ——. H. S. A. Holt and K. Reinking, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 826,428, July 17, 1906.

SEE Eng. Pat. 6495 of 1905; this J., 1905, 543.—T.F.B.

FRENCH PATENTS.

Cuprammonium solutions [for manufacture of artificial silk]; Purification of ——. A. Lecœur. Fr. Pat. 362,986, Feb. 3, 1906.

THE ammoniacal solution of cupric hydroxide is subjected to dialysis to deprive it of crystallisable salts, such as sodium chloride and potassium sulphate, the presence of which is stated to induce decomposition of the cuprammonium at ordinary temperatures; whereas, when thus purified, the solution is said to be stable, and in suitable condition to dissolve cellulose to a viscid solution, appropriate to the manufacture of artificial silk.—E. S.

Dyeing with sulphide dyestuffs; Process for ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 363,028, Feb. 6, 1906. Under Int. Conv., March 30, 1905.

THESE dyestuffs are dyed with the addition of various organic acids, which have reducing properties. The acids increase the affinity of the dyestuffs for the fibre, and also prevent any action of the sulphur compounds on animal fibres, so that the dyestuffs can be used for dyeing solid shades on half-silk, half-wool, or other mixed fabrics.

Example.—1·6 kilos. of Katigen Black T. G. extra are dissolved in a solution of 2·4 kilos. of crystallised sodium sulphide in water. This solution is made up to 200 litres with water, and 4 kilos. of salt, a solution of 600 grms. of calcined sodium carbonate, and 1·2 kilos. of commercial lactic acid are added. 10 kilos. of half-wool are placed in this solution, heated to 60° C., and dyed for one hour at this temperature. After dyeing, the material is rinsed with water, and then with dilute acetic acid. The wool can be dyed to shade by topping in a fresh bath with an acid dyestuff.—A. B. S.

Organic or inorganic compounds; Process for the reduction of ——. S. Kapff. Fr. Pat. 362,985, Feb. 3, 1906. VII., page 811.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 757.)

UNITED STATES PATENT.

Wall-coverings; Machine for printing decorative materials and ——. E. C. Baeck and R. R. Bertelli, New York, Assignors to Baeck Wall Paper Co., New York. U.S. Pat. 825,693, July 10, 1906.

A CONTINUOUS web or strip of the material is guided by rollers over and around an impression-cylinder, and means are provided for applying to the material a background of any desired character. The printing-roller is of relatively large size, and contains a complete continuous design suitable for so much of the wall of a room as is to be covered with single lengths of material. A device is provided for applying colouring material to the printing-roller, and a belt and graduated pulleys for driving the impression-cylinder and printing-roller in unison at the same surface speed.—B. N.

FRENCH PATENT.

Wood dyeing; Process of ——. M. Grünhut. Fr. Pat. 362,997, Feb. 5, 1906.

THE wood is first steamed in order to remove albuminous matters, and is then impregnated with chemical products in order to produce the colour desired. The colours are obtained by impregnating the wood with two or more chemicals in turn, the chemicals employed reacting on one another inside the wood, and so producing a very intimate dyeing effect—*e.g.*, to produce a reddish-brown, the wood is first impregnated with a solution of potassium thiocyanate (sulphocyanide) and then, six hours later, with a solution of ferric chloride.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 760.)

Ozone and nitric oxide; Thermic formation of —— in moving gases. F. Fischer and H. Marx. Ber., 1906, **39**, 2557—2566.

THE formation of ozone at high temperatures in air or oxygen can be shown without sudden cooling (see this J., 1906, 314), if the stream of air be blown away from the high-temperature space with sufficient velocity. In this way the authors find that ozone, hydrogen peroxide, and nitric oxide are all formed in the hydrogen flame, and that with the Nernst filament the product varies with the speed of the current of air, nitric oxide being formed at a low, and ozone at a high speed. By regulating the speed, it may be possible to form nitrogen oxides and ozone in such proportions that the final product, after reacting with water, may be entirely nitric acid.—J. T. D.

Hydriodic acid; Rapid method for the preparation of ——. F. Boudroux. Bull. Soc. Chim., 1906, **35**, 493—494.

SULPHUR dioxide reacts with iodine dissolved in barium iodide solution, yielding hydriodic acid and insoluble barium sulphate. Working details for the preparation of the acid are given. 50 grms. of iodine are slowly added to 60 grms. of barium peroxide suspended in 100 c.c. of warm water. The clear liquid is separated, and further 50 grms. of iodine are dissolved in it. Then a current of sulphur dioxide is passed through the solution until colourless. After filtering, acid of about 35 per cent. strength, containing only traces of sulphuric acid, is obtained, and this may be concentrated by distillation. 140 grms. of the hydrate boiling at 127° C. were obtained by the author in three hours.—F. SODN.

Alkaline-earth halogenates; Solubility of ——. *I. Barium halogenates.* M. Trautz and A. Anschütz. Z. physik. Chem., 1906, **56**, 230—242.

THE results obtained are given in the following table, the figures referring to the percentage of anhydrous salt in the saturated solution, although in all three cases the solid phase consisted of a mono-hydrated salt.

Temperature. ° C.		Salt. Barium chlorate.	Barium bromate.	Barium iodate.
Eutectic point	−2·479 + 0·004	15·28	—	—
	−0·034 + 0·002	—	0·280	—
	−0·046 ± 0·002	—	—	0·008
	0·0	16·90	0·286	—
	10·0	21·23	0·439	0·014
	20·0	25·26	0·652	0·022
	25·0	27·53	0·788	0·028
	30·0	29·43	0·95	0·031
	40·0	33·16	1·31	0·041
	50·0	36·69	1·72	0·056
	60·0	40·05	2·271	0·074
	70·0	43·04	2·922	0·093
	80·0	45·90	3·521	0·115
	90·0	48·70	4·26	0·141
	98·7	—	5·256	—
	99·1	51·17	—	—
Boiling point	100·0	—	—	0·197
	100·39	—	5·39	—
	105·0	52·67	—	—

—A. S.

Substances soluble with difficulty; Studies of the solubility of ——. *II. Solubility of silver chloride, bromide, and thiocyanate at* 100° C. W. Böttger. Z. physik. Chem., 1906, **56**, 83—94.

THE solubilities were calculated from conductivity determinations made with the solutions contained in a bomb lined with platinum. The results, together with some

previously obtained at 20° C. by Kohlrausch, and by the author, are given in the following table:—

Salt.	Grm.-equivalents per litre.	
	at 100° C.	at 20° C.
Silver chloride	158×10^{-6}	$10{\cdot}6 \times 10^{-6}$
Silver thiocyanate	39×10^{-6}	$0{\cdot}88 \times 10^{-6}$
Silver bromide	20×10^{-6}	$0{\cdot}54 \times 10^{-6}$

The results show that the washing of precipitates of silver chloride with hot water in quantitative analysis is not free from risk. One litre of the solution saturated at 100° C. contains 0·0218 grm. of silver chloride, so that the loss on washing may be somewhat considerable, especially if, as frequently happens, unnecessarily large quantities of washing water are used.—A. S.

Sulphur; Ionisation of ——, and the complex ions of mercury. I. Knox. Z. Elektrochem, 1906, **12**, 477—481.

Both red and black mercuric sulphide are soluble in sodium sulphide solution, the amounts dissolved increasing from 0·008 to 0·783 for the red, and from 0·011 to 0·856 for the black modification, as the concentration of the sodium sulphide increases from 0·10 to 1·52 (all expressed in gram-molecules per litre). The solubility is due to the formation of a complex anion, which, from the rate of increase of solubility, as sodium hydroxide is added to the sulphide solution, and also from measurements of E.M.F., the author concludes to be HgS_2'', arising from the electrolytic dissociation of Na_2HgS_2.

At the end of the paper are calculated the concentrations of S″ and other characteristic ions in solutions used for the precipitation of sulphides (all containing a gram-molecule in the litre, save the solutions of hydrogen sulphide). The results are tabulated below:—

Solution.	S″	HS′	H_2S	H′	OH′
Na_2S	0·09	0·01	$1{\cdot}3 \times 10^{-7}$	$1{\cdot}3 \times 10^{-14}$	0·01
$NaHS$	$3{\cdot}6 \times 10^{-5}$	1·0	$3{\cdot}6 \times 10^{-4}$	$3{\cdot}3 \times 10^{-11}$	$3{\cdot}6 \times 10^{-4}$
$(NH_4)_2S$	$3{\cdot}0 \times 10^{-6}$	1·0 (about)	$5{\cdot}0 \times 10^{-3}$	$5{\cdot}0 \times 10^{-10}$	$2{\cdot}5 \times 10^{-3}$
NH_4HS	$1{\cdot}6 \times 10^{-7}$	0·93	0·07	$0{\cdot}7 \times 10^{-3}$	$1{\cdot}7 \times 10^{-6}$
Water saturated with H_2S	$1{\cdot}2 \times 10^{-15}$	$0{\cdot}95 \times 10^{-4}$	0·1	$0{\cdot}95 \times 10^{-4}$	$1{\cdot}8 \times 10^{-10}$
N/1$HC_2H_3O_2$, saturated with H_2S	$0{\cdot}6 \times 10^{-18}$	$2{\cdot}0 \times 10^{-6}$	0·1	$4{\cdot}0 \times 10^{-3}$	$3{\cdot}6 \times 10^{-12}$
N/1HCl, saturated with H_2S	$1{\cdot}1 \times 10^{-23}$	$0{\cdot}91 \times 10^{-3}$	0·1	1·0	$12{\cdot}0 \times 10^{-14}$

The low concentration of S″ ions in solutions of hydrogen sulphide is remarkable, in view of the completeness of the precipitation of metallic sulphides by these solutions.—J. T. D.

Sulphur; Vapour pressure of ——. W. Matthies, Physik. Zeits., 1906, **7**, 395—397. Chem. Centr., 1906, **2**, 204.

The author determined the vapour pressure of sulphur at temperatures below its boiling point. The temperatures were measured by a thermo-couple, graduated at the ordinary temperature, at 100° C., and at the boiling point of sulphur (444·53° C. at 760 mm. pressure). The values found by the author were as follows:—

Pressure.	Temperature.	Pressure.	Temperature.
mm.	°C.	mm.	°C.
1·35	210·2	20·5	265·0
3·20	222·4	53·5	306·5
5·54	234·4	133·0	352·5
8·45	241·8	250·1	379·4

—A. S.

Nitroprussides; Reaction of sulphides on ——. F. Virgili. XXIII., page 828.

Hydroxylamine; Decomposition of —— in presence of hydroferrocyanic acid. Formation of crystallised ferricyanogen-violet and nitroprusside. K. A. Hofmann and H. Arnoldi. IV., page 806.

Ozone; Detection of —— by means of tetramethyl p-diaminodiphenylmethane. F. Fischer and H. Mar XXIII., page 829.

Sicilian sulphur. Chem. and Drug., Aug. 4, 1906. [T.R

There has been much agitation among the produce of Sicilian sulphur on account of the combination know as the "Consorzio Obligatorio." The law institutin the "Consorzio" has now passed the Italian Parliamen and from August 1 the industry will be placed on new footing. The chief provisions of this Bill are follows:—

1. All the sulphur-producers are constituted into body for twelve years.

2. The crude sulphur will be sold exclusively for accoun and in the interests of its members.

3. Refining, grinding, and shipping of sulphur are fre

4. The exportation of crude sulphur for Europe open to all.

5. The Anglo-Sicilian Sulphur Co. may for the stock will hold on August 1, either join the Trust or sell it stock to it at 59 lire per ton of 1,000 kilos., f.o.b., payabl by debentures at par, bearing 3·65 per cent. per annu interest, free of present or future taxes, and redeemabl within twelve years by yearly drawings. The capita and interest are guaranteed by the Government, and is said the Anglo-Sicilian Co. has preferred to sell.

6. The Trust has the right to limit production, and wil be controlled by the following organisation:—

(*a*) A committee of fifty members, elected by th producers.

(*b*) A board of nine members, named in part by th Minister of Commerce, the Banco di Sicilia, and th Chambers of Commerce of the Sicilian province in which the mines are situated.

(*c*) A general manager named by the Government.

7. The law provides (*a*) for the institution of publi warehouses in the sulphur ports; (*b*) that the Banco d Sicilia may advance up to ten millions lire on thei warrants; (*c*) for creating a mining bank with fou million lire capital, with the object of assisting smal producers.

8. The law reduces railway freights, and exempts from taxes the production of sulphur and all the industries in which the national sulphur forms a principal element. This exemption, it is expected, will benefit the sulphur industry considerably.

Government intervention in the sulphur industry had become a necessity, as the American competition from the Louisiana sulphur mines had made itself felt even in the European markets. The Sicilian producers, however, may now lose their best market—the United States—as Mr. Frasch, the agent of the Louisiana mines, insisted, when negotiations took place at Rome, on reserving the whole of the American market for the home product. The magnitude of this loss may be gathered from the fact that the American consumption of sulphur last year amounted to over 600,000 tons, of which Sicily supplied 70,000 tons. As the American output grew, the imports from Sicily gradually declined. In 1902, 170,000 tons were taken from Sicily by the United States, so that there has been a loss of 100,000 tons in three years. Two years ago Italy and Sicily produced 96 per cent. of the world's output of sulphur, but the pendulum is now swinging the other way. One of the features of the new Italian law is the limiting of production if necessary. In May last the stocks in Sicily amounted to 424,640 tons, compared with 313,625 tons in 1905.

Barium carbonate. U.S. Customs Circular. Oil, Paint, and Drug Rep., Aug. 6, 1906. [T.R.]

The decision of the Board of United States General Appraisers (T.D. 25,504) of Nov. 16, 1901, holding that precipitated barium carbonate was dutiable at the rate of 25 per cent. *ad valorem* as a chemical compound, under the provisions of paragraph 3 of the Act of July 24, 1897, was reversed by a decision of the United States Circuit Court for the Southern District of New York, in the case of Gabriel & Schall *v.* United States (T.D. 24,331), which held that said article was free of duty under the provisions of paragraph 489 of said Act, for "baryta; carbonate of, or witherite." The department is now of the opinion that "witherite" being a narrower and more particular term than "carbonate of baryta," and being included therein, the inclusion of the words "or witherite" in said paragraph would be superfluous and without meaning, unless the same be interpreted to limit the barium carbonate therein provided for to the form thereof known as witherite.

Duty is, therefore, to be assessed upon precipitated barium carbonate at the rate of 25 per cent. *ad valorem* under paragraph 3 of the Act of July 24, 1897.

This ruling will apply only to merchandise exported after July 26, 1906.

Carbon dioxide; Production of ——, in the United States. Oil, Paint, and Drug Rep., Aug. 6, 1906. [T.R.]

THERE are now about 40 factories producing liquefied carbon dioxide in the United States, the annual output amounting to about 30,000,000 lb.

Although carbon dioxide occurs in almost every natural water, it is rarely present in quantities sufficient for commercial purposes. It is only at Saratoga Springs, New York, that practical use is made of it in the United States in the production of liquefied acid. To meet the increasing demand, over 40 wells, generally 6 ins. in diameter and ranging from 30 to 300 ft. in depth, have been drilled to secure the carbon dioxide gas, the total yield of which is estimated at about 20,000 lb. per day. It is reported that a considerable proportion of the 20,000 lb. is obtained from the drift into which it has passed from the underlying rocks, only about half of which is recovered. The largest producers, therefore, are said to be the relatively shallow wells, 30 to 100 ft. in depth, of which many have been drilled south of the town. Of the rock wells, those south of the town yield the most gas, at depths from 150 to 600 ft. The rock gas, if found at all in commercial quantities, is generally encountered at the junction of the argillaceous Utica shale just over the Trenton limestone. Many wells have been drilled which have proved non-producing.

Compression of the gas.—From the wells the water and associated gas are piped to a separator, a large tank equipped with a 2-ft. trap at the bottom, from which the water escapes, and with a pipe at the top leading to the gasometer into which the gas discharges. From the gasometer the gas is drawn through calcium chloride driers to remove the moisture, after which it passes to the compressor, working generally in three stages, at, approximately, 60, 300, and 1000 lb. After cooling, fixed weights of the liquid are admitted into cylinders for shipment.

The cylinders are made of lap-welded or seamless steel tubing; the smaller cylinders are about 5¼ ins. in outside diameter and 4 ft. long and are charged with 20 lb. of liquid, while the larger are 8½ ins. in diameter and 51 ins. long and are charged with 60 lb. This is two-thirds of the water capacity. The bursting pressure of the tubes varies between 5100 and 5900 lb. per square inch in the case of the seamless tubes and between 4900 and 5500 lb. for the lap-welded. All are tested to 3700 lb. before filling. Since the pressure, even at 55° C., is only 2240 lb., there is a wide margin of safety.

Arsenic. C. C. Schnatterbeck. Mineral Resources of the United States, 1905. [T.R.]

THE United States utilises over half of the world's production of metallic arsenic, arsenious oxide, and arsenic sulphides. Every year several hundred tons of arsenic sulphide, obtained in purifying sulphuric acid, are wasted. An economical method of treating this arsenious by-product is needed. In addition to the arsenic recovered from arsenical pyrites mined in Washington and from the ores which occur in Virginia, attempts are being made to recover the arsenic which is going to waste in the smelter fumes at Anaconda, Mont.

In 1905 there was produced in the United States 1,507,386 lb. of arsenious acid, valued at $35,210, as compared with 72,413 lb., valued at $2,185, in 1904.

Production of arsenic in the United States, 1901—1905.

[Pounds.]

Year.	Quantity.		Value.
1901	600,000	..	$18,000
1902	2,706,000	..	81,180
1903	1,222,000	..	36,691
1904	72,413	..	2,185
1905	1,507,386	..	35,210

Imports of metallic arsenic, white arsenic (arsenious oxide), and arsenic sulphides (orpiment and realgar) into the United States, 1900—1905.

[Pounds.]

Year.	Quantity.		Value.
1900	5,765,559	..	$265,500
1901	6,989,668	..	316,525
1902	8,110,898	..	280,055
1903	8,357,661	..	294,602
1904	6,800,235	..	243,380
1905	7,675,088	..	256,540

A noteworthy feature of the industry has been the growth in the production of Spain, a country which shipped to the United States in 1905 approximately 1750 short tons of white arsenic, containing 99·8 per cent. of arsenious oxide. The largest producer of metallic arsenic and arsenious oxide in the world is Germany, by far outclassing Great Britain, which until 1902 held first place among the producing countries. Hopes are entertained that Canada may become an important producer through the development of its new deposits of mispickel in Ontario. As for the United States, there are signs that the domestic production of arsenic will show marked expansion in the near future.

The world's annual production of arsenic, 1901—1905

Year.	Canada.		Germany. (a)		Italy. (a)		Japan.	Portugal.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Quantity.	Value.
	m. tons.	dols.	m. tons.	dols.	m. tons.	dols.	m. tons.	m. tons.	dols.
1901	630	41,676	2,549	256,750	6	120	10	527	35,277
1902	726	48,000	2,827	260,000	(b)	(b)	12	736	33,063
1903	233	15,420	2,768	253,500	(c)	(c)	6	698	29,984
1904	(c) 66	6,900	2,800	244,917	(b)	(b)	(b)	1,370	58,887
1905	54	5,400	—	—	—	—	(b)	—	—

(a) Metallic arsenic and arsenious oxide. (b) Statistics not available at time of publication. (c) Exports.

Year.	Spain. (d)		United Kingdom. (e)		United States. (e)	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	m. tons.	dols.	m. tons.	dols.	m. tons.	dols.
1901	120	14,400	3,416	197,270	272	18,000
1902	(f)	(f)	2,165	92,905	1,226	81,180
1903	1,088	87,040	916	31,750	554	36,691
1904	(f)	(f)	992	27,795	33	2,186
1905	—	—	—	—	684	35,210

(d) Arsenic sulphide; in addition to these quantities, during 1903 there were produced 22 tons of orpiment valued at $3,337.
(e) Arsenious oxide.
(f) Not reported.

Monazite sand. Eng. and Min. J., July 21, 1906. [T.R.]

THE total European demand for monazite sand, including that exported from Europe to America, is 1200 to 1500 metric tons per year. Brazil alone can supply 10,000 tons easily, which exceeds all possible consumption. However, prospecting for new sources of supply is being actively carried on, and not without success. The result is that the monazite sand business will before long cease to be remunerative, and even now, owing to contracts, the stocks in Europe are sufficient to inundate the markets at any moment. In such circumstances, observes "La Nature," June 9, the German Thorium Convention is not likely to be renewed on its expiry in 1907.

ENGLISH PATENTS.

Nitric acid or the salts of nitric acid; Utilisation of the nitrogen of the air by the oxidation of the same, and conversion of the product into ——. O. H. U. Brünler, Leipzig-Gohlis, Germany. Eng. Pat. 5901, March 10, 1906.

A MIXTURE of oxygen and nitrogen, together with combustible gases, is passed under pressure into a combustion chamber, disposed in a closed vessel containing water. The gases are ignited within the furnace, the proportion of the constituents and the pressure being so adjusted that a temperature of about 2500° C. is attained. The burning gases issue from an opening in the bottom of the combustion chamber, in the form of a pointed flame, which shoots down into the water in the containing vessel, and becomes enclosed by an envelope of superheated steam. Under these conditions, the production of nitric acid may, it is stated, be carried on as a profitable process, as the steam is decomposed into its elements, and "furthers the chemical action by the formation of new combinations." Instead of pure water, a saline solution, such as of sodium chloride, may be used as absorber, in which case sodium nitrate is formed. (Reference is made to Eng. Pat. 5540 of 1904; this J., 1905, 276.)—E. S.

Sulphate of ammonia; Apparatus for making ——. S. H. B. Langlands, Glasgow, and H. O'Connor, Edinburgh. Eng. Pat. 17,267, Aug. 26, 1905.

THE saturator and draining tray are made of porcelain, glazed earthenware, or the like, being constructed in parts, which are connected by means of suitable holes or lugs contained in or projecting from them, through which holes, bolts, preferably made of lead, are passed.—E. S.

UNITED STATES PATENTS.

Sulphuric acid; [Electrolytic] Method of making ——. W. M. Johnson. U.S. Pat. 825,057, July 3, 1906. XIA., page 816.

Alumina; Process of manufacturing ——. H. C. Peffer, East St. Louis, Ill., Assignor to the Pittsburgh Reduction Co., New Kensington, Pa. U.S. Pat. 826,354, July 17, 1906.

BAUXITE is heated with lime or other compound of calcium, to produce calcium aluminate, which is digested with a solution of sodium carbonate. From the filtered solution of sodium aluminate thus obtained, alumina is precipitated by a current of carbon dioxide.—E. S.

Leaching solutions; Process of treating acid ——. P. F. Cowing, Assignor to P. de P. Ricketts, New York. U.S. Pat. 825,302, July 10, 1906.

PYRITES containing iron as well as metals capable of being precipitated from a mineral acid solution by hydrogen sulphide, is fused out of contact of air and in presence of metallic iron. The fused product, containing metal sulphides, is subjected to the action of an "acid leaching solution containing a metal whose sulphide is insoluble in the acid in the presence of hydrogen sulphide," during the evolution of which the iron dissolves, whilst the other indicated metals in the product and in the leaching solution are precipitated, or remain undissolved.—E. S.

Potassium chloride; Extracting —— from seaweed. D. M. Balch, Assignor to A. P. Stephens, Coronado, Cal. U.S. Pat. 825,953, July 17, 1906.

THE seaweeds are "sweated," and dried in an enclosure, and the exuded salts are then separated by mechanical agitation. (Compare U.S. Pat. 794,481 of July 11, 1905; this J., 1905, 883.)—E. S.

FRENCH PATENT.

Organic or inorganic compounds; Process for the reduction of ——. S. Kapff. Fr. Pat. 362,985, Feb. 3, 1906. Under Int. Conv., Feb. 8, 1905.

FORMIC and sulphurous acids, or their compounds, are used in combination to effect reductions, which, in many cases, neither reagent, taken separately, can realise. For example, on heating a mixture of water, sodium formate, sodium bisulphite, and hydrochloric acid, with nitrobenzene, aniline is produced. Thus also, an aqueous solution of sodium bisulphite and formic acid reduces Indigo Carmine on heating. Solution of ferric chloride may be reduced by the same reagents. Many examples are given of the application of this reducing compound in discharging the colours of certain dyes on cotton, silk, &c., and for the reduction of ferric salts, in the cellulose industry, &c.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page 760.*)

Smalt; Defects of —— in the salt-glazing kiln. W. Scheller and O. Geiz. Sprechsaal, 1906, **39**, 420; Chem.-Zeit., 1906, **30**, Rep. 239.

THE addition of a highly fusible frit to the pigment, in order to fuse the particles of smalt that are liable to volatilise in the salt-glazing kiln and produce irregular colouring of the ware (stoneware), is insufficient to obviate the defect at the places where the salt comes most in contact with the ware when thrown into the kiln, and it is therefore better not to place any blue ware in those parts of the kiln. The following mixture is recommended as a frit for smalt: $(0{\cdot}2K_2O,0{\cdot}2Na_2O,0{\cdot}6CaO)1{\cdot}8—2SiO_2$.
—C. S.

Stoneware glaze. E. Berdel. Sprechsaal, 1906, **39**, 402; Chem.-Zeit., 1906, **30**, Rep. 239.

A LEADLESS glaze, rich in alumina and silica, and suitable for use on stoneware to be fired at a finishing heat corre-

sponding to Seger cone 1—3, can be obtained by fritting Norwegian felspar 55·6 parts, calcined borax 50·5, marble or calcspar 20, and quartz sand 54 parts. Of this frit 170 parts are ground with 55·6 parts of felspar, 29·6 of barium carbonate, 20 of marble, 22·2 of calcined kaolin, 25·8 of raw kaolin, and 42 of quartz sand. The glaze may be coloured with metal oxides, preferably added to the fritting charge.—C. S.

FRENCH PATENT.

Glass articles; Staining ——. R. Kessler. Fr. Pat. 362,972, Feb. 3, 1906.

FOR colouring hollow beads, artificial fruits, and other similar articles of glass, a mixture is used consisting of powdered aluminium and gelatin, to which an aniline colouring matter is added.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 760.)

Portland cement; Influence of added substances on the strength of ——. Wormser. Tonind. Zeit., 1906, **30**, 949; Chem.-Zeit., 1906, **30**, Rep. 239.

IN order to ascertain whether any increase of strength could be imparted to a mixture of cement and sand (1:3), by the addition of acids and saline solutions that form insoluble or sparingly soluble compounds with lime, test blocks of cement prepared in (*a*) rotary tube furnaces, (*b*) shaft furnaces, and (*c*) ring furnaces, were treated with oxalic acid, chromic acid, or phosphoric acid, or the sodium or ammonium salts of these acids; also with ammonium fluoride, sodium silicate, borax, or boric acid, in solutions of varying concentration. The cements (*b*) and (*c*) gave better results than when mixed with water alone, especially after standing for 28 days, but only a slight increase of strength was exhibited by (*a*).—C. S.

Portland cement; Influence of sulphates on the setting properties of ——. L. Périn. Le Génie Civil, Paris, **46**, 390—391. Proc. Inst. Civil Eng., 1905—1906, **163**, 54.

THE author determined the rate of setting of (1) plaster of Paris; (2) Portland cement; and (3) mixtures of Portland cement with quantities of different substances containing equal amounts of sulphuric anhydride, viz., (*a*) with 1 per cent. of plaster of Paris; (*b*) with 1·12 per cent. of raw gypsum; (*c*) with 1·54 per cent. of potash alum; and (*d*) with 0·86 per cent. of ammonium sulphate. It was found that the retarding effect of plaster of Paris was identical with that of raw gypsum, but less than that of ammonium sulphate; the addition of alum had practically no effect. The author expresses the opinion that the retarding action is due to chemical causes, and depends, within limits, on the quantity of sulphuric anhydride present. The increased action of ammonium sulphate is considered to be due to the relative instability of that compound, whilst the negative result, obtained with alum, is probably due to the presence of aluminium in that salt.—A. S.

UNITED STATES PATENT.

Cement; Apparatus for manufacturing ——. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 825,305, July 10, 1906.

THE apparatus consists of a rotary kiln with a blast gas-burner or other fuel-feeding arrangement at its lower end, and a housing enclosing its upper end. In this housing are placed baffle-plates, which cause a deposition of dust, and force the products of combustion to adopt a circuitous route, thereby heating a number of air-flues, also placed in the housing. The dust deposited is removed through doors. From the air-flues, a connecting pipe leads the heated air to the blast burner, which is fed from a producer into which waste gases from the kiln, after traversing the housing, are delivered.—A. G. L.

X.—METALLURGY.

(*Continued from page* 765.)

Slags; New apparatus to determine the melting points of ——. W. McA. Johnson. Electrochem. and Metall. Ind., 1906, **4**, 262—263.

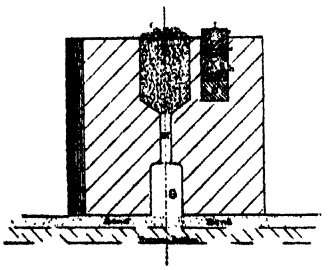


FIG. 1.

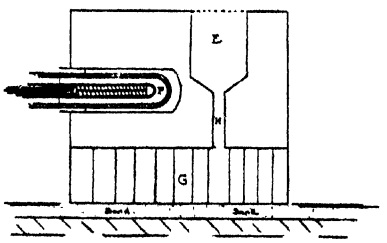


FIG. 2.

A PIECE of a round 4-in. bar of Acheson graphite, 3½ ins. long, has a narrow slot, G, $\frac{5}{8}$ in. wide and 1½ ins. high, cut in its bottom (see Fig. 1). In the top of this block a hole, E, of 1 in. diam. (Fig. 2), is drilled to a depth of 1 in., and this is continued by a hole, H, $\frac{1}{2}$ in. diam., to the narrow slot. A horizontal 1-in. hole is drilled above the level of the slot, to receive a Le Chatelier pyrometer, P, to a point as near as possible to the $\frac{1}{2}$ in. "dripping hole." A small quantity of the slag, or of the mixture of slag-forming materials, is placed in the upper hole, E, and the whole is placed in an oil-fired experimental reverberatory furnace having a layer of sand on the hearth. The pyrometer is inserted through a hole in one side of the furnace, whilst through an opening in another side, the point at which the slag drops through the hole, H, into the slot, G, is observed. It is stated that results agreeing within 5° C. can be obtained.—A. S.

Zirconium and titanium; Silicides of ——. O. Hönigschmid. Compt. rend., 1906, **143**, 224—227.

THE reduction of zirconium or titanium oxides or of their double potassium fluorides with aluminium gives, in presence of a large excess of silicon, the silicides, $ZrSi_2$ and $TiSi_2$, respectively. They are purified in the same manner as thorium silicide (this J., 1906, 481). These silicides are obtained as minute hard iron-grey crystals. The zirconium compound has the sp. gr., 4·88, and burns when heated in oxygen; the titanium compound has the sp. gr., 4·02, and is oxidised with difficulty. Both compounds are unaffected by acids (excepting hydrofluoric acid), but decompose readily when fused with caustic potash.—F. SODN.

Lead and calcium; Alloys of ——. L. Hackspill. Compt. rend., 1906, **143**, 227—229.

BY melting together lead chloride and metallic calcium, alloys of lead and calcium are formed (compare this J., 1906, 124), but the yields are poor. The alloys are harder

than lead, and tarnish rapidly. Water decomposes them with disintegration.

A crystallised compound or alloy, Pb_3Ca_2, melting at 775° C., and of sp. gr., 7·6, is obtained by distilling off the excess of lead contained in the crude alloy *in vacuo* at about 1000°.—F. Sodn.

Iron; Chemistry of ——. H. von Jüptner. Ber., 1906, 39, 2376—2402.

A lecture, summarising the present position of our knowledge of the chemistry of the iron-carbon, iron-silicon, and iron-phosphorus compounds in iron and steel.—J. T. D.

Silicon and graphite; Influence of —— *on the open-hearth process.* A. S. Thomas. Iron and Steel Inst., July, 1906 [Advance proof].

In making "acid" steel, the author finds that to obtain the best results, the pig-iron used should contain from 1·25 up to 2 per cent. of silicon; with less than this, the "banks" are invariably fluxed, whilst with more, bad "bottoms" often occur, and he suggests that in furnaces making acid steel with low silicon iron, the acid bottoms now used should be replaced by basic bottoms. He also finds that by using iron with a high percentage of combined carbon, instead of highly graphitic iron, the output is increased by 25 per cent., whilst the wear and tear of the furnace is reduced 100 per cent. When using high graphitic iron less than 10 per cent. of the carbon contents are eliminated during the melting period. In all cases the metal must be kept covered with a proper quantity of slag which is not thick and viscous.—J. H. C.

Siemens-Martin furnace; Chemical reactions in the —— Deslandes. Bull. Soc. d'Encourag., Revue de Metall., 1906, 3, 213—222.

The author has studied the "coefficients of distribution" of various elements (*i.e.*, ratio of percentages in slag and in metal) after fusion in the furnace, when equilibrium may be supposed to have been attained. These coefficients depend on the temperature, and on the composition of slag and of metal. The composition of the metal is sufficiently characterised by its content of carbon, that of the slag by its content of silica.

Silicon.—If the percentage of silica in the slag be plotted as abscissæ, (x), and that of carbon in the metal as ordinates, (y), then for metals containing from 0·15 to 0·50 of carbon, and slags containing 45 to 56 of silica, the line $x+28{\cdot}25y=59{\cdot}6$ separates the diagram into two regions—where $x+28{\cdot}25y>56$ the metal contains silicon, and in the other region it contains none. Whether the silica in the slag be saturated by iron or manganese makes no difference. Elevation of temperature favours retention of silicon in the metal, but the influence of temperature is only slight. Equilibrium is long in being attained, or in being re-established if disturbed by addition of silicon to the metal. Additions to the slag much more rapidly adjust themselves.

Manganese.—For percentages of carbon, from 0·55 to 0·20, and of silica from 59 to 53, if $x+44y>30{\cdot}8$ the metal will contain more than 0·2 per cent. of manganese—if $x+44y<30{\cdot}8$ the manganese will be below 0·2 per cent. Here, too, temperature has but a secondary influence, though high temperature favours increase of manganese. The silicon in the metal, as well as the carbon, has an influence on the manganese: if (a being the percentage of carbon, and b that of silicon) $a>0{\cdot}33+3{\cdot}4b$, the percentage of manganese depends only on the silicon, and increases with it; if $0{\cdot}33+3{\cdot}4b>a>0{\cdot}12+0{\cdot}9b$, the content in manganese depends on and increases with both carbon and silicon; if $0{\cdot}12+0{\cdot}9b>a$, the content in manganese depends only on the carbon, and increases with it. Thus, while the metal as a whole may not be in equilibrium with the slag, internal equilibrium in the metal among carbon, silicon, and manganese, may exist.

Sulphur.—This has not been fully worked out, but the coefficient of distribution seems to diminish as the basicity of the slag (especially the basicity in manganese) increases. High temperature favours the elimination of sulphur.

—J. T. D.

Copper; Solidification of ——. P. Dejean. Bull. Soc. d'Encourag., Revue de Metall., 1906, 3, 149—158.

The author has determined the temperature of solidification of copper by a thermo-electric pyrometer, comparing the indications of the same instrument given by each sample of copper with those given by gold. Assuming that the solidifying point of gold is known to be 1065° C., his conclusions are as follows:—

1. Pure copper solidifies at 1085° C.

2. It forms with cuprous oxide a eutectic containing 4·5—5·0 per cent. of oxide.

3. This eutectic solidifies near to 1065° C. The solidifying point falls slightly as the percentage of oxide is reduced, probably through impurities in the copper, which are all dissolved in the oxide.

The solidifying point of copper may be used to calibrate a thermo-electric pyrometer. For this purpose it is best to melt the copper in an open crucible; the oxidation during the time of experiment will give 2 to 3 per cent. of oxide, and the mixture will usually show two points of arrest on cooling. The temperature of the second arrest may be taken as 1062° C.—J. T. D.

Brasses; Special ——. L. Guillet. Bull. Soc. d'Encourag., Revue de Metall., 1906, 3, 159—204.

A more detailed memoir than that abstracted in this J., 1906, 540. The chief additional points are as follows:—

Ordinary brasses.—Those containing 48—55 per cent. of copper, consist chiefly of the constituent β, which is forgeable hot; yet brasses with less than 55 per cent. of copper are rarely met with industrially. This is, perhaps, because (1) they are hard and difficult to work; (2) the interval of temperature over which they can be rolled or hammered is restricted, and would be difficult to maintain in practice. Moreover, small amounts of impurities have an important influence on the mechanical properties; the author's experimental brasses were all made from pure materials, which could not be used industrially.

Brasses containing Aluminium.—Aluminium can be added to brass to the extent of about 10 per cent. before it forms a special constituent. The properties of the alloys are closely similar to those of the "equivalent" ordinary brass (*i.e.*, having really the "imaginary" percentage of the alloy), but the elastic limit is distinctly higher in the aluminium brass than in the equivalent ordinary brass. In alloys with the same "imaginary" percentage of copper, the elastic limit and hardness rise, the elongation, reduction in area, and resistance to shock fall, as the percentage of aluminium increases.

Brasses containing manganese.—It needs 8 per cent. of manganese in an alloy containing 60 per cent. of copper, before a sensible amount of a special constituent is formed; and with higher percentages of copper, even 15 per cent. of manganese shows no trace of it. Manganese brasses resemble in properties the equivalent ordinary brasses, but the elastic limit and breaking stress are considerably raised. Manganese alloys with the same "imaginary" percentage of copper, but different percentages of manganese behave, as to their relative mechanical properties, like aluminium brasses. The addition of manganese allows of rolling, industrially, brasses composed entirely of the constituent β.

Brasses containing iron.—The author has not investigated these very fully. Up to 1·66 per cent., iron produces very little effect on the mechanical properties; the breaking stress is slightly lowered, the hardness increased.

Brasses containing tin.—Tin dissolves first in the constituent α; the more zinc this contains the less tin can it dissolve. When the α-constituent is saturated, the tin forms a special constituent, similar to that found by Heycock and Neville in bronzes. In brasses containing both the α and β constituents, the α-constituent first takes up about 0·7 per cent. of tin, then the β-constituent an equal percentage, then the special constituent begins to be formed, first at the expense of the β-solution, and, when that is all absorbed, at that of the α-solution. An amount of tin not more than necessary to saturate the α and β solutions has but little effect on the mechanical properties, but when it exists

in greater quantity it is injurious. Brasses with these higher proportions of tin are, however, much more resistant to sea-water than ordinary brasses.

Brasses containing lead.—Lead dissolves to the extent of about 0·9 per cent. in both the α and β solutions, and in that condition is almost without effect; but in larger amount, when it exists as lead, it rapidly lowers the mechanical qualities of the alloy.

Brasses containing silicon.—The solution β can dissolve more silicon as its zinc content is lower—1·4 per cent. at 63 per cent. of copper, 2 per cent. at 90 per cent. of copper. The solution β dissolves about 1·4 per cent. Higher percentages give rise to a special constituent similar to one found in industrial copper-silicons. The properties of silicon brasses not containing the special constituent are very similar to those of the equivalent ordinary brasses, but the elastic limit is raised. When the special constituent forms, the mechanical qualities undergo rapid degradation.

Brasses containing magnesium.—Not more than 0·2—0·3 per cent. of magnesium can be dissolved without formation of a special constituent which is highly injurious. Magnesium must, therefore, be used very sparingly and carefully, if used at all, for deoxidising brasses.

Antimony behaves, as regards its solubility and its effects, almost identically with magnesium.

Complex brasses.—When more than one substance is added to a brass, each behaves as though it were the only substance added.—J. T. D.

Metallic alloys compounded in atomic proportions; Physical properties of —— at ordinary and higher temperatures. W. Rubel. Ann. Gewerbe- u. Bauw., 1906, **59**, 9; Chem.-Zeit., 1906, **30**, Rep. 243.

SMELTING furnaces with natural draught give alloys of better quality, with less waste, than when artificial draught is employed, owing to the smaller excess of oxygen in the former. The conductivity of copper smelted under the first-named conditions was found to be 110 per cent. (referred to standard copper), whilst in the other case it was only 73 per cent.

An alloy with the composition Cu_2Fe_2NiAl gave the tensile strength 82 kilos. per sq. mm. with only 3 per cent. of elongation, perfectly uniform structure, and only two constituents (α- and β-crystals), no eutectic being formed. The elongation increased to 13 per cent. (in the quickly cooled state) on altering the proportions in such ratio as would correspond to $Cu_2Fe_2Ni_2Al$, the tensile strength being 75·7 kilos. per sq. mm.; surface of fracture, copper red; worked surface, the colour of nickel; cost of production and resistance to the action of chemicals, both high. An alloy of the composition Cu_2Zn was melted with a small proportion of the foregoing, and gave a product with the tensile strength of 48·7 kilos. per sq. mm., elongation 31 per cent., limit of elasticity 20 per cent., fusing point 950° C. Tin is unsuitable for alloys of the kind under consideration that are to stand strain up to 250° C., and manganese quite unsuitable for such as are to be exposed to high temperatures.—C. S.

Gas-engine exhaust gases; Resistance of metals to corrosion by ——. J. Pintsch. II., page 802.

Antimony and tin; Separation of ——. A. Czerwek. XXIII., page 829.

Zinc; Analysis of industrial ——. A. Hollard and L. Bertiaux. XXIII., page 829.

Copper Mining in Japan. Eng. and Min. J., July 21, 1906. [T.R.]

ACCORDING to recent advices, the copper-mining industry of Japan is in a very prosperous condition, and the production of the important mines is rapidly increasing. The chief feature of the recent history is the remarkable development of the Kosaka mine, in the northern part of the island of Nippon. This property was originally worked as a silver mine, but in passing below the line of oxidation, the ore changed into an enormous mass of mixed sulphides.

The Kosaka ore deposit appears to be a blanket vein, dipping at an angle of about 45°. The hanging wall is an andesite tuff; the foot wall is diorite. The deposit is about 400 ft. in thickness, measuring at right angles to the dip of the vein. Immediately under the hanging wall is a large zone of mixed sulphides, so closely mingled that mechanical separation is impossible. This ore averages 40 to 45 per cent. of barium sulphate, 10 per cent. of zinc, 10 per cent. of lead, 2 per cent. of copper, 0·02 per cent. of silver, and a trace of gold. Immediately under it is a zone of iron pyrites containing 1 to 2 per cent. of copper, and below the latter occurs siliceous ore containing from 1 to 1·5 per cent. of copper.

The three kinds of ore are mined, and mixed in such proportion as to produce a self-fluxing product. This is smelted semi-pyritically, about 2 per cent. of anthracite being employed as fuel. Smelting is done in six furnaces, each 3·5 by 25 ft. at the tuyères. These furnaces reduce the charge at the rate of about 3 tons per square foot of hearth area per 24 hours. The slag is essentially a silicate of iron and baryta. A new furnace, 3·5 by 60 ft., is now being erected. The product of the blast furnaces is a lead-copper matte containing about 30 per cent. of copper. This is crushed, roasted, and smelted for blister copper in reverberatory furnaces. The blister copper is refined electrolytically, and the capacity of the refinery is now being increased so as to work the entire product of the works.

The Kosaka mine has now displaced the famous Ashio mine from the premier position among Japanese copper producers. Its output last year was approximately 7200 tons of copper, against 6600 tons from the Ashio mine, and 5500 tons from the Besshi mine.

Mineral production of Bosnia. Eng. and Min. J., July 21, 1906. [T.R.]

THE mineral production of Bosnia and the Herzegovina for the year is reported as below, in metric tons:—

——	1904.	1905.	Changes.
Iron ore	127,297	122,540	D. 4,757
Copper ore	640	670	I. 30
Chrome ore	278	186	D. 92
Manganese ore	1,114	4,129	I. 3,015
Pyrites	10,421	19,045	I. 8,624
Coal	483,617	540,237	I. 56,620

The Bosnian coal is all lignite, and is obtained from a few mines.

The metal production of all kinds was as follows, also in metric tons:—

——	1904.	1905.	Changes.
Mercury	8	10	I. 2
Copper	115	39	D. 76
Pig iron	47,678	43,074	D. 4,604
Castings	3,211	3,951	I. 740
Steel ingots	24,111	29,644	I. 5,533
Wrought iron	19,622	23,200	I. 3,578

The steel made is all open-hearth steel. The decrease in iron was due to the partial suspension of the Vares works.

Nickel; Production of ——. Ch. of Com. J., Aug., 1906. [T.R.]

REPORTING on nickel production for the Ontario Bureau of Mines, Prof. A. P. Coleman says that New Caledonia is the only real competitor of Ontario as a nickel producer. Though the United States has dropped out of the race as a producer of nickel ore, it is still one of the most important countries for the refining and utilisation of metallic nickel, much the greater part of the Canadian metal being treated at Constable Hook, New Jersey. The Sudbury nickel field has long been known as the most important source of that metal in America. All the ore deposits of any economic importance are at or near the outer margin of a huge laccolithic sheet of eruptive rock a mile and a quarter thick, 36 miles long, and 17 miles wide. The rock composing this sheet is diorite at the outer and lower edge, merging into granite or granodiorite at the inner (upper) edge. The ore bodies are round the margin of the diorite, or along dike-like offsets from it. Canada is presently to have a mint, and Prof. Coleman recommends

that it should begin its work by coining 1-cent and 5-cent pieces of pure nickel, making use of a distinctively Canadian metal.

World's production of nickel.—The nickel production of the Sudbury field for the calendar year 1904 is given as 4,729 tons, valued at £302,656, and the total production of the district since the discovery of the nickel deposits there, up to and including the year 1904, at 43,877 tons, valued at £2,532,014. A table giving the world's production of nickel (in metric tons) accompanies the report. Discarding fractions of tons, this table is as follows :—

Year.	Sweden and Norway.	New Caledonia.	Canada.	United States.
1889 ..	80	1,332	377	115
1890 ..	100	1,634	651	101
1891 ..	125	2,494	1,830	54
1892 ..	97	1,606	1,095	42
1893 ..	90	2,493	1,807	22
1894 ..	90	2,422	2,226	4
1895 ..	40	2,548	1,764	5
1896 ..	20	2,707	1,541	8
1897 ..	—	2,858	1,813	11
1898 ..	—	3,648	2,503	5
1899 ..	—	4,205	2,605	10
1900 ..	—	4,526	3,211	4
1901 ..	—	5,210	4,168	3
1902 ..	—	4,024	4,850	3
1903 ..	—	4,750	6,348	52

Mercury Production in U.S.A. Oil, Paint, and Drug Rep., Aug. 6. [T.R.]

THERE was an important decline in the output of mercury during 1905. The decrease in value was even greater, due to a marked decrease in demand, the average price for the year being $36.22 per flask, as compared with $43.50 in 1904. The following is an abstract of this report :—

The production of mercury in the United States during the year 1905 amounted to 30,451 flasks (of 75 lb. net each), valued at $1,103,120, as compared with 34,570 flasks, valued at $1,503,795, in 1904, a decrease in quantity of 4119 flasks, and in value of $400,675. This output was produced by four States as follows :—California, 24,035 flasks; Texas, 4723 flasks; Utah, 1050 flasks: Oregon, 43 flasks. This falling off in production was due primarily to a lack of demand and a consequent decline in price, and also to a depletion of the richer ore produced in some of the larger mines.

California.—The amount of mercury produced in California during 1905 was 24,635 flasks, valued at $886,081, as compared with 29,217 flasks, valued at $1,270,200, in 1904. This output represents 81 per cent. of the total production of the country. The decrease of 4565 flasks in the quantity of mercury produced in California during 1905 is due rather to a lessened production of all the mines than to any serious falling off in the output of any single one, with the exception, perhaps, of the new Almaden property in Santa Clara county. This is the oldest mercury mine in the country, and for years was the largest producer on North America. Of the total output of the whole State of California during the last fifty-five years, nearly 2,000,000 flasks, fully one-half, has been produced by the New Almaden. At present the New Idria mine in San Benito county is the largest producer in the State. The Napa Consolidated, in Napa county, and the New Almaden come next as regards output. The Oceanic, the Great Western, the Great Eastern, the Socrates, the Karl, and the Altoona are the other principal producing mines of the State.

The outlook for an increased production of mercury in California is not encouraging, and a further decrease in the output for 1906 is indicated by the decline in production from 3449 flasks in January and 2526 flasks in February of 1905 to 1588 flasks in January and 1904 flasks in February of 1906—a decrease of 861 and 622 flasks respectively.

Texas.—The developments of the mercury industry in Texas during 1905 were the most important in this country. The mercury deposits are situated in the extreme south-western part of the State, about 300 miles south-east of El Paso, about 100 miles south of the line of the Southern Pacific Railway, and from 7 to 15 miles north of the Rio Grande. They lie in three areas, known respectively as Terlingua, Study Butte, and Chisos districts.

The Terlingua district comprises an area of about 25 square miles in the immediate vicinity of Terlingua. The Study Butte district embraces about six square miles about ten miles east from Terlingua. The Chisos district, the last discovered and the least developed, lies immediately east of the districts mentioned, and south-east of the Chisos mountains.

The mining methods employed in this region are extremely crude. The deepest shaft in the region is down only about 300 ft. in limestone. The shales have been penetrated only to a depth of 200 ft.

The production of mercury in Texas during 1905 was 4723 flasks, valued at $173,302, as compared with 5336 flasks in 1904, valued at $232,116, a loss of 613 flasks in quantity and of $58,754 in value. This output for 1905 represents 15·53 per cent. of the total production of the country. The decrease in the output was in a large measure due to a very heavy decline in the price of mercury

Prices.—During 1905 the price of mercury suffered a heavy decline, due to a marked decrease in demand. The average San Francisco price for the year was $36.22 per flask of 75 lb. Corresponding average quotations were $44.10 per flask in 1902, $45.29 in 1903, and $43.50 in 1904. In San Francisco wholesale quotations of mercury for domestic delivery ranged from $37 to $42 per flask, and metal for export was quoted at $35 to $41. In New York prices were $38 to $42.50 per flask, and in London from £7 2s. 6d. to £7 12s. 6d. per flask.

Imports.—There is an import duty of 7 cents per lb. on mercury, which is sufficient practically to prohibit importation. During the past five years the value of the product imported has ranged from $789 to $2166. The quantities are not stated.

Exports.—The exports of mercury from the United States during 1905 were 1,009,444 lb., as compared with 1,611,635 lb. in 1904, a decrease of 602,191 lb., or 37·4 per cent.

Mineral production of Tasmania in 1905. Bd. of Trade J., Aug. 9, 1906. [T.R.]

THE following statistics of the mineral production of Tasmania during the years 1904 and 1905 are taken from the report for 1905-06 of the Hobart Chamber of Commerce :—

		Quantity.		Value.	
		1904.	1905.	1904.	1905.
				£	£
Copper (blister)*	Tons	8,371	[8,610	582,540	704,287
Tin and tin ore†	,,	2,316	3,891	266,121	362,670
Gold	Fine oz.	65,921	73,540	280,015	312,380
Silver lead ore	Tons	51,138	75,270	203,702	246,868
Copper and copper ore	,,	316	1,500	16,056	52,939
Coal	,,	61,109	51,993	51,942	44,194
Iron ore	,,	6,840	6,300	2,975	2,600
Wolfram	,,	15	32	1,147	2,371
Bismuth	Cwt.	6	70	15	300
Zinc ore	Tons	1,931	—	1,932	—
Flux ore	,,	9,869	—	4,597	—
Total value		—	—	1,411,192	1,729,189

* Value of gold contents deducted. † Exported.

ENGLISH PATENTS.

Smelting ores in blast furnaces; Method of and means for ——. W. Kemp, Tucson, Ariz., U.S.A. Eng. Pat. 20,961, Oct. 16, 1905.

SEE Fr. Pat. 358,645 of 1905; this J., 1906, 270.—T. F. B.

Furnaces for re-heating and like purposes. H. Hart, Rotherham, Yorks. Eng. Pat. 19,670, Sept. 29, 1905.

THE furnace is supplied with means for preheating the air needed for combustion, consisting of a culvert built below the furnace floor level, extending from the firing end down one side to the opposite end or thereabouts, crossing over, and returning down the opposite side, where it terminates in a nozzle directed under the fire-grate. The entrance end of the culvert is provided with a regulating valve; air is blown into it by a fan or blower; and baffle-walls may be placed in it. The firing-hole and the ash-pit are made with suitably closing doors. —A. G. L.

[*Jig-washing machine.*] *Mineral washing and separating apparatus.* R. M. Howatt, London. Eng. Pat. 7541, March 28, 1906.

A NUMBER of jig compartments are placed around a refuse chamber common to all the jig compartments, and from which the refuse received is removed by a suitable elevator. The whole is preferably made in the form of a V-shaped tank, the jig compartments forming smaller V-shaped chambers along the two upper edges of the tank, and being provided with suitable valves to drop the refuse into the common central channel. Lateral channels may also be provided between the compartments to allow of the removal, by means of valves, of refuse collected above the sieves in the compartments.—A. G. L.

Alloy for bearings or the like. Siemens und Halske A.-G., Berlin. Eng. Pat. 10,513, May 4, 1906. Under Int. Conv., Sept. 22, 1905.

THE alloy consists of approximately equal parts of cadmium and zinc, to which up to 10 per cent. (but preferably only 5 per cent.) of antimony is added. It is claimed that this alloy is easily worked and turned, fills the moulds completely, possesses relatively great hardness, and has a very small coefficient of friction. —A. G. L.

UNITED STATES PATENT.

Furnace; Tilting ore-roasting ——. T. Edwards, Ballarat, Australia. U.S. Pat. 825,446, July 10, 1906.

THE furnace comprises a long ore-roasting chamber disposed above, and connected with a heating chamber. The ore chamber is provided with a series of rabbles, and the heating chamber is divided by a longitudinal partition, to provide a circuitous path for the hot gases. Both of the chambers discharge into a flue at one end of the furnace, and dampers are provided so that the gases from the ore-roasting chamber can pass either directly into the flue, or first into the lower heating chamber and thence into the flue.—A. S.

FRENCH PATENTS.

Zinc; Manufacture of ——. R. Fritsch and E. Nonnast. Fr. Pat. 363,036, Feb. 6, 1906.

BEFORE being distilled, the mixture of zinciferous mineral and carbonaceous material is first moulded into blocks corresponding with the cross-section of the retort. The moulding may be done by adding binding agents, or in the hydraulic press, or by a combination of the two methods. It is claimed that this invention facilitates charging of the retorts, and enables from 35 to 40 per cent. more material to be distilled in one operation.—A. G. L.

Gold, platinum, silver, nickel, and copper; Wet method of extraction of ——. A. Seigle. Fr. Pat. 363,039, Feb. 6, 1906. Under Int. Conv., Feb. 6, 1905.

THE invention consists essentially in extracting metals from their ores by subjecting the finely powdered mineral to the action of steam under pressure in the presence of silicic acid (or boric acid) and a solution of chloride of sodium, calcium, or magnesium. The operation is carried out in a suitable autoclave provided with stirrers under a steam pressure of 3 kilos. per sq. cm. If the ore itself is not sufficiently siliceous, a suitable amount of silica (or boric acid) is added to it. In extracting copper and nickel, the ore is first gently roasted; if much sulphur or arsenic is present, a little ferrous sulphate is added to the sodium (or other) chloride used in the extraction. The copper and nickel go into solution as more or less complex chlorides, and are recovered in any usual way. If a silver ore is to be treated, sufficient sodium chloride must be present to dissolve the silver chloride formed. Comparatively rich gold and platinum ores are treated with sodium chloride and nitrate, the nascent chlorine produced being said to be specially active in dissolving the precious metals. Poor gold ores and residues are first treated with a solution of potassium ferrocyanide through which air is blown, after which the whole mass is treated with steam under pressure in an autoclave.—A. G. L.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 767.)

(*A.*)—ELECTRO-CHEMISTRY.

Ozone; Influence of pressure and the character of the discharge on the formation of ——. A. Chassy. Compt. rend., 1906, **143**, 220—222.

THE percentage of ozone formed, when equilibrium is established, decreases slightly as the pressure is lessened, though the initial increase in concentration per unit of time is greater. Quite abruptly, however, at pressures below 60 mm., no ozone at all is produced. At these low pressures the discharge is seen as a uniform glow quite different from the appearance at higher pressures, and the difference in results seems to correspond with that in the character of the discharge. Ozonised oxygen below this pressure of 60 mm. is at once decomposed by the action of the discharge.—F. SODN.

ERRATUM.

This J., 1906, p. 765, col. 2, l. 7 from top, *for* Brown *read* Bronn.

Mineral waters; Difference between the electrical resistances of natural and artificial ——. D. Negreano. XVIII*A*., page 824.

ENGLISH PATENT.

[*Vanadium carbide*] *Filaments for electric incandescent lamps; Impts. in* ——. The British Thomson-Houston Co., Ltd. From General Electric Co. Eng. Pat. 19,264, Sept. 23, 1905. II., page 803.

UNITED STATES PATENTS.

Furnace; Rotary electric ——. W. M. Johnson, Iola, Kans. U.S. Pat. 825,058, July 3, 1906.

THE furnace, which is mounted so that it can be rotated, consists of separate sections with insulating material between them. Each section has a lining of refractory material, and the furnace is heated by a resistance body of divided conducting material embedded in the linings. —A. S.

Sulphuric acid; [Electrolytic] Method of making ——. W. M. Johnson, Iola, Kans. U.S. Pat. 825,057, July 3, 1906.

A SOLUTION of sulphuric acid containing sulphur dioxide is electrolysed by means of electrodes connected in series, the anode faces of the electrodes being composed of lead, and the cathode faces of a metal, such as electro-deposited copper, having a low cathode potential. When the

concentration of sulphuric acid in the solution has increased to the desired extent, a portion is withdrawn, the remainder is diluted, a further quantity of sulphur dioxide is introduced, and the electrolysis is repeated.—A. S.

Calcium carbide; Producing ——. J. M. Morehead, Chicago, Ill. U.S. Pat. 825,234, July 3, 1906.

The charge is fed downwards into a region of reduction established under a gas-tight hood depending into the furnace chamber, the lower end of the hood and the upper end of the furnace chamber being sealed by the charge material. The waste gases are withdrawn from the hood. —E. S.

Lead into lead sulphate; [Electrolytic] Method of converting spongy ——. C. J. Reed, Philadelphia, Pa., Assignor to Security Investment Co. U.S. Pat. 825,981, July 17, 1906.

This invention relates to a method of converting the spongy or finely-divided lead, of a negative pole secondary battery electrode, into lead sulphate, and consists in connecting the same in a closed circuit with an electrode of electro-negative material, having a coating or deposit of platinum black or finely-divided platinum, in a bath of dilute sulphuric acid. A similar method of reversing a spongy-lead electrode and charging the same as a peroxide plate is also claimed.—B. N.

Nitrogen compounds; Electrochemical process of producing ——. J. W. Wood, Moulton, Iowa. U.S. Pat. 826,301, July 17, 1906.

This invention relates to an electrochemical process for making nitrogen compounds, and consists in continuously charging a liquid electrolyte, such as "an aqueous solution of nitrogen," with air under pressure in order to furnish it with an excess of nitrogen. The liquid is subjected to the action of an electric current in order to dissociate the water, and the nitrogen and other compounds formed are finally carried off at the anode and cathode respectively. —B. N.

(*B.*)—ELECTRO-METALLURGY.

Ferrosilicon manufactured in electric furnaces; Phosphuretted hydrogen poisoning from ——. P. Lehnkering. Z. Unters. Nahr. und Genussm., 1906, **12**, 132—135.

In investigating the cause of death of two children upon a Rhine boat carrying ferro-silicon, the presence of some 0·15 per cent. of phosphorus in the 57·69 per cent. silicon alloy was determined. The product, which had already been exposed somewhat to rain, was only examined some five or six days after the loading of the vessel, but still evolved 0·0227 grm. of hydrogen phosphide per kilo. in contact with water. The evolution of this gas is ascribed to the presence of calcium phosphide, iron phosphide being stable in presence of water. The cabin occupied by the children for two or three days continuously was situated over the hold in which the kegs of ferrosilicon were stored.

Mention is made of several other cases of sudden death on Rhine boats during the last six months, and to the explosions at Liverpool (this J., 1904, 324 and 622), which may probably also be ascribed to phosphuretted hydrogen. —R. S. H.

Strontium amalgams. A. Guntz and G. Rœderer. Bull. Soc. Chim., 1906, **35**, 494—503.

By the electrolysis of a saturated solution of strontium chloride, using mercury at the cathode, the authors have succeeded in obtaining crystals, in large quantity, of an amalgam $SrHg_{11}$, the existence of which had been disputed. The electrolysis was carried out at 20 volts and 1—1·5 ampères per sq. cm. of cathode, and the temperature was maintained at 20°—30° C. by special cooling arrangements. The crystals, which contain 3·8 per cent. of strontium, change rapidly in the air, and are easily decomposed by water. They may be preserved, however, in an atmosphere of dry carbon dioxide. No mercury is lost by subjecting them to a pressure of 5000 kilos. per sq. cm., but on heating *in vacuo*, mercury is given off, and richer amalgams are obtained. In one experiment definite crystals containing 6·8 per cent. of strontium, corresponding to the formula $SrHg_6$, were obtained. The amalgams with 6—10 per cent. of strontium are brittle, hard, and fine-grained, and are not much affected by air. Experiments at high temperatures were carried out in a manner similar to those with barium amalgam (this J., 1905, 278), but pure strontium cannot be obtained, for at 1000° C., instead of a further loss of mercury, the amalgam containing about 50 per cent. of strontium, distils unchanged.—F. Sodn.

English Patents.

Metal tubes and other bodies; Electrolytic manufacture of ——. W. Clark, London. From F. Darmstadter, Darmstadt, Germany. Eng. Pat. 24,724, Nov. 29, 1905.

See U.S. Pat. 817,419 of 1906; this J., 1906, 767.—B. N.

Metallic deposits; Process for obtaining electrolytic ——. L. Trunkhahn, Vienna. Eng. Pat. 11,498, May 16, 1906.

This invention relates to the production of adherent and lustrous metallic deposits by means of an electrolytic bath to which sugars are added, and consists in the addition to the same of a ferment. The following is given as an example of a zinc bath:—25 kilos. of crystallised zinc sulphate; 15 kilos. of aluminium sulphate; 1 kilo. of calcium carbonate; 4 kilos. of maltose or dextrose; 0·5 kilo. of beer barm.—B. N.

United States Patents.

Furnace; Electric ——. F. T. Snyder, Oak Park, Ill. U.S. Pat. 825,359, July 10, 1906.

This invention relates to an electric furnace of the transformer or induction type, and comprises a core contained within a chamber, the latter being adapted to hold material forming a secondary circuit about the core. A primary induction-coil winding is arranged on the core substantially concentric with the secondary, but relatively displaced along the core such a distance as to allow sufficient magnetic leakage between primary and secondary to maintain constant current in the secondary, upon the application of constant-potential alternating current to the primary winding. The laminated iron magnet core is provided with means for clamping the laminæ together, non-conducting material being disposed about an arm of the core so as to form a vertically-disposed annular chamber surrounding the core. Between the laminæ of the core is a closed trough having a transverse web, and adapted to contain water, the core projecting outside the wall of the chamber, means being provided for circulating water between the core and the chamber. The core is placed within a bridge of refractory material which extends across the central portion of the chamber, dividing the latter into two vertical wells on each side of the bridge. The secondary circuit comprises a low-resistance metal conductor consisting of multiple bars of copper passing under the core from one well to the other, and molten electrodes of the metal to be smelted are in contact with the terminals of the low-resistance conductor, the bridge separating the two electrodes. A slag containing the same metal is supported on the molten electrodes to a level above the level of the bridge, thus uniting electrically the electrodes, and ore to be smelted is fed upon the molten material through a suitable opening in the reverberatory roof of the furnace. The slag at the top offers the highest resistance, and the maximum heating effect is thus developed in the upper portion of the secondary circuit. The chamber is provided with an opening through which the quantity of material in the secondary circuit may be varied in order to vary the resistance, and the temperature of the furnace may thus be adjusted and automatically maintained constant. The resistance of the metal increases with rise in temperature, and that of the slag decreases, and the relative resistance of the metal and slag are so proportioned that the resistance of the secondary will increase with a fall of temperature in the furnace.—B. N.

Furnace; Electric ——. J. F. Hammond, Brewster, N.Y. U.S. Pat. 825,386, July 10, 1906.

The furnace consists of a muffle having its four sides and top permanently closed, and mounted on a suitable frame by means of a pivoted joint whereby the muffle can be inverted from its normal position, switch-blades, secured to the frame and muffle-body respectively, engaging when the muffle-body is swung on the frame. A bottom member, vertically movable in the frame, engages and closes the bottom of the muffle, the bottom member being reciprocated by a cam controlled by a handle-lever, rollers connected to the bottom member guiding it in the frame. Means are provided for locking the bottom when engaging the muffle. Electric coils are arranged in each of the six portions of the muffle, the coils being divided into four groups, one group, *a*, being disposed in the top, bottom, front, and back of the muffle, a second group, *b*, disposed in the bottom and top of the muffle, a third, *c*, in the front and back of the muffle, and a fourth, *d*, in the two other sides of the muffle. The terminals of the coils are connected with an electric switch in such a way that the "groups will first be connected in series, and in the successive positions of advancement of the commutator, the latter will so connect the terminals of the groups whereby in the second position a shunt of low resistance will be established around two of such groups as *c* and *d*; in the third position of the commutator the groups *c* and *d* will be out, leaving *a* and *b* in circuit; in the fourth position of the commutator groups *a* and *b* in series will be connected in parallel with groups *c* and *d* in series; in the fifth position of the commutator a shunt of low resistance will be established around group *c* in the latter multiple-series arrangement; in the sixth position the groups *a* and *b* in series will be connected in parallel with the group *d*; in the seventh position the groups *a* and *b* connected in series will be connected in parallel with group *c* and also with group *d*; in the eighth position a shunt of low resistance will be established around the group *b* in the seventh position; in the ninth position the groups *a*, *c*, and *d* will be connected in parallel; and in the tenth position the four groups *a*, *b*, *c*, and *d* will be connected in parallel.—B. N.

Nickel-copper matte; [Electrolytic] Method of treating ——. W. M. Johnson, Iola, Kans. U.S. Pat. 825,056, July 3, 1906.

The matte is treated with hot dilute hydrochloric acid, whereby a solution rich in nickel, and a residue rich in copper are obtained. The solution is freed from iron, and electrolysed to recover the nickel. The copper is recovered by "converting the residue into anodes rich in copper," and then refining the latter electrolytically, the refining solution being subsequently treated for the recovery of nickel salts.—A. S.

Ferro alloys; Process of producing low-carbon ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 825,348, July 10, 1906.

This invention relates to a process of producing low-carbon alloys of iron, such as ferro-chromium, and consists in providing a charge containing ferro-silicon and an oxidised compound of a metal, such as chromium, which is reducible by silicon and which will alloy with iron, together with a basic flux. An electric arc is established within the charge, a considerable body of the latter surrounding the zone of reduction, and protecting the electrodes from the oxidising effect of the atmosphere. Between the electrodes is maintained the minimum potential difference requisite to effect reduction, thereby preventing loss of electric current by leakage through the charge. The resulting slag and ferro alloy are separately tapped from the furnace at different levels, and the charge mixture supplied as required.—B. N.

Metals from ores; Extracting —— by electrolytic means. A. Lénárt, jun., Buda-Pesth, Austria-Hungary. U.S. Pat. 826,435, July 17, 1906.

See Fr. Pat. 356,825 of 1905; this J., 1906, 29.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page 768.*)

Linseed oil and cake; Properties of ——, in connection with various solvents and physical conditions. A. Mitarewski. Westnik gigieni, 1906, **42**, 578; Chem.-Zeit, 1906, **30**, Rep. 241.

Oil extracted with ether, petroleum spirit, benzene or carbon bisulphide lacks the characteristic smell of linseed and of the pressed oil. In the case of the last solvent, the oil has a strong garlic smell and a dark reddish-yellow colour, the others giving it a smell of fish oil and a more or less pronounced greenish-yellow tinge. Solvents do not cause any determinable alteration in the nature of the oil and cake, except carbon bisulphide, which increases the quantity of the volatile acids, and therefore raises the saponification value. Pressed oil contains more true fat. When oil is stored, the temperature influences the degree of oxidation, which is accelerated by storage at 70° C. and also by exposure to the air, although exposure to light for 26 days was found to have little effect.—C.S.

Oil from the seeds of the berries of Rhamnus cathartica. [*Purging buckthorn*]. N. Krassowski. J. russ. phys.-chem. Ges., 1906, **38**, 144—161; Chem. Centr., 1906, **2**, 348—349.

The seeds were disintegrated, and the oil extracted by ether, and purified by treatment with light petroleum spirit and sodium carbonate solution; yield 8·85 per cent. The oil is odourless, slightly soluble in alcohol, and easily soluble in ether, chloroform, and benzene. It has the sp. gr. 0·9195 at 15°/4°; saponification value, 186; Hehner value, 95·77; iodine value, 155; Reichert-Meissl value, 0·89; and acid value, 5·64. The non-volatile fatty acids have the iodine value, 160·6; acetyl value, 25·8; and mean molecular weight, 288·9. The unsaponifiable matter contains phytosterol (0·48 per cent. of the oil), and a saturated hydrocarbon melting at 81°—82° C. (0·11 per cent.). The author detected the presence, in the volatile acids, of butyric acid, and an acid crystallising in leaflets at the ordinary temperature; in the solid acids, of stearic and palmitic acids; and in the liquid acids, of linolenic, isolinolenic, linolic, and oleic acids. The following is the probable composition of the oil:—Unsaponifiable matter (phytosterol and a hydrocarbon), 0·5%; volatile acids (butyric acid, &c.), 0·24; stearic acid, 6·00; palmitic acid, 1·12; isolinolenic and linolenic acids, 22·40; linolic acid, 35·20; oleic acid, 30·10; and glyceryl radical (C_3H_5), 4·32 per cent.—A. S.

Japanese sardine oil; New unsaturated fatty acid in ——. M. Tsujimoto. J. Coll. Engineering, Imp. Univ., Tokyo, 1906, **4**, 1—9. (See also page 798.)

Japanese sardine oil, obtained from *Clupanodon melanosticta*, T. and S. (Japanese, *ma-iwashi*), is produced in large quantities on the southern and eastern coasts of Japan. The larger portion of the oil is exported to Europe, the figures for 1905 being 2,379,267 kin. (1,430,810 kilos.), valued at 125,260 yen. Three specimens of oil, from different localities, examined by the author, varied in colour from greenish-brown to reddish-brown; all of them deposited somewhat large quantities of "stearine" at low temperatures. The following values were obtained on examining the oils:—

	Sample 1.	Sample 2.	Sample 3.
Place of origin	Chita (Aichi prefecture)	Choshi (Chiba prefecture)	Hakodaté (Hokkaido)
Sp. gr. at 15·5° C. ..	0·9347	0·9318	0·9316
Acid value	1·32	3·22	5·15
Free acids, as oleic acid	0·66%	4·13%	2·59%
Saponification value..	195·76	196·16	194·81
Iodine value (Wijs' method)	180·70	180·57	187·25
Refractive index at 20° C.	1·4803	1·4802	1·4807
Melting point of fatty acids (capillary tube method)	35·4°	36·2°	35·8°

The oil is practically free from unsaponifiable matter. From the fatty acids, a bromine addition compound was prepared by dissolving about 1 grm. in 10 c.c. of glacial acetic acid, cooling the solution, and adding excess of bromine, drop by drop. The precipitate, after being washed on a filter with a large quantity of ether, was found to have a composition corresponding to the formula, $C_{18}H_{28}Br_8O_2$. The compound is thus an octobromide, derived from an unsaturated fatty acid, $C_{18}H_{28}O_2$, which the author names *clupanodonic acid*. The yield of octobromide was from 44·24 to 47·09 per cent. of the weight of the mixed fatty acids, corresponding to a content of from 13·34 to 14·20 per cent. of clupanodonic acid in the mixed acids. The free acid was obtained from the bromine compound by treatment with zinc and alcoholic hydrochloric acid, but the yield was poor. It is a yellow liquid with a fishy odour, having the iodine value 344·42; it becomes oxidised when exposed to the air, drying completely in a few days.

No hexabromide insoluble in ether was obtained from the fatty acids; hence the occurrence of jecoric acid in the oil appears to be doubtful (compare Fahrion, Chem-Zeit., 1893, 521).—A. S.

Clupanodonic acid; Occurrence of —— in herring and whale oils. M. Tsujimoto. J. Coll. Engineering, Imp. Univ., Tokyo, 1906, **4**, 11—14.

The author found that clupanodonic acid, the most characteristic unsaturated acid of Japanese sardine oil, is also present in herring oil (*Clupea pallasi*, C. and V.: Japanese, *ni-shin*) (3·82—6·54 per cent. of the mixed fatty acids); and in whale oil (*Rhachianectes glauca*, Cope) (8·39 per cent. of the fatty acids). No evidence was obtained of the presence of two highly unsaturated acids, $C_{20}H_{32}O_2$ and $C_{24}H_{40}O_2$, stated by Bull (Chem. Zeit., 1899, 906) to be present in herring oil.—A. S.

Soaps; Revised classification of ——, in Bulgaria. Bd. of Trade J., Aug. 2, 1906. [T.R.]

A circular has been issued by the Minister of Finance containing modified instructions to Bulgarian Customs officials with regard to the tariff classification of imported soaps.

The following are declared to be dutiable under No. 170 of the tariff as "toilet soaps, &c." at the (conventional) rate of 70 frs. per 100 kilos. (£1 8*s.* 5*d.* per cwt.):—

(*a*) All scented, medicinal, and cosmetic soaps, without regard to their size, shape, or packing.

(*b*) All unscented soaps of the usual shapes and packed in the ordinary manner, where it is proved by analysis that the bulk of the stock of which they are made is refined, as in the case of toilet soaps, *i.e.*, that it contains no other admixture than refined salts of sodium or of sodium and potassium.

(*c*) All coloured soaps, scented or not, having the shapes of toilet soaps.

The following will be dutiable under No. 134 as "soaps for washing and other ordinary use" at the (conventional) rate of 12 frs. per 100 kilos. (4*s.* 10½*d.* per cwt.):—

(*a*) All soaps with regard to which it is established by analysis that they are made of an unrefined stock, *i.e.*, similar to that of which common soaps are generally made, even though such soaps be shaped and packed like toilet soaps.

(*b*) Unscented soaps, prepared by means of a refined or coloured stock or not, if imported in the shape of large cubes (*pains*) or bars, and destined for laundry purposes; and

(*c*) All other soaps made of an unrefined stock and destined exclusively for laundry purposes.

In their reports on the results of the analyses made, the officials are to state specifically that "the stock is refined" or "the stock is unrefined," in order to intimate that in the first case the soap is dutiable under No. 170, and in the second case under No. 134.

Soap for wool-washing in Natal. Bd. of Trade J., Aug. 2, 1906. [T.R.]

The "Natal Government Gazette," for June 29 last, contains a proclamation notifying that a rebate of the whole of the Customs duties will be allowed upon soap and other substances imported for, and used exclusively in connection with the industry of wool-washing in the Colony.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 769.)

(*A.*)—PIGMENTS, PAINTS.

Ultramarine; Contributions to the study of ——. C. Chabrié and F. Levallois. Compt. rend., 1906, **142**, 222—224.

When ultramarine is heated with silver nitrate solution in a sealed tube at 140° C. for many hours, much silver nitrite is formed besides the products noticed by former observers.

Sodium is not entirely replaced by silver in silver ultramarine, and therefore the formula based on this assumption is open to question. The ethyl, phenyl, and benzyl derivatives of ultramarine, on treatment with hydrochloric acid, do not give off sulphuretted hydrogen, as does the original blue, being unattacked by that acid in the cold. They lose their sulphide character on heating in the air, whereas ordinary ultramarine is little altered by this treatment. The ordinary blue is desulphurised by heating with mercuric oxide. By heating with water at 200°—300° C. for 100 hours, ultramarine is completely decolorised, sodium sulphide going into solution, and the residue containing no sulphur.—F. Sodn.

(*B.*)—RESINS, VARNISHES.

Turpentine oil; Swedish ——. J. Kondakow and J. Schindelmeiser. Chem.-Zeit., 1906, **30**, 722—723.

Oil of turpentine is termed pine-needle oil and pine-wood oil, according as it is distilled from pine needles or the thicker parts (roots) of the pine tree.

These oils, whether of Russian, Swedish, or French origin, are dextro-rotatory (this J., 1906, 487), and contain *d*-pinene, *d*-sylvestrene, and probably bornyl acetate. By repeated fractionation of a specimen of Swedish turpentine oil, and subsequent treatment with hydrochloric acid gas, the authors obtained a residue which was optically inactive and consisted of *p*-cymene. This is probably the first time that the existence of this substance in turpentine oil has been proved.—C. E. F.

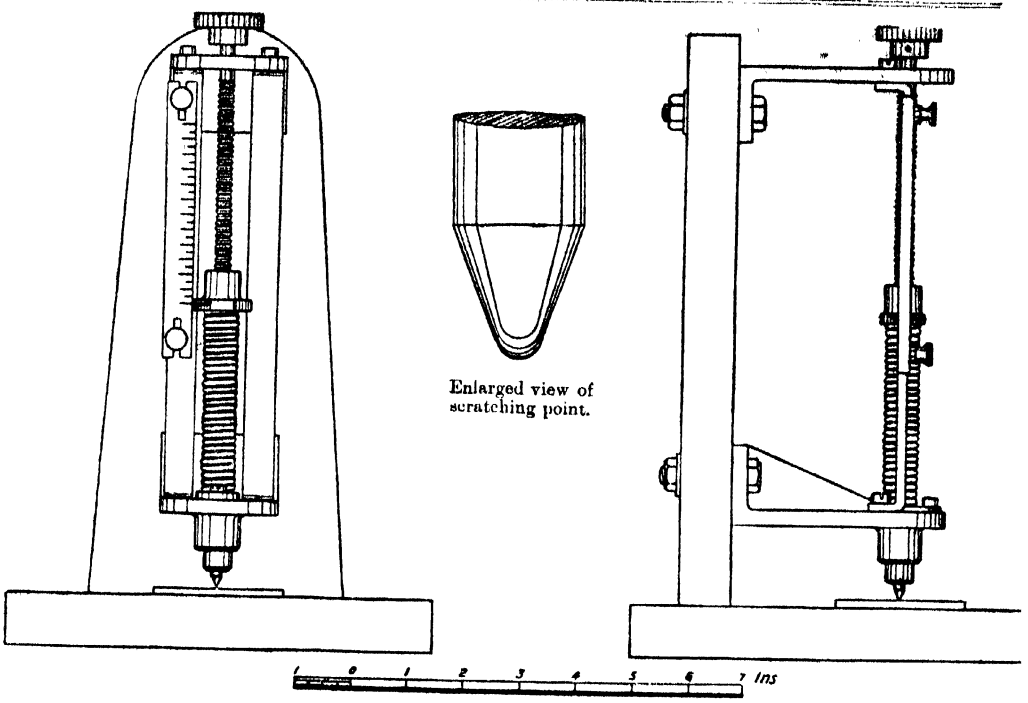
Gum elemi. A. Vesterberg. Ber., 1906, **39**, 2467—2472.

The crystallisable part of Manila gum elemi contains two isomeric monohydric alcohols (this J., 1891, 56): these are α- and β-amyrin, having the formula, $C_{30}H_{49}OH$, and are dextro-rotatory. This gum elemi contains also breïn, which is separated from amyrin by crystallisation from benzene. Breïn is a dihydric alcohol and has probably the formula $C_{30}H_{48}(OH)_2$. It is dextro-rotatory; measurements on an alcoholic solution gave $[\alpha]_D = 65·5°$.

Breïn and breïn acetate, when dissolved in acetic anhydride and treated with concentrated sulphuric acid, give a yellow solution which on warming becomes dark brown. Amyrin tested in this way gives a reddish-violet coloration.—C. E. F.

Varnishes; A new method of testing the hardness and elasticity of ——. A. P. Laurie and F. G. Baily. J. Roy. Scott. Soc. Arts., 1906, **17**, 101—110.

The method devised by the authors consists in determining the degree of pressure required to scratch a film of the given varnish by means of a hard point. The apparatus they have constructed for the purpose (see Fig.) has a central rod moving easily in openings in the two horizontal supports. The upper part of this rod has a screw thread on which is a running nut, prevented from turning, by guides which project into its wings, but made to travel up and down by turning the milled head at the top of the rod. To the lower part of the nut is attached one end of a helical steel spring, the other end of which is



fixed to the lower bracket. A blunt point of hard steel with a radius of 1 mm. is fixed to the lower end of the rod, and can be raised or lowered by screwing the nut up or down so as to compress or slacken the spring. The plate with the film of varnish is placed beneath this, and the point brought exactly to the same height, which is taken as zero. Any arbitrary scale can be used, and should be attached to one of the guides, whilst a fiducial mark is made on the wing of the nut. In the authors' apparatus, the spring gave a maximum pressure of 1200 grms. (which was required by few of the best varnishes), and the scale indicated fractions of a kilo., 1 representing 0·1 kilo., 2 representing 0·2 kilo., and so on. The film was prepared by heating the thoroughly cleansed and polished plate, and the varnish, together in a hot water oven, then pouring the varnish on to the centre of the glass, distributing it with the finger, warming the plate to make the layer level and uniform, and finally leaving it to dry in a cupboard with levelled glass shelves. In testing the varnished surface, the point of the instrument is raised to the zero position, and the plate drawn slowly and smoothly across it, the pressure being meanwhile gradually increased by turning the milled head, until a white scratch becomes visible. In many cases, grooving appears long before the scratch, but so long as the transparency of the varnish is unaffected, this can be neglected. It is, in fact, rather an indication of toughness. The results thus obtained by different observers usually agree within 5 per cent. The thickness of the film has but little influence unless it be excessively thin or thick. In experiments with varnishes prepared by the authors, it was found that mastic varnish, which was taken as typical of a spirit varnish, broke down at a pressure of 1, and the fracture examined under the microscope had a characteristic conchoidal appearance. Oil varnishes prepared from rosin varied in hardness from 1 to 3, according to the proportion of the oil; whilst varnishes prepared from copal, animi, manila, and kauri resins with oil and turpentine, required a pressure of 9 to 12.

Rosin varnish hardens rapidly and the process is complete in a short time. On the other hand, the hard church oak varnishes dried very slowly, in spite of the process being accelerated by heating them to 70°—80° F. for a fortnight, after eight months' drying. In order to determine the influence of the atmosphere and frost upon the varnishes, plates were exposed to the air for three months. It was found that the amber varnish and an inferior copal had deteriorated after a fortnight and had quite disappeared in three months. The oak varnishes showed cracks, and one of them had peeled slightly. The other trade varnishes were apparently sound and transparent, but their hardness had fallen to 1 or 2, and the scratch produced had a splintered appearance. It is pointed out, however, that these varnishes would probably have lasted better on an absorbent surface. The authors conclude that the test is capable of detecting deterioration in a varnish before it becomes manifest to the eye.—C. A. M.

Rosin size; Detection and determination of ——. H. Rebs. XXIII., page 830.

Turpentine and resin industry of United States. Foreign Office Misc. Series, No. 647. [T.R.]

The British Commercial Agent, Mr. Bell, has, acting under instructions from the Foreign Office, made an investigation of the turpentine and resin ("Naval Stores") industry of the United States, and the following is a summary of his report:—

The following figures, taken from the United States census returns, show the progress of the industry since 1850:—

Year.	Number of Establishments.	Value of Products.
1850	856	$2,855,659
1860	625	6,468,367
1870	227	3,585,225
1880	508	5,876,983
1890	670	8,077,379
1900	1,503	20,344,888

Resin is obtained chiefly from the long leaf pine, of which there was formerly an unbroken forest extending from Southern Virginia through the South Atlantic and Gulf States to Eastern Texas. More than one-half of the

original forest, however, has been exhausted and there has been little or no renewal.

For a number of years the seat of the naval stores industry continued near the forests of North Carolina. It was transferred to South Carolina at a later period, and within recent years the districts have been very much extended, and now the centre is in Florida and reaches into Alabama, Mississippi, and Louisiana.

Under the present methods of cutting the trees, it is merely a question of a comparatively short time before the supply will be exhausted. The best quality of crude turpentine from the long leaf pine is obtained during the first year the tree is worked. Each succeeding year the colour becomes deeper and the resin is poorer in volatile oil. After the fourth year the turpentine orchard is generally abandoned. It is only in North Carolina that the smaller landowners work their trees for 10 or more successive seasons, protect the trees against fire, and, after giving them a rest for a series of years, apply new boxes on spaces left between the old chips—"reboxing."

The present system of gathering turpentine in the United States cannot be otherwise than wasteful. It has been proved that the cutting of the box does not assist the flow of turpentine, but, on the contrary, it diminishes the flow. The cut weakens the tree, leaving it more subject to being blown down, and opens the trunk to disease.

With a view to avoid if possible this waste the United States Department of Agriculture undertook in 1901 a series of experiments. Many suggestions were made and tested, but only one was found to be of value, and it has already been put in operation. The new method is styled the cup and gutter system.

The value exported from the United States in 1904 and 1905 is shown as follows:—

	1904.		1905.
Resin	$6,621,870	..	$7,069,084
Tar	44,944	..	60,520
Turpentine and pitch	32,253	..	74,938
Spirits of turpentine	9,446,155	..	8,902,101
Total	$16,145,224	..	$16,106,643

Of the spirits of turpentine exported in 1905, 43·1 per cent. went to the United Kingdom, 14·5 per cent. to Belgium, and 14·1 per cent. to Germany. Of the remaining naval stores 24·3 per cent. went to the United Kingdom, and 28·1 per cent. went to Germany.

English Patents.

Waterproofing composition, applicable also as a vehicle for pigments. T. L. Leishman, Edinburgh. Eng. Pat. 4533, Feb. 24, 1906.

The following compositions are claimed: (*a*), a vehicle for the preparation of waterproof paints, and (*b*), a waterproof coating for fabrics.

	(*a*)		(*b*)
Linseed or other drying oil	70	..	80
Oxidised rosin	15	..	5
Casein	5	..	5
Lime water (or equivalent)	10	..	10
Algin solution (1 in 10)	11	..	11

—A. S.

Linoleum for writing or drawing purposes; Process for the manufacture of mono-coloured ——. A. Sommer, Siegen, Germany. Eng. Pat. 8884, April 12, 1906. Under Int. Conv., May 19, 1905.

Suitable quantities of powdered glass, powdered pumice-stone, and the constituents of wall or "black" board varnish are added to the linoleum composition during the mixing process. The mass is then rolled, pressed, and dried in the usual manner. It is stated that the resulting linoleum has a rough surface, which remains unaltered after long use, and is suitable for writing and drawing purposes.—A. S.

(*C.*)—INDIA-RUBBER, &c.

India rubber; Vulcanisation of —— *in presence of litharge.* R. Ditmar. Gummi-Zeit., 1906, **20**, 1077—1078.

A mixture of Peruvian, Manaos scrap, and "thimbles" was vulcanised with 5 per cent. of sulphur, and increasing proportions of litharge; one series of test-pieces was cured in the autoclave for 45 minutes, at 145° C., and another similar series in the hot-air oven for two hours at 130° C. The elasticity of the products showed no regular variation with the amount of litharge added, and was throughout greater in the latter series than in the former. The strength increased with the proportion of litharge, but reached a maximum, in the steam cure series, at 35—40 per cent. The best results, on the whole, were obtained with 35 per cent. of litharge in the steam cure, and 30 per cent. in the dry cure. Blank specimens without litharge were found to be well vulcanised in the autoclave, but scarcely at all in the air oven.—W. A. C.

India rubber; Chalk in vulcanised ——. E. Herbst. Gummi-Zeit., 1906, **20**, 998—999.

A statement of R. Ditmar (this J., 1906, 326) has evoked a controversy on the influence of chalk in rubber, which turns mainly on the meaning of the term "colloidal combination." However this may be, the author shows by experiment that chalk, when present in vulcanised rubber, is certainly attacked and dissolved out by dilute acids.—W. A. C.

English Patent.

Fabrics; Manufacture of ——, *by covering leather, rubber, and other materials with cork.* Soc. Anon. du Grimson, Charenton, France. Eng. Pat. 26,599, Dec. 20, 1905. Under Int. Conv., July 5, 1905.

Cork, previously cut into thin sheets and "molecularly transformed" (see Eng. Pat. 14,839 of 1904; this J., 1905, 887), is "demineralised," soaked in a solution of pure Para rubber in benzine, and dried. The cork thus treated is fixed on the india-rubber or other fabric to be coated by means of a cement or an adhesive with a rubber base, and the coated fabric is vulcanised. Claim is made for the manufacture of protecting bands for pneumatic tyres by this process.—A. S.

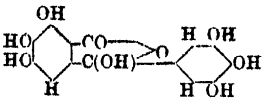
XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 770.)

Tannin; Constitutional formula of ——. J. Dekker. Ber., 1906, **39**, 2497—2502.

The author shows that Schiff's digallic acid formula for tannin is not in accord with its properties. Tannin is dextro-rotatory (see Walden, this J., 1898, 190). A sample of the purest tannin (*Tannigenum levissimum purissimum*) had $[\alpha]_D = 65°$; on boiling a 10 per cent. aqueous solution with one-quarter of its volume of 10 per cent. sulphuric acid under a reflux condenser, the rotation fell to $[\alpha]_D = 22°$ after 1 hour, $[\alpha]_D = 7°$ after 2 hours, and $[\alpha]_D = 6°$ after 6 hours, whilst after the same periods the percentages of unaltered tannin were 48·7, 26·6, and 26 respectively. The constitutional formula of tannin should afford an explanation of the following facts:—(1) The almost complete conversion into gallic acid by hydrolysis. (2) The production of diphenylmethane by distillation with zinc dust (Nierenstein). (3) The production of a hexamethyl derivative of tannin. The compound prepared by Herzig and Tscherne from tannin by the action of diazomethane must be regarded as a hexamethyl derivative, both on account of its analytical figures, and the production of trimethylgallic acid from it by the action of alcoholic potash. (4) The electric conductivity of tannin, which is so low that the compound can scarcely be regarded as an acid. (5) The properties of the benzoyl derivative (Böttinger), which point to the absence of a carboxyl group and the probable presence of a carbonyl group. Further, the acetyl derivative of tannin is shown to give figures which agree best with those of a hexa-acetyl derivative. The formula which affords

the best explanation of these facts, and also the formation of rufigallic acid (hexahydroxyanthraquinone) by the action of concentrated sulphuric acid on tannin, is the following:—



—A. S.

Jellies; Influence of foreign substances on diffusion in ——. H. Bechhold and J. Ziegler. Z. physik. Chem., 1906, **56**, 105—121.

THE authors made a series of experiments to ascertain the effect of the addition of certain substances (electrolytes and non-electrolytes) on the diffusion of other substances (colouring matters and electrolytes) in gelatin and agar jellies. The electrolytes used were sodium chloride, sodium iodide, and sodium sulphate; the non-electrolytes were dextrose, glycerol, alcohol, and urea; and the colouring matters were Methylene Blue, Azolitmin from litmus, and the red juice of the beet. The influence of the added substances on the melting points of the jellies was also determined, but there appeared to be no relation between the effect on diffusion and on the melting point. The diffusion of the red beet juice in gelatin jelly is only slightly affected by the addition of sodium chloride or sodium iodide to the gelatin; any influence is exerted in the direction of favouring diffusion. Addition of sodium sulphate favours diffusion. None of the three substances mentioned has any influence on the permeability of the gelatin itself, the colouring matter diffusing just as far into a 20 per cent. jelly as into a 5 per cent. jelly. Sodium chloride and sodium iodide have no effect on the diffusion of beet juice in agar jellies, nor on the permeability of agar. Sodium sulphate retards diffusion, but has no influence on the permeability of the agar. Dextrose, glycerol, and alcohol retard the diffusion of beet juice in both gelatin and agar jellies; they also increase the permeability of gelatin, but have no effect on that of agar. Urea accelerates slightly the diffusion of beet juice in the jellies, but has practically no effect on the permeability of the colloids. Dextrose and glycerol accelerate the diffusion of Methylene Blue in gelatin jellies; alcohol and urea also accelerate diffusion in 5 per cent. gelatin jellies, but have little effect in the case of 20 per cent. jellies. The permeability of gelatin for Methylene Blue is increased by dextrose, hardly affected by glycerol, and diminished by alcohol and urea, especially by the latter. Gelatin in the form of a 5 per cent. jelly is impermeable to Azolitmin, but becomes permeable even up to a concentration of 20 per cent., if urea be added to it. Dextrose, glycerol, and alcohol retard the diffusion of sodium chloride and sodium sulphate in both gelatin and agar jellies, but increase the permeability of the colloids. Urea has a much smaller retarding influence on the diffusion, and at times even acts favourably.—A. S.

Eucalyptus; Recent chemical discoveries relating to the ——. H. G. Smith. XX., page 826.

Egg-yolk; Proposal for an official method for the commercial analysis of ——. Report of Turin Congress Commission. XXIII., page 829.

UNITED STATES PATENT.

Tanning; Process of ——. J. L. Martin, Terrell, Tex. U.S. Pat. 825,852, July 10, 1906.

THE hide is tanned with a mixture of 10 galls. of "broomweed ooze," 4 lb. of gum-gambier, 1 lb. of powdered alum, 2 lb. of common salt, and 3 lb. of persimmon bark.—A. S.

FRENCH PATENT.

Leather and leather articles; Process for strengthening, stiffening, and waterproofing ——. E. Laurent. Fr. Pat. 363,045, Feb. 7, 1906. Under Int. Conv., March 2, [illegible], and Feb. 8, 1906.

[illegible] process consists in immersing the leather in a bath of molten paraffin at a temperature not exceeding 70° C. The soles of boots may be dipped in the bath, and in the case of leather for wheel-tyres, the strips are mounted on moulds so that only the tread of the tyre is immersed in the bath, leaving the edges of the strip supple.—W. P. S.

XV.—MANURES, &c.

(*Continued from page* 770.)

Vinasse and molasses; Treatment of ——, for recovery of nitrogenous matter after removal of potash. Vasseux. XVII., page 823.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 771.)

Beetroot; Process for complete extraction of sugar, without formation of by-products, from ——. E. Lallemant. Bull. Assoc. Chim. Sucr. et Dist., 1906, **23**, 1428—1434.

THE beetroot, in the form of cossettes, is rapidly dried at a medium temperature in Lafeuille's drying apparatus; no loss of sugar occurs in this operation if the latter is properly conducted. The dried cossettes are then ground as finely as possible, and heated with 90 per cent. alcohol (150 litres per 100 kilos. of dry cossettes) at 75° C. until the latter is saturated. The alcoholic solution is run into a cooling apparatus and, when cold, is seeded with a small quantity of finely ground sugar. The sugar readily separates, impurities being left in the solution. The cossettes may be treated with a second quantity of hot alcohol while the first solution is cooling. After separation of the sugar, the mother liquor from the first solution is used for another extraction of the cossettes, the second solution being run into the refrigerator, and being cooled in its passage to the latter by the cold mother liquor of the first solution. A saving of fuel is thus effected. The above cycle is repeated until all the sugar is dissolved out of the cossettes (10 to 12 operations according to the sugar content of the beetroot). The mother liquors may be used to dissolve the sugar from five more batches of cossettes, and hence the amount of sugar remaining dissolved in the final mother liquor is comparatively very small (scarcely 0·15 per cent. of the beetroot). The alcohol is recovered from the mother liquors and exhausted cossettes by distillation, the last traces being removed from the latter by a current of hot air. The dried, exhausted cossettes form a very good cattle food. The sugar which is deposited in the refrigerating apparatus, and which retains a small quantity of alcohol, is at once dissolved to a syrup in slightly alkaline water. The syrup is then boiled, the alcohol being collected separately and returned to the general reservoir of the factory. Owing to the purity of the syrup, the subsequent refining is simpler and more economical than by other processes. The amount of alcohol required in the above process is comparatively small (131·25 hectolitres for 21 tons of beetroot) and only a small quantity is required to make up for loss due to leakage, &c.—L. E.

Diffusion juice; Acidity of ——. A. Grosjean. Bull. Assoc. Chim. Sucr. et Dist., 1906, **23**, 1418—1420.

FROM the estimations of acidity of various samples of diffusion juice by L. Herme's method the author draws the following conclusions:—In diffusion juice of acidity corresponding to not more than 0·120 grm. of oxalic acid ($C_2H_2O_4.2H_2O$) per 100 c.c., the apparent purity varies very slightly, and the amount of glucose present is small. In juice of higher acidity there is a decided decrease in the purity and a considerable increase of reducing sugars. In all cases the degree of purity and the amount of reducing sugars in the juice are closely connected with the acidity of the latter. The author also quotes experiments which show that the juice deteriorates much more rapidly when kept in the collecting back than it does when it remains in the diffusion battery for the same length of time.—L. E.

Polarisation of sugar solutions; New researches on the total effect of clarification with basic lead acetate on ——. L. Pellet. Bull. Soc. Chim. Sucr. Dist., 1906, 23, 1466—1471.

In clarifying sugar solutions with basic lead acetate, two sources of error are introduced:—(1) Owing to the volume occupied by the precipitate, the true concentration of the sugar solution is greater than the apparent concentration, the polarisation reading being thereby increased. (2) The precipitate retains a quantity of the sugar mechanically, the polarisation reading being thereby reduced. To determine how far these errors compensate each other, the author has made the following experiments:

A measured quantity of molasses was placed in a graduated flask, clarified with basic lead acetate, mixed, made up to volume at a known temperature, filtered, and polarised. A similar quantity of the same sample was clarified in a small flask with exactly the same amount of basic lead acetate as before, mixed, filtered rapidly through a small filter, and the filtrate collected in the same graduated flask as was used in the first experiment. The precipitate was then washed perfectly free from sugar, the washings added to the filtrate, the whole made up to volume at the same temperature, passed through a filter of the same kind, and polarised in the same tube and at the same temperature as in the first experiment.

In the first case the reading was affected by the errors above mentioned; in the second, these errors were eliminated. Molasses from various sources were examined. The results show that, on the average, the readings obtained after removing and washing the precipitate are very slightly higher than when the clarified solution is read directly after filtration. The differences, however, are within the limits of experimental error, and, practically, there is no necessity to make any correction on account of clarification with basic lead acetate. The author also cites an experiment on Scheibler's method. Two quantities of 50 c.c. of molasses were each clarified with 22 c.c. of lead solution, and made up to 100 and 200 c.c. respectively. The first polarised 50·395, and the second 50·420 (mean of 20 readings). Owing to greater concentration, more sugar was retained by the precipitate in the first case than in the second, but the volume of the precipitate also bore a greater proportion to the volume of the solution; hence the readings were almost identical, the latter being, contrary to Scheibler's theory, slightly higher.—L. E.

Maple products; Determination of the lead [malic acid] value of ——. A. P. Sy. XXIII., page 830.

Vinasse and molasses; Treatment of ——, *for recovery of nitrogenous matter after removal of potash.* Vasseux. XVII., next column.

Sugar duties in Great Britain in 1905–06. Ann. Rep. of Comm. of Customs. Sugar Customs Rep., 1906. [T.R.]

The net revenue from the sugar duties reached a total of £6,177,953, or practically the same as in the previous year. Included in this amount is £154,441 duty received on account of sugared goods and saccharin, and £162,622 for glucose, both these amounts being slightly better than the previous year. Of molasses 1,033,793 cwt. was delivered on drawback or free of duty to the British distiller, thus enabling him to manufacture cheap spirit, compared with 932,985 cwt. in 1904–05. Most of it is of foreign and colonial make.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 773.)

Barley cultivation experiments of the Verein Versuchs- und Lehranstalt für Brauerei; Report on ——. C. v. Eckenbrecher. Wochensch. f. Brau., 1906, 23, 365—368, 377—382.

This report deals with Original Hanna barley, Heines Hanna barley, "Hannchen" barley, Primus barley, and Svanhals barley grown in various soils during the year 1905. The season was a wet one, and consequently the grain was only of medium quality. Moreover, in the majority of the experimental fields the weather conditions during harvest were very unfavourable. The "Hannchen" barley gave the most abundant yield and best type of grain for brewing purposes, particularly when grown in light soil, and in many cases also when grown in better barley soil. The yield of straw was second only to that of Heines Hanna barley. The "Hannchen" barley showed the greatest weight per hectolitre, the least weight per 1000 corns, and the lowest percentage of albumin (11·77) of the above-mentioned kinds. The quality of the grain also was the best. The two Hanna barleys stood next to the "Hannchen" barley. Original Hanna barley gave a better yield of grain than Heines Hanna barley; the latter, however, was of better quality. Their albumin contents were 12·26 and 12·16 per cent. respectively.

The two Imperial barleys, Primus and Svanhals, in all cases, especially when grown in light soil, gave the smallest yields, and were decidedly poorer in quality than the above-named varieties. Their albumin contents were 12·33 and 12·66 per cent. respectively.—L. E.

Wines; The "graisse" disease [ropiness] of ——. E. Kayser and E. Manceau. Compt. rend., 1906, 143, 247—248.

The results of experiments with the ferment described previously (this J., 1906, 386) are given, particular attention being paid to the degree to which various sugars are attacked by the ferment and to the products formed. Portions of a white wine of the Champagne district, after receiving the addition of different sugars, were inoculated with the ferment, and kept in closed bottles for a month. The following figures represent grms. per litre:—

	Original sugar.	Sugar remaining.	Sugar destroyed
Wine, no added sugar	1·60 (as lævulose)	1·31	0·29
Wine, + dextrose	34·09	29·18	8·91
Wine, + saccharose	33·57	15·33	18·24
Wine, + lævulose	22·21	1·59	20·62

The organism, consequently, thrives best in a medium containing lævulose. The products formed vary according to the sugar which has been attacked; lævulose gives mannitol, lactic, acetic, and traces of higher acids; dextrose yields lactic and volatile acids; and saccharose gives the products of lævulose and dextrose.—W. P. S.

Vinasse and molasses; Treatment of ——, *for recovery of nitrogenous matter after removal of potash.* Vasseux. Bull. Assoc. Chim. Sucr. et Dist., 1906, 23, 1381—1382.

The nitrogenous matter contained in molasses is more valuable than the potassium salts contained in the latter; it is generally lost, however, by incineration during the process of working up the saline matter. The author proposes the following method for its recovery:—The vinasse, after concentration to a suitable degree, is treated with the requisite quantity of sulphuric acid. Nearly the whole of the potash is converted into sulphate which crystallises out. The mother liquors are evaporated to dryness in special apparatus. The nitrogenous organic residue contains 5—7 per cent. of nitrogen and 6—7 per cent. of potash.—L. E.

Malt extracts; Examination of commercial ——. E. F. Harrison and D. Gair. XXIII., page 830.

Yeast; Acclimatisation of —— *to saccharine mineral nutrient media. "Bios" question.* H. H. Pringsheim. Centr. Bakt., Abth. 2, 1906, 16, 111—119. Woch. f. Brau., 1906, 23, 401.

Wildiers observed that although a single cell of yeast is sufficient to start a culture in media containing organic nutrients, it is necessary to sow a large number of cells in order to obtain cultures in media containing nothing but

sugar and mineral salts. The difference is essentially one which concerns the nitrogen, phosphorus, and sulphur. The author explains that if these elements are already present in the form of albuminoid derivatives, *e.g.*, peptones, a very much smaller expenditure of energy is necessary on the part of the yeast to effect their reconversion into albumin than if they are present as ammonium and other mineral salts. Although yeast can accommodate itself to the greater strain involved by the synthesis of its albumin from mineral nutrients, several of the cells succumb in the process. The organic products of these cells assist the survivors in the same way as an addition of a yeast decoction. The minimum number of cells which will grow in a mineral medium is smaller in the case of yeast taken from a wort-culture rich in nitrogen than in the case of pressed yeast which is generally poor in nitrogen. It is quite unnecessary to assume, as Wildiers does, the existence of a specific principle ["bios"] to explain these observations.—J. F. B.

Spirit duties in Great Britain in 1905–06. Ann. Rep. of Comm. of Customs. [T.R.]

The net receipts from foreign spirit show a decrease of £97,839, or 2·56 per cent., as compared with 1904–05, following on a decrease of £635,936, or 14·3 per cent., in the preceding year. This is mainly due to a falling-off in the importation of foreign plain spirit, both for potable and for industrial purposes, the amount imported from Germany being 186,934 galls., against 338,836 galls. in 1904–05, while there were no importations of foreign spirit for methylating purposes last year, the decrease having been continuous since 1902–03, in which year 1,196,167 galls. were imported for methylating. During the past five years wide variations have occurred both in the quantities imported and the average values of the imports of spirit from Germany, which variations are mainly governed by the quantity of potatoes available in Eastern Europe for conversion into spirit. Low prices ruled from 1901 to 1903, the imports in those years being 3,089,909 galls. and 1,808,769 galls. respectively; consequently spirits of this kind displaced home-made spirits to a great extent during those years. Now the position is reversed, as, owing to the advanced prices ruling in German spirit during the past two years, the British distiller has been enabled to hold his own at home, and hence the trade with Germany is almost at a standstill. The quantity of foreign spirits retained for home consumption again fell last year to 750,865 proof galls., yielding £477,290, or a decrease of 8·06 per cent. In the case of perfumed spirits there is little change—37,217 galls., yielding £33,900, having been imported, compared with 38,163 galls., yielding £34,707, in 1904–05.

Spirit; Duty free ——, *in U.S.A.* Oil, Paint, and Drug Rep., Aug. 6, 1906. [T.R.]

The preliminary annual report of the Commissioner of Internal Revenue for the fiscal year 1906 is unusually interesting, owing to the bearing it has upon the newly adopted free alcohol policy of the Government.

The receipts from all sources of internal revenue for the fiscal year 1906 were $249,102,738, as compared with $234,187,976 for 1905, an increase of 6 per cent. The increase in 1906 over 1904 was only 0·5 per cent. The cost of collecting the revenue in 1906 was $4,720,768, or about 2 per cent. The principal items of revenue included $143,394,053 from distilled spirits, $55,041,858 from fermented liquors, and $48,422,997 from tobacco. While the largest relative increase is noted in fermented liquors, it is suggestive that the increase in the tax on distilled spirits was no less than $7,435,542 in 1906 over 1905, while in 1905 the increase over 1904 was less than $150,000.

The very large increase in the tax paid on distilled spirits in 1906 is highly encouraging to the administration, and especially to the officials of the Internal Revenue Bureau, who are looking forward with considerable anxiety to the effect upon the revenues of the new law granting free denatured alcohol for industrial purposes. The most authoritative estimates thus far made with regard to the effect on the revenues of the free alcohol statute predicts a loss of $200,000 to $600,000. This is a negligible sum in view of the magnitude of the revenue from this source, but even the preposterous figures submitted by the opponents of the free alcohol law, at the recent session of Congress, indicating a loss of $5,000,000 per annum, have no terrors for the Treasury officials in view of the current increase in the spirit revenue. This is believed to be due not only to increased consumption, but especially to better administrative methods, which have reduced illicit distillation to a minimum and made it practicable to collect the tax on nearly all the spirits actually produced.

United States Patents.

Fermentable products from grain; Process of developing the ——. A. F. Kniesche, Syracuse, N.Y. U.S. Pat. 825,662, July 10, 1906.

This process consists in preparing a mash of corn-meal, cooking the same for a sufficient length of time at a temperature of about 212° F., cooling to 150° F., and then stirring in uncooked dry rye-meal; adding to this mash a mixture formed by macerating malt-meal in water at a temperature of 50°—80° F., until the water has extracted the diastase and other soluble parts of the malt; then allowing the whole mixture to rest from one to two hours at about 142° F. to convert the contained starch into fermentable sugar, and afterwards cooling the entire mixture to 75°—80° F.—T. H. P.

Soy; Process of brewing ——. T. Suzuki, Sunamura, Japan. U.S. Pat. 825,500, July 10, 1906.

This improved process consists in initially mixing approximately 5·1 bushels of barley with 5·13 bushels of soy beans, adding about 2·05—3·6 "bushels" of salt dissolved in 63·52 imperial galls. of boiling water, slowly and continuously stirring under a substantially constant heat until matured, then adding further saline solution, and continuing the stirring for several days.—T. H. P.

Wood-alcohol; Process of making ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 824,906, July 3, 1906.

This process consists in distilling from crude pyroligneous acid a concentrated distillate of between 10 and 25 per cent. alcohol content and of acid nature, in which oily impurities are insoluble; allowing the distillate to stand to permit the impurities to separate; decanting off the clear liquid, and adding to it an excess of alkali; decanting from the resinous deposit formed, and refractionating the decanted liquid to form a strong alcohol which is above 80 per cent. strength and perfectly miscible with water.—T. H. P.

Alcoholic spirits; Process for producing ——. G. W. Palmer, Seattle, Wash. U.S. Pat. 825,342, July 10, 1906.

Claims are made for a sour-mash process of producing spirits without the use of grain or malt, consisting in inducing rapid fermentation in a new or sweet mash composed of bran, sugar, and water by adding to it a retained portion of the old or sour mash composed of the same ingredients previously fermented and soured.

—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 775.)

(*A.*)—FOODS.

Mineral waters; Difference between the electrical resistances of natural and artificial ——. D. Negreano. Compt. rend., 1906, 143, 257—258.

The resistance of a natural mineral water is practically constant for the water from any particular spring, whilst waters prepared artificially in imitation of the natural spring waters have quite different resistances from the

latter. For instance, a sample of Vichy water had a resistance of 140 ohms at 18° C., and similar water, prepared artificially, a resistance of 112 ohms. Natural Evian water showed a resistance of 1280 ohms; similar artificial water had a resistance of 1120 ohms. The resistance of a natural mineral water diminishes with the temperature. For moderate ranges of temperature, the resistance at a temperature of $t°$ may be calculated to that at 18° C. by the formula: $R_t = R_{18}[1-\alpha(t-18)]$, where α is the coefficient of variation and is approximately 0·02.—W. P. S.

Malt extracts; Examination of commercial ——. E. F. Harrison and D. Gair. XXIII., page 830.

UNITED STATES PATENT.

Grain; Process of conditioning ——. H. J. Caldwell and J. R. Barr, Earl Park, Ind. U.S. Pat. 825,378, July 10, 1906.

IN this process, the superficially-moistened grain is subjected to the action of cooled bleaching chemical fumes, such as sulphurous fumes, either by themselves, or diluted with several times their own volume of air.—T. H. P.

(C.)—DISINFECTANTS.

FRENCH PATENTS.

Barium sulphide; Application of —— in agriculture [as insecticide]. C. P. Chalap. Fr. Pat. 362,967, Feb. 3, 1906.

BARIUM sulphide, and especially the crude sulphide obtained by the reduction in a furnace of barium sulphate, is finely powdered and dissolved in water, the solution being applied to vines attacked by oïdium. Or the sulphide may be mixed, for special purposes, with a copper salt; or with iron sulphate or zinc sulphate, for general use, to form a compost containing iron or zinc sulphide and barium sulphate, applicable in place of sodium sulphide or calcium sulphide against cryptogamic maladies. —E. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page 775.*)

Paper machine; Driving of the ——, and drying cylinders. C. Hofmann. Papier-Zeit., 1906, **31**, 2430.

THE essential part of the equipment of a high-speed paper machine consists of a very large number of drying cylinders. No satisfactory paper can be made if it has to be dried too rapidly, and in order to ensure gradual drying, every increment in the speed of the machine should be accompanied by a corresponding increase in the number of drying cylinders. The slower the drying, the less is the alteration in the length of the web, and if a sufficient number of moderately heated drying cylinders be provided, they can all be driven at the same speed, and the complicated mechanism for the regulation of the "draws" becomes unnecessary. The author describes a machine recently constructed in Germany which possesses 41 drying cylinders and eight separate felts and felt dryers. The machine is driven by a 300-h.p. engine, the exhaust steam from which is condensed in the drying cylinders. The speed of the machine can be varied between 59·5 and 160 metres per min., when working on "news," by simple regulation of the engine, whilst an alternative drive is provided for making cardboard, by which the speed can be varied between 25 and 66·5 metres per min.—J. F. B.

Rosin size [in paper]; Detection and determination of ——. H. Rebs. XXIII., page 830.

UNITED STATES PATENTS.

Cellulose acetate; Process of making ——. A. Corti, Dübendorf, Switzerland. U.S. Pat. 826,229, July 17, 1906.

CELLULOSE is heated with a mixture of acetic anhydride, acetic acid, and dimethyl sulphate, the proportion of acetic anhydride to acetic acid being in the ratio of 70 to 120.—J. F. B.

Cellulose; Product obtained from ——, and process of its manufacture. M. G. Olivier, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 826,351. July 17, 1906.

CELLULOSE xanthate, whilst still in a soluble and uncoagulated condition, is ground to a smooth and plastic mass without the addition of water. The product is then compressed, and forced into suitable moulds, in which the xanthate is coagulated and decomposed. The regenerated cellulose is then washed, dried, and moulded.—J. F. B.

FRENCH PATENTS.

Cellulose compound; Process of making a non-nitrated, non-inflammable ——. C. Trocquenet. Fr. Pat. 362,989, Feb. 5, 1906.

THE compound consists of a mixture of cellulose, asbestos, and the organic matter contained in oyster shells. To obtain the cellulose, seaweed is successively treated with alkali and acid, and washed. The asbestos is ground to a paste with petroleum oil of sp. gr. 0·880, whilst the oyster shells are ground, treated with hydrochloric acid, and the insoluble residue boiled with water, then washed with water containing a weak alkali, and finally collected on a filter. From 55 to 65 parts of the cellulose, 2 to 12 parts of the oiled asbestos, and 20 to 45 parts of the oyster-shell substance are mixed together and treated with formaldehyde. After removing the excess of the latter, the mass is suitably coloured, pressed, and is then fit for use as a substitute for celluloid.—W. P. S.

Organic or inorganic compounds; Process for the reduction of ——. S. Kapff. Fr. Pat. 362,985, Feb. 3, 1906. VII., page 811.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page 777.*)

Meroquinine and the constitution of the cinchona alkaloids. W. Koenigs. Annalen, 1906, **347**, 143—232.

MEROQUININE, $C_9H_{15}O_2N$, can be obtained either by hydrolysing cinchene or quinene with aqueous phosphoric acid under pressure, or more conveniently by oxidising cinchonine with chromic and sulphuric acids. Meroquinine is easily soluble in water, sparingly so in alcohol, and forms colourless crystals, melting at 223—224° C.; it is dextro-rotatory, having $[\alpha]_D$ about 27·6°, and yields a characteristic hydrochloride, also gold and platinum double salts. The methyl and ethyl esters are oils giving crystalline hydrochlorides. Acetylmeroquinine crystallises in plates, melting at 100° C., whilst nitrosomeroquinine melts at 67° C.; the formation of these derivatives indicates the presence of an imino group in meroquinine. On oxidation with chromic acid, meroquinine is converted into cincholoiponic acid, whilst, when reduced, cincholoipone is formed. A saturated base β-ethyl-γ-methyl pyridine (β-collidine) is produced on heating with mercuric chloride and dilute hydrochloric acid. By the action of bromine water a hydrobromide of bromomeroquinine is formed, to which the author assigns a lactonic structure, and which, on boiling with water, is converted into oxymeroquinine, a colourless crystalline substance melting at 208°—210° C. These results make it possible to assign to meroquinine the formula

$$NH\begin{<}CH_2\cdot CH(.CH:CH_2)\\ CH_2\text{——————}CH_2\end{>}CH.CH_2.CO_2H.$$

The formation from cinchene takes place in accordance with the equation

$$\underset{\text{Cinchene.}}{C_9H_{20}N_2} + 2H_2O = \underset{\text{Lepidine.}}{CH_3C_9H_6N} + \underset{\text{Meroquinine.}}{C_9H_{15}O_2N}$$

The author discusses the work done both by Skraup and others and by himself on the cinchona alkaloids, and

the evidence available for establishing their constitution. Applying the formula above, established for meroquinone, he is able to propose structural formulæ for quinene, cinchonine, quinine, &c. The course of reasoning followed is briefly as follows:—

By fusing the cinchona alkaloids with potash the following compounds have been obtained:—Quinoline, lepidine (γ-methylquinoline), *p*-methoxyquinoline, β-ethylpyridine and β-ethyl-γ-methylpyridine. As oxidation products, the following have been identified:—γ-quinolinecarboxylic acid, α, β, γ-pyridinetricarboxylic acid and β,γ-pyridinedicarboxylic acid. The cinchona alkaloids are bitertiary bases; they yield monoacetyl derivatives, and therefore contain a hydroxyl group, quinine in addition containing methoxyl. They are unsaturated, adding 2 atoms of bromine or a molecule of the halogen hydrides, and therefore contain the vinyl group.

Quinine, $C_{20}H_{24}O_2N_2$, may thus so far be expanded to $C_9H_5(OCH_3)N.C_6H_{12}(OH)N.CH:CH_2$.

Cinchene and quinene differ from the corresponding alkaloids in being broken up on heating with concentrated hydrobromic acid into apocinchene $C_{19}H_{18}(OH)N$ and apochinene $C_{19}H_{19}O_2N$, which compounds have been proved to be *a*-phenylquinoline derivatives. On the other hand, on heating with phosphoric acid, quinene is converted into *p*-methoxylepidine and meroquinene. The constitution of this latter being established, it is possible to assign to cinchene ($C_{19}H_{20}N_2$) the formula

$$C_9H_6N.CH:\begin{array}{l}C.CH_2.CH<\begin{array}{l}CH(C_2H_3).CH_2\\CH_2\text{——}CH_2\end{array}>N\end{array}$$

which fully explains the above-mentioned decompositions. From this the structure of quinine may be deduced as

$$CH_3O.C_9H_5N.CH_2.C(OH)<\begin{array}{l}CH_2\text{——}CH\\[CH_2]_2\\N\text{——}CH_2\end{array}>CH.C_2H_3$$

The author draws attention to the great unstability of the quinine molecule and the large number of possible stereoisomerides. He forecasts the possibility of synthesising quinine either from β-ethyl-γ-methylpyridine or from *p*-methoxylepidine, but does not expect any possible technical future for this process any more than has attended the synthesis of atropine or cocaine.

—E. F. A.

Caffeine; New derivatives of ——. and the reactions of its glyoxaline nucleus. Brissemoret. Bull. Soc. Chim., 1906, **35**, 316—321.

When a hot solution of 10·5 grms. of caffeine and 7 grms. of salicylic acid in 1000 c.c. of water is suddenly cooled, the compound $C_8H_{10}O_2N_4.C_7H_6O_3$ separates out in the form of white needles, sparingly soluble in cold water, more soluble in warm water, and also in sodium acetate solution. The aqueous solution of this compound, which has an acid reaction to litmus, forms Tanret's double salt, $C_7H_5O_3Na.C_8H_{10}O_2N_4.H_2O$, when treated with the theoretical amount of alkali, and evaporated; this yields up its caffeine to chloroform. When the base is treated with 7·6 grms. of protocatechuic acid, under similar conditions, the analogous compound, $C_8H_{10}O_2N_4.C_7H_6O_4$, is obtained. If 9 grms. of gallic acid be employed in this manner, the resulting compound is $C_8H_{10}O_2N_4.C_7H_6O_5$, which forms grey, microscopic needles. These compounds are permanent in the air.

3·7-Dimethylxanthine forms similar compounds with these acids, but when neutralised with sodium bicarbonate the aqueous solutions of these liberate dimethylxanthine. Similarly, glyoxaline can be obtained, but on account of the solubility of the compounds in water, solutions in ether must be employed. Ethereal solutions of 1 grm. of glyoxaline and 2 grms. of salicylic acid give the compound $C_3H_4N_2.C_7H_6O_3$ in white needles insoluble in ether. 2-Methylglyoxaline gives similar compounds with salicylic and gallic acids. Benzoic acid reacts thus neither with xanthine nor glyoxaline bases.—J. O. B.

Iso-coniine and the synthesis of coniine. A. Ladenburg. Ber., 1906, **39**, 2486—2491.

As working with *d*-coniine purified through the bitartrate, the author concludes that iso-coniine is present in synthetic coniine. By heating *a*-picoline with aldehyde and water to 150° C., methylpicolylalkine,

$$NC_5H_4.CH_2.CH(OH).CH_3,$$

is produced, boiling between 116° and 120° C. at 13 mm. This substance was heated with hydrochloric acid to 185° C. and the product reduced with sodium and alcohol. The racemic coniine so obtained boils at 166°—168° C. The bitartrate of this base was crystallised from water, the solution being sown with a crystal of *d*-coniine bitartrate: the product obtained melted at 56° C. The iso-coniine obtained from this salt had $[\alpha]_D = 19·2°$. The rotation of the purest *d*-coniine is 15·6°. Iso-coniine boils at 167° C. corr.; sp. gr., 0·8445 at 20° C., and 0·8472 at 17° C. The hydrochloride melts at 221°—222° C., and the platinum double salt at 174° C. after drying. These results and the crystallographic properties of the salts agree with those of *d*-coniine. The sole difference between iso-coniine and *d*-coniine lies in the optical rotation. If *i*-coniine be heated with solid caustic potash to 240°—248° C. for several hours, a base with $[\alpha]_D = 17·1°$ is produced. Also if *i*-coniine be heated by itself to 290°—300° C. a base is produced boiling at 164°—166° C. and with $[\alpha]_D = 15·67°$, and which is practically pure *d*-coniine.—F. Shdn.

Eucalyptus; Recent chemical discoveries relating to the——. H. G. Smith. Brit. Pharm. Conf., Birmingham, 1906. Pharm. J., 1906, **77**, 101—102.

Kinos.—The best kino for pharmaceutical use, which does not gelatinise in tinctures, is the product of *Eucalyptus microcrys*, but it is not available in commercial quantities; the next best is that from *E. calophylla*, which can be obtained in quantity. The kino of *E. rostrata* is not so good, since it tends to gelatinise, and is not so astringent as the former kinds. There are two, if not three, tannins present in eucalyptus kinos. One of these, which gives a violet colour-reaction with ferric chloride, gelatinises in alcoholic solution. It is found in the kinos of the "iron barks," "stringy-barks," and "peppermint" eucalypts. The other tannin, which gives a green colour-reaction with ferric chloride, does not gelatinise.

Oxalic acid.—Since calcium oxalate occurs in considerable quantity in the bark of certain eucalypts, sometimes to the extent of 16 per cent., it might, when accompanied by tannin, be a cheap source of oxalic acid. In the case of *E. salubris* the considerable amount of tannin present, which is equal in tanning properties to that of "mallet-bark," is readily extracted. The residual bark should yield oxalic acid as a profitable by-product.—J. O. B.

Sodium amide and cyclic ketones. Derivatives and constitution of fenchone and camphenilone. F. W. Semmler. Ber., 1906, **39**, 2577—2582.

In dealing with fenchone and camphenilone, a reagent is required which will attack the CO-grouping and split the molecule in its neighbourhood. Where a dimethylated carbon atom is next to the CO-grouping, the action of sodium amide results in the breaking of the ring and the formation of the sodium amide of the corresponding acid

$$\begin{array}{l}C.C(CH_3)_2\\C.CO\end{array}\rightarrow\begin{array}{l}C.C(CH_3)_2\\H\end{array}+C.CO.NHNa.$$

Dihydrofencholenic acid amide (*b*), $C_{10}H_{19}ON$, is produced by boiling together molecular proportions of fenchone and sodium amide in benzene, and pouring the liquid into ice-water. The amide melts at 94° C., and boils at 160° C. at 11 mm. This amide is different from the isomeric dihydrofencholenic amide (*a*) obtained by Mahla (Ber., 1901, **34**, 3777) from fenchonimine and melting at 130·5° C. Dihydrofencholenic acid (*b*), $C_{10}H_{18}O_2$, boils at 140°—141° C. at 10 mm., has sp. gr., 0·9742 at 15° C., and sets to a solid at the ordinary temperature. The methyl and ethyl esters were prepared. On reducing the acid with sodium and alcohol, dihydrofencholenic alcohol (*b*), $C_{10}H_{20}O$, is produced. It boils at 100° C. at 11 mm.; sp. gr., 0·8869 at 22° C.; $n_D = 1·45662$. The corresponding aldehyde, $C_{10}H_{18}O$, boils between 90°—95° C. at 10 mm.; sp. gr., 0·886 at 20° C.; $n_D = 1·445$. The semicarbazone of this aldehyde melts at 144°—145° C. Camphenilone is attacked by sodium amide in the same way as fenchone.

with the formation of dihydrocamphoceenic amide (*b*), $C_9H_{17}ON$, melting at 168° C. The corresponding dihydrocamphoceenic acid (*b*), $C_9H_{16}O_2$, boils at 138°—139° C. at 12 mm.; sp. gr., 0·9815; $n_D = 1·45662$. The bearing of these results on the constitution of fenchone and camphenilone is then discussed.—F. Shdn.

Di-isoapiol, di-isoeugenol methyl ether, and di-asarone. T. Széki. Ber., 1906, **39**, 2422—2424.

An ethereal solution of isoapiol was saturated with hydrochloric acid gas; the ether was distilled off, and the residue heated in a sealed tube to 200° C. By crystallising the residue from alcohol, fine white crystals of di-isoapiol $C_{24}H_{28}O_8$, were obtained, melting at 97° C. The substance does not take up bromine. Di-isoeugenol methyl ether, $C_{22}H_{28}O_4$, was produced by a similar reaction from isoeugenol methyl ether. It forms snow-white silky needles, melting at 106° C., and does not take up bromine. Di-asarone, $C_{24}H_{32}O_8$, formed from asarone melts at 100° C., and does not form a bromine addition compound. Another compound, melting at 96° C. is formed with di-asarone. Its analysis agrees with that of symmetrical di-trimethoxyphenylethylene.—F. Shdn.

Benzoic acids; Differentiation of natural and synthetic ——. H. Cormimbœuf and L. Grosman. Ann. Chim. anal. appl., 1906, **11**, 243—244.

Synthetic benzoic acid from toluene invariably contains a distinct trace of chlorine, whereas the natural acid, sublimed from gum benzoin, is free from that element. —J. O. B.

Sulphoacetic acid. O. Stillich. J. prakt. Chem., 1906, **74**, 51—56. (See this J., 1906, 713.)

The author has examined the action of sulphoacetic acid on amines, and found that it behaves similarly to acetic acid. When sulphoacetic acid is warmed with primary amines (aniline, *p*-phenetidine, *p*-anisidine, *o*-toluidine and α-naphthylamine) neutral salts are obtained: $HSO_3.CH_2.COOH + 2RNH_2 = RNH_3SO_3.CH_2.COORNH_3$; these salts are easily decomposed at a higher temperature into the amine salt of a sulphoacetylamine:

$$RNH_3SO_3.CH_2.COORNH_3 = RNH_3SO_3.CH_2.CORNH + H_2O.$$

The yields obtained are almost theoretical. With primary amines containing acid groups, *e.g.*, *p*-aminophenol, the reaction does not take place. By the action of sulphoacetic acid on methylaniline, the methyl group is split off, and the aniline salt of sulphoacetanilide produced. These amine salts are soluble in warm water or alcohol, and in dilute acids, from which they separate out unchanged. The amine salts are converted into hydrochlorides by concentrated hydrochloric acid, and into the corresponding sodium salts by the action of sodium hydroxide.—C. E. F.

Cerium compounds; Purification of ——. N. A. Orlow. Chem.-Zeit., 1906, **30**, 733.

Ceric, in contradistinction to cerous, compounds have the property of forming a soluble, readily decomposable oxalate with excess of ammonium oxalate, analogous to that formed by thorium salts under similar conditions. This reaction affords a convenient method of preparing cerium salts free from all other rare-earth compounds. A solution of the impure oxides in warm sulphuric acid is diluted, poured into a large excess of ammonium oxalate solution, and filtered rapidly. The dark orange filtrate, containing the double oxalates of thoria and ceria (the other oxalates remaining insoluble), gradually becomes colourless on standing, owing to reduction of the ceric salt, and precipitation of the cerous oxalate formed. The thorium oxalate remains in solution, and the cerous oxalate is perfectly free from other earths. The reduction and precipitation can be expedited by reagents such as sodium sulphite. Other organic acids besides oxalic acid form double salts with tetravalent cerium, *e.g.*, double salicylate of sodium and cerium.—H. B.

Formaldehyde and formic acid; Volumetric determination of —— by means of permanganate in acid solution. H. Grossmann and A. Aufrecht. XXIII., page 830.

Citrates and tartrates; Detection of ——. J. F. Tocher. XXIII., page 829.

Ethers and esters; British duties on ——, *in* 1905–06. Ann. Rep. of Comm. of Customs. [T.R.]

Among dutiable articles there was an all-round decline, the chief item being chloral hydrate, which dropped from £1215 to £1060. Acetic ester realised £209, butyric ester £487, sulphuric ether £131 (£55 less), ethyl bromide £2, ethyl chloride £422 (£139 less), ethyl iodide £1, and transparent soap in the manufacture of which spirit has been used declined, by £23, to £77.

Hexamethylentetramine. U.S. Customs decision. Oil, Paint, and Drug Rep., Aug. 6. [T.R.]

The protest of the importers was sustained regarding merchandise invoiced as "hexamethylentetramine" on which duty was assessed at 55 cents per pound, under the provisions of paragraph 67 of the Tariff Act of 1897, as a medicinal preparation in the manufacture of which alcohol is used. The importers claimed the goods to be dutiable at 25 per cent. *ad valorem*, under paragraph 68 of said Act, as a medicinal preparation in the manufacture of which alcohol is not used. The merchandise was found to be identical with that passed upon in Gen. Appr. 6403 (T. D. 27,505), and in accordance with said decision the protest was sustained and the decision of the collector reversed with instructions to reliquidate accordingly.

United States Patents.

Borneol; Process of making ——. A. Hesse, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat., 826,165, July 17, 1906.

See Fr. Pat. 359,547 of 1905; this J., 1906, 392.—T.F.B.

Creosote compounds. R. Berendes, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 824,901, July 3, 1906.

Alkyloxyacetyl compounds of creosote, obtained by the action of alkyloxyacetyl chloride on creosote, are colourless liquids, soluble in ether and alcohol, liberating creosote when treated with alkali hydroxides; they are said to possess valuable therapeutic properties. The ethoxyacetyl creosote compound is especially claimed: it boils from 152° to 176° C., (20 mm. pressure). (See also U.S. Pat. 822,339 of 1906; this J., 1906, 653.)—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 777.)

Mercurous oxalate emulsions. L. Castellani. Phot. Korr., 1906, **43**, 281; Chem.-Zeit., 1906, **30**, Rep. 244.

Mercurous oxalate, prepared by acting on mercurous nitrate with oxalic acid at 80° C., was washed, and made into a coagulable, white, fine-grained emulsion with dissolved gelatin and salt, the latter being essential to coagulability. Plates coated with this emulsion, then bathed in bichromate, and, when dry, exposed under a negative, were found suitable for phototype printing, and were very fine in the grain, though not standing pressure very well. No heat is required to form the grain, and the films on the used plates do not lose the property of swelling up.—C. S.

Photographic process; Investigations into the theory of the ——. Lüppo-Cramer. Phot. Korr., 1906, **43**, 80, 241; Chem.-Zeit., 1906, **30**, Rep. 244.

The substance of the negative cannot be made entirely soluble by oxidation with acid permanganate, conversion into ferrocyanide, or by chlorination with nascent chlorine or cupric chloride, though it becomes soluble when exposed to bromination, iodisation, or the conjoint

influence of silver bromide and potassium ferricyanide. The residue left on treating a negative with chromic acid is insoluble in thiosulphate, but is soluble in a strongly acid fixing bath or in ammonium thiocyanate containing sulphuric, nitric, hydrochloric, or citric acid. The author therefore differentiates two substances in the finished negative—one soluble in chromic acid, nitric acid, &c., and presumably pure silver, and one probably consisting of a solution of silver in silver bromide, rather than a sub-halide.—C. S.

ENGLISH PATENT.

Photographic plates, films and the like; Preparation and development of ——. W. F. C. Kelly and J. A. Bentham, London. Eng. Pat. 8911, April 27, 1905.

THE various substances necessary for developing photographic plates or films are applied to the back of the plate or film by aid of a suitable colloid; a preservative such as boric acid or an alkali borate is also added. The mixture may be applied as one layer, or the substances may be separated into different areas, containing, for example, the alkaline constituents in one set of areas, and the reducing agents in another. In order to avoid reflection of light from the glass, a "backing" layer may be interposed between the sensitive film and the support, or a light-absorbing substance may be incorporated with the developing constituents. When the invention is applied to "roll" films, an impervious band is rolled with the film to prevent the action of the developing substances on the emulsion. The plates or films are developed by immersion in water. (Compare Eng. Pat. 3164 of 1905; this J., 1906, 560.)—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 778.)

Nitroglycerin explosives; Uncongealable ——. F. Roewer. Z. ges. Schiess- u. Sprengstoffw., 1906, 228; Chem.-Zeit., 1906, **30**, Rep. 240.

NITRATED monochlorhydrin, being able to withstand temperatures of – 25° to – 30° C. without freezing, and being non-hygroscopic and insoluble in water and acids, is recommended as an adjunct in the composition of nitroglycerin explosives. It possesses the advantages of being easy to separate from the nitrating acid, and to wash, besides acting as a good solvent of trinitroglycerol. An addition of 5—10 per cent. of dinitromonochlorhydrin considerably lowers the freezing point of the product, and 20 per cent. gives a product that will stand very low winter temperatures. Other qualities imparted by this addition are diminished susceptibility to shock and percussion, without injuring the other properties of the explosives. An objectionable feature is that free hydrochloric acid is liberated when the explosives are detonated, but this could be ameliorated by the use of alkali nitrates or metals. Explosives prepared in the above manner have stood the test of storage for 18 months.—C. S.

Explosion; Circumstances attending an ——, *which occurred in the Corning House of the Gunpowder Factory at at Blackbeck, in the County of Lancaster on April* 30, 1906, Major A. Cooper-Key, H.M. Inspector of Explosives.

A QUANTITY of press-cake, amounting to nearly half a ton, was undergoing the process of "corning" when a violent explosion occurred, killing two men.

An examination of the débris indicated that the explosion was due to the friction of two steel surfaces owing to an ill-fitting key, by which a pinion wheel was keyed to the shaft. It appeared that the key was originally driven into position from the outside, and retained there by a coupling piece in such a manner that, provided the key was an ordinary mechanical fit, no "play" could be possible, and the shaft and pinion would be virtually one piece. A small amount of "play" would, however, soon cause a considerable "burring," and a gap such as that found, would result, in which, on starting or stopping the machine, the impact of one steel surface on another would be sufficient to explode any of the fine dust with which everything in the "corning house" is covered. The machine had been erected for six years, and the key had not been inspected during that period, and, moreover, it is doubtful whether an inspection would have revealed the misfit until the machine had been running for a considerable time.—B. J. S.

ENGLISH PATENT.

Nitrating cotton or the like; Apparatus for ——. H. Wolfshohl, Spandau, Germany. Eng. Pat. 23,920, Nov. 20, 1905.

SEE Fr. Pat. 359,625 of 1905; this J., 1906, 393.—T. F. B.

UNITED STATES PATENTS.

Smokeless powder, and process of making same. W. J. Williams, Philadelphia, Pa. U.S. Pat. 825,168, July 3, 1906.

THE grains of a smokeless powder are immersed in a solution of mononitronaphthalene in a relatively volatile liquid until they begin to soften, when they are removed, and dried first by exposure to the atmosphere, and then at a temperature of 40°—70° C.—A. S.

Explosive; Chlorinated ——. L. Thomas, Paris. U.S. Pat. 826,389, July 17, 1906.

SEE Eng. Pat. 8746 of 1905; this J., 1905, 986.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 780.)

APPARATUS, &c.

ENGLISH PATENT.

Gas; Apparatus for analysing ——. E. Schatz, Frankfort on Maine, Germany. Eng. Pat. 3417, Feb. 12, 1906. Under Int. Conv., May 11, 1905.

SEE Second Addition of Dec. 4, 1905, to Fr. Pat. 350,352 of 1905; this J., 1906, 778.—T. F. B.

UNITED STATES PATENT.

Gas-analysis apparatus. J. M. Morehead, Chicago, Ill. U.S. Pat. 824,999, July 3, 1906.

THE apparatus consists of a graduated explosion burette, with a bulb-shaped expansion at the lower end, connected by a three-way tap, and rubber tubing, to a water-sealed outlet and to a levelling-bottle. At the top of the burette there is also a three-way tap which serves to connect it with a funnel, and with another three-way tap, which communicates with a "storage-bulb," and "control-bottle," or with a wash-bottle.—W. H. C.

INORGANIC—QUALITATIVE.

Nitroprussides; Reaction of sulphides on ——. J. F. Virgili. Z. anal. Chem., 1906, **45**, 409—439.

A SOLUBLE sulphide, reacting on a nitroprusside, soluble or insoluble, produces a blue substance. Alkali must not be present, nor be formed during the reaction; certain salts also, by the hydrolysis of which alkali is formed—carbonates of the alkalis or alkaline earths, alkali silicates, borates, phosphates, &c.—interfere with the production of the blue colour. The blue substance appears to be a molecular addition-product of the sulphide with the nitroprusside.

With regard to the use of nitroprussides for analytical purposes, the author concludes that sodium nitroprusside is not a reagent for the sulphide-ion, but for un-ionised soluble sulphides, and is hence less sensitive than metallic salts which react with the sulphide ion. Its sensitiveness is increased by the addition of any reagent which hinders or lessens the ionisation of the sulphide; for this purpose

alkali or alkali carbonate may be employed, but ammonia is less effective than the fixed alkalis. A still further increase of sensitiveness is attained by cooling to the freezing point of the solution; but even then, reagents acting on the sulphide-ion are more sensitive. It is impossible, by means of nitroprusside, to distinguish between sulphide and sulphydrate, or to determine sulphides colorimetrically with any approach to accuracy. —J. T. D.

Ozone; Detection of —— by means of tetramethyldi-p-diaminodiphenylmethane. F. Fischer and H. Marx. Ber., 1906, **39**, 2555—2557.

Paper dipped in this reagent—so-called "tetramethyl-base-paper"—while moist, is coloured violet by ozone, whilst nitrogen oxides colour it straw-yellow. If both substances are present, an intermediate and not very characteristic tint is produced. The dry paper is useless. To detect small amounts of nitric oxide and ozone in presence of each other, the gas to be examined is led into liquid air, which dissolves the ozone, and solidifies the nitric oxide. On filtering, the presence of nitric oxide on the filter and of ozone in the filtrate, can be demonstrated by the tetramethylbase-paper.—J. T. D.

INORGANIC—QUANTITATIVE.

Zinc; Analysis of industrial ——. A. Hollard and L. Bertiaux. Bull. Soc. d'Encourag., Revue de Metall., 1906, **3**, 138—139.

If the zinc contain no arsenic, and no other reducing substance than iron, the latter can be determined by permanganate in the sulphuric acid solution of the zinc, and the lead by dissolving 10 grms. of the zinc and 10 grms. of copper in 87 c.c. of nitric acid, and depositing as peroxide (0·3 ampère).

If other substances be present, 5 grms. are dissolved in hydrochloric acid, and the solution boiled to expel arsenic; any insoluble metal is dissolved by adding a little hydrogen peroxide. The acid is nearly neutralised, and the liquid saturated with hydrogen sulphide. The sulphides are washed, dissolved in nitric acid, and evaporated to dryness, taken up with nitric acid and filtered; any tin is either weighed as stannic oxide or determined electrolytically. The filtrate is evaporated to fuming, with sulphuric acid, filtered, and the lead determined as sulphate or as peroxide. The filtrate, after adding nitric acid, is electrolysed for copper, and the remaining liquid evaporated to expel nitric acid, and made up to 300 c.c., which should contain 5 c.c. excess of sulphuric acid and sodium sulphate equivalent to 10 grms. of the anhydrous salt. It is then electrolysed for cadmium (1 ampère), using a cathode plated with cadmium. In the filtrate from the hydrogen sulphide precipitate, the iron is precipitated as hydroxide, and determined iodometrically. Arsenic is determined iodometrically after removal of the antimony.—J. T. D.

Antimony and tin; Separation of ——. A. Czerwek. Z. anal. Chem., 1906, **45**, 505—512.

Tin may be separated from antimony by precipitation as the double compound of stannic acid and phosphoric acid, but it is necessary that chlorine ions should be absent. For the analysis of an alloy, 0·5 grm. is covered with a mixture of 15 c.c. of nitric acid (sp. gr., 1·42), 15 c.c. of water, and about 6 grms. of tartaric acid, the temperature being 40°—50° C. When solution is complete, the liquid is heated to boiling, and 5—30 drops of 45 per cent. phosphoric acid (sp. gr., 1·3) are added, according to the amount of tin present. After diluting with about 300 c.c. of boiling water, and allowing to stand on the water-bath for 15 minutes, the solution is decanted on to a filter, and the precipitate washed with water containing ammonium nitrate. The precipitate is dissolved in warm ammonium sulphide, and then, after cooling and diluting largely, the tin is again precipitated by adding sulphuric acid. The mixture is allowed to stand some time on the water-bath, and the greenish-grey precipitate is then filtered off, and washed as before. The dried precipitate is added to the filter ash in a crucible, oxidised with nitric acid (sp. gr., 1·42), dried on the water-bath, ignited, and weighed as tin dioxide. The filtrate from the tin is neutralised with ammonia, and then warmed with ammonium sulphide, and acidified with acetic acid. The precipitated antimony sulphide is dissolved in ammonium sulphide, evaporated to dryness, and oxidised to antimony tetroxide in the usual way, with fuming nitric acid.

Analyses are given of alloys containing antimony and tin only, and also of those containing lead, copper, and zinc in addition. In dealing with these latter, tin is precipitated as before, and ammonium sulphide separates the other metals from the filtrate. In all cases in which antimony and tin have been obtained free from other metals by solution in ammonium sulphide, electrolytic precipitation has been found satisfactory as a preliminary to their separation.—F. Sodn.

Substances soluble with difficulty; Studies of the solubility of ——. II. Solubility of silver chloride, bromide, and thiocyanate at 100° C. W. Böttger. VII., page 806.

ORGANIC—QUALITATIVE.

Citrates and tartrates; Detection of ——. J. F. Tocher. Brit. Pharm. Conf., Birmingham, 1906. Pharm. J., 1906, **77**, 87.

Tartaric acid.—On adding a few c.c. of cobalt nitrate solution to a solution of an alkali tartrate, a fine red colour is produced, which is discharged on adding excess of sodium hydroxide solution. If the alkaline liquid be boiled, a deep blue colour appears, which fades as the mixture cools, and reappears on again heating.

Citric acid.—Alkali citrates give an immediate deep blue colour, in the cold, with cobalt nitrate solution in the presence of free caustic alkali.

Tartar emetic does not behave like other tartrates with cobalt nitrate. It produces an immediate blue colour in the cold, similar to the reaction obtained with citrates. —J. O. B.

ORGANIC—QUANTITATIVE.

Egg-yolk; Proposal for an official method for the commercial analysis of ——. Report of Turin Congress Commission. Collegium, 1906, 242—244.

The following conditions are proposed, under which the determinations of water, fat, sodium chloride, and ash in samples of egg-yolk are to be performed. Care should be taken to well shake and stir all vessels containing the egg-yolk before drawing the samples.

Water.—From 15 to 20 grms. of the sample are weighed out into a flat-bottomed basin tared together with a little dry sand and a small glass rod. The mixture is heated cautiously at first, and well stirred so as to break up all lumps; it is afterwards dried at a temperature of 100°—105° C. to constant weight.

Fat.—The dry residue is extracted in a Soxhlet apparatus with petroleum spirit (b.pt. 70°—75° C.). When the ether which siphons over is colourless, the residue is withdrawn from the apparatus, dried, powdered, and extracted for a further period. The extract is evaporated, and the residue dried for one hour at 100°—105° C. before being weighed. Should the sample contain boric acid, a portion will remain in the fat, and its quantity must be determined and allowed for.

Sodium chloride.—The residue insoluble in petroleum spirit is dried, dissolved in water, the volume diluted to 250 c.c., and the chlorine titrated in a known volume of the solution with standardised silver nitrate solution using potassium chromate as indicator.

Ash.—Ten grms. of the sample are placed in a platinum basin, dried, and carbonised at a low temperature. The mass is extracted with hot water, and the extracts evaporated in a weighed basin, whilst the carbonaceous residue is burnt to a white ash, which is added to the extract in the basin. When dry, the whole is heated for some time at a temperature of 100°—105° C. before weighing.

A difference of more than 1·5 between the percentage

amounts of sodium chloride and total ash, points to the presence of boric acid or other added mineral matter. —W. P. S.

Maple products; Determination of the lead [malic acid] value of ——. A. P. Sy. J. Franklin Inst., 1906, **162**, 71—72.

THE precipitate obtained on treating maple products with basic lead acetate, consists principally of lead malate; this precipitate is more or less copious in genuine samples, but only slight in adulterated samples. The following method of determining the "lead value" is stated to be convenient and trustworthy: A portion of the sample is treated with lead acetate, and the precipitate formed collected on a filter. After washing, both filter and precipitate are heated in a beaker with nitric and hydrochloric acids, sulphuric acid being added finally, and the heating continued until fumes are given off. If blackening occur, a little nitric acid is added. When cold, the mixture is diluted, alcohol is added, and the lead determined as usual.—W. P. S.

Malt extracts; Examination of commercial ——. E. F. Harrison and D. Gair. Brit. Pharm. Conf., Birmingham, 1906. Pharm. J., 1906, **77**, 94—95.

Total solids.—Twenty grms. are dissolved in water, and made up to 100 c.c., and the sp. gr. of the solution determined. The percentage of total solids is then calculated by the aid of the formula

$$\text{T.S.} = \frac{\text{Sp. gr} - 1000}{3{\cdot}92} \times 5$$

Maltose.—Five c.c. of the above 20 per cent. solution are diluted to 100 c.c., and 10 c.c. of Fehling's solution are titrated with this. The percentage of maltose is found by the aid of the formula $\frac{805}{m}$, where m = the number of c.c. of malt extract solution used up.

Diastase.—An amount of potato starch equivalent to 1 grm. of dry starch is weighed off, mixed in a mortar with a few c.c. of cold water, and poured into 65 c.c. of boiling water. The mortar is rinsed with a little more water, so as to make up 80 c.c. of mucilage in all, which is again boiled for one minute to ensure complete gelatinisation. The mucilage is then cooled to 40° C., and 20 c.c. of the same 1 per cent. solution of malt extract as used for the determination of the maltose are added to it. This is equivalent to 0·2 grm. of the original extract. The mixture is maintained at 40° C. for half an hour, and then boiled to stop further hydrolysis. When cold, 10 c.c. of Fehling's solution are titrated with it. From the total maltose found, the maltose introduced with the extract is deducted.

The calculations may be combined by the use of the following formula:—

$$\left.\begin{array}{l}\text{Weight of anhydrous starch}\\ \text{completely converted} \ldots\end{array}\right\} = 1{\cdot}184\left(\frac{8{\cdot}35}{n} - \frac{1{\cdot}61}{m}\right),$$

where n is the number of c.c. used in the last titration, m (as above) represents the c.c. used in the former maltose titration, and 1·184 is the factor $\frac{100}{84{\cdot}4}$ for calculating maltose into starch.

The figures given in the table for diastase represent the percentage of starch which the extract is capable of completely converting in half an hour at 40° C. Since 0·2 grm. is the weight of extract taken for the test, the above result must be multiplied by 500; or

$$\text{Diastatic value} = 592\left(\frac{8{\cdot}05}{n} - \frac{1{\cdot}61}{m}\right)$$

Proteid.—This was determined by the Kjeldahl-Gunning method.

The following table gives the results of the examination of 13 commercial samples:—

Sample.	Total solids.	Maltose.	Proteids.	Diastatic value.	Remarks.
	per cent.	per cent.	per cent.		
I.	73·2	65·4	6·7	468	—
II.	79·8	64·4	5·3	346	—
III. ...	69·8	58·5	5·5	356	—
IV. ...	77·0	54·0	3·6	10	—
V.	72·3	52·1	3·8	15	—
VI ...	95·9	82·1	5·7	89	Solid extract.
VII. ..	78·8	66·0	6·1	96	Considerable salicylate present.
VIII. .	74·3	62·5	6·1	65	Ditto.
IX. ...	73·0	47·1	3·8	17	9·5 per cent. of cane-sugar present.
X.	66·2	49·7	3·9	0	—
XI. ...	78·7	74·2	5·5	268	High maltose figure probably due to glucose.
XII ...	64·9	58·8	3·9	0	—
XIII. .	73·9	63·6	6·6	137	—

—J. O. B.

Rosin-size [in paper]; Detection and determination of —— H. Rebs. Papier-Zeit., 1906, **31**, 2158.

TURPENTINE-ROSIN (ordinary colophony) is a mixture of abietic acid with varying proportions of its anhydride. The acid is readily soluble in alcohol or light petroleum spirit, but the anhydride is nearly insoluble. For the determination of rosin in paper, 10 grms. of the sample are torn up, and heated with 25 c.c. of 10 per cent. alcoholic potash under a reflux condenser. The liquid is filtered, and the rosin is precipitated in the form of abietic acid by the addition of dilute hydrochloric acid to the filtrate. The precipitate is collected, washed with cold water, and dried at a moderate temperature. The crude product is then purified by extraction with 50 c.c. of light petroleum spirit on the water-bath. The petroleum extract is filtered, and a little ammonia is added to the solution. Ammonium abietate is thus precipitated in the form of a gelatinous mass. This is filtered off and dried on the water-bath; the combined ammonia is then driven off by carefully heating the soap by means of a very small flame, and the residual abietic acid is weighed. It is stated that the gelatinous precipitate formed by the action of ammonia on the petroleum extract, is absolutely characteristic of abietic acid, and serves for the separation of colophony from all other resin-acids, even when it is present in very small quantities.—J. F. B.

Formaldehyde and formic acid; Volumetric determination of —— by means of permanganate in acid solution. H. Grossmann and A. Aufrecht. Ber., 1906, **39**, 2455—2458.

THE authors confirm a statement of Vanino and Seitler, that formaldehyde can be completely oxidised by permanganate in acid solution in the cold; the excess of permanganate must, however, be allowed to act for an hour, otherwise too low values are obtained.

With formic acid or its salts, contact with permanganate in the cold for six hours is requisite; then the solution is warmed to 40° C., excess of standard oxalic acid solution added, and the remaining excess titrated with permanganate. The fact that formic acid is more slowly oxidised than formaldehyde seems to preclude the possibility of formic acid being a stage in the oxidation of formaldehyde; the authors consider that an addition compound is first formed, $HCOH + O_2 = H.C(O:O)OH$, which then breaks up into water and carbon dioxide.—J. T. D.

New Books.

CLASS LIST AND INDEX OF THE PERIODICAL PUBLICATIONS IN THE PATENT OFFICE LIBRARY. 2nd Edition. Darling and Son, Ltd., 34—40, Bacon Street, E. Published at the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. 1906. Price 6d.

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DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy. A form of application for this purpose will shortly be issued.

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Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

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Cowburn, W. H.; Journals to Belmont Villa, Birkbeck Grove, Acton, W.

Dixon, Fred. W., l/o Fifth Avenue; 557, West 144th Street, New York City, U.S.A.

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Haff, Max M.; Journals to Laboratory, 188, Metcalfe Street, Ottawa, Canada.

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Barnes, F. V., l/o 4, Annesley Grove, Nottingham.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 18,106. Stubbs. Apparatus for heating or cooling fluids. Aug. 13.

,, 18,336 Ogle. Thermostats. Aug. 15.

,, 18,361. Sundberg. Centrifugal liquid separators.* Aug. 15.

,, 18,405. Berretz. Shaft furnaces or kilns.* Aug. 16.

,, 18,409. Giron. Apparatus for decanting gases under pressure. [Fr. Appl., Aug. 25, 1905.]* Aug. 16.

,, 18,491. Allison (Barry). Filter frame and process of filtration.* Aug. 17

,, 18,594. Memminger. Cooling apparatus * Aug. 20.

,, 18,708. De Laval and Fagerstrom. *See under* XVIII*A*.

,, 18,732. Lake (Bush). Furnaces.* Aug. 21.

,, 18,870. Andrews. Furnaces. Aug. 23.

,, 19,001. Mayor, Aldermen and Citizens of Bradford, Wyld and Shepherd. Towers or other apparatus for the absorption or elimination of chemical vapours. Aug. 25.

[C.S.] 18,593 (1905). Wetter (Besemfelder). Retorts for heating or cooling solid, granular, or pasty materials, with or without simultaneous treatment of the same with gases. Aug. 22.

,, 18,596 (1905). Reyscher. Drying apparatus. Aug 22.

,, 20,079 (1955). Hubert. Means for storing explosive fluids or fluids under pressure. Aug 22.

,, 20,697 (1905). Kestner. Machine for atomising liquids. Aug. 29.

,, 21,330 (1905). Smith and Smith. Boiler compositions. Aug. 29.

,, 5867 (1906). Vial. Drying drums for drying sediments or other wet materials. Aug 22

,, 10,162 (1906). Petitpierre. Homogenising breaker to homogenise, emulsionise, and pulverise liquid or semi-liquid matters. Aug. 29.

II.—FUEL, GAS, AND LIGHT.

[A.] 18,131. Mehta. Manufacture of fuel-briquettes. Aug. 13.

,, 18,152. Van Vriesland. Incandescent gas mantle.* Aug. 13.

,, 18,256. Clark (Dellwik-Fleischer Wassergas Ges.). Water-gas producers. Aug. 14.

[A.] 18,487. British Thomson-Houston Co. (General Electric Co.). Filaments. Aug. 17.

,, 18,488. British Thomson-Houston Co. (General Electric Co.). Filaments. Aug. 17.

,, 18,505. Feld. *See under* VII.

,, 18,514. Bessey. Extracting water from peat for fuel. Aug. 17.

,, 18,602. Coxhead. Incandescent gas mantles. Aug. 20.

,, 18,622. Justice (Deuts. Gasglühlicht A.-G.). Production of metallic incandescence bodies for electric glow lamps.* Aug. 20.

,, 18,643. Michaud and Delasson. Production of indestructible filaments for lighting and heating installations. [Fr. Appl., Sept. 30, 1905.]* Aug. 20.

,, 18,680. Simmance and Abady. *See under* XXIII.

,, 18,686. Lynde. Apparatus for producing gas from petrol and other hydrocarbons. Aug. 21.

,, 18,738. Lederer. Manufacture of filaments of tungsten or molybdenum for electric incandescent lamps. Aug. 21.

,, 18,745 and 18,747. British Thomson-Houston Co. (General Electric Co.). Method of manufacturing filaments. Aug. 21.

,, 18,746. British Thomson-Houston Co. (General Electric Co.). *See under* VII.

,, 18,748 and 18,749. British Thomson-Houston Co. (General Electric Co.). Filaments. Aug. 21.

,, 18,750, 18,751, and 18,752. British Thomson-Houston Co. (General Electric Co.). Manufacture of electric conductors especially applicable for use as incandescing bodies in electric lamps. Aug. 21.

,, 18,828. Gobbe. Coke ovens. Aug. 22.

,, 18,879. Bradley. Gas producer.* Aug. 23.

,, 18,926. Spatz. Coke ovens and like furnaces.* Aug. 24.

,, 18,967. Jouques. Manufacture of briquettes for fuel.* Aug. 24.

,, 18,974. Vanino and Lambrecht. Production of pulverous or stone-hard luminous bodies of considerable luminous power. [Ger. Appl., Aug. 30, 1905.]* Aug. 24.

,, 19,048. Deschamps. Gas producers. [Belg. Appl., Aug. 25, 1905.]* Aug. 25.

[C.S.] 12,516 (1905). Noll and Trainer. Manufacture of briquettes from fuel, ores, and the like. Aug. 22.

,, 14,898 (1905). Crawford. Manufacture of filaments for incandescing electric lamps. Aug. 29.

,, 16,298 (1905). Forbes. Prepared carbides for acetylene generators, &c. Aug. 22.

,, 16,579 (1905). Bueb. Vertical retort ovens. Aug. 22.

,, 16,955 (1905). Shadbolt. Gas manufacture. Aug. 29.

,, 20,066 (1905). Schiefner. Fabrics for incandescing mantles. Aug. 22.

,, 26,847 (1905). Green and Mievillo. Apparatus for producing gas from petrol or other suitable volatile spirit or oil. Aug. 22.

,, 3509 (1906). Iseki. Filament for incandescent lamps. Aug. 22.

,, 14,798 (1906). Robin. Mantles for incandescent lighting. Aug. 29.

,, 15,295 (1906). Albrecht. Method of producing incandescent mantles. Aug. 22.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 18,810. Arcéluz. Lubricating composition.* Aug. 22.

[C.S.] 6289 (1906). Chapman and Knowles. Lubricating compounds. Aug. 29.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 18,504. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Aug. 17.
[C.S.] 27,000 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of an indophenol. Aug. 22.
„ 7287 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters from naphthalene derivatives. Aug. 22.
„ 9989 (1906). Meister, Lucius, und Brüning. Manufacture of a dyestuff and colour lakes therefrom. Aug. 29.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 18,127. Rogers. Process and apparatus for retting and degumming and subsequently cleaning and drying fibrous materials. Aug. 13.
„ 18,165. Terrell. Treatment of ramie and other like fibres. Aug. 13.
„ 18,512. Bendel. Treatment of ramie and other textile substances. [Fr. Appl., Dec. 14, 1905.]* Aug. 17.
„ 18,522. Hunt and Moscrop. Bleaching of textile fabrics. Aug. 18.
„ 19,017. Zeunert. *See under* VI.
[C.S.] 10,465 (1905). Radclyffe. Decorticating, scutching, and degumming fibres. Aug. 29.
„ 19,508 (1905). Marr. Apparatus for drying warps or hanks of yarn. Aug. 29.
„ 21,079 (1905). Thompson (Mound City Paint and Colour Co., and Boardman). Manufacture of sheet material or fabric from wood or the like. Aug. 22.
„ 23,206 (1905). Miller and Ginger. Colouring compound for marking textile materials. Aug. 29.
„ 2359 (1906). Lorrain (Gebr. Schmid). Process for simultaneously ungumming and dyeing raw natural silk. Aug. 22.
„ 14,343 (1906). Rohner. Alkali salts of formaldehyde-sulphoxylic acid. Aug. 29.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

[A.] 18,562 Imray (Livingston). Process of printing in gelatin colours with oiled forms. Aug. 18.
„ 19,017. Zeunert. Manufacture and colouring of paper, linen, and the like.* Aug. 25.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 18,446. Bainbridge. Production of sulphurous anhydride. Aug. 17.
„ 18,447. Bainbridge. Production of sulphur. Aug. 17.
„ 18,505. Feld. Treatment of gases for the extraction of ammonia therefrom. Aug. 17.
„ 18,603. Pauling. Concentration of nitric acid.* Aug. 20.
„ 18,746. British Thomson-Houston Co. (General Electric Co.). Manufacture of boron and boron compounds and production of electric incandescing bodies therefrom. Aug. 21.
„ 18,927. Guttmann. Manufacture of sulphuric acid.* Aug. 24.
„ 19,023. Knudsen. Treatment of liquid air. Aug. 25.
[C.S.] 1299 (1906). Conedera. Depuration of copper sulphate contaminated with iron salts, and direct extraction of copper sulphate from ores. Aug. 29.
„ 4219 (1906). Johnson (Badische Anilin und Soda Fabrik). Production of nitrites. Aug. 29.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 18,663. Marks (Colburn). Production of sheet glass.* Aug. 20.
„ 18,763. Jones. Manufacture of glass. Aug. 22.
[A.] 18,769. Twyford and Moore. Gas-fired pottery kilns and ovens. Aug. 22.
„ 19,045. Meran frères. Ceramic products. [Fr. Appl., Oct. 6, 1905.]* Aug. 25.
[C.S.] 15,560 (1905). Gibbons and Masters. Glass melting furnaces. Aug. 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 18,294. Batt and Bowden. Dressing or grading china clay, ores, and the like. Aug. 15.
„ 18,449. Morgan. *See under* XIX.
„ 18,564. Hughes. Tar macadam.* Aug. 18.
„ 18,851. Barnett and Hadlington. Brick kilns. Aug. 23.
„ 18,907. Howorth (Marti). Imperforable and flexible protective material.* Aug. 23.
„ 18,964. Schwanenberg and Rinne. Hardening artificial stone compositions containing lime by means of carbon dioxide. Aug. 24.
„ 19,038. Schwanenberg and Rinne. Hardening artificial stone formed of hydrate of lime and filling materials. Aug. 25.
[C.S.] 16,841 (1905). Richards. Cement for attaching glass or pottery tiles to bricks, walls, and other surfaces. Aug. 22.
„ 26,539 (1905). Smith and Atherton. Asphalt composition. Aug. 22.
„ 3182 (1906). Alexander-Katz. Process of manufacturing artificial stone. Aug. 29.

X.—METALLURGY.

[A.] 18,134. Stolzenwald. Method of realising the value of material containing zinc, and profiting by the zinc and carbon constituents contained in the residue of zinc works.* Aug. 13.
„ 18,157. Johnson (Badische Anilin und Soda Fabrik). Coating metals and alloys with lead. Aug. 13.
„ 18,294. Batt and Bowden. *See under* IX.
„ 18,489. British Thomson-Houston Co. (General Electric Co.). Method of purifying metallic compounds. Aug. 17.
„ 18,574. Gathy. Extraction of copper and lead from ores or mineral compounds. [Belg. Appl., Aug. 21, 1905.]* Aug. 18.
„ 18,671. Cowper-Coles. Production of aluminium. Aug. 21.
„ 18,723. Steinhart and Vogel. Treatment of tin ores, concentrates, &c. Aug. 21.
„ 18,742. Bontempi. Production of articles of an alloy of iron and hydrogen.* Aug. 21.
„ 18,792. Churchward. Iron and steel alloys and manufacture of castings therefrom.* Aug. 22.
„ 18,801. Atkinson. Treatment of refractory ores. Aug. 22.
„ 18,803. Hyde and Swan. Coating metals with metals. Aug. 22.
„ 18,910. Cowper-Coles. Coating wire with zinc and other metals. Aug. 24.
[C.S.] 12,516 (1905). Noll and Trainer. *See under* II.
„ 25,371 (1905). Boult (Brown). Treatment of sulphide and other ores. Aug. 22.
„ 1299 (1906). Conedera. *See under* VII.
„ 9453 (1906). Wallis and Wallis. Cast iron. Aug. 29.
„ 10,303 (1906). Imbert. Process of treating zinc and lead sulphide ores. Aug. 22.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY

[A.] 18,435. Pauling. Processes for producing electric discharges. [Ger. Appl., Aug. 18, 1905.]* Aug. 16.
„ 18,599. Pauling. Production of voltaic strong-current arcs.* Aug. 28.
„ 18,600. Pauling. Electrodes.* Aug. 20.

[A.] 18,729. Wingren. Electric furnaces. [U.S. Appl., Aug. 21, 1905.]* Aug. 21.
„ 18,886. Joel. Electrodes for secondary batteries. Aug. 23.
[C.S.] 516 (1906). Benson and Co., and Leaver. Apparatus used in electro-plating. Aug. 22.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 18,925. Thompson. Manufacture of soap. Aug. 24.
[C.S.] 16,371 (1905). Gesner and Brandly. Process and apparatus for extracting oils. Aug. 22.
„ 25,680 (1905). Verein. Chem. Werke, A.-G. Manufacture of fatty acids from fatty acid esters. Aug. 29.
„ 26,119 (1905). Pochin and Richardson. Manufacture of soap powders and detergents. Aug. 29.
„ 4290 (1906). Harris. Process for purifying tallows. Aug. 29.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

[A.] 18,936. Fanshawe and Shardlow. Paints, inks, colouring matters, pigments and the like. Aug. 24.
[C.S.] 18,683 (1905). Milburn. Anti-corrosive paints or compounds. Aug. 29.
„ 9989 (1906). Meister, Lucius, und Brüning. *See under* IV.

XIV.—TANNING. LEATHER, GLUE, SIZE, &c.

[A.] 18,267. Dowson and Walter. Adhesive compounds. Aug. 14.
„ 18,499. Meers. Artificial leather and process of making the same.* Aug. 17.
[C.S.] 25,187 (1905). British Algin Co., and Ingham. Manufacture of products from seaweed. Aug. 22.
„ 9622 (1906). Soc. Franç. La Norgine. Method of obtaining a soluble glutinous substance in a dry and neutral state from tang acid. Aug. 22.

XVI.—SUGAR, STARCH, GUM, &c.

[C.S.] 6009 (1906). Drost. Mashing apparatus for promoting crystallisation of sugar masses and for mixing other pulpy masses with diluting agents. Aug. 29.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 18,540. Hunt. Improving, maturing, or ageing fusel oil, whisky, brandy, and rum. Aug. 18.
„ 18,611. Grosfils. Process of fermenting worts.* Aug. 20.
[C.S.] 2559 (1906). Hartley. Improving the flavour and aroma of carbon dioxide used for carbonating beer. Aug. 29.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

[A.] 18,130. Boult (Rennick). Preserved vegetable foods. Aug. 13.
„ 18,708. De Laval and Fagerström. Centrifugal separators for cream and other liquids.* Aug. 21.
„ 18,831. Zundel-Donati. Removal of moisture from milled products of certain cereals and legumens. Aug. 22.
[C.S.] 6375 (1906). Meyer. Preparation or treatment of coffee. Aug. 22.
„ 8077 (1906). Badoud. Preservation of alimentary products. Aug. 29.
„ 12,916 (1906). Müller. Process for the manufacture of artificial butter. Aug. 22.

(*B.*)—Sanitation; Water Purification.

[A.] 18,806. Dünkelberg. Apparatus for purifying water. Aug. 22.
„ 19,130. Candy. Purification of water. Aug. 25.
„ 19,031. Candy. Manufactures for use in the purification of water. Aug. 25.
[C.S.] 22,148 (1905). Clark. Treatment of the feed water of steam boilers. Aug. 29.
„ 22,645 (1905). Bell and Bell. Machines for the filtration of water, sewage, and other liquids. Aug. 22.
„ 24,414 (1905). Meinl. Manufacture of malt-containing chocolate. Aug. 29.
„ 10,080 (1906). Lambert. Process for purifying water. Aug. 22.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 18,449. Morgan. Method of rendering wood, paper, cardboard, and the like, non-inflammable. Aug. 17.
„ 18,821. Stevens and Harrold. Manufacture of celluloid articles. Aug. 22.
„ 18,878. Lyons and Parsons. Method of manufacturing papers. Aug. 23.
„ 18,919. Bertram and Milne. Paper and pulp making machines. Aug. 24.
„ 18,977. Linfoot. Manifold paper. Aug. 24.
„ 19,017. Zeunert. *See under* VI.
[C.S.] 16,965 (1905). Stettner and Hellmann. Paper-making machines. Aug. 29.
„ 17,164 (1905). Friedrich. Manufacture of solutions of cellulose. Aug. 29.
„ 19,808 (1905). Evans. Treatment of paper pulp. Aug. 29.
„ 8167 (1906). Trocquenet. Manufacture of non-inflammable material containing non-nitrated cellulose. Aug. 29.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 18,280. Weizmann, and The Clayton Aniline Co., Ltd. Manufacture of isobornyl esters. Aug. 14.
[C.S.] 9008 (1906). Nitritfabrik Ges. Process for the production of formates. Aug. 22.
„ 11,725 (1906). Fritzsche and Ostermann. Manufacture of neutral oxyquinoline salts. Aug. 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 18,741. Davies. Colour photography.* Aug. 21.
[C.S.] 17,638 (1905). Grünbaum. Photographic three and four-colour printing processes. Aug. 22.
„ 996 (1906). Bloxam (Neue Photographische Ges.). Method of printing from a surface in relief. Aug. 29.
„ 7250 (1906). New Graphic Akt.-Ges. Apparatus for the production of pictures, patterns, &c., by photographical method. Aug. 22.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 18,223. Luis and Williamson. Explosive. Aug. 14.
[C.S.] 21,779 (1905). Cocking, and Kynoch, Ltd. Smokeless powder. Aug. 29.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 18,680. Simmance and Abady. Gas analysis apparatus. Aug. 21.
[C.S.] 12,225 (1905). Sodeau, and Brady and Martin, Ltd. Apparatus for gas analysis. Aug. 22.

Sydney Section.

Meeting held at Sydney, on Wednesday, May 9, 1906.

PROF. LIVERSIDGE, F.R.S., IN THE CHAIR.

EXAMINATION OF SOME WESTERN AUSTRALIAN BARKS.

BY E. A. MANN AND E. E. COWLES.

Of late years there has arisen a considerable industry in Western Australia through the discovery of the valuable tanning properties of the bark of the so-called "mallet" gum, and the following investigation was undertaken to determine whether the barks of any of the other commonly occurring trees of our forest areas were worthy of special attention for tanning purposes. The mallet bark has, of course, received considerable attention from leather chemists(1), but the only account which we have been able to find of the examination of other barks from this State is a report by H. G. Smith, published in the Western Australian Journal of the Department of Agriculture, Vol. XI., Part 4, 1905.

Through the courtesy of Mr. R. W. Synnot we obtained the following specimens:—

	Ordinary name.	Botanical name.	Mean thickness of bark in mm.
1	Ordinary mallet .	Eucalyptus occidentalis	7
2	Salmon gum	,, salmonophloia	15
3	Manna or wattle	Acacia decurrens	4
4	York gum	Eucalyptus loxiphleba	6
5	Morral	,, longicornis	9
6	White gum	,, redunca	13
7	Silver mallet	,, occidentalis(2)	6
8	Black mallet	,, ,, (2)	8
9	Yate	,, cornuia	8
10	Salmon gum (large)	,, salmonophloia	10
11	Salmon gum (small)	,, ,,	7

With the exception of Nos. 1, 6, and 8, none of the barks showed much signs of kino. In Nos. 1 and 8 the gum veins were very prominent. The barks were sampled by planing off a strip the full length of the sheet, which was then broken and ground to pass a 40-mesh sieve. The methods of analysis employed were those of the International Association of Leather Trades Chemists, including alterations adopted at the Leeds Conference in 1902(3), with the exception that, for estimation of non-tannins, the chromed hide-powder method of the Association of the Official Agricultural Chemists of America was used. Kaolin was not used in any filtration, as perfectly clear solutions were obtained without its use. All dryings were done at 100° C. for eight hours. The hide-powder was examined and found to contain 12·26 per cent. of nitrogen calculated to 18 per cent. moisture.

Table I. gives the results of the analyses of the samples, and Table II. (see next page) shows the behaviour of their extracts with various reagents.(4)

TABLE I.

	Grms. taken for 1000 c.c. of infusion.	Moisture percentage.	Non-tannins percentage.	Tannins percentage.
1	6	10·45	16·23	44·5
2	16	9·48	7·06	16·9
3	20	7·05	6·84	15·1
4	24	7·11	8·75	19·8
5	24	5·56	6·74	8·73
6	20	10·59	7·46	19·5
7	8	10·76	13·66	14·67
8	8	11·77	5·05	35·2
9	24	8·69	7·3	16·1
10	12	10·15	6·45	18·8
11	20	8·49	11·61	19·25

Sample No. 6 has a peculiar character. Though it apparently acts, when the infusion is the ordinary way, it does not react with hide quite like an ordinary tannin, and presumably true tannins are absent from this bark. It would appear from the above reactions that the tannins all belong to the catechol rather than to the pyrogallol class.(5)

As regards the colour of the leather produced by these various barks, the following observations may be recorded:—Nos. 1, 4, 8, 10, and 11 were similar in appearance and colour, and would probably produce a good leather of light colour. Nos. 2, 5, 7, and 9 gave a reddish tinge to the leather, and would not be considered so satisfactory as the preceding numbers. No. 3 was of indifferent quality, having a decided purplish tinge. No. 6 was very highly coloured, giving a deep brick-red coloration and harsh character. It is not to be understood, however, that we place too much reliance on this classification. We recognise that it is only by practical trial in a tanyard that the real value of a bark can be ascertained, and it is in the hope of attracting the attention of practical tanners to these barks for that purpose that these results are published. While it will be seen it must that none of the other barks are equal in value to the "mallets," and none of them rich enough for profitable use in tanning, the majority of them could probably be used with great advantage in the preparation of tanning extracts, provided that the leather produced is found on trial to be of good quality.

We have been much indebted to Mr. R. Rosenstamm, of Perth, and Mr. L. Benjamin, of Footscray Tannery, Melbourne, for advice and assistance in connection with this investigation. A further investigation has now been begun as to the percentages of tannin contained in the woods of the above trees as well as in some other Western Australian barks, the results of which we hope to publish at an early date.

(1) An exhaustive report by Professor Eitner, of Vienna, dealing with the mallet bark, and published in "Der Gerber," is not available here at the time of writing.

(2) We were unable to find out whether these mallets are distinct species, or only varieties of ordinary mallet.

(3) H. R. Procter. "Principles of Leather Manufacture," 1903, Appendix A., page 475.

(4) Allen. "Comm. Organic Analysis," Third Edition, 1901, Vol. III., Part I., page 56.

(5) H. R. Procter, "Principles of Leather Manufacture," page 294.

Meeting held at Sydney, on Tuesday, June [illegible]

PROF. LIVERSIDGE, F.R.S., IN THE CHAIR.

THE FERMENTATION OF CANE MOLASSES, AND ITS BEARING ON THE ESTIMATION OF THE SUGARS PRESENT.

BY DR. GEORGE HARKER.

The question of the determination of the sugars, and more especially of the saccharose, in cane molasses is one which has caused much discussion. On account of the large proportion of reducing sugars present in cane molasses, it is recognised that no reliance can be placed on the saccharose figure obtained by direct polarisation, since the reducing sugars present also affect the polarisation. For exact determinations recourse is generally had to the Clerget method, which is not affected by the presence of reducing sugars. In this method, after obtaining the figure for direct polarisation, the solution is inverted with acid and the polarisation again made. The reducing sugars are not affected by the acid and the difference in the two polarisations is taken to be due to the production of invert sugar from the saccharose originally present. From this difference the saccharose is calculated.

Fresh interest has been aroused recently by Remy [illegible] Chim. Soc. Dict., 1904, 21, 1902), who has

Table II.

Reagent	1.	2.	3	4	5	6.	7.	8.	9.	10.	11.
Boiled, with equal vol. dil. sulphuric acid (1—5).	No precipitate, cloudy on cooling.	No ppt.	No ppt.	Fairly heavy flocculent ppt.	Slight ppt.	No ppt.	Slight ppt., heavier on cooling	Very slight ppt. heavier on cooling	Flocculent red-brown ppt. heavier on cooling	Cloudy appearance	Slight cloudiness on cooling
Bromine water.	Fairly heavy ppt.	Faitly heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.	Heavy ppt.
Dilute ferric chloride.	Dark green ppt. and colour.	Green-brown ppt. and colour.	Greenish-brown ppt.	Dark green colour and ppt.	Greenish-brown ppt.	Red-brown coloration	Heavy green-brown ppt. and colour	Slight green-brown ppt. and and colour	Dark brown ppt.	Greenish-brown ppt.	Slight green-brown ppt.
On addition of ammonia.	Heavy red-brown ppt.	Heavy red-brown ppt.	Heavy-red brown ppt.		Heavier ppt.	No ppt	Change to red-brown	Heavy red-brown ppt.	No alteration.	Heavy dark brown ppt.	Very heavy dark brown ppt.
Soln. tartar emetic.	No ppt.	No ppt.	No ppt.	No ppt.	No ppt	No ppt.	No ppt.	No ppt.	No ppt.	No ppt.	No ppt.
On addition of amm. chloride	Cloudy white ppt.	Cloudy.	White ppt.	Heavy reddish ppt.	Fairly heavy light red ppt.	Only slight clouding	White ppt.	Pale red ppt.	Slight red ppt.	White ppt.	White ppt.
Copper Sulphate	Pale green ppt.	Pale green ppt.	Slight light-coloured ppt.	Fairly heavy reddish ppt.	Slight greenish ppt.	Violet colour	Pale ppt.	Slight pale ppt.	Slight yellowish ppt.	Yellow colour	Greenish-yellow colour
On addition of ammonia	Greenish colour-slight ppt.	Blue-black colour and ppt.	Deep violet colour and ppt.	Blue-black colour and ppt.	Blue-black colour and ppt.	No ppt.	Dirty brown ppt.	Greenish-blue colour, slight ppt.	Dark blue colour and ppt.	Dark ppt. with soln. greenish-blue	Dark blue colour slight ppt.
Lime water	Slight red-brown ppt.	Slight red-brown ppt.	Purple coloured ppt.	Fairly heavy red-brown ppt.	Fairly heavy brown ppt.	No ppt.	Fairly heavy red-brown ppt.	Fairly heavy red-brown ppt.	Fairly heavy red-brown ppt.	Light brown ppt.	Brown ppt.
Conc. sulphuric acid to cut drop of reagent.	Claret colour at point of contact	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.	Same as 1.
Solution of iron alum.	Dark green colour and ppt.	Dark green colour and ppt.	Very heavy greenish ppt.	Heavy green-black ppt.	Greenish-black ppt.	Golden-brown coloration, no ppt.	Heavy green-black ppt.	Green-black colour and slight ppt.	Greenish coloration, red-brown ppt.	Dark green colour, slight ppt.	Dark green colour, slight ppt.
Ammonium molybdate in nitric acid.	Lighter colour, no ppt.	No ppt.	Slight dark red ppt.	Fairly heavy red ppt.	Slight cloudiness.	No ppt.	Heavy light brown ppt.	No ppt.	Light brown ppt.	No ppt.	No ppt.

opposed the Clerget method on the ground that the presence of the invertase present in the ferment is not so sensitive to acid in neutral as in acid solutions. Lindet, however (Bull. Assoc. Chim. Sucr. Dist., 1900, 18, 574), has shown that the error can only be a very slight one.

An important paper dealing with the whole question of the determination of saccharose in cane molasses has been published recently by H. and L. Pellet (Bull. Assoc. Chim. Sucr. Dist., 1905, 22, 744—752). Numerous experiments have been made by the authors with different molasses, in which the reducing sugars present before and after inversion with acids were determined by means of Fehling's solution. The saccharose was thus calculated by a method independent of the optical properties of the sugars, and in all cases was found to be in very close agreement with the Clerget figure for the same sample. The authors consider that the accuracy of the Clerget method is beyond question.

Now when cane molasses is fermented, the quantity of alcohol produced is generally much less than that which is indicated by calculation from the figures of analysis for the saccharose and reducing sugars in the molasses; and it is evident that the yield of alcohol has an important bearing on the question of the determination of the sugars. In this connection an account of some experiments undertaken by the author on the fermentation of cane molasses may be of interest, as they seem to cast some doubt on the methods of analysis for the sugars present.

To account for the low yields of alcohol obtained from the fermentation of molasses several explanations have been given. Of these, apart from bacterial losses, the most important seem to be the presence of organic acids and the possible presence in the molasses of sugars fermentable only with difficulty.

Lafar has shown (Z. Spiritusind. 1895, 18, 238) that free organic acids hinder fermentation.

Bau (Z. Spiritusind. 1894. 17, 366) has discussed the resistance of beet molasses to fermentation and concludes that it is chiefly due to the presence of sugars fermentable only with difficulty. Boiling with sulphuric acid not only removes volatile acids, but also inverts such sugars as raffinose fermentable only with difficulty, and so increases the yield.

The majority of the experiments, of which an account is given in this paper, were performed upon a sample of molasses which had the following composition:—

Saccharose (Clerget)	41·52
Reducing sugars	9·26
Other organic matter	11·66
Ash	11·50
Water	26·06
	100·00
Brix	75·1
Specific gravity	1·3832

Total sugar as reducing sugar, 52·94 (43·68 + 9·26). Polarisation direct, 38·80.

After inversion with acids, 55·12 per cent. of reducing bodies, estimated by Fehling's solution, were present; subtracting from this the 9·26 per cent. present before inversion, and, following Pellet, calculating the saccharose from the difference, the figure 43·57 was obtained, which seemed to show that the Clerget figure was if anything lower than the truth. It was only as the investigation proceeded that a contrary opinion was formed.

In all the fermentation experiments, whether saccharose or molasses was employed, the solutions were always made so as to contain 10 grms. of sugar, calculated as reducing sugar, in every 100 c.c. of solution. By this means a comparison of results was rendered very easy. The volume of solution fermented was in all cases 500 c.c. The solutions were placed in bottles previously cleaned, sterilised, and dried. The mouth of each bottle was closed by a plug of cotton-wool and the bottles were then placed in a water-bath, which was kept at a temperature of 31° C. by means of a thermostat. The yeast employed for most of the experiments was pure culture yeast and was obtained from the Berlin Institute. In a few experiments ordinary brewery yeast was used.

The attenuation of the solution on fermentation was taken as a basis for calculating the yield of alcohol. The attenuation in the figure multiplied by 1000 gives the difference in the specific gravity of the solution before and after fermentation. When 19 or 20 solutions were fermented in one operation, as was often the case, it would be difficult to estimate the alcohol in each by distillation on account of the time occupied. The yield of alcohol could be calculated with close approximation by means of the following formula: $\frac{\text{attenuation} \times 100}{47{\cdot}5}$.

At the end of a number of experiments the alcohol was removed by distillation, and the yield so obtained compared with that calculated from the attenuation. The distillations were conducted with great care, a long fractionating column being used. According to Pasteur, 100 grms. of reducing sugar produce on fermentation 48·47 grms. alcohol, and as each solution of 500 c.c. contained 50 grms. of sugar, calculated as reducing sugars, the maximum yield of alcohol obtainable was 24·235 grms. The following table gives a comparison of some of the yields of alcohol actually obtained by distillation, with the yields calculated from the attenuation figures:—

Material fermented.	Attenuation obtained.	Percentage yield calculated from attenuation.	Alcohol produced.	Percentage yield calculated from alcohol produced.
			grms.	
Saccharose	43·0	90·5	22·01	90·8
Molasses	39·3	82·7	19·90	82·1
Molasses	39·3	82·7	19·81	81·75

In the case of the cane sugar the yield actually obtained was slightly above, while with molasses it was somewhat below that calculated from attenuation, and this was observed in other cases; but by adding 0·5 per cent. to the yield calculated in the case of the saccharose solutions and by subtracting 0·5 per cent. in the case of the molasses, figures were obtained which were in good agreement with the percentage yields of alcohol obtainable by actual distillation. Accordingly in calculating the yields from the attenuation figures these corrections were applied.

Fermentation of the molasses.—As the total sugar by analysis in the molasses was 52·94 per cent., each solution for fermentation (500 c.c.) contained 94·65 grms. of molasses. When the molasses was fermented in simple aqueous solution, without any previous treatment, the attenuation obtained was 38·3, corresponding to a yield of 80·1 per cent. by calculation. The yield of alcohol was not increased to a material extent by boiling the solution to sterilise it, nor by adding sulphuric acid before fermentation. The addition of Pasteur's mineral nutrient increased the attenuation to 39·3, corresponding to a calculated yield of 82·2 per cent. In a few experiments the sugar in the molasses solutions was completely inverted by treating with excess of sulphuric acid (16 grms. per 500 c.c.) at 70° C. After this treatment the acid was nearly neutralised with sodium carbonate, mineral nutrient matter was added, and the solution fermented. Although no sugar was destroyed during inversion the yield of alcohol was very little increased—attenuation 39·5. In all cases in which the molasses was fermented the fermentation was vigorous.

Although treatment with sulphuric acid may improve the yield from beet molasses, it was of very little value here, and consequently the explanation given by Bau to account for the difficulty of fermenting beet molasses cannot be applied to the cane molasses under consideration. Further, as after the acid treatment all the sugar was present as reducing sugar, the low yield obtained under ordinary circumstances cannot be due to incomplete inversion of the saccharose, as has been asserted. The maximum attenuation obtained, viz., 39·5, corresponded to a percentage yield of 82·7, so that even under the best conditions the yield of alcohol was very low.

To whatever [illegible] the molasses solutions were subjected before fermentation there was always a small quantity of some substance present in the spent wash which reduced Fehling's solution. The quantity of this, although small, was constant, and amounted to about 2·46 per cent. on the weight of molasses taken. In calculating the possible yield of alcohol obtainable from a given molasses it is always taken that the reducing sugars given by analysis are completely fermentable; but if we assume that the substance left in the spent wash, which reduces Fehling's solution, is present in the original molasses and is not formed during the fermentation, a correction must be applied to the analysis figures if we wish to know the amount of fermentable reducing sugar. Thus, in the molasses under consideration, of the 9·26 per cent. of reducing bodies present, only 6·80 can be considered as fermentable sugars; the total sugar calculated as reducing sugar falls to (52·94—2·46) = 50·48 per cent., and the percentage yield of alcohol obtainable becomes $\frac{50{\cdot}48 \times 100}{52{\cdot}94} = 95{\cdot}3$ per cent. of that originally calculated as the maximum possible.

The yield of alcohol of 82·7 per cent. actually obtained was calculated on the basis of 52·94 per cent. of fermentable sugar, but this is still considerably less than 95·3 per cent., and if, after making the allowance for the reducing substance in the spent wash, the figures of analysis for saccharose and fermentable reducing sugars are correct, then the low yield of alcohol can only be explained by the harmful effect on the fermentation of bodies either present in the original molasses or produced during the course of the fermentation.

Defecation of the molasses before fermentation.—A few preliminary experiments were made in order to determine the effect of removing organic matter by means of lead salts. To solutions of molasses, not too concentrated, basic lead acetate was added to precipitate organic matter. After filtering off the precipitate, the excess of lead was removed by sulphuretted hydrogen, and after boiling to remove this gas, the solutions were made nearly neutral and were fermented. Before fermentation a sample was taken for the determination of saccharose and reducing sugars present, and the percentage yield of alcohol was calculated from these figures. Although the solutions fermented rapidly the yield of alcohol was not improved. To avoid the accumulation of acetic acid in the solution, resulting from the employment of basic lead acetate, normal lead nitrate and lime were also used to precipitate the organic matter, but the yield of alcohol was not raised.

Fermentation of saccharose in pure nutrient solutions and in solutions of spent wash.—To determine with more certainty whether or not the presence of the non-sugar bodies in the molasses exerts a deterrent effect on the fermentation, as is constantly asserted, experiments were made in which saccharose was fermented in solutions of spent wash. For purposes of comparison cane sugar was also fermented in pure nutrient solutions under similar conditions. In these latter cases the solutions contained 47·5 grms. of pure cane sugar, equal to 50 grms. of reducing sugars in each 500 c.c., and in addition the nutrient materials necessary for the growth of the yeast cells. Pasteur's nutrient mixture was found the best of several tried, but when used by itself the fermentation of the cane sugar took several days to complete, while in the case of a molasses solution, or of a solution of cane sugar in spent wash, the fermentation was always finished in 48 hours. However, by the addition to every solution of 2 grms. of a nitrogenous yeast food sold under the name of "levurogene," which itself contained no fermentable material, the time taken over the fermentation was reduced to two or three days.

The fermentation of saccharose in the pure nutrient solutions did not proceed so regularly as was expected. In many cases the attenuation reached the figure 45·5, corresponding to a yield of alcohol of 96·3 per cent.; a considerable number varied between 45 and 45·5, but sometimes with poor fermentations the attenuation was as low as 43. The principal aim, however, was not to obtain a theoretical yield of alcohol, but to find out how much alcohol was produced when cane sugar was fermented under conditions approaching as closely as possible to [illegible] during the manufacture of fermentation [illegible]. The experiments showed that under these conditions from a definite weight of cane sugar the alcohol obtained was about 96 per cent. of the quantity obtained by Pasteur.

In the case of the fermentation of cane sugar in solutions of spent wash, the solutions were prepared by evaporating the alcohol from solutions of molasses which had been completely fermented, care being taken that the solutions were not being too strongly heated. In many cases the solutions had been allowed to stand several days after all fermentation was finished before the alcohol was removed. 47·5 grms. of saccharose were then dissolved in the solution, nutrient matter and yeast added, and the volume made up to 500 c.c. In this way a known amount of sugar was fermented in the presence of all the non-sugar bodies contained in the molasses, with the exception perhaps of the most volatile organic acids. The quantity of these removed could only have been very small, as the acidity of the solution of spent wash did not alter to any extent during the removal of the alcohol. Many experiments were made; the fermentation was always more vigorous and the results obtained more regular than with saccharose in nutrient solutions. The addition of Pasteur's nutrient improved the yield slightly, but no gain resulted from the addition of "levurogene," as the spent wash itself contained sufficient nitrogenous food for the growth of the yeast cells.

The experiments proved conclusively that the yield of alcohol obtained is just as large when saccharose is fermented in solutions of spent wash as when fermented in pure nutrient solutions, and that, consequently, *the non-sugar bodies present in the spent wash exercise no harmful influence on the fermentation.*

In some cases the attenuation was as low as 43 or 44, but in most it varied from 45 to 45·5. In one or two cases the calculated figures were checked by actual distillation of the alcohol, when it was found, as for saccharose in nutrient solution, that the yield by distillation was slightly higher than the calculated. A yield of at least 96 per cent. of the maximum (taking Pasteur's figures) was obtained.

These results gave rise to a strong belief that the low yields obtained in the case of the molasses were due to the fact that the percentage of sugars present in the molasses is much less than that shown by analysis. It might be said, however, that in the case of molasses, the bodies originally present, whatever they may be, which exercise a harmful influence on the fermentation, are themselves altered during the course of the fermentation, and that consequently, although pure sugar gives a theoretical yield of alcohol when fermented in spent wash, it might not do so if fermented in the original molasses.

Experiments already described had shown that a solution containing 47·5 grms. of cane sugar in 500 c.c. gave an attenuation of 45·5, and one containing 94·45 grms. of molasses, in 500 c.c. an attenuation of 39·5. Hence, if the fermentation of saccharose proceeds as well in molasses solutions as in pure nutrient solutions, 28·75 grms. of cane sugar and 37·22 grms. of molasses in 500 c.c. should give an attenuation of 41·5.

The average figure for seven separate determinations was 41·3, giving further evidence that on fermentation the sugar in a molasses solution is completely converted into alcohol.

Assuming that this is the case, the amount of fermentable sugar present can be calculated. On the basis of 52·94 per cent. of fermentable reducing sugar, it was found that the best results obtained from the fermentation of the molasses gave a yield of 82·7 per cent. of alcohol; when pure saccharose was fermented in spent wash under similar conditions the yield of alcohol was 96 per cent., or, in other words, only a small proportion of the sugar was not converted into alcohol. Assuming that this slight loss of sugar takes place also in the case of the molasses, we may consider that

$$\frac{82{\cdot}7 \times 100 \times 52{\cdot}94}{96} = 45{\cdot}63$$

is the percentage of fermentable sugar, in terms of

reducing sugar, present in the molasses. This quantity is 39·2 per cent. by the methods given by analysis.

Determination of carbon dioxide as dioxide on fermentation of the molasses.—In order to determine whether the fermentation of the molasses was normal, the ratio of the carbon dioxide to alcohol was obtained. The ratio was also determined for pure nutrient solutions of saccharose.

The solutions for fermentation were prepared as previously described, and out of each 500 c.c., 50 c.c. were removed for the estimation of the carbon dioxide. The remainder, to act as a check, was placed in a bottle and fermented under the same conditions as the smaller quantity. The 50 c.c. were placed in a small flask, which was immersed in water kept at 31° C. The carbon dioxide was estimated from the loss of weight sustained by the flask and attached drying apparatus. In the first experiments on molasses and saccharose, the gas which escaped was absorbed in potash bulbs to ensure that the loss was due to carbon dioxide, but this precaution was found unnecessary. A current of dry air removed the last of the carbon dioxide from the apparatus.

Results.

Material.	Attenuation.	Grms. carb. diox.	Grms. alcohol.	Ratio alcohol : carb. diox.
Saccharose ..	44·0	2·325	2·257	0·971
" ..	45·5	2·34	2·336	0·998
Molasses	39·3	2·02	1·993	0·986
"	39·3	2·00	1·993	0·996

Each 50 c.c. of solution contained 5 grms. of sugar, in terms of reducing sugar, it being understood that in the case of molasses the solutions were always made up on the assumption that the analysis figures were correct, and that the content of the molasses in fermentable sugar was 52·94 per cent. Pasteur gives for the fermentation of 5 grms. of reducing sugar, carbon dioxide, 2·338 grms., alcohol, 2·424 grms.; ratio, carbon dioxide: alcohol = 1:1·037.

The fermentations of the nutrient saccharose solutions were never so good as those obtained by Pasteur, hence the ratios of carbon dioxide to alcohol were lower. It is interesting to note, however, that the ratios with molasses were quite as high as those obtained from the nutrient saccharose solutions.

Inversion of sugar in molasses by means of invertase.—Although all the evidence derived from the fermentation experiments seemed to indicate the presence of less sugar than was given by analysis, the quantity of reducing bodies produced by inversion with acids supported the analysis figures. Consequently it was of importance to determine, if possible, the amount of reducing bodies produced in molasses by the action of invertase.

The invertase was prepared by mixing a weighed quantity of fresh yeast with water, and keeping it at a temperature of 60° C. for some time. The solutions for inversion were made so as to contain 10 grms. of sugar calculated as reducing sugar per 100 c.c., and generally 200 c.c. were inverted in each experiment. The temperature of inversion was between 55° C. and 60° C. Saccharose either in aqueous solution or dissolved in spent wash was inverted rapidly and completely.

Turning now to molasses, the action of invertase was found to be much slower. In solutions of saccharose in spent wash 98 per cent. of the sugar added was inverted in 24 hours, while 48 hours were required for the maximum inversion in molasses. If the figures of analysis for saccharose and reducing sugars are correct, there should have been present, after inversion with invertase, 10 grms. of reducing sugars in each 100 c.c. of solution, but the quantity obtained actually was only 86 to 87 per cent. of this.

Now it has already been shown that the quantity of alcohol obtained on the fermentation of the molasses accounts for about 86 per cent. of the sugar indicated by analysis, and this quantity should all be present after inversion with invertase; but to this must be added the unfermentable reducing substance found in the spent wash after fermentation of a molasses solution, which of course does not contribute to the production of alcohol, but is present in the solution. Its amount was found to be 2·46 per cent., calculated on the molasses, or 4·65 per cent. of the total sugar, in terms of reducing sugar. Hence, after inversion with invertase, at least 91 per cent. of the sugar indicated by analysis would be expected. The amount found in the experiments was not more than 86 to 87 per cent. But when the solutions, after inversion with invertase, were fermented, the yield of alcohol obtained was some 2 or 3 per cent. lower than usual, so that evidently a little fermentable sugar had been destroyed during the prolonged inversion. The amount of the loss was easily calculated by subsequent fermentation, and allowing for it, the total quantity of reducing bodies after inversion was found to be about 90 per cent. (9 grms. per 100 c.c.) of that indicated by the analysis. Of this 4·65 per cent. is unfermentable, and the quantity of fermentable sugar in the molasses, in terms of reducing sugar, becomes 45·18 per cent. The figure obtained before from consideration of the alcohol produced from the molasses was 45·68 per cent., and although both these figures are only approximations, the agreement between them made it clear that when the molasses was treated with invertase just that quantity of reducing sugar was formed which was necessary to produce the quantity of alcohol obtained when the molasses was fermented. Consequently a considerable portion of what analysis indicated as saccharose was not inverted by invertase, and was in reality not that substance.

Although the action of invertase on molasses took a longer time than when cane sugar was inverted in a solution of spent wash, the results obtained were fairly concordant. This was also found in the case of another molasses treated in a similar way, though with one particular sample no results of value could be obtained, as the action of invertase speedily came to an end, there being evidently something present which inhibited the action of the enzyme. The experiments with invertase confirmed in a striking manner the results obtained earlier in the investigation, and left no room for doubt that the analysis figure for saccharose was considerably too high.

The quantity of reducing bodies produced by the action of acids was very much greater than by that of invertase, but on subsequent fermentation the yield of alcohol—allowing for the slight destruction of fermentable sugar during inversion with invertase—was no greater. Hence the reducing bodies produced by acids and not by invertase were not fermentable sugars, and were therefore not derived from saccharose.

H. and L. Pellet, in the paper referred to above, laid great stress on the close agreement of the figures for saccharose in cane molasses obtained by the Clerget method and by calculation from the reducing bodies present before and after inversion with acids. Thus for the molasses under consideration, we have:

Saccharose (Clerget).	Reducing bodies after inversion.	Reducing bodies before inversion.	Difference.	Saccharose calculated.
41·52	55·12	9·26	45·86	45·67

The authors mentioned obtained a much closer agreement for the molasses examined by them, and they regard it as a complete confirmation of the accuracy of Clerget's process, but since a considerable proportion of the reducing bodies obtained by inversion with acids are not fermentable sugars, no figure for saccharose of any value can be deduced from them.

The conclusion of the investigation was, therefore, that the possible yield of alcohol from cane molasses indicated by analysis is considerably higher than that which can be obtained by fermentation, and that this is due to the fact that the analytical figures overstate the amount of fermentable sugars actually present.

By making use of the figures obtained in some of the experiments it becomes possible to apply a correction

to the ordinary analysis. Thus for the molasses under consideration, the quantity of fermentable reducing sugar being 6·80 instead of 9·26, the figure for saccharose can be obtained by first subtracting this from the total fermentable sugar, expressed in terms of reducing sugar. For this two figures were arrived at, viz., 45·63 and 45·18. Taking the mean of these, viz., 45·41, and subtracting 6·80, we obtain 38·61 as the figure for saccharose expressed in terms of reducing sugars. Whence saccharose itself, $\frac{38{\cdot}61 \times 95}{100} = 36{\cdot}68$ per cent.

On making these corrections we have—

	Original analysis.	Corrected analysis.
Saccharose	41·52 ..	36·68
Sugars reducing	9·26 ..	6·80
Other organic matter ..	11·66 ..	18·96
Ash	11·50 ..	11·50
Water	26·06 ..	26·06
	100·00 ..	100·00
Total sugar as reducing sugar	52·94 ..	45·41

If we call the possible yield of alcohol calculated from the total sugar in the original molasses 100, then the yield possible from the corrected analysis is only 85·8.

One of the most interesting but puzzling questions in connection with the investigation related to the manner in which the character of the unfermentable bodies, appearing as saccharose in the original analysis, changes during the course of the fermentation. If these bodies did not alter they could be estimated in the spent wash after fermentation, and there would be no difficulty in accounting for the low production of alcohol from the molasses. But the fact that only a small quantity of reducing bodies is found in the spent wash even on inversion of this with acids makes it appear as if a loss of sugar actually took place.

When measured quantities of liquid were removed from a solution of molasses at different stages of the fermentation, and were treated with acid, and the reducing bodies so produced estimated, it was found that they diminished rapidly during the earlier stages of the fermentation.

Thus:—

Attenuation.	Reducing bodies (expressed in terms of reducing sugars) grms. per 100 c.c.
0·0	10·3
0·5	9·5
2·5	8·62
5·5	8·28
Fermentation complete ..	0·7

Hence when alcoholic fermentation had only just started (atten. 0·5) the quantity of reducing bodies which could be produced by inversion with acids had already become very considerably diminished and was very little in excess of the quantity (9·0 grms.) produced by treating the molasses with invertase.

A similar observation was made in the experiments with invertase. When inversion with invertase was complete an estimation of the reducing bodies produced by inversion with acids, including those already produced by invertase, showed that the quantity of these was not much in excess of these latter, whereas before the action of the invertase the quantity of reducing bodies produced by the acid treatment was much greater. Thus if we call the quantity of reducing bodies produced from a given weight of molasses by the action of acids 10·3 and the quantity by invertase 8·7 grms., then after inversion with invertase further treatment with acids produced a total quantity of only 9·0 grms., showing that a considerable change in the character of the bodies invertable by acids and not by invertase had taken place. This was quite apart from any loss of fermentable sugar during the inversion, which loss, as proved by subsequent fermentation, was very small. Besides, if it had been fermentable sugar which was disappearing, owing to any bacterial action, the loss should have increased with the time, but it did not. Sufficient evidence has already been given that the loss of fermentable sugar due to bacterial action during the fermentation of the molasses would only have been very small, since even prolonged treatment with sulphuric acid failed to materially raise the yield, and further, if bacteria were present we should expect the wash to become acid. Under ordinary circumstances, however, the increase of acidity in the solutions during fermentation is slight.

It appears probable that the bodies, whatever they may be, which appear as saccharose in the analysis and which are inverted by acids but not by invertase, are decomposed by some enzyme in the yeast during the earlier stages of fermentation.

Discussion.

Mr. J. A. Schofield asked if the ordinary methods of analysis when applied to beet molasses also gave high results. It was rather strange that the sugar that seemed to disappear should not only have the rotatory power of saccharose, but should also yield bodies with the same reducing power as invert sugar.

Dr. R. Greig-Smith suggested that the apparent loss of sugars might arise from these particular bodies being readily decomposable, and thus supplying cell material for the growing yeast. During his researches on vegetable gums he had found some bodies that yielded, on hydrolysis, reducing substances that were not sugars capable of forming ordinary osazones, for the compounds melted at too low a temperature, and yielded tarry bodies with acetic acid. Possibly some similar substance might be present in molasses. With regard to sugar in molasses fermenting more quickly than pure sugar aided by Pasteur's nutrient, he thought this was due to the high proportion of salts present. He deprecated the assumption that some "enzyme" had been acting, when as a matter of fact the nature of the change was simply unknown.

Dr. Harker, in reply to Mr. Schofield, said that in beet molasses reducing sugars were absent, and raffinose was the only substance known to be present that made a correction necessary in the polariscopic reading. With regard to Dr. Greig-Smith's remarks, he thought the disappearance of the apparent saccharose was too rapid to be explained as due to its being used as food for yeast cells. He was of opinion that the rapidity of fermentation in molasses was due to the large proportion of nitrogenous yeast foods, rather than to the salts.

Yorkshire Section.

Meeting held at the University, Leeds, on Monday, June 18th, 1906.

PROF. A. G. GREEN IN THE CHAIR.

DETERMINATION OF MINERAL ACIDS IN VINEGAR.

BY F. W. RICHARDSON AND J. LEONARD BOWEN.

There are upon the market at the present time vinegars which in outward appearance resemble malt vinegar, but which are really fabricated articles, and consist of mixtures of acetic acid, burnt sugar, some little salt and more or less malt vinegar with water. As long as these are not sold as malt vinegar and do not contain objectionable substances such as free mineral acids, the law cannot prevent their sale. It is another matter when the article sold is described as malt vinegar. As genuine malt vinegars vary considerably in their composition, the amounts of nitrogen and phosphorus being an exception, it is not easy to fix a standard, and, probably no two analysts would agree as to what malt

vinegar should be. To make a really satisfactory analysis of a vinegar—to ascertain whether it has been produced largely by the assistance of surrogates, or whether it is a pure article—a very full analysis is required. We do not suppose that there would be any injury to health from using vinegar containing 0·1 per cent. of sulphuric acid; but some limit must be established, and if it is clearly proved that the addition of any quantity, however small, of sulphuric acid is really not necessary, the exclusion of mineral acids is undoubtedly advisable.

The estimation of mineral acids in vinegar is not easy. With the exception of Hehner's original method, the published processes are all, in our opinion, unreliable. In König's recent work ("Die Untersuchung der landwirtschaftlich und gewerblich wichtigen Stoffe," page 702) are several references to this question, and we do not hesitate to affirm that not one of the methods cited is capable of giving even reasonably approximate results. In the *Analyst* for August, 1903, is a paper by Schidrowitz upon the detection and estimation of mineral acid in acetic acid and vinegar. The method is based upon the supposition that the addition of ethyl alcohol to a solution of acetic acid entirely prevents the reaction of the latter with the indicator. We were quite unable to make anything like an accurate estimation of free sulphuric acid when this was mixed with pure acetic acid and water. We used a white vinegar which we made to contain 5 per cent. of acetic acid and 0·1 per cent. of sulphuric acid. As the following table shows, we could get any results we wished for by varying the amounts of alcohol and vinegar. A very pure methyl orange was used as indicator, and 25 c.c. of the vinegar were taken in each experiment:—

	92 per cent. alcohol.	Ratio of vinegar to alcohol.	*N*/10 sodium hydroxide.
	c.c.		c.c.
1	15	1 to 0·6	10·0
2	20	1 ,, 0·8	5·0
3	25	1 ,, 1·0	3·0
4	30	1 ,, 1·2	2·5
5	50	1 ,, 2·0	nil.

Schidrowitz says, "The best results are obtained by adding an equal volume of alcohol to the solution to be titrated, and subsequently 1 c.c. of alcohol for every 3 c.c. of deci-normal alkali run in."

Had the end reactions been other than hopelessly indefinite, we should have found, according to our third result, about two-thirds of the actual amount of sulphuric acid present.

It is obvious that a method which depends upon the exact adjustment of the amounts of an adjunct to attain an end reaction, which at the best is indefinite, is scarcely suited to the requirements of a busy analyst. The complete suppression of all acidity by the addition of a further amount of alcohol shows how very dubious the results obtained by such a method must be.

From a large number of experiments we are of opinion that even such a good process as that suggested by Hehner and described in the first volume of the *Analyst*—the method which is taken as the standard—when wrongly applied, may miss free mineral acids in vinegars. In general the Hehner method consists in adding standard alkali to some of the vinegar, evaporating to dryness, reducing the residue to ash at a low temperature, treating the ash with a measured quantity of deci-normal sulphuric acid (which must be in excess of the original alkali used) and noting the loss of acidity, which represents an equivalent amount of alkali neutralised by the free mineral acids in the vinegar. When acetate of soda or potash, which would be formed when standard alkalis are added in sufficient quantities to vinegar, are incinerated, they produce alkali in quantity corresponding to the alkali used, so that the acetic acid does not interfere with the process.

As a number of chemists find the present Hehner method is not properly given, and the reader is advised to simply ascertain the alkalinity of the ash after evaporation with a measured quantity of standard alkali. Here a serious error may arise on account of the conversion of calcium salts such as the malate into the carbonate. When the ash is treated with an excess of decinormal sulphuric acid, as Hehner directs, of course the carbonate of the lime exerts its alkaline effect, and the mistake does not occur.

The ash of a genuine malt vinegar consists to the extent of more than half its weight of potassium phosphate; but it is wrong to say that the ash of malt vinegar contains free phosphoric acid. The fact of the presence of so much phosphate of potash in vinegar when made largely from malt should be taken into consideration, lest complications occur interfering with the accuracy of any process devised for the purpose of estimating free mineral acids, as it is well known that should any of the phosphoric acid become liberated during the carrying out of the method, it reacts with standard soda or potash with methyl orange as indicator in a very different way to ordinary mineral acids.

Thomson has demonstrated that when normal potash is added to a solution of phosphoric acid the pink colour of methyl orange is discharged when dihydrogen potassium phosphate is formed, so that one only really obtains one-third of the actual amount of phosphoric acid in the titration with methyl orange. It is also to be noted that when phenolphthalein is used the end reaction occurs when dipotassium hydrogen phosphate is produced. We simply instance these particulars because they show that it is not so easy to estimate the absolute amount of free sulphuric acid which may have been actually added to a vinegar; thus, if any alkaline acetate were present, as well as free sulphuric acid, and the Hehner process were applied, to the extent of the percentage of acetate present there would be a corresponding disappearance of free sulphuric acid in the analytical result.

It may be said that this would be a rather desirable feature, as sulphuric acid would really decompose the sodium acetate with the production of acetic acid and the formation of sodium sulphate, and no longer be present as free acid; still, there are no facts to show that, when sulphuric acid is present to the extent of only one in a thousand, it really does decompose any small amounts of alkaline acetate in the cold, although on boiling to dryness and incineration such decomposition does occur.

One would like to know whether in the human organism the sulphuric acid in such cases does really act as such, despite the presence of the acetate. That the ash of vinegar really does contain normal potassium phosphate is sufficiently evident from such an experiment as the following: 100 c.c. of a pure malt vinegar gave an ash—obtained by charring—the soluble constituents of which showed an alkalinity equal to 5·2 c.c. of *N*/10 sulphuric acid, to methyl orange, followed by an acidity equal to exactly half this amount—*viz.*, 2·6 c.c.—to phenolphthalein.

On the average, a good malt vinegar will contain 0·2 per cent. of mineral matters expressed as "ash," and our analyses show that 0·16 of this will consist of potassium phosphate (with a little sodium phosphate) and 0·025 per cent. of calcium phosphate.

In the estimation of free mineral acids, *e.g.*, sulphuric acid, what error would be introduced by these quantities of phosphates? (1) In the presence of methyl orange, and when the neutralisation point has been reached, sulphuric acid reacts with potassium phosphate as follows:—

$$K_3PO_4 + H_2SO_4 = K_2SO_4 + KH_2PO_4.$$

1 c.c. of *N*/10 sulphuric acid is equivalent to 0·01062 grm. of tripotassium phosphate. Therefore 100 c.c. of the vinegar would contain sufficient phosphate to account for 15·06 c.c. of *N*/10 sulphuric acid, whence 15·06 × 0·0049 = 0·0738 per cent. = 1 part of sulphuric acid in 1356 parts of vinegar is masked by the phosphate of potassium.

(2) 0·025 per cent. of calcium phosphate would produce the following somewhat complex change when estimated by the full Hehner process:—

The sodium hydroxide becomes inactive in the incineration process and reacts with the calcium phosphate, calcium [illegible]

by sulphuric acid, with formation of sodium dihydrogen phosphate. The calcium carbonate formed neutralises exactly as much sulphuric acid as the equivalent amount of soda which has helped to produce it; therefore, the sodium phosphate formed exerts extra alkaline, i.e., acid-masking action, and 1 c.c. of $N/10$ sulphuric acid = 0·008207 grm. trisodium phosphate. Also 0·025 grm. tricalcium phosphate = 0·02644 grm. trisodium phosphate = 3·22 c.c. $N/10$ sulphuric acid = 0·0158 grm. of sulphuric acid for tricalcium phosphate in ash, 0·0738 grm. of sulphuric acid for tripotassium phosphate in ash, making a total of 0·0896 grm. of sulphuric acid, i.e., a combined obscuration of one part of free sulphuric acid in 1116 parts of the vinegar. It is therefore obvious that if we wish to estimate the actual amount of free mineral acid added to a vinegar, we shall require to know the amount of phosphoric acid present in a combined state in the vinegar itself. If we assume all the phosphoric acid to be present as potassium phosphate, and introduce the calculation given above, only a very slight error can arise.

As an illustration, we give the results of an analysis of a genuine malt vinegar. We made one portion to contain 0·098 per cent. and another 0·049 per cent. of sulphuric acid, and we also submitted the untreated vinegar to the same process as the acidified samples.

In each case, 25 c.c. of vinegar were mixed with 25 c.c. of $N/10$ sodium hydroxide, and the solution was evaporated to dryness, and the residue heated over a low Bunsen flame to produce a thoroughly charred mass. The heat used must not be sufficient to cause fusion. The black ash is cooled and treated with 5 c.c. of neutralised peroxide of hydrogen, as we find this absolutely necessary to prevent the liberation of hydrogen sulphide, which would interfere with the accuracy of the result. Then 50 c.c. of $N/10$ sulphuric acid are added, and the mixture boiled. After filtration and thorough washing of the carbonised mass, the filtrate is coloured with methyl orange or lacmoid, and made neutral to $N/10$ sodium hydroxide, the number of c.c. being noted. We acidify with a few drops of $N/10$ sulphuric acid and boil for five minutes to remove all carbon dioxide. After neutralisation by $N/10$ sodium hydroxide, phenolphthalein is added and the acidity to $N/10$ sodium hydroxide determined. We give an example of the method of calculation.

After carrying through the first part of the above process, 26·1 c.c. of $N/10$ sodium hydroxide were required to make neutral to lacmoid. After expelling carbon dioxide, the solution was treated with phenolphthalein, and then required 2·0 c.c. of $N/10$ sodium hydroxide. The first part, that is, the part previous to the addition of phenolphthalein, and with the exception of our improvement in regard to hydrogen peroxide, is virtually the Hehner method.

25 c.c. of $N/10$ sodium hydroxide were added to the vinegar, and 26·1 c.c. were required to neutralise the filtrate, giving a total of 51·1 c.c. of alkali; 50 c.c. of $N/10$ acid was added to the ash, thus the excess of alkali was 1·1 c.c. 1·1 c.c. $\times$ 4 $\times$ 0·0049 = +0·0216 per cent. free sulphuric acid by the Hehner method. Our method carries the results and calculation further. We have an excess of decinormal alkali of 1·1 c.c., but we must add twice the number of c.c. of alkali required after adding the phenolphthalein, and the result will therefore be—

	+1·1 $N/10$ alkali by Hehner method	
2·0 c.c. $N/10$ alkali $\times$ 2 + 4·0	„ „ R. & B.	„
Total ..	+5·1 „ „	in 25 c.c. vinegar

neutralised by mineral acid; therefore = 0·0999 per cent. sulphuric acid, instead of 0·0980 per cent. actually present. Error +0·0019 per cent.

Tabulated, the results appear as follows:—

Actual per cent. of sulphuric acid added.	With methyl orange.		With lacmoid.	
	Hehner method.	R. and B.	Hehner method.	R. and B.
A 0·098	+ 0·033	+ 0·099	+ 0·0216	+ 0·0999
B 0·049	— 0·033	+ 0·064	—0·0450	+ 0·0450
C nil.	— 0·080	+ 0·023	—0·0980	+ 0·0040

Here it is obvious that by the Hehner method as much as 0·065 or 1 part of sulphuric acid in 1540 of vinegar would be entirely obscured, while by our method the total amount of acid originally added is estimated. Of course it may be said that the analyst is only asked to determine the amount of free sulphuric acid actually present, and that our method does not do this. We are of opinion that this contention has to be proved. The mere fact that the sulphuric acid does not appear as such in the residue does not for a moment show that it is not present in a free condition in the original vinegar; in any case the sulphuric acid, if it does act at all upon the potassium phosphate, liberates an equivalent quantity of phosphoric acid, which in itself is a mineral acid, and its presence as such in vinegar is no more to be tolerated than sulphuric acid. It is certainly advisable that a process should exist which will enable one to ascertain the actual amount of free mineral acid which has been deliberately added to a vinegar by the manufacturer, and we claim that our method enables us to do this. On the whole we are inclined to the contention that lacmoid is a more valuable indicator than methyl orange where great accuracy is required. As is well known, carbon dioxide does exert some influence upon methyl orange, but with lacmoid the carbonic acid is always expelled by boiling, and it is possible to ascertain the end reaction to a single drop of deci-normal acid. The results with lacmoid are more reliable than those with methyl orange, the latter results tending to be somewhat too high, and we think that this is due to the action of the carbon dioxide.

ERRATUM.

This J., 1906, p. 784, col. 2, line 39, *for* "(1851-2)" *read* (1852-3).

Journal and Patent Literature.

I.—PLANT, APPARATUS, & MACHINERY.

(*Continued from page* 802.)

Electric vacuum furnace; The ——. W. C. Arsem. XIB., page 854.

ENGLISH PATENTS.

Gases or vapours; Apparatus for subjecting —— to the action of liquids. J. Y. Johnson, London. From W. Feld, Hüningen on Rhine, Germany. Eng. Pat. 11,296, May 22, 1906.

Ger. Pat. 160,378 of 1903; this J., 1906, 485.—T. F. B.

Gas mixtures for turbines or other engines driven by combustion gases or a mixture of combustion gases and other gases; Improved method of, and means or apparatus for producing ——. A. Greenwood and K. Andersson. Eng. Pat. 14,641 of 1905. II., page 841.

Separating matters in suspension from liquids; Apparatus for ——. C. Hannig, Frankenstein, Germany. Eng. Pat. 15,514, July 26, 1905.

Ger. Pat. 156,322 of 1905; this J., 1905, 1202.—T. F. B.

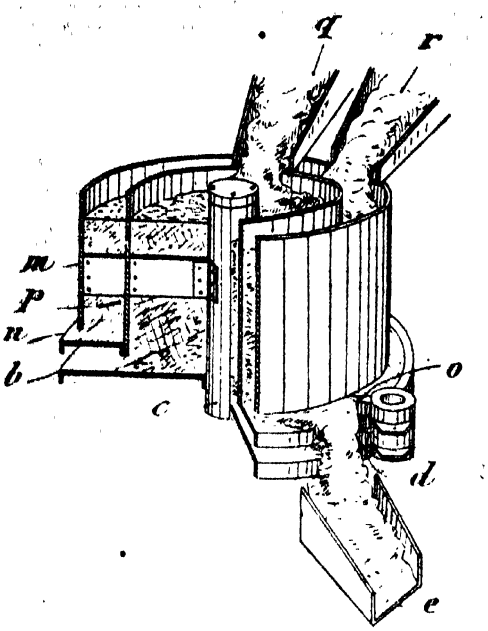
Drying chambers or ovens. A. Schröder, Berlin. Eng. Pat. 17,451, Aug. 29, 1905. Under Int. Conv., Aug. 30, 1904.

Ger. Pat. 157,760 of 1905; this J., 1906, 113.—T. F. B.

Mixing liquids in definite proportions; Device for ——. H. Schumacher, Cologne, Germany. Eng. Pat. 20,144, Oct. 8, 1905.

See Fr. Pat. 357,963 of 1905; this J., 1906, 113.—W.H.C.

Delivering materials in proportional mixtures; Apparatus for ——. H. H. Lake, London. From E. N. Trump, Syracuse, New York. Eng. Pat. 703, Jan. 10, 1906.



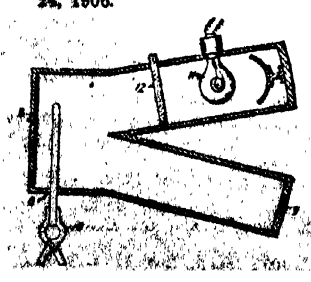
A HORIZONTAL plate, *b*, is attached to the shaft, *c*, a short distance below the lower edge of the bottomless cylinder, *p*, to the lower edge of which is attached another plate, *n*, and another cylinder, *m*. The materials to be mixed are fed into the cylinders, *m* and *p*, by the shoots, *q* and *r*, pass through the bottom openings on to the plates, *n* and *b*, and are spread out by the rotatory motion imparted to the plates by the shaft, *c*. By setting the arms, *o* and *d*, any desired proportion of the materials are swept off the plates into the shoot, *e*.—W. H. C.

Sugar and similar materials; Centrifugal machines for clarifying and washing ——. C. Schüler. Eng. Pat. 10,278, 1906. XVI., page 859.

Filtering and washing apparatus, more particularly for use in brewing. A. Jacobs, and L. Desenfans. Eng. Pat. 19,730, 1905. XVII., page 861.

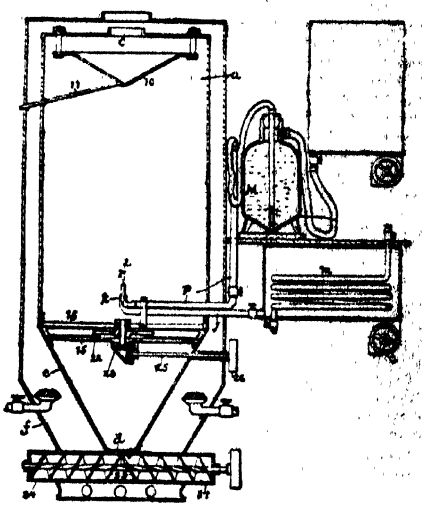
UNITED STATES PATENTS.

Temperatures; Method and apparatus for gauging ——. F. L. Morse, Trumansburg, N.Y., Assignor to H. H. Westinghouse. New York. U.S. Pat. 826,594, July 24, 1906.



A neutral-tinted screen, 5, is illuminated with light of any desired tint, and the body, 10, the temperature of which is to be judged, is inserted through the aperture, 8, and viewed through the eye-opening, 9. Light from the lamp, 11, is directed by the mirror upon the neutral-tinted screen, 5, and is tinted to the desired colour by being passed through the colour screen, 12. The latter consists of a simple or multiple glass cell with parallel faces, and is filled with a suitable coloured liquid. On looking through the opening, 9, it is possible to judge when the object has the same tint as the illuminated screen.—W. H. C.

Desiccating or evaporating apparatus. W. E. Jaques, Grand Rapids, Mich., Assignor to International Desiccating Co., Chicago, Ill. U.S. Pat. 827,183, July 31, 1906.



A CYLINDRICAL drying chamber, *a*, having a conical bottom, *e*, is surrounded by a heating jacket, *f*, and has a vapour escape-opening, *c*, in the top, underneath which is arranged an open-topped deflecting cone, 10, provided with a drain pipe, 11. The liquid to be evaporated is forced, under pressure, from the reservoir, M, through the pipe, *p*, out of the nozzle, r^2, in an upward direction, and is heated and sprayed by a jet of air, heated by being passed through the coil, *m*, and which issues from the nozzle, *k*, and strikes against the jet of liquid from r^2, at an angle. The liquid is evaporated in the chamber, and the vapour escapes through the top opening, *c*, whilst the solid particles, being deflected by the cone, 10, fall back into the chamber, their descent being retarded by the action of the fan, 22, carried on the cross-bars, 16, and driven by the mechanism, 23, 25, 26. The dried solids pass out of the chamber by the opening, *d*, into the right- and left-handed screw-conveyor, 33, 34.—W. H. C.

Desiccating apparatus. J. C. McLachlan, Chicago, Ill. U.S. Pat. 827,172, July 31, 1906.

IN order to obtain the solid matter of a solution in the form of a dry powder, the liquid is sprayed from an atomising jet by the aid of heated, compressed air, into a tall chamber. The latter is open at the top to allow the escape of the vaporised liquid, and is surrounded by a heating jacket. It is of such a height that the solid particles which fall to the bottom, are removed from the influence of the vapour of the liquid during the latter part of their descent.—W. H. C.

Filter; Centrifugal ——. T. S. Patterson, New York. U.S. Pat. 827,265, July 31, 1906.

A DRUM provided with a series of concentric, perforated, frusto-conical partitions, pitched alternately in opposite directions, and attached at their smaller ends to the bottom or top of the drum, is mounted on a vertical axis so that it can be rotated in a casing. The partitions are covered with filter cloth, and the drum has outlet and

outlet openings in the bottom and top, opposite the wider ends of the conical partitions. The casing is provided with steam inlet and outlet pipes, and with a drain pipe at the bottom.—W. H. C.

Filter. J. T. H. Paul, Assignor to E. Goldman and Co., Chicago. U.S. Pats. 827,389 and 827,390, July 31, 1906.

See Eng. Pats. 2992 and 2991 of 1906; this J., 1906, 683.—T. F. B.

Separator; Centrifugal ——. J. J. Berrigan, Orange, N.J. U.S. Pat. 827,903, Aug. 7, 1906.

The apparatus consists of a horizontal cylinder, mounted on bearings so that it can be rotated, and having another horizontal cylinder fixed eccentrically within it. The inner cylinder is divided into a number of chambers by conical partitions, all placed with their smaller ends in the same direction. The mixture of solids and liquid is fed into the inner cylinder at one end, and enters the larger end of the first cone. Here some of the liquid is separated from the solids, and is drawn off, the solids being delivered through the smaller end into the next cone, where the process is repeated. The solids pass from cone to cone, becoming drier as they advance, and are finally delivered into a shoot from the last cone.

—W. H. C.

FRENCH PATENT.

Evaporation, concentration, distillation, and drying of liquids. A. Montupet and L. Jamin. First addition, dated Feb. 7, 1906, to Fr. Pat. 339,177, Nov. 21, 1903 (this J., 1905, 144).

The addition relates to an improved method of regulating the supply of live steam, and consists in employing several "injector-mixers" arranged in groups. When it is desired to reduce the supply of live steam, one or more of the injectors are shut off, leaving the others to work at full pressure.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 804).

Acetylene; Reactions of —— with acidified solutions of mercury and silver salts. J. A. Nieuwland and J. A. Maguire. J. Amer. Soc. Chem., 1906, **28**, 1025—1031. See Brit. Assoc. Rep., 1904, "On Double Acetylides," Major Edwards and Dr. W. R. Hodgkinson, this J., 1904, 954.

The authors have obtained a number of acetylene-mercury and acetylene-silver compounds by passing the purified gas into solutions of the metal salts acidified with the acid contained in the radical of the salt. Amongst the compounds obtained were: acetylene-mercuric chromate, acetylene-mercuric chlorate and perchlorate, acetylene-mercuric cyanide, acetylene-mercuric nitrate, acetylene-mercuric acetamide, and acetylene-mercuric bromate; these substances are not necessarily explosive unless there is present in the compound an acid grouping that is itself unstable, such as chloric or perchloric acid. They all give off aldehyde when heated with dilute acids, or even with water. With solutions of silver salts, similar compounds were obtained. Those yielded by acid solutions of silver fluoride, fluosilicate, and fluoborate were all explosive. With silver chromate no precipitate was obtained. Acetylene-silver phosphate appears to be a very stable compound, and differs considerably from the other silver compounds. Acetylene-silver perchlorate is, even in the moist condition, almost as explosive as nitrogen iodide. Acetylene-mercuric fluosilicate and fluoborate could not be obtained, the boron and silicon of the acids either taking no part in the reaction, or being removed by the acetylene.—W. P. S.

Incandescence mantles; New process of manufacturing —— in which copper-cellulose is used as fabric. W. Bruno. Z. angew. Chem., 1906, **19**, 1387—1389.

Mantles made of copper-cellulose are impregnated with solutions of thorium and cerium, then treated with reagents to convert the nitrates into hydroxides, and finally burned out for use. The essential step is the conversion of the nitrates into the hydroxides. Instead of converting the nitrates by means of ammonia, the impregnated fabrics may be treated with hydrogen peroxide at 60° C. in acid solution. This converts the thorium nitrate into insoluble hydroxide; cerium nitrate is not converted, but dissolves in the peroxide solution. The fabric, however, mechanically retains sufficient cerium salt. The author states that mantles made according to the peroxide process do not consist of thoria and ceria, but of thorium peroxide, Th_2O_7, and a cerium peroxide.

—H. B.

Coals and lignites; Determination of volatile combustible matter in ——. E. E. Somermeier. XXIII., page 870.

Coke production of the United States. Bd. of Trade J., Aug. 16, 1906. [T.R.]

The Geological Survey reports that the amount of coke manufactured in the United States in 1905 was 28,777,794 tons (of 2240 lb.) as compared with 21,125,986 tons in 1904, an increase of 7,651,808 tons or 36·22 per cent. As a result of the demand created by the unprecedented production of pig-iron in nearly every iron-making district of the United States, the average price per ton advanced from 2.18 dols. in 1904 to 2.52 dols. in 1905. In 1905 there were 519 coke-making establishments, which owned 87,564 ovens, against 507, owning 83,599 ovens in 1904. Of the total number of completed ovens in the United States in 1905, 3159, or 3·6 per cent., were of the by-product recovery type, and the total amount of coke made in these ovens was 3,091,382 tons, or 10·74 per cent. There were under construction at the close of 1905, 4751 ovens, of which 417 were of the retort by-product type.

ENGLISH PATENTS.

Coking ovens; Impts. in ——. E. Ledoux, Sheffield, and the Simon-Carvès Bye-Product Coke Oven Construction and Working Company, Ltd., Manchester, Eng. Pat. 4990, March 1, 1906.

The coking oven is heated by a range of vertical flues, the coking chambers being disposed between these flues. The gas is supplied from a common gas main, with a single longitudinal gas outlet to each flue separately, and the supply is controlled by dampers which can be operated from the end of the "canal" by the aid of a suitable tool. The air flues, placed below the coking chambers, have separate openings to each vertical flue provided with dampers, which may likewise be controlled from the oven front by the aid of a suitable tool. A partition-wall in the lower part of the vertical flue, prevents the air and gas from being mixed and burned before they reach the place where the heat is required, which place is at the base of the coking chamber.—R. L.

Coke ovens; Impts. in ——. M. E. Bellberg, Cleveland, U.S.A. Eng. Pat. 8030, April 2, 1906. Under Int. Conv., April 8, 1905.

See U.S. Pat. 804,053 of 1905; this J., 1905, 1220.—T. F. B.

Coke and Gas; Manufacture of ——. J. Armstrong, London. Eng. Pat. 1642, Feb. 15, 1906. Under Int. Conv., June 20, 1905.

To obtain a dense coke in the manufacture of illuminating gas, coal is carbonised in a high and narrow chamber oven with thin walls, heated on the outside by a mixtu of gas and compressed air, which forces the gas high u in the heating flue, the air being preheated in seconda regenerative flues. The coal is fed into the bottom pa of the chamber by means of a ram acting in an upwa direction, and supplied from the sides by means of a feedin worm, whereby the fresh coal passes into the hottest por of the chamber. The ram is provided with an ambe head, which may be cooled by means of a water-jacke whilst the heavy hydrocarbons are decomposed in th hottest region of the oven, a gas free from tar and naphtha can be abstracted from the top. The coke can be cooled by means of a water-jacket at the top of th

[illegible] and [illegible] ... [illegible] ... [illegible] ...

portion of colloidal oxides or hydroxides of difficultly fusible metals. For example, 5 to 20 parts of colloidal oxide of tungsten are mixed with 95 to 80 parts of the plastic masses formerly described, and the threads obtained are converted into the crystalline state by heating them to a white heat in a reducing atmosphere. The plastic masses containing colloidal oxides or hydroxides may be used for making conductive connections between filaments and supply conductors, by applying them (according to Eng. Pat. 15,462 of 1905; this J., 1906, 307) in a dilute state to the joints, and afterwards heating to a white heat in a reducing atmosphere.—H. B.

UNITED STATES PATENTS.

Agglomerates [fuel] and agglutinants; Process of making ——. R. A. Le Maître, Brussels. U.S. Pat. 826,948, July 24, 1906.

SEE Fr. Pat. 356,961 of 1905; this J., 1906, 10.—T. F. B.

Furnace; Roasting or oxidising ——. C. E. Dewey, Assignor to The American Zinc and Chemical Co., Denver, Colo. U.S. Pat. 828,095, Aug. 7, 1906.

THE body of the furnace is provided with chambers arranged above each other, a vertical rotating shaft being located centrally in the furnace. Rabble arms, provided with ploughs or stirrers, are connected with the shaft, which is geared to a journaled shaft below the furnace. A track projecting upwards, and consisting of two separated members, is arranged outside the furnace. An outlet conduit communicates with the lower chamber of the furnace, and extends downwards from it, the lower extremity of this conduit being closed by a shoot pivoted and weighted; this shoot has a depending portion projecting into the space between the two members of the track. A bucket carrier slides on the track members, and carries a bucket pivoted so as to tend to tip it inwards, and prevented by a guide from tipping until it has passed a certain elevated point. The bucket carrier is alternately raised and lowered by suitable connection with the operating-shaft. The depending part of the shoot lies in the path of the bucket, the shoot being carried downwards by the descending bucket so as to allow the conduit to discharge into the bucket.—A. G. L.

Gas; Method of manufacturing ——. J. E. Allen, Columbia, Ohio, Assignor to A. C. Ellis, Pittsburg, Pa. U.S. Pat. 826,511, July 17, 1906.

AIR, compressed and heated, is driven through successive portions of heated petroleum oil, and the residual oil, from which the light hydrocarbons have been extracted, is heated in presence of a porous, non-oleaginous, carbonaceous substance, until vaporised, the resulting vapour being mixed with the first product. The gas is afterwards subjected to the action of heated, porous, non-oleaginous, carbonaceous matter, by passing it through a mass of such substance.—C. S.

Illuminating gas; Apparatus for the manufacture of ——. C. W. Bilfinger, Brooklyn, N.Y., Assignor to Columbia Engineering Works, and A. P. Bachman, New York. U.S. Pat. 827,075, July 31, 1906.

A VERTICAL cylindrical retort is set in a flue, and has its sides heated by gases from an external furnace. The retort has a removable cover at the top and a branched outlet pipe at the bottom; one branch of the latter is horizontal, and is normally closed by a plug, and the other passes vertically upward to the purifying and storage apparatus. The carbonaceous material to be distilled is contained in a "cartridge" or cylindrical vessel, open at the top, which is lowered into the retort by a derrick, and stands vertically on the bottom in such a manner that an annular space, of equal dimensions all round, is left between it and the walls of the retort. The "cartridge" is consequently heated only by radiation, through the annular space, from the walls of the retort, and the gas given off leaves the "cartridge" at the top, and passes down through the annular space to the outlet pipe at the bottom of the retort.—W. H. C.

Gas; Apparatus for manufacturing ——. P. I. Cohen, New York. U.S. Pat. 827,084, July 31, 1906.

THE claim refers chiefly to the method of regulating the supply of liquid or semi-liquid material which is converted into gas by passage through a coil heated in a furnace. The pipe which supplies steam to the pump used for forcing the liquid into the coil, has a governor connected to a device, or valve, on the delivery pipe to the coil. In this way the admission of steam to the pump is regulated by the delivery of oil, and a constant and regular feed is obtained.—W. H. C.

Gas; Process of producing ——. H. Gerdes, Berlin, Germany, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 827,862, Aug. 7, 1906.

THE claim is for the production of a gaseous fuel practically free from tarry matters. The raw fuel is distilled in the upper part of the charging tube or bell of the producer, and the distilled gases produced are drawn off and burnt with excess of air to ensure complete combustion. The products of combustion, along with any excess of air, are then passed back to the lower part of the producer, where they pass through a layer of incandescent fuel from which all volatile matter has been previously driven off. The resulting gas is drawn off separately, and is said to be free from tarry matters.—W. H. C.

Gas-purifying apparatus. S. F. Seager, Assignor to American Suction Gas Producer Co., Lansing, Mich. U.S. Pat. 826,691, July 24, 1906.

THE purifier is formed of two concentric cylinders, the gas entering through an inlet at the bottom of the inner cylinder, and leaving by an outlet at the bottom of the outer cylinder. The gas passes upwards through the inner cylinder, which is packed with coke, and is washed by liquid from a spraying nozzle at the top. It then passes down through the annular space between the two cylinders, and is further purified by passing through purifying material, supported on grids.—W. H. C.

Gas; Apparatus for purifying ——. T. Redman, Bolton, Bradford. U.S. Pat. 826,747, July 24, 1906.

SEE Eng. Pat. 12,659 of 1904; this J., 1905, 611.—T. F. B.

Gas calorimeter. H. L. Doherty, Madison, Wis., Assignor to Combustion Utilities Co., New York. U.S. Pat. 828,306, Aug. 14, 1906.

SEE Eng. Pat. 8806 of 1906; this J., 1906, 633.—T. F. B.

Carbide; Manufacture of ——. H. L. Hartenstein, Constantine, Mich., Assignor to Electro-Chemical and Development Co., Pierre, S.D. U.S. Pat. Reissue, 12,519; Original Pat. 819,222, May 1, 1906 (this J., 1906, 544). Aug. 7, 1906.

POWDERED limestone is calcined, and to the still hot lime, carbonaceous material is added, and the mixture is subjected to fusion, with exclusion of oxygen. Or, to the heated mixture of lime and carbonaceous material, a superheating flux, such as a mixture of calcium carbide, manganese dioxide, bituminous coal, aluminium and potassium chlorate, is added, and the whole subjected to fusion.—E. S.

Reducing compounds and producing carbides. E. F. Price, Assignor to Union Carbide Co. U.S. Pats. 826,742—826,745, July 24, 1906. XI*A*., page 853.

FRENCH PATENTS.

Gas for illuminating, heating, and power purposes; Process and apparatus for the manufacture of ——. H. S. Elworthy. Fr. Pat. 361,450, May 8, 1905.

SEE Eng. Pat. 7713 of 1905; this J., 1906, 527.—T. F. B.

Gas; Production of combustible —— *free from tar.* Deutsche Banke-Gas Ges.m.b.H. Fr. Pat. 363,348, Feb. 16, 1906.

THE fuel is charged into a tube which descends nearly to the grate-bars of the producer shaft, from which the gas is drawn off by a tube at the upper end. The tube

vapours given off in the upper part of the charging tube are drawn off by means of an injector through a tube which passes through the wall of the producer, then extends downwards, and finally again enters the producer, air being drawn in through an opening at the bottom of the vertical part of the tube. The mixture of air and gas is injected into the hottest part of the producer, or the reduction zone, where the tarry vapours are completely burnt and gasified.—W. H. C.

Gas; Process and apparatus for washing ——, *particularly for completely eliminating sulphuretted hydrogen from lighting gas.* E. Ott. Fr. Pat. 363,539, Feb. 22, 1906. Under Int. Conv., March 17, 1905.

THE gas is treated with successive small portions of the washing liquid, and each portion of liquid is immediately removed from contact with the gas before the addition of a fresh portion of washing liquid. This is done to prevent the return of any of the previously absorbed impurities to the gas. The gas, in each stage of the treatment, is drawn through an injector by the washing liquid, which is delivered under pressure, so that a very intimate contact between the gas and liquid is obtained.—W. H. C.

Incandescence [*electric*] *lamps; Filaments for* ——. A. Just and F. Hanaman. Second Addition, dated Feb. 5, 1906, to Fr. Pat. 347,661, Nov. 4, 1904. (This J., 1905, 431, 1220.)

THE impregnated filaments are first treated with an acid to convert the salts of molybdenum or tungsten into molybdic or tungstic acid. The acids are then converted into their respective metals by the subsequent treatment described.—W. H. C.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 805.)

Petroleum Spirit ["*Benzine*"]; *Explosions of* ——, *and the Martini-Hueneke process.* Effenberger. J. Gasbel., 1906, **49**, 689.

THE Martini-Hueneke process consists in replacing the air in benzine storage vessels, which are always kept underground, by carbon dioxide or other indifferent gas or gaseous mixtures. A special system of service pipes is also arranged which allows no escape of benzine, in case of a breakage. There are also automatically closing valves provided. The system works so successfully that, in one case, the storage "without a protecting zone" of 17,500 litres of benzine in the Westphalian mining district, in another of 15,000 litres in the heart of the city of Berlin, was permitted by the authorities.—R. L.

ENGLISH PATENT.

Emulsifying mineral oils, and the manufacture of mineral oil soaps; Process for ——. J. C. Fell. Eng. Pat. 14,294, July 11, 1905. XII., page 856.

UNITED STATES PATENTS.

Tar; Treatment of —— *for the manufacture of pitch and recovery of light oils.* W. Oppenheimer, Ewell. U.S. Pat. 827,113, July 31, 1906.

SEE Fr. Pat. 334,472 of 1903; this J., 1904, 55.—T. F. B.

Oil from oil-coated fines; Process for distilling off the ——. E. B. Kirby, Rossland, Canada. U.S. Pat. 825,909, July 17, 1906.

THE oil-concentrated "mineral fines" are fed into a retort, and heated to a temperature suitable for distilling off the oil, the feed of the concentrates through the heat zone being regulated automatically by disposing the charge in such a manner that the concentrates adhere to the supporting medium so long as they are wet, but slip down when dry. Means are provided for collecting the concentrates, and clarifying oil from the distilled vapours.—T. F. B.

FRENCH PATENT.

Antiseptic; A new —— [*from petroleum*], *and method of making the same.* C. Trocquenet. Fr. Pat. 362,990, Feb. 5, 1906. XVIIIC., page 863.

GERMAN PATENT.

Distillation of moist materials such as peat, wood, coal; Process for the ——. A. Jaba. Ger. Pat. 165,611, June 1, 1904.

THE moist goods, before passing into the still, are conveyed through a drying chamber, wherein they are dried by a current of air. The moist effluent air from the drying chamber is dried by passing it through an air-condenser, then warmed by leading it through a jacket surrounding the still, and again passed through the drying chamber. The air used for cooling in the air-condenser is also passed through the drying chamber, and is then used, together with fresh air, for cooling the distillation products from the still in separate coolers, the effluent air from which is also passed through the drying chamber. Dry air is systematically withdrawn from the plant, and used for burning fuel in the furnace by which the still is heated. The uncondensable distillation-products, after being used for cooling the distillation residue, may be burnt in the furnace. —A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 807.)

Arylamines; Conversion of aromatic ketones into ——. M. Prud'homme. Rev. Gén. des Mat. Col., 1906, **10**, 225—226.

THE author has previously shown (this J., 1906, 64) that reduction products (anthranols) of hydroxyanthraquinones, when treated at the ordinary temperature with aqueous solutions of ammonia, are transformed into imino compounds. He now finds that hydroxyanthraquinones are directly transformed into the corresponding imines by the action, at about 200° C., of ammonium salts of organic acids, in the presence of glycerol. Thus, alizarin (0·3 grm.), when fused with ammonium formate, oxalate, tartrate, citrate, &c. (1 grm.) or ammonium carbonate (1·5 grm.), and glycerol (4 grms.), yields a compound, "alizarinimine," which dyes a weak iron mordant in a blue shade. With ammonium thiocyanate (5 grms.), alizarin (1 grm.), in the absence of glycerol, gives at 159° C., a compound which dyes the same iron mordant in a greyish purple colour. The sulphur of the thiocyanic acid, it would appear, enters into reaction, as the same or a similar compound is formed when a little sulphur or sodium sulphide is added to the melt containing alizarin, glycerol, and the ammonium salt of an organic acid.

Tetramethyldiaminobenzophenone reacts imperfectly with ammonium carbonate, but readily with ammonium thiocyanate and the ammonium salts of organic acids, forming Auramine.

Alizarin Yellows A and C (B.A.S.F.), when fused with ammonium salts of organic acids, yield dyestuffs which dye the customary mordants in shades of yellow and olive, differing from those given by the original dyestuffs. The new compounds dissolve in alkali solutions with a green colour, whilst the alkali solutions of the original dyestuffs are yellow or yellowish-orange.

The conversion of hydroxyanthraquinones into the corresponding imino compounds may be effected by the following methods:—

(1) The action, at high temperatures and under pressure, of ammonia dissolved in absolute alcohol. (Friedländer's Fortschritte, V. Bayer and Co.) (See also this J., 1906, 584.)

(2) The action, at the ordinary temperature, of a dilute

aqueous solution of ammonia on the reduction-compounds (anthranols).

(2) The action, at about 200° C., of normal ammonium salts of organic acids, in the presence of glycerol.—E. B.

Diazoamines and aminoazo compounds; Influence of substitution on the formation of ——. Part V. s-Dimethyl-4.6-diamino-m-xylene. G. T. Morgan and A. Clayton. Chem. Soc. Trans., 1906, **89**, 1054—1058.

It has been shown previously that aminoazo compounds can be obtained from primary aromatic meta-diamines containing substituents in both the para positions with respect to the amino groups, although the reaction takes place less readily than when one of these para positions is still unoccupied (Chem. Soc. Trans., 1902, **81**, 86; 1905, **87**, 935, 944; this J., 1902, 36; 1905, 795). The present communication deals with the effect of partial alkylation of the amino groups in a dipara-substituted meta-diamine, it having been found (Chem. Soc. Trans., 1902, **81**, 656) that complete alkylation prevents the formation of an azo compound. *s*-Dimethyl-4.6-diamino-*m*-xylene was prepared from 4.6-diamino-*m*-xylene, the latter being first converted into *s*-dibenzenesulphonyl-4.6-diamino-*m*-xylene by means of the Schotten-Baumann reaction, and this in turn methylated, and the methyl derivative hydrolysed by heating with 15 parts of concentrated hydrochloric acid in a sealed tube for five hours at 160° C. On cotton cloth impregnated with diazotised Primuline, *s*-dimethyl-4.6-diamino-*m*-xylene produces a reddish-brown ingrain azo colour. With diazotised *p*-nitraniline it yields about 10 per cent. of *p*-nitrobenzene-5-azodimethyl-4.6-diamino-*m*-xylene and about 25 per cent. of a diazoamino compound, the formation of the azo compound probably being as follows:—

$$(CH_3)_2C_6H_2(NH.CH_3)_2 \rightarrow$$
$$NH(CH_3).C_6H_2(CH_3)_2.N(CH_3).N_2.C_6H_4(NO_2) \rightarrow$$
$$(NO_2)C_6H_4.N_2.C_6H(CH_3)_2(NH.CH_3)_2.$$

By the interaction of *p*-nitrobenzenediazonium chloride and 5-bromo-*as*(4)-dimethyl-2.4-diaminotoluene, also a diazoamine and an aminoazo compound are produced; and it may, therefore, be accepted that the dimethylation—both symmetrical and unsymmetrical—of a dipara-substituted meta-diamine greatly hinders, but does not entirely prevent, the introduction of a diazo residue into the aromatic nucleus of the diamine.—A. S.

Colouring matters [Dyestuffs]; Prohibition of the use of injurious —— in Austria-Hungary. [T. R.] XIII*A*, page 857.

English Patents.

Dyestuffs of the triphenylmethane series; Manufacture of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 25,498, Dec. 7, 1905.

Ethyl-4-alkyldiaminodiphenylmethanemonosulphonic acid may be obtained in good yield by the action of formaldehyde on a mixture of dimethyl- or diethylaniline with dimethyl- or diethylaniline-*m*-sulphonic acid. The diphenylmethane derivative is oxidised to the corresponding leuconol (*e.g.*, by means of lead peroxide and dilute sulphuric acid), which is then condensed with ethyl- or methyl-ethylanilinesulphonic acid, and the resulting leuco-compound oxidised, for instance, by lead peroxide and acetic acid. The resulting "acid" dyestuffs dye unmordanted wool clear blue to violet shades, fast to alkali.—T. F. B.

Compounds of the Anthracene series [Nitrobenzanthrones]; Production of new ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 12,518, May 29, 1906.

Benzanthrone and benzanthrone compounds, other than dyestuff derivatives (for the nitration of which see U.S. Pat. 796,259 of 1905; this J., 1905, 912), are acted upon by nitrating agents, with the production of nitro-derivatives.—E. B.

United States Patents.

Dyestuff; Green anthracene ——. R. E. Schmidt, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 826,760, July 24, 1906.

See Fr. Pat. 358,271 of 1905; this J., 1906, 260.—T. F. B.

Anthraquinone aldehyde, and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 828,741, Aug. 14, 1906.

See Eng. Pat. 16,632 of 1905; this J., 1906, 868.—T. F. B.

French Patents.

Dyestuff especially adapted to the manufacture of lakes; Process for producing a monoazo ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,434, May 3, 1905.

See Eng. Pat. 9325 of 1905; this J., 1906, 65.—T. F. B.

Arylsulphamides; Process of making nitro-derivatives of aromatic ——. Act.-Ges. f. Anilinfabr. First Addition, dated May 5, 1905, to Fr. Pat. 349,566, April 2, 1904.

See Eng. Pat. 9074 of 1905; this J., 1906, 65.—T. F. B.

Dyestuffs derived from "naphtène" [naphthalene]; Production of black ——. Badische Anilin und Soda Fabrik. Fr. Pat. 361,447, May 5, 1905.

See Eng. Pat. 9547 of 1905; this J., 1905, 725.—T. F. B.

Indigo pastes; Process for preserving fermentable ——. Badische Anilin und Soda Fabrik. First Addition, dated Jan. 29, 1906, to Fr. Pat. 348,292, Feb. 4, 1904. Under Int. Conv., Jan. 2, 1906.

See Eng. Pat. 1954 of 1906; this J., 1906, 470.—T. F. B.

Dyestuff; Process for making a black ——, a tanning material or a second black dyestuff, and other useful products from coal or lignite. D. Lerman, B. B. D. Schwartz, and P. Pikos. Fr. Pat. 363,244, Feb. 13, 1906.

See Eng. Pat. 3107 of 1906; this J., 1906, 806.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 808.)

Colouring matters [Dyestuffs]; Prohibition of the use of injurious —— in Austria-Hungary. [T. R.] See XIII*A*., page 857.

English Patents.

Vegetable fibre for spinning or other purposes; Preparation of ——. B. Summers, Port Huron, Michigan, U.S.A. Eng. Pat. 2330, Jan. 30, 1906.

Linen, hemp, and other bast fibres are separated from the woody portions of the stems from which they are obtained, by a process which consists in subjecting the latter to prolonged artificial refrigeration, *e.g.*, for a period of from sixty to a hundred hours, at a temperature of 0°—10° F., and then breaking the woody parts of the stems and removing the fibres from these, *e.g.*, by a passage through a "cleaning" machine, while the stems are still in a frozen condition. For the proper working of the "breaking" machine, and to obtain the fibres in as perfect a state as possible, the stems, when operated upon, should contain a certain amount of moisture, which may be introduced into them, if necessary, either before or after they are refrigerated.—E. B.

Silk, artificial; Apparatus for the manufacture of ——. H. E. A. Vivenet, Lyon-Monplaisir, France. Eng. Pat. 14,067, June 19, 1906. Under Int. Conv., June 20, 1905.

See U.S. Pat. 822,155 of 1906; following these.—T. F. B.

Red [Thioindigo Red], on textile fibres; Dyeing and printing ——. Kalle und Co., Aktiengesellschaft, Biebrich-on-the-Rhine. Eng. Pat. 14,261, June 21, 1906. Under Int. Conv., June 26, 1905.

See Fr. Pat. 359,400 of 1905; this J., 1906, 426.—E. B.

Calico, paper and the like printing. W. Longley, Whalley Bridge, near Stockport. Eng. Pat. 19,328, Sept. 25, 1905.

Colour mixtures for use in printing calico, paper, &c., are prepared by dissolving a basic dyestuff in acetic acid or other suitable solvent, and adding a 3—6 per cent. aqueous solution of the gelatinous matter extracted from Irish moss, and also phenol or other phenolic compound or source of phenol, the latter to enable the mixture to be made homogeneous.—T. F. B.

Ornamental effects on woven fabrics [Flock printing]; New or improved means for producing ——. Tootal Broadhurst Lee Co., Ltd., and A. Brookes, Manchester. Eng. Pat. 27,048, Dec. 28, 1905.

Ornamental effects, in imitation of those produced by sewing upon tissues narrow velvet or other materials, are obtained by printing in adhesive substances stripe or other patterns on tissues, and then dusting upon them flocks or fluff "such as may be produced from wool or like materials." These adhere only to the printed parts. The non-adhering flocks are blown off, or otherwise removed from, the tissues, leaving the patterns in relief upon the latter. The flocks before use may be dyed in black or other colours.—E. B.

Absorbent materials, textiles, paper, or other lamellar materials; Improved method for treating, or impregnating —— with resins, fatty acids, or the like. H. O. Brandt, Manchester. Eng. Pat. 23,787, Nov. 18, 1905. Under Int. Conv., Nov. 19, 1904.

The materials are treated with dissolved ammonium compounds of resinous or fatty acids, and then heated to a temperature at which the ammonia is expelled, leaving the free resinous or other acid on the material. Suitable filling, weighting or finishing substances may be added to the impregnating solution, and they are fixed on the material by the acids liberated during the heating process; or powdered metal, glass, sand, or similar substance, may be sprinkled on the impregnated material, and fixed by the heating process.—C. S.

Soap for use in finishing woollen goods; Improved ——. J. Proude, Halifax, Yorks. Eng. Pat. 3864, Feb. 16, 1906.

A suitable quantity of ordinary white curd soap is heated in a steam-jacketed pan. When the soap boils, about 0·074 per cent. of Aniline Violet 8B, dissolved previously in water, is added, and thoroughly mixed with it. It is then cooled and cut up as usual. One pound of this coloured soap is mixed with every 5, 6, 7, or more pounds of the white curd soap, used in milling the fabric. The better the quality of the latter, the less the quantity of coloured soap needed to remove all natural tints and to produce a perfectly white article.—W. P. S.

Drying fabrics; Vacuum apparatus for ——. E. Gessner, Aue, Germany. Eng. Pat. 7928, April 2. 1906.

In order to prevent air from entering the suction chamber through the portions of the suction slot not covered by the goods to be dried, the slot is provided with slides adapted to close it from beneath, and adjustable lengthwise of the slot. The entire width of the slot is also covered from above by means of strips of fabric fastened lengthwise, at suitable angular intervals, around a rotating roller, the strips of fabric, which hang freely, hence falling successively, and being drawn one after the other transversely across the slot, in the direction in which the fabric to be dried is passing. The moisture removed from the fabric collects in a suitable chamber provided with valves or cocks, by which it can be alternately put in communication with the suction chamber and the outside, thus enabling the suction chamber to be [illegible] A sieve or filter mounted in the suction chamber serves to arrest hairs or other matter drawn into the chamber with the moisture.—T. F. B.

United States Patents.

Threads; Apparatus for the production of artificial ——. E. W. Friedrich, Blaton, Belgium. U.S. Pat. 827,[illegible], July 31, 1906.

See Fr. Pat. 357,172 of 1905; this J., 1906, 70.—T. F. B.

Artificial silk; Apparatus for the manufacture of ——. H. E. A. Vittenet, Aurce sur Loire, France. U.S. Pat. 828,155, Aug. 7, 1906.

Apparatus for forming a filament of metamorphosed cellulose is provided with a closed "fixing" tube, having a small orifice for the passage of the filament, and tubes attached for supplying and exhausting a fixing gas. The fixing tube comprises two concentric tubes having elongated slots, and flaring radial slots in their tops, one tube being adapted to turn relatively to the other, so as to close or open the tube by bringing the slots into or out of register. —E. S.

French Patents.

Dyeing wound spindles, cops, bobbins, &c.; Machine for —— Gebr. Wansleben. Fr. Pat. 363,079, Feb. 8, 1906. Under Int. Conv., March 1, 1905.

See Eng. Pat. 3194 of 1906; this J., 1906, 586.—T. F. B.

Dyeing fabrics; Apparatus for ——. E. A. F. Zillessen. Fr. Pat. 363,366, Feb. 17, 1906.

See U.S. Pats. 813,478 and 813,479 of 1906; this J., 1906, 372.—T. F. B.

Ketone sulphoxylates; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 363,485, Feb. 16, 1906. Under Int. Conv., Sept. 30, 1905.

See Eng. Pat. 4073 of 1906; this J., 1906, 474.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page 908.*)

English Patent.

Dyeing of wood and similar pulp. W. Longley, Whalley Bridge, near Stockport. Eng. Pat. 19,256, Sept. 21, 1905.

A dilute solution (*e.g.*, 1 to 2 per cent.) of the gelatinous substance extracted from Irish moss or analogous seaweed, is added to the usual dye-bath for paper and similar pulp. The following quantities serve for dyeing [illegible] of wood pulp:—5 lb. of the basic dyestuff in suitable solution; 4 lb. of resin soap, containing excess of alkali and dissolved in 10 galls. of water; 4 lb. of alum dissolved in 10 galls. of water, and a solution of 1 lb. of the gelatinous matter in 10 galls. of water. It is stated that the addition of the gelatinous substance causes the dye-bath to be completely exhausted, and also removes all the [illegible] alum from it, leaving an innocuous effluent.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS AND NON-METALLIC ELEMENTS.

(*Continued from page 811.*)

Chamber gases; Detection of nitrous oxide in ——. W. Hempel and O. Heymann. Z. Elektrochem., 1906, 12, 600—604.

In the course of a laboratory study of the chamber process it was found that if steam, oxygen, and sulphur dioxide are simultaneously brought, in the required quantities, into a glass vessel containing nitric oxide, nitrogen, and oxygen, exceptionally large quantities of nitrous oxide are produced. The conclusion to be drawn is that the steam should only be introduced gradually, as is done

case in technological practice. An apparatus was devised for detecting the presence of minute quantities of nitrous oxide in chamber gases. Briefly described, the method consists in cooling the gases to the temperature of liquid air, after their compression to about 10 atmospheres. The gases then separated into two fractions, one of which contains the condensable nitrous oxide. This is subsequently estimated by causing its dissociation by explosion with oxy-hydrogen gas, and noting the increase in volume.

Analysis of exit gases from several works showed the presence of from 0·063 to 0·25 per cent. of nitrous oxide, and a calculation is given showing that 0·1 per cent. of nitrous oxide corresponds to an expenditure of 1·11 kilo. of nitric acid per 100 kilos. of sulphuric acid, and thus it is probable that the greater part of the loss of nitre may be ascribed to the formation of nitrous oxide.—R. S. H.

Hydrogen peroxide and potassium persulphate; Study of the reaction between ——. J. A. N. Friend. Chem. Soc. Trans., 1906, **89**, 1092—1101.

By determinations of the relative amounts of hydrogen peroxide and potassium persulphate decomposed in a given time, and by determinations of the rate of decomposition, it was found that the reaction between these two substances: $H_2O_2 + K_2S_2O_8 = 2KHSO_4 + O_2$, is unimolecular, owing to the formation of a highly unstable intermediate addition compound. The intermediate compound may be isolated in an impure form by evaporating a mixture of hydrogen peroxide and potassium persulphate over sulphuric acid. The presence of sulphuric acid has a retarding effect on the reaction between the two substances, as also have the sulphates of sodium, potassium and manganese; the last-named, however, slightly accelerates the reaction towards the end. The reaction is accelerated by colloidal platinum, the hydrogen peroxide undergoing rapid additional decomposition.—A. S.

Aurous halides; Compounds of ammonia with ——. F. Meyer. Compt. rend., 1906, **143**, 280—282.

Liquid ammonia reacts with aurous chloride, bromide, and iodide, forming colourless compounds. The bromine compound is very unstable, but the others are quite stable at − 28° C., having respectively the formulæ, $AuCl,12NH_3$ and $AuI.6NH_3$. At the ordinary temperature they lose ammonia, and leave the compounds, $AuCl,3NH_3$ and AuI,NH_3 respectively. The iodine compound can also be formed by passing ammonia over aurous iodide at the ordinary temperature. Aurous bromide similarly yields $AuBr,2NH_3$. All these compounds are decomposed by water, with formation of ammonium halide and metallic gold.—J. T. D.

Boron sulphide; Preparation of —— from ferroboron. J. Hoffmann. Z. angew. Chem., 1906, **19**, 1362—1363.

Ferroboron, containing 20 per cent. of boron, is heated in a glass tube to above 400° C. in a stream of dry hydrogen sulphide. The boron sulphide formed, along with some sulphur, condenses chiefly in the hinder portions of the tube, and any escaping vapours are caught in an ice-cooled U-tube. The substance remaining after the reaction still contains some boron, besides iron and sulphur. Boron sulphide is not sensibly dissolved by carbon bisulphide, and the product can therefore be purified from sulphur by means of this reagent. The method is much less costly than that of Wöhler and Deville, in which amorphous boron is used.—J. T. D.

Nitric acid; Technical production of —— from nitrous gases. J. Klaudy. XIA., page 852.

Nitric acid in commercial hydrochloric acid; Determination of small quantities of ——. B. N. Gottlieb. XXIII., page 849.

Nitric acid; Determination of —— in air, and some of the reactions involved. Le Blanc. XXIII., page 869.

English Patents.
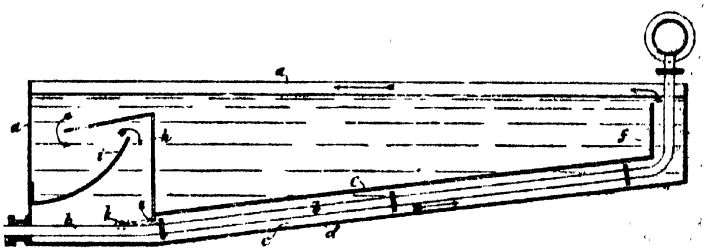
Nitric acid; Apparatus for the oxidation of the nitrogen of the air for the purpose of obtaining —. O. H. U. Brünler, Leipzig-Gohlis, Germany. Eng. Pat. 5852, March 10, 1906.

The furnace is placed, mouth downwards, within a closed, pressure-resisting vessel, partly filled with water, and supplies of compressed oxygen, and of combustible gas or oil, coal-dust or the like, are admitted through inlets opposite to one another. The nitrogen is either mixed with the oxygen or is introduced through a separate pipe. The issuing jets of burning gas are said to gyrate within the furnace, whereby a rapid combustion is produced, and a temperature approaching 3000° C. is attained. The flame, issuing from the narrowed mouth of the furnace, is shown as burning under water in a pointed form. Means are provided for withdrawing the nitric acid solution thus formed, and for conveying away the gaseous products insoluble in water. Compare Eng. Pat. 5901, of 1900; this J., 1906, 811. Reference has been directed to Eng. Pats. 9855 of 1898; 16,506 of 1901 (this J., 1902, 970); and 25,748 of 1903.—E. S.

Carbonic acid; Processes for solidifying ——, *and apparatus therefor.* E. G. Elworthy, Administratrix of late H. S. Elworthy, St. Albans. Eng. Pat. 2450, Jan. 31, 1906. Under Int. Conv., Jan. 31, 1905.

See Fr. Pat. 355,503 of 1905; this J., 1905, 1231.—T. F. B.

Heating and evaporating solutions [Brine], and apparatus therefor. J. Hargreaves, Farnworth-in-Widnes. Eng. Pat. 16,035, Aug. 5, 1905.



The pan, *a*, has a sloping bottom, *d*, and is heated by the steam pipes, *b*, above which is a false-bottom or "table," *c*. The liquid to be evaporated is supplied, preferably under considerable pressure, through the perforated pipe, *k*, and circulates in the direction indicated by the arrows, under the "table," *c*, and over the upturned end, *f*. Here it begins to cool, and deposits crystals on the upper surface of *c*, which become larger in size the further they are deposited from *f*. The liquid flows over the partitions, *h* and *i*, which serve to prevent the crystals from getting beneath the table, *c*, and blocking the coils. The crystals are allowed to accumulate until they have attained sufficient size to be ready for removal. A modification is claimed, in which the pan is built over a flue, and heated by direct fire.—W. H. C.

Sodium monosilicate; Manufacture of crystallised ——. W. N. Bacon, London. Eng. Pat. 24,226, Nov. 23, 1905.

Sodium carbonate and silica are heated together in such proportion as to form a silicate having the composition, Na_2SiO_3, the solution of which, in water, concentrated until a temperature of about 219° F. is reached, cooled, and then stirred, yields the crystallised monosilicate, $Na_2SiO_3,9H_2O$. Or, the same product is obtained by adding the necessary proportion of sodium hydroxide and water to a strong solution of commercial sodium silicate to constitute the monosilicate, and stirring to [illegible] crystallisation.—E. S.

Hydrosulphites [Hyposulphites]; Manufacture and production of stable dry ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 26,380, Dec. 18, 1905.

FRESHLY precipitated and dry calcium hyposulphite is mixed with quicklime, and is then washed with a liquid miscible with water, such as alcohol; or the washing may precede the addition of the lime. Or, the calcium hyposulphite may be stirred with a mixture of alcohol and lime. The quicklime may be replaced in the process by other alkaline earths, or by a dry alkali hydroxide, the proportion of which may be varied, but should not be less than 10 per cent. The product, however obtained, should be dried, *in vacuo*, preferably at an "elevated temperature." (Reference is made to Eng. Pat. 18,852 of 1900; this J., 1901, 988).—E. S.

Bleaching medium; Apparatus for producing a gaseous ——. F. H. Loring. Eng. Pat. 22,101, 1905. XI*A*., page 853.

UNITED STATES PATENTS.

Hydrochloric acid and calcium carbide; Process of making ——. W. H. Seamon, El Paso, Tex. U.S. Pat. 826,614, July 24, 1906.

A GASEOUS hydrocarbon, particularly acetylene, is passed through fused calcium chloride, which is thus converted into calcium carbide. The hydrochloric acid set free in the process is collected.—E. S.

Sulphur trioxide; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 828,268, Aug. 7, 1906.

A SUBSTANCE capable of forming sulphur trioxide on oxidation, such as sulphur dioxide, is oxidised by the action of an oxide of nitrogen, such as nitrogen tetroxide, in the presence of a substance, such as carbon dioxide, capable of being dissociated by the action of and by the absorption of heat, the proportion of the ingredients being so adjusted as to prevent the generation of a temperature capable of dissociating the sulphur trioxide formed. In general terms, the process in its entirety, according to one of the claims, "consists in controlling the evolution of sensible heat while oxidising a substance which, upon oxidation, will form sulphur trioxide, by the action of an oxide of nitrogen, by removing the heat evolved from the sphere of formation of the sulphur trioxide by associating therewith substances capable of chemically absorbing heat during reaction, separating the compound containing the chemically-absorbed energy from the sulphur trioxide, discharging the energy therefrom thereafter by chemical action, and producing a substance capable of being re-used as a chemical refrigerant in the further continuance of the process." See also U.S. Pat. 778,099 of 1904; this J., 1905, 90.—E. S.

Alkali-metal oxides; Process of making ——. G. W. Meiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 828,759, Aug. 14, 1906.

SEE Fr. Pat. 321,416 of 1902; this J., 1903, 212.—T. F. B.

Hydrosulphite [Hyposulphite] solutions; Method of making ——. P. S. Clarkson, Beverly, N.J., Assignor to H. A. Metz, Brooklyn, N.J. U.S. Pat. 827,420, July 31, 1906.

SULPHUROUS acid is acted upon by a reducing agent, such as zinc, in presence of "an alkali-metal salt of a tribasic acid having an acid reaction to litmus." The use of "trisodium phosphate" is also claimed to produce a hyposulphite solution.—E. S.

Salts of oxy-acids of chlorine [chlorates, e.g.]; [Electrical]. Process of producing ——. A. E. Gibbs, Assignor to The National Electrolytic Co., Niagara Falls, N.Y. U.S. Pat. 827,721, Aug. 7, 1906.

A SOLUTION containing a chloride is electrolysed in a diaphragm cell with a carbon or graphite anode, at a temperature below 40° C. (to avoid disintegration of the anode), and the resulting solution, now containing a hypochlorite, is heated out of contact with the electrodes, to produce a chlorate. A general claim is also made for obtaining a chlorate by treating a hypochlorite solution with a chromic acid compound, applicable in the case described.—E. S.

FRENCH PATENTS.

Carbonic acid; Chemical product for use in obtaining ——. J. A. Ageron and B. J. M. Remy. Fr. Pat. 361,416, April 22, 1905.

A COMPOUND of magnesium sulphate with sodium sulphate or bisulphate is heated with addition of as much concentrated sulphuric acid or sulphuric anhydride as it will absorb, consistently with leaving on cooling a solid product, utilisable, in place of sulphuric or other liquid acid, in liberating carbon dioxide from carbonates.—E. S.

Nitric and sulphuric acids; Process for obtaining concentrated ——, *from nitro-sulphuric acid or nitrous sulphuric acid [in part electrical]*. Der Norske Akt. f. Elektrokemisk Ind., and M. B. F. Halvorsen. Fr. Pat. 363,157, Feb. 13, 1906.

NITROSULPHURIC or nitrous sulphuric acid is dissolved in an excess of concentrated sulphuric acid, a little water is added, and an oxidiser, such as manganese dioxide, lead dioxide, chromic acid or a chromate, in suitable proportion. The nitric acid thus formed is distilled off in iron retorts, and the residue is diluted and electrolysed to recover the oxidiser, thus represented:—

$$Cr_2(SO_4)_3 + 6H_2O = 2CrO_3 + 3H_2SO_4 + 3H_2.$$

The hydrogen formed, is collected; or it may be utilised in electrolytic apparatus in obtaining electrolytic copper from copper salts. Ozone or hydrogen peroxide may be used as the oxidiser, but cannot be regenerated.

—E. S.

Acids [Sulphuric acid]; System of tubes for the concentration of ——. G. Krell. Fr. Pat. 363,604, Feb. 24, 1906.

TUBES intended to be used in the concentration of acids, and in particular of sulphuric acid, are formed of an unattackable material, such as well-tempered white cast iron, in comparatively short pieces. Such pieces are superposed, end to end, and ordinary molten cast iron is run upon them so as to form an exterior coating, making tight joints at the places of junction of the pieces.—E. S.

Nitric acid; Apparatus for oxidising atmospheric nitrogen for the production of ——. O. H. U. Brünler and G. H. Kettler. Fr. Pat. 363,617, Feb. 24, 1906.

SEE Eng. Pat. 5852 of 1906; preceding these.—T. F. B.

Nitric acid or nitrates; Process for utilising atmospheric nitrogen by oxidation, for the production of ——. O. H. U. Brünler and G. H. Kettler. Fr. Pat. 363,618, Feb. 24, 1906.

SEE Eng. Pat. 5901 of 1906; this J., 1906, 811.—T. F. B.

Nitrites; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 363,643, Feb. 26, 1906. Under Int. Conv., Jan. 26, 1906.

THE gases, formed by passing electric discharges through air, are heated to about 300° C. before bringing them into contact with alkali or alkaline-earthy carbonates or hydroxides, to form nitrites, as at that temperature oxidation beyond the state of nitrogen trioxide (N_2O_3) does not take place. Gases containing nitrogen peroxide even, can be utilised in obtaining nitrites by heating them to a sufficiently high temperature before presenting them for absorption, as they thus suffer partial decomposition.

—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 812.)

Glass of low resistivity. C. E. S. Phillips. Brit. Assoc. (Sect. A), York, Aug. 7, 1906; through Electrician, 1906, **57**, 707.

The glass is made by fusing together 32 parts of sodium silicate and 8 parts of calcined borax; an addition of 1·25 parts of Powell's flint glass ensures greater stability, and improves the surface without greatly affecting the conductivity. The density of the glass is 2·490; the resistivity of 1 c.c. at 20° C. is of the order of 10^9 ohms, about one five-hundredth of that of ordinary glass, and changes markedly with the temperature. The glass is somewhat harder than ordinary soda glass; it shows no fluorescence under cathode radiation, is very transparent to X-rays, and opaque to ultra-violet light. When powdered and fused on to clean copper, it adheres well without cracking. It may be cast into plates, but is otherwise not very workable on account of its low fusing-point.—A. G. L.

United States Patent.

Glass; Device for mixing ingredients for making ——, and for feeding them to furnaces. H. M. Brookfield, New York. U.S. Pat. 826,139, July 17, 1906.

The ingredients are placed in separate hoppers, each of which is fitted with a tapering screw-conveyor for impelling the contents toward the discharge orifice. Gearing is provided for working these screws at predetermined speeds, so as to discharge given proportions of the ingredients on to a conveyor. This conveyor carries them to a lifting device, which delivers them into a receiving hopper, fitted in the same way as the others, and discharging into the furnace. All the operations are performed automatically.—C. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 812.)

English Patent.

Cement kilns; Impts. in ——. T. M. Morgan, Longue Pointe, Canada. Eng. Pat. 6946, March 22, 1906.

The kiln is of the rotary type, fitted with circumferential baffle-plates at the mouth, and provided with means for discharging jets of hot air or steam against the baffle-plates, so as to prevent the access of cold air into the kiln. The arrangement of the baffle-plates is such as will impart a revolving motion to the entering air, thus facilitating its admixture with the inflammable gas, and assisting the complete combustion of the latter.—C. S.

United States Patents.

Fireclay retort and brick. E. C. Hegeler, La Salle, Ill. U.S. Pat. 826,032, July 17, 1906.

The retorts or bricks, which are designed for zinc-smelting furnaces, are made of a mixture of burnt and raw fireclay rich in alumina, the burnt portion being heated to a higher temperature than that reached in the zinc-smelting furnace.—C. S.

Refractory material; Manufacture of ——. H. A. D. Collins, Abermellte. U.S. Pat. 826,763, July 24, 1906.

See Eng. Pat. 16,215 of 1902; this J., 1903, 867.—T. F. B.

Cement clinker; Process of burning —— by flame impingement, and apparatus therefor. C. Ellis, White Plains, N.Y. U.S. Pat. 827,517, July 31, 1906.

Into a rotary kiln is delivered from a suitable burner a stream of air, products of combustion, and powdered fuel, at a point above the axis of the kiln, and so as to impinge directly on to a flattened stream of raw material moved past this point. The quantity of inert gas in the blast is regulated, so as to keep the temperature within the limits of safe and effective clinkering.—A. G. L.

French Patents.

Wood; Method of and apparatus for the impregnation and colouring of ——. J. Meyerson. Fr. Pat. 363,072, Feb. 8, 1906.

Trunks of trees of varying diameter are impregnated and coloured with liquids by placing the trunk in a horizontal position with its ends in two cylindrical vessels, one of which, larger in diameter than the other, is fixed, whilst the other can be moved on rails so as to allow for the different lengths of the logs. The joint between the wood and the cylinders is made by rubber (or other elastic) cylindrical envelopes, which are kept tightly pressed against the wood. The impregnating liquid is first forced, under great pressure, from one cylinder to the other through the wood, and then back again, without being at all contaminated by contact with the bark of the tree.—A. G. L.

Wood; Apparatus for impregnating ——, used for constructional work, with antiseptic liquids. H. Altena. Fr. Pat. 363,811, March 3, 1906.

The wood to be impregnated is placed in trucks, which are run on to a stage near the top of a vessel resembling a gas-holder. This vessel can be raised or lowered above a reservoir containing the impregnating liquid by admitting, or withdrawing, compressed air from it. When it is in its lowest position, the charge of wood is completely covered by the liquid. Air is then quickly admitted so as to raise the vessel, and, at the same time, force the liquid into the wood, the operation being repeated if necessary. Special means of regulation are supplied to guard against too rapid an ascent or descent of the vessel.—A. G. L.

Plaster obtained by precipitation; Preparation of ——, for stucco. R. Koepp and Co. Fr. Pat. 363,564, Feb. 23, 1906.

The plaster is obtained chemically by precipitation, burnt as usual, and then subjected to a process of pounding and pugging, by means of which its volume and porosity are diminished, and its specific gravity is increased.

—A. G. L.

Magnesian cement, and method of making the same. W. Jeroch and Deutsche Ferrit-Cement Ges. m.b.H. Fr. Pat. 363,103, Feb. 9, 1906.

The cement is composed of a mixture of calcined magnesia and magnesium sulphate, analogous to Sorel cement; it is claimed to have greater constancy of volume than the latter. Sulphates of bases weaker than magnesia (*e.g.*, of aluminium, zinc) may be added, as also a small quantity of any lead salt, *e.g.*, lead acetate, free from chlorine. A suitable composition is made by mixing 72 parts of magnesium oxide, 23 parts of magnesium sulphate, and 5 parts of lead acetate. The lead salt hardens the mass, and prevents the formation of magnesium sulphate crystals on the surface.—A. G. L.

X.—METALLURGY.

(*Continued from page* 816.)

Gold from cyanide solutions; Electrolytic precipitation of ——. B. Neumann. Z. Elektrochem., 1906, **12**, 569—578; and Electrochem. and Met. Ind., 1906, **4**, 297—302.

For the recovery of gold from dilute cyanide solutions, the author finds that the lead peroxide anodes recommended by Andreoli are unsuitable; the metallic lead beneath the layer of peroxide becomes attacked, forming lead cyanide. Experiments were carried out to determine the current efficiency. When using the ordinary process (lead cathodes and iron anodes), this was found to be exceedingly low, under all practical conditions being far below 1 per cent.

It was subsequently found that graphite electrodes are quite durable in dilute cyanide solutions, and may

be used under certain conditions in place of lead cathodes. If such electrodes be employed, it is possible to directly refine the cathode deposit by employing the electrodes as anodes in a gold chloride solution containing free acid, as is used, for instance, by Wohlwill. By employing this process, the latter part of which can be carried out with very high current efficiencies, the whole difficulty of treating the lead cathodes, containing 2 to 12 per cent. of gold, is overcome, and fine gold of 0·988 purity is obtained instead of bullion of 0·800 to 0·900 purity.
—R. S. H.

Nickel wire; Structural changes in —— at high temperatures. H. C. H. Carpenter. Brit. Assoc., York; through Engineering, 1906, **82**, 222–223.

THE author has investigated the cause of the deterioration and ultimate failure of nickel wire used as the resistance in electrical furnaces of the Heræus type, but with the platinum replaced by nickel. These furnaces stand temperatures of 1200° C. or even 1300° C. well, but ultimately break down, the nickel wire being then found to be very brittle, and to consist of a mass of fibres, which, under the microscope, can be seen to be made up of large crystals. The nickel wire used had the composition: nickel, 98·60; cobalt, trace; iron, 1·22; manganese, 0·16; total, 99·98 per cent. It was made by the Fleitmann process. The author believes the remaining 0·02 per cent. to be dissolved gases, probably nitrogen and carbon monoxide, of a volume greater than that of the nickel they are contained in. From a micrographic study of the changes in the wire, it appears that, under the combined influence of the electric current and the high temperature, these gases are liberated in the nickel, and by alternate heating and cooling are concentrated more and more nearly at the centre of the wire, until their pressure becomes so great that they force a way out between the interstices of the nickel crystals, which have in the meantime been growing larger and larger. The vapour pressure of the nickel itself, which is considerable at 1200° C., probably aids the process. As the author points out, this theory leaves unexplained why platinum wire, which contains no dissolved gases and has no appreciable vapour tension at temperatures up to its fusing-point, does not give results very much better than those afforded by nickel.—A. G. L.

Manganese; Theory of the magnetic alloys of ——. C. E. Guillaume. Bull. Soc. Internat. Electriciens, June, 1906; through Electrician, 1906, **57**, 707.

HEUSLER discovered in 1904 the existence of magnetic properties in alloys containing only manganese, aluminium, and copper. Since then he has shown that the copper acts only as solvent, and that the magnetic properties are due to a manganese-aluminium alloy, $MnAl$; also, that another alloy, Mn_2Sn, is also magnetic. Bismuth, arsenic, antimony, and boron, added to manganese, also yield magnetic alloys, but magnetically feebler than the tin alloy. Aluminium and tin resemble one another in that they give alloys with other metals which melt at a temperature above that of the highest melting constituent. Thus the alloy, Al_2Au, melts at 17° C. above the melting-point of gold; the alloy, AlSb, at about 400° C. above that of antimony; and $NaSn$ at 344° above that of tin. Experiments have also shown that very pure manganese is perceptibly magnetic, but that probably its transformation point is too low for it to exhibit magnetic properties in the ordinary way. The effect of the addition of aluminium and tin to it appears to be to raise the transformation point, and hence to render the magnetic properties evident.—A. G. L.

Manganese and molybdenum; Alloys of ——. Arrivant. Compt. rend., 1906, **143**, 285—287.

BY fusing the metals together, or by reducing mixtures of their oxides with aluminium, the author has obtained a series of alloys containing from 12 to 29 per cent. of molybdenum. They are all well fused and homogeneous, hard, brittle, and non-magnetic; dissolved by acids, and oxidised by fusion with alkali nitrates, bisulphates, or carbonates. Alcoholic solution of acetic acid or of ammonium acetate dissolves manganese from them, leaving the definite compound Mn_6Mo or Mn_4Mo, according to the percentage of manganese originally present.
—J. T. D.

Sulphur; Determination of —— in iron. W. Schulte. XXIII., page 869.

Tin and gold in Federated Malay States. Bd. of Trade J., Aug. 23, 1906. [T.R.]

THE total mining revenue derived from all sources was $9,689,501 for 1905, against $9,249,189 for 1904 an increase in 1905 of $447,312. The export duty on tin amounted to $9,249,627, an increase as compared with 1904 of $434,939; the export duty on tungsten yielded $2213; and the royalty on gold produced only $11,439 as compared with $28,148 in 1904. The output of tin is stated to have been 856,660 pikuls, a decrease, as compared with the output of 1904, of 12,468 pikuls; 548,371 pikuls were exported in the form of tin ore, and 308,289 pikuls as block tin. The market rate was subject to less fluctuation in 1905 than during the preceding year, the highest figure reached having been $88.75 and the lowest $76. The average rate of exchange was higher, and thus the value in sterling of the output amounted to £7,063,407, being at the rate of £138 10s. 5d. a ton. The Acting Senior Warden sees no cause for alarm in the decreased output, and is of opinion that no evidence is forthcoming to show that the stanniferous deposits of the country are nearing exhaustion.

Pig-iron production of United States. Bull. of Amer. Iron and Steel Assoc. [T.R.]

	First half of 1905. Long tons.		First half of 1906. Long tons.
Bessemer pig	5,930,790	..	6,784,619
Low phosphorus pig	77,637	..	114,447
Basic pig	1,966,592	..	2,449,275
Charcoal pig	170,512	..	204,135
Spiegeleisen, ferro-manganese, ferro-phosphorus, Bessemer pig-iron	129,040	..	160,833
Other kinds of pig-iron	2,888,604	..	2,889,592
Total	11,163,175	..	12,602,901

Pig-iron production of Canada. Bull. of Amer. Iron and Steel Assoc. [T.R.]

THE production of pig-iron in Canada in the first half of 1906 amounted to 282,010 tons, against 210,206 tons in the corresponding period of 1905. The production in the first six months of 1906 was the greatest in any half-year in the history of the Dominion, exceeding by 24,213 tons that of the last half of 1905, the next highest half-year. It was also greater than the production of any whole year prior to 1902.

The production of Bessemer pig-iron in the first half of 1906 amounted to 79,051 tons, against 63,785 tons in the first half of 1905. The production of basic pig-iron amounted to 135,298 tons, against 68,378 tons.

Iron ore production of the United States. Bd. of Trade J., Aug. 23, 1906. [T.R.]

ACCORDING to the report of the United States Geological Survey, the year 1905 stands pre-eminent in production of iron ore, with a total for the United States of 42,526,133 long tons, an increase of 20 per cent. over the previous maximum output, 35,554,135 tons in 1902. As compared with the record of the year 1904, the increase in 1905 was 54 per cent.

The following is a summary of the iron ore statistics for the United States for 1905:—

	Tons of 2,240 lb.
Domestic iron ore produced—	
Red hæmatite	37,540,198
Brown hæmatite	2,546,662
Magnetite	2,417,274
Carbonate	21,999
Total	42,526,133
Zinc residuum produced	90,289
Concentrated iron ore produced	755,677
Stocks of iron ore at mines, 31st December, 1905	3,812,281
Stocks of iron ore at lower Lake ports, 31st December, 1905	6,758,511
Production of mines in the Lake Superior region	33,325,018

Steel hardening metals; Production of —— in the United States. Bd. of Trade J., Aug. 23, 1906. [T.R.]

THE United States Geological Survey reports a decline in the total production of steel-hardening metallic ores and concentrates in 1905, as compared with 1904, but the value of the output shows a material increase. Under this head are included all the metals that are used for steel hardening purposes, whether or not this is the main use of the metal. During 1905 the total production of steel hardening metal ores and concentrates amounted to 922 short tons, valued at $288,836, as compared with 1004 tons, valued at $259,620 in 1904. Of the 1905 value, over nine-tenths was due to the production of tungsten ores. There was no production of metallic nickel or of cobalt in 1905, and there was only a very small quantity of nickel and cobalt ore reported sold. All of the chromium ore produced in the United States during 1905 was from California; it amounted to only 25 tons, valued at $375, as compared with the production of 123 tons, valued at $1845, in 1904. There was a considerable increase in the production of tungsten ore during 1905, as compared with that of 1904, and also a general increase in the price paid per ton for the concentrates containing from 60 per cent. and over of tungstic oxide. The total production of the ore was approximately 18,851 tons, from which there was obtained 803 tons of concentrates, valued at $268,676. During 1905 the production of molybdenite and of wulfenite was in excess of the 1904 production of 14½ tons, valued at $2175. The value of the molybdenum ores varies from $230 to $430 per ton, according to the contents. The production of the ores of uranium and vanadium during 1905 amounted to approximately 4 tons, valued at $750. This ore, as shipped, contained 3·06 per cent. of uranium oxide. The total tonnage of ore taken out, as reported to the Survey, is 2081 tons. The production of titanium was somewhat larger than that of 1904, and was entirely from Roselands, Nelson County, Va.

ENGLISH PATENTS.

Heating, smelting, or reducing materials; Process of ——, and means for carrying out the same. E. A. A. Grönwall, Ludvika, Sweden. Eng. Pat. 9799, April 26, 1906. Under Int. Conv., May 8, 1905.

GASES containing carbon dioxide are drawn or forced through glowing carbon in a chamber provided for the purpose. The carbon dioxide is reduced to carbon monoxide, which is then forced into the blast furnace or other apparatus containing the materials to be treated. —J. H. C.

Sand-moulding powder for application to patterns. A. Kemper and F. Damhorst (trading as Kemper and Damhorst), and E. Utke, all of Berlin. Eng. Pat. 14,532, July 14, 1905.

CALCIUM carbide, quicklime, or other powdery mineral material adapted to generate gas or vapour on coming into contact with the moisture of the moulding-sand, is dusted into the mould, or mixed with petroleum or other chemically indifferent liquid, and sprayed into the mould. —J. H. C.

Alloy; A new ——. H. Wilkins, Sheffield. Eng. Pat. 14,733, July 18, 1905.

THE invention relates to a new alloy, stated to be exceedingly ductile, and possessed of great tensile strength, for use as a substitute for German silver, nickel silver, and the like. The proportions of the metals of which the alloy is composed, may be varied, but the following is given as an example: Copper, 50 parts; spelter (zinc), 30; and nickel, 17 parts; with 3 per cent. or less of manganese. Reference is directed to Eng. Pats. 2064 of 1874; and 8137 of 1891 (this J., 1892, 533).—A. S.

Iron or steel; Manufacture of —— in an electric furnace. P. Gredt, Luxembourg. Eng. Pat. 17,178, Aug. 24, 1905.

SEE Fr. Pat. 360,404 of 1905; this J., 1906, 546.—T. F. B.

Steel; Improved process for the manufacture of ——, and apparatus therefor. T. B. MacKenzie and D. Colville and Sons, Ltd., Motherwell, Scotland. Eng. Pat. 21,963, Oct. 28, 1905.

IN the manufacture of steel from molten iron in the open-hearth furnace, a suitable quantity of molten slag from a previous charge is introduced into the furnace, preferably before running in the molten metal from a blast-furnace, in order to avoid unnecessary oxidation of the iron, and also to protect the bottom or bath of the furnace from the corrosive action of the molten metal. The furnace is provided, low down, with an extra door, upon the sill of which a bank of sand or other material is built, to allow of the draining off of surplus slag as the process goes on. —A. S.

Steel; Electric mixing furnace for making ——. Soc. Electro-Métallurgique Française, Froges, France. Eng. Pat. 3004, Feb. 7, 1906. Under Int. Conv., Feb. 11, 1905.

SEE Fr. Pat. 360,072 of 1905; this J., 1906, 485.—T. F. B.

Steel; Process of treating manganese ——. W. Brinton, High Bridge, N.J., U.S.A. Eng. Pat. 3901, Feb. 16. 1906.

SEE U.S. Pat. 812,811 of 1906; this J., 1906, 269.—T. F. B.

Ore concentration; Impts. in ——. H. L. Sulman, London. Eng. Pat. 19,709, Sept. 29, 1905.

THE process claimed is an improvement on that described in Eng. Pat. 7803 of 1905 (see Fr. Pat. 354,960 of 1905; this J., 1905, 1177). The powdered ore is mixed with acidified water, a small proportion (5 per cent. on the weight of ore, or less) of an oily substance such as oleic acid, insufficient to cause the flotation of the metalliferous matter is added, and the mixture is agitated, heated approximately to boiling point until the oil-coated metalliferous matter forms a froth, and then distributed on the surface of a current of water, so that the froth is floated away by the current, while the remaining mineral matter (gangue) sinks.—A. S.

Comminuted materials; Process and apparatus for mechanically discharging —— from receptacles, retorts, or crucibles, whether cold or heated, and in particular the crucibles of zinc-smelting furnaces. Soc. Anon. de Fonderies et Laminoirs de Biache-Saint-Vaast, Paris. Eng. Pat. 98, Jan. 1, 1906. Under Int. Conv., Jan. 5, 1905.

A CURRENT of compressed air, steam, or the like, is conveyed through a hollow rod which is introduced into the retort or crucible. The compressed fluid passes out through two openings in a head-piece fixed on the end of the rod, *viz.*, one jet through an axial opening for the purpose of disintegrating the material in the retort, and a second jet through a peripheral opening so formed that the loosened material is propelled rearwards out of the retort.—A. S.

Aluminium foil; Manufacture of ——. H. H. Lake, London. From Aluminiumwarenfabrik Gontenschwil A.G., Gontenschwil, Switzerland. Eng. Pat. 2146, Jan. 27, 1906.

To obtain flexible aluminium foil of less thickness than

0·1 mm., well-annealed sheet aluminium of about 1 mm. thickness is rolled to 0·3 mm., and the sheet is then folded upon itself, and again rolled between cylinders heated to about 45° C., but in no case to so high a temperature as 100° C. The sheet is then unrolled, and coated with a mixture of "mineral oil soluble in water," and water, and is again folded, and passed through the heated cylinders until the length has again been doubled. One side of the sheet is then coated with the oily solution, folded, and again rolled, and so on, there being always a slight layer of the oily solution between the sheets. When the sheets are reduced to the desired thinness, the group is annealed in the retort of a furnace in which a vacuum has been formed.—E. S.

UNITED STATES PATENTS.

Furnace; Metallurgical ——. R. L. Lloyd and P. Thill, Great Falls, Mont. U.S. Pat. 12,511, July 24, 1906. Re-issue of U.S. Pat. 781,834, Feb. 7, 1905; this J., 1905, 242.

THE hearth of the furnace forms a continuous longitudinally-curved helical path for the ore, from the feed to the discharge end. The hearth is disposed about a vertical axis, and rabble mechanism carrying rabble arms is provided, the rabble arms being capable of conjoint vertical and rotatory reciprocating movement, following the pitch of the helix.—A. G. L.

Furnace; Calcining ——. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 827,089, July 31, 1906.

SEE Eng. Pat. 4735 of 1902; this J., 1903, 367.—T. F. B.

Furnace; Roasting ——. H. W. Fox, Colorado Springs, Colo. U.S Pat. 827,226 July 31, 1906.

THE invention relates to a roasting furnace, having metallic portions through which rabble-shafts pass. A flue leads from the fireplace to an opening at the top of the ore chamber, and injectors are arranged to project jets of air, or of air and steam, across this opening, in order to deflect the gases from the fireplace away from the parts of the furnace which should not be too highly heated. —A. S.

Furnace; Metallurgical ——. G. H. Benjamin, New York. U.S. Pat. 827,498, July 31, 1906.

THE furnace consists of a heating chamber permanently closed at the top and sides, and of a diameter approximately equal to its vertical height; also of a separable bottom furnished with means for rotating it, and for moving it up and down. A number of hearths can be moved on to and off this bottom by hydraulic power. A gas-producer is placed at the side of the heating chamber, the producer being divided into two sections, each section comprising an air-regenerator, and a producing chamber. By means of suitable ports and passages, the heating chamber can always be filled with flame whatever the position of the bottom.—A. G. L.

Oil from oil-coated fines; Process for distilling off the ——. E. B. Kirby. U.S. Pat. 825,909, 1906. III., page 843.

Precious-metal bearing materials; Process of treating ——. C. W. Merrill, Lead., S.D., U.S.A. U.S. Pat. 825,920, July 17, 1906.

THE crushed material is treated in a container with a cyanogen-bearing solution, then with an alkali or alkaline-earth hypochlorite solution, and finally with a cyanogen-bearing solution, each solution being drained off thoroughly before the next one is applied.—J. H. C.

Lead-bullion; Desilverising ——. A. Raht, San Francisco. U.S. Pat. 826,114 July 17, 1906.

ZINC, followed by sal-ammoniac, is added to the molten bullion, which is then well stirred, and the scum, containing a portion of the lead, is removed.—J. H. C.

Silver; Selective solvent for ——. F. J. Hobson, Guanajuato, Mexico. U.S. Pat. 827,368, July 31, 1906.

CLAIM is made for the use of a 0·05—0·5 per cent. solution of mercurous-potassium cyanide, $KHg(CN)_2$, in presence of alkali, as a solvent for silver when in combination with sulphur.—A. S.

Silver extraction; Process of ——. F. J. Hobson, Guanajuato, Mexico. U.S. Pat. 828,287, Aug. 7, 1906.

ORES containing silver in combination with sulphur are treated with an alkaline solution of mercurous-potassium cyanide of from 0·05 to 0·5 per cent. strength. The mercury sulphide, which precipitates, is removed, and the silver is recovered from the solution.—A. S.

Silver extraction; Process of ——. F. J. Hobson, Guanajuato, Mexico. U.S. Pat. 828,288, Aug. 7, 1906.

THE ore is treated with a solution of potassium cyanide and potassium ferrocyanide in presence of mercuric chloride and an alkali, and the silver is recovered from the solution. —A. S.

Matte; Process of treating ——. J. Savelsberg, Germany. U.S. Pat. 825,983, July 17, 1906.

THE matte is mixed with suitable fluxes, and charged in a suitable apparatus on to a bed of glowing material; an air-blast is then forced through the charge, to sinter it, after which the mass is cooled, broken up, and smelted in a shaft-furnace, thus slagging off the iron, and producing a matte free from iron.—J. H. C.

Brass or other copper alloys; Casting —— into metallic moulds. J. E. Fowler, Assignor to H. H. Beck, Youngstown, Ohio. U.S. Pat. 826,157, July 17, 1906.

THE interior of the mould is treated with a solution of boric acid or other boron compound.—J. H. C.

Flux for extracting metals from ores. A. Gutensohn, Southend. U.S. Pat. 826,568, July 24, 1906.

SEE Eng. Pat. 2619 of 1905; this J., 1906, 319.—T. F. B.

Ores, &c.; Process of sulphatising ——. E. Enke, Kattowitz, Germany. U.S. Pat. 826,925, July 24, 1906.

SEE Ger. Pat. 163,410 of 1904; this J., 1906, 221.—T. F. B.

Ores; Treating ——. F. J. Crane, Denver, Colo. U.S. Pat. 827,620, July 31, 1906.

THE apparatus comprises a tank, an ozone-chamber in the upper portion of the tank, a pump, and an "arrester" or pan with a perforated bottom and a perforated false bottom, disposed above the ozone-chamber, together with the necessary connections. The solution is drawn off from the tank, and returned by the pump through a feed-pipe, which discharges it against the arrester with sufficient impact to effect the pulverisation of the ore. Ozone is introduced into the ozone-chamber, through which the solution passes on its way from the arrester to the tank, and also into the feed-pipe.—A. S.

Zinc and other metals; Process of refining ——. J. Callmann and R. Bormann, Berlin. U.S. Pat. 827,418, July 31, 1906.

SEE Eng. Pat. 3252 of 1906; this J., 1906, 481.—T. F. B.

Composite metals; Process of making ——. T. A. Edison, Llewellyn Park, N.Y. U.S. Pat. 827,717 Aug. 7, 1906.

A SOLUTION containing salts of two or more metals is precipitated, so as to give reducible compounds of the metals in intimate physical admixture, the precipitate then being washed, dried, screened into granules, and subjected to heat in a reducing atmosphere. For example a solution containing nickel sulphate and cobalt sulphate may be precipitated by means of an alkali, and the mixed hydroxides of nickel and cobalt reduced as above.—A. G. L.

Metals; Apparatus for treating, refining, and purifying ——. W. S. Simpson, London, Assignor to the Simpson-Cook Co., Baltimore. U.S. Pat. 828,142, Aug. 7, 1906.

See Fr. Pat. 360,408 of 1905; this J., 1906, 542.—T. F. B.

Iron; Manufacture of ——. O. Thiel, Landstuhl, Germany. U.S. Pat. 828,583, Aug. 14, 1906.

See Fr. Pat. 354,104 of 1905; this J., 1905, 1071.—T. F. B.

FRENCH PATENTS.

Nickel; Production of —. H. S. Elworthy. Fr. Pat. 361,452, May 9, 1905.

See Eng. Pat. 7714 of 1905; this J., 1906, 257.—T. F. B.

Iron ores; Process for reducing ——. Westman Process Co. Fr. Pat. 363,069, Feb. 8, 1906.

See U.S. Pat. 812,247 of 1906; this J., 1906, 269.—T. F. B.

Steel; Method of treating manganese ——. W. Brinton. Fr. Pat. 363,401, Feb. 16, 1906.

See U.S. Pat. 812,811 of 1906; this J., 1906, 269.—T. F. B.

Steel; Process of producing —— in small quantities. A. Tropenas. Fr. Pat. 363,507, Feb. 20, 1906.

See Eng. Pat. 6484 of 1906; this J., 1906, 764.—T. F. B.

Aluminium foil and process for making same. Aluminium-warenfabrik Gontenschwil A.-G. Fr. Pat. 363,489, Feb. 14, 1906. Under Int. Conv., March 25, 1905.

See Eng. Pat. 2146 of 1906; preceding these.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 818.)

(*A.*)—ELECTRO-CHEMISTRY.

Standard cells; Influence of the size of grain upon behaviour of mercurous sulphate in ——. H. von Steinwehr. Z. Elektrochem., 1906, **12**, 578—581.

THE author is in agreement with Hulett (this J., 1904, 665) that the slight variations in the E.M.F. of the Clark and Weston cells must be ascribed to the mercurous sulphate; but gives evidence against the latter's conclusion that the presence of a basic salt causes the discrepancies. Experiments are described in support of an explanation that the variation in the size of the crystals may lead to values varying by as much as $5{\cdot}0\times10^{-4}$ volt. A method is described for obtaining crystals of the necessary physical constitution, and the view is expressed that, unassisted, the adjustment of the size of crystals occurs too slowly to be of any practical use.—R. S. H.

Nitric acid; Technical production of —— from nitrous gases. J. Klaudy. Z. Elektrochem., 1906, **12**, 545—551.

BY passing an electric discharge through air, some nitric oxide, NO, and nitrogen peroxide, NO_2, are produced. 438 kilos. of nitrogen peroxide or 600 kilos. of nitric acid are obtained under present working conditions by the expenditure of one kilowatt-year of electrical energy, and it is probable that with improved conditions, 900 kilos. of nitric acid might be obtained. If water power be used and the cost of one kilowatt-year be taken at 20*s.*, then the cost of producing 1 kilo. of nitrogen in the form of nitrogen peroxide, is about 2*d.* If water power be replaced by gas or oil engines, the cost is about four times this value.

The best method of utilising the nitrogen peroxide is to bring it at once into chemical action—the manufacture of sulphuric acid by the chamber process or the manufacture of nitric acid and nitrates. In the manufacture of sulphuric acid it is found that the cost of the necessary amount of NO_2 (using a gas engine for generating the electricity) is about one-half the cost of nitre, which has hitherto been used.

Air containing nitrogen peroxide, NO_2, may also be used directly for the manufacture of nitric acid by passing it through water;

$$2NO_2+H_2O=HNO_3+HNO_2.$$
$$3HNO_2=HNO_3+2NO+H_2O.$$

Nitric oxide, NO, is evolved, but being mixed with excess of air it oxidises again to nitrogen peroxide, and is absorbed by water in another vessel. In this way a nitric acid of 50 per cent. strength is produced, and this is concentrated by distillation with sulphuric acid. The total cost of producing 100 kilos. of nitric acid by this method is about 5*s.*, with a sale price of 40*s.*

The production of nitrates for manure would probably be best carried out by using lime as the base.—C. E. F.

Colloids of opposite electric sign; Influence of non-electrolytes on the mutual precipitation of ——. J. L. des Bancels. Compt. rend., 1906, **143**, 174—176.

THE experiments were carried out with the couples colloidal ferric hydroxide and Aniline Blue, colloidal arsenic sulphide and Magdala Red, whilst the non-electrolytes employed were urea, dextrose, saccharose, glycerol, alcohol, formaldehyde, and acetone. It is experimentally shown that, as a rule, a mixture of two colloids of opposite sign, in presence of non-electrolytes, causes precipitation which is complete when the elements are present in proper proportions. Whilst some electrolytes facilitate the mutual precipitation of the two colloids, others, on the contrary, retard it. These latter retarding non-electrolytes are also able to dissociate the resulting precipitate, the retarding and dissociating actions approximately corresponding in intensity.—E. F. A.

Nitric oxide; Determination of —— in air, and some of the reactions involved. Le Blanc. XXIII., page 869.

ENGLISH PATENTS.

Electrodes; Storage Battery ——. T. A. Edison and W. Aylsworth, Orange, N.J. Eng. Pat. 1928, Jan. 25, 1906. Under Int. Conv., April 28, 1905.

THE positive, nickel oxide, electrode consists of a metal grid, on which are supported a number of perforated tubes containing the active material. The tubes are filled, under pressure, with an intimate mixture of nickel hydroxide and conducting flakes of cobalt, or cobalt-nickel alloy; after which the tubes are closed, the flattened ends serving for attachment to the grid.—R. S. H.

Electrode for storage batteries. T. A. Edison, Orange, N.J. Eng. Pat. 1924, Jan. 25, 1906. Under Int. Conv., Nov. 2, 1905.

THE positive electrode comprises a number of tubular perforated pockets about 10 cm. long and 6·5 mm. internal diameter, made of steel of about 0·1 mm. thickness, which has been plated with an alloy of cobalt and nickel, and submitted to a welding temperature in a hydrogen atmosphere before being made into tubes. These tubes are filled with about eight grms. of the active mixture, consisting of relatively large particles of nickel hydroxide and conducting flakes of cobalt or cobalt-nickel alloy, the latter taking the place of graphite, which has been found to deteriorate in use. The above-mentioned materials, mixed with glucose or other sticky material, the proportions being 60 per cent. of nickel hydroxide, and 20 per cent. each of glucose and metal flakes, are stamped into the tubes in very small increments, some 50 or 100 being submitted to a pressure of more than 1400 kilos. per sq. cm. In this way the active particles are deformed, and brought into good contact with the conducting flakes, whilst the glucose assists the adherence of the hydroxide to the metal flakes. Upon subsequently dissolving out the glucose, a network of circulating channels is left, which enables the whole contents of the pockets to be acted upon. Before the ends of the tubes are closed off, metal discs are inserted, which serve to maintain the pressure on the active mass.

—R. S. H.

Arc lamp [Flaming] electrodes, and method of making the same. The British Thomson-Houston Co., Ltd. From Gen. Electric Co. U.S. Pat. 18,484, Sept. 13, 1905. II., page 841.

Filaments for incandescent electric lamps; Manufacture or treatment of ——. H. Zerning. Eng. Pat. 2437, Jan. 31, 1906. II., page 841.

Electric incandescence bodies of difficultly fusible conductive materials; Process for manufacturing ——, *and for uniting such bodies to supply conductors.* H. Kuzel, Eng. Pat. 8057, April 3, 1906. II., page 841.

Bleaching medium; Apparatus for producing a gaseous ——. F. H. Loring, London. Eng. Pat. 22,101, Oct. 30, 1905.

A HOLLOW reciprocating piston forms the chamber in which an electric arc is struck in air. The terminal electrodes, between which the arc plays, are hollow tubes, and are periodically short-circuited by a secondary electrode moving with the piston. Valves are also supplied for the admission of air, and its expulsion after treatment. A felt dust jacket prevents the particles thrown off from the arc from coming into contact with the sliding surfaces of the piston. A special form of O-shaped link is described for connecting the piston to a moving crank, enabling the take-up for wear to be easily carried out.—R. S. H.

Heating matter in high vacua to high temperatures in glass vessels; Apparatus for use in [electrically] ——. F. Soddy, Glasgow. Eng. Pat. 5348, March 5, 1906.

Fig. 1.

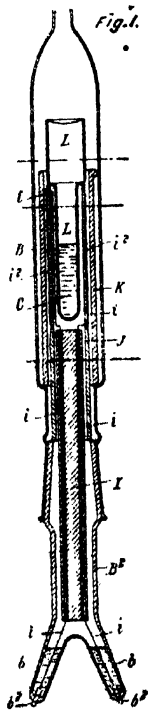
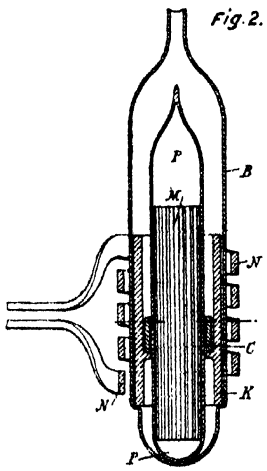


Fig. 2.



THE first form of apparatus is shown in Fig. 1, and consists of an outer glass vacuum vessel, B, into which the lower part, B^2, fits by an air-tight ground joint. The lower part, B^2, has two pockets, *b*, which contain mercury, and into which the platinum electrode wires, b^2, are sealed. The substance, C, which is to be heated, is contained in the porcelain vessel, L, and is heated by the resistance wires, i^2, wound on the porcelain tube, J, and connected to the mercury cups by the wires, *i*, which pass through holes in the porcelain rod, I. The glass vessel, B, is protected from the heat by a porcelain shield tube, K.

The other form of apparatus, shown in Fig. 2, is used when the body to be heated is a conductor, and can be formed into a ring, C; this is supported on a ledge on the porcelain shield, K, which is placed within the glass vacuum tube, B. A bundle of iron wires or strips, M, contained in the thin glass tube, P, serves as a core, and is inserted in the ring, C, and a helical conductor, N, is placed outside the tube, B. When an alternating current of high periodicity is passed through the helix, N, the arrangement becomes an alternating current transformer, and a secondary current is induced in the ring, C, which forms a single short-circuited secondary, this current serving to heat the body, C.—W. H. C.

UNITED STATES PATENTS

Battery; Alkaline ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., West Orange, N.Y. U.S. Pat. 827,297, July 31, 1906.

THE battery is provided with an insulator, or support, which is exposed to the action of the electrodes, and an alkaline electrolyte, the insulator being composed of rubber substantially free from active or uncombined sulphur, whereby the formation of sulphides is avoided. —B. N.

Reducing metallic compounds and producing carbides. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 826,742, July 24, 1906.

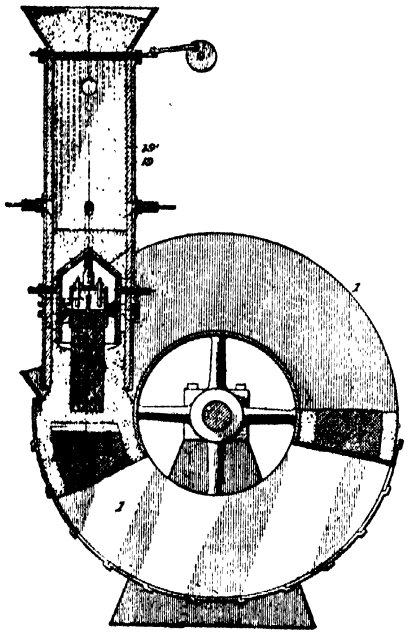
THE process described, which is covered by twenty-six claims, consists essentially in preheating the charge of an electric furnace, by passing the finely-divided materials through a hot atmosphere, previous to smelting with electric arcs. The heating can be carried out by utilising the carbon monoxide or other gases resulting from the smelting After passing through the preheating chamber, the finely-divided particles are caused to coalesce, and the relatively large body of material is then electrically heated to the temperature required for reaction. The process is described as carried out in a rotating drum furnace, the whole arrangement of apparatus being that described in U.S. Pat. 826,744. (See following abstracts.)—R. S. H.

Reducing compounds and producing carbides. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 826,743, July 24, 1906.

THE finely-divided substances, which are to react together, are showered through a preheating chamber, and after being collected to a body of material, are subjected to heating by an electric current passing through a resistance-conductor. By an increase of current density, the heat supplied by the conductor increases along the path of the electric current to a point where the product becomes molten and may be tapped. The preheating may be effected by burning the gases resulting from the electric smelting, and the process can be carried on continuously. The detailed description refers to the electric furnace which is the subject of a separate specification. (See U.S. Pat. 826,745, below.)—R. S. H.

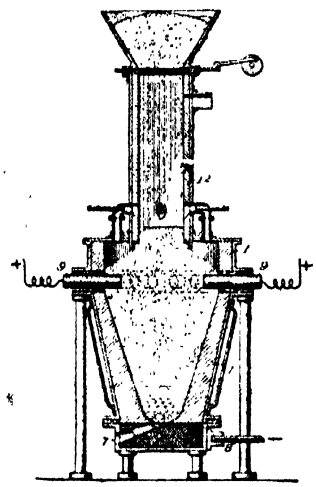
Reducing metallic compounds and producing carbides; Apparatus for ——. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 826,744, July 24, 1906.

A PREHEATING chamber, 19, is combined with a rotating drum electric furnace, 1. Means are provided for showering the finely-divided material through the preheating chamber, in which the waste gases (carbon monoxide, &c.), from the electric smelting are burnt by introducing air. The finely-divided particles are collected at the bottom of this chamber into a relatively large body of material, which passes on to the electric furnace, where it is heated by an electric arc. The arc is struck between electrodes, the ends of which are embedded in the material. The electric furnace is capable of rotation so as to withdraw the product from the zone of high temperature as the



reaction proceeds, and fresh quantities of the substances are thus caused to react.—R. S. H.

Reducing compounds and producing carbides; Apparatus for ——. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 826,745, July 24, 1906.



The electric resistance furnace, 1, is surmounted by a preheating chamber, 12. Before reaching the electric furnace the reacting materials traverse the preheating chamber, in which the waste gases from the electric furnace are burnt. The electric current enters the furnace by a series of electrodes, 9, which project through the walls, and flows down through the conducting charge to the other electrode, 8. The temperature increases towards the bottom of the furnace, on account of the shape causing increased current density. The conditions are so proportioned that the product is brought into a molten condition, and flows out of the furnace by the tapping hole, 7.—R. S. H.

French Patents.

Incandescence [Electric] lamps; Filaments for ——. A. Just and F. Hanaman. Second Addition, dated Feb. 5, 1906, to Fr. Pat. 347,661, Nov. 4, 1904. II., page 843.

Electric resistance furnace of carbon protected against oxidation. C. Féry and C. Langlet. Fr. Pat. 363,437, Feb. 17, 1906.

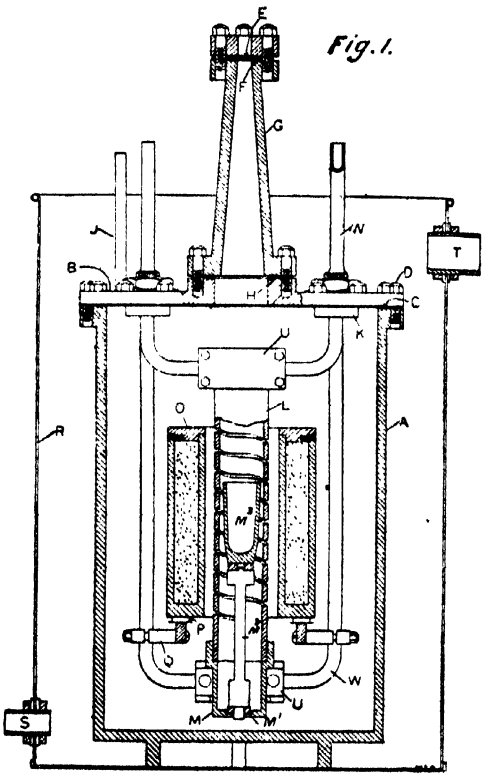
The furnace chamber is formed of a tube or muffle of refractory material, and to the walls of this the heating resistance of carbon is applied. The carbon conductor is protected from oxidation by a layer of lampblack or powdered wood charcoal which may have some refractory material added to it. The heating resistance may be formed of carbon rods of various shapes connected in series or parallel according to the voltage of the current available, or may be in the form of a helix worked around the furnace chamber.—R. S. H.

Copper sulphide; Process for making —— for use in the construction of thermo-electric couples. Comp. Thermo-Electrique (Système Hermite). Fr. Pat. 361,420, April 27, 1905.

See Eng. Pat. 11,300 of 1905; this J., 1905, 805.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Electric vacuum furnace; The ——. W. C. Arsem. J. Amer. Chem. Soc., 1906, 28, 921—935.



The author points out that previous work *in vacuo* at high temperatures was limited by the temperature at which the vessel, in which the substance experimented with was contained, and which was exposed to external atmospheric pressure, collapsed. The apparatus described obviates this difficulty as only the crucible containing the substance is heated, and both crucible and heater are contained in a vacuum chamber which may be of any suitable material, and is kept at a low temperature. A gun-metal chamber, A, Fig. 1, has a cover, B, fastened down by the cap screws, D, the joint being made tight by a lead gasket, C. The

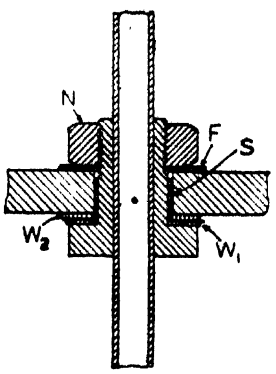


FIG. 2.

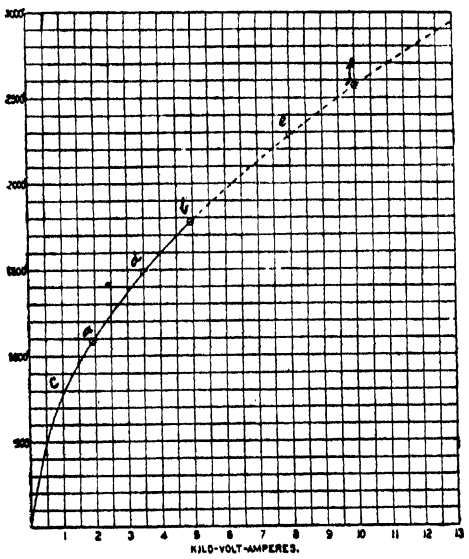


FIG. 3.

vessel, A, stands in a water-jacket, R, provided with inlet and outlet tubes, S, and T, and is raised on four legs to allow the water to circulate underneath the bottom of A. It is provided with a window-tube, G, bolted on to the top, the joint being made tight by a lead washer, H. A window formed of a sheet of white mica, E, 0·005 in. thick, is clamped between two lead washers, F, by a brass cap and screws. The vessel, A, is exhausted through the tube, J, soldered to the top, and the current is led in by the electrodes, W, formed of brass tube, through which water is circulated and which pass through the brass bushings, K. Two lead washers, W_1, and W_2, Fig. 2, separated by a mica washer, are interposed between the cover, B, and the flange of the bushing, which is insulated by the "fibre sleeve," S. The joint is screwed tight by the nut, N, insulated by the "fibre washer," F, and both fibre washers are rendered water-tight by being impregnated with paraffin. The heater, L, is a helix of conducting material, formed preferably of artificial graphite, and is made by sawing a slot in a hollow cylinder of that material. It is supported by copper clamps, U, U, fastened to the electrodes, the lower clamp also serving to support the graphite cup, M, containing the lava insulating ring, M^1, on which the support, M^2, carrying the crucible, M^3, rests. The heater is surrounded by a screen, O, formed of a double-walled cylinder of graphite having the space between the walls filled with powdered graphite. This is supported by the copper arms, *q*, from which it is insulated by the lava buttons, P, and serves to prevent loss of heat by radiation from the outer surface of the heater. The crucibles are formed of any suitable material but magnesia and thorium oxide are very serviceable; the former, however, must have been previously heated strongly to avoid the fracture of the crucible from shrinkage. The crucible containing the substance to be experimented upon is put in position, and the vessel, A, closed and exhausted, the current is then passed, and the behaviour of the substance observed through the mica window; coloured glass is used to protect the eyes at high temperatures. The temperature is estimated from the electrical energy required to produce the observed effect, and the apparatus is calibrated by determining the energy required to melt copper and platinum. The amounts of energy measured in kilo-volt-ampères, *a*, *b*, Fig. 3, corresponding to the melting points of copper and platinum, are plotted on squared paper, and the other points, *c*, *d*, *e*, *f*, are calculated from the formula $y^n = ax$, in which y = the temperature of the crucible above that of the room, x = the energy in kilo-volt-ampères, and n and a constants, the values of which were found to be $n = 1{\cdot}895$ and $a = 285200$. The curve is completed, and the chief error was found to be due to variation in the voltage of the generator, and may amount to 25°, and to 50° for higher temperatures in the neighbourhood of 3000°. It is proposed to verify the temperatures by the use of an optical pyrometer. The number of turns and the width of the slot in the heater must be adjusted so as to avoid arcing and "Edison effect," which destroys the heater. The apparatus has been used for experiments on melting points, the direct production of alloys, and for following gas-producing reactions, and the author consider that it will be useful for the investigation of high temperature phenomena under exact and easily controlled conditions. —W. H. C.

Molybdenum dioxide; Reduction of —— by boron, and the combination of boron with molybdenum. B. du Jassoneix. Compt. rend., 1906, 143, 169—172.

MOLYBDENUM dioxide, mixed with the theoretical quantity of boron, and heated in the electric furnace in a boat of pure magnesium oxide until the mixture begins to melt, is reduced to metallic molybdenum, which is malleable, easily filed, and does not scratch glass. In presence of an excess of boron, the fusion becomes more difficult, a current of 600—700 ampères and 100 volts being required. Compounds of boron and molybdenum containing up to 20 per cent. of boron are prepared in magnesium crucibles, heated in an oven with a current of 400 ampères and 100 volts for two or three minutes after melting; compounds with more boron require a larger current of 500—600 ampères and three or four minutes' fusing. The alloys containing up to 20 per cent. of boron are brittle and have a density decreasing to about six with increasing boron content; the hardest of them scratch quartz. Above 20 per cent. they lose their metallic appearance, and become slate-like and of a bluish-grey hue; their hardness and density diminish. The alloy richest in boron obtained contained 45·6 per cent., and had a density of 3·3. None of the compounds obtained showed a crystalline structure. They are all attacked by fluorine in the cold, and by chlorine above a dull red heat. The powdered compounds are oxidised in the air, and burn in oxygen. Hydrochloric and hydrofluoric acids are without action. Strong sulphuric acid dissolves them on heating; cold dilute nitric acid acts but slowly, though rapidly when heated.—E. F. A.

Gold from cyanide solutions; Electrolytic precipitation of ——. B. Neumann. X., page 848.

ENGLISH PATENT.

Electric furnaces. T. Parker, London. Eng. Pat. 14,884, July 19, 1905.

THE furnace described employs electric resistance and

induction heating, and is intended for refining steel and for smelting nickel and other metals. Electric conductors of carbon, or other material, are embedded in spiral form in the bottom, sides, or top of the furnace casing. On passing an alternating current through these conductors, the molten metal in the furnace is heated by radiation from the incandescent conductors, and also by magnetic and current heating effects produced by induction in the molten metal itself.—R. S. H.

United States Patents.

Iron-oxide scale; Process of electrolytically dissolving ——. C. J. Reed, Philadelphia, Pa. U.S. Pat. 827,179, July 31, 1906.

This invention relates to a process of electrolytically dissolving iron-oxide scale from the surface of a metal, and consists in placing the metal in a solution of sulphuric acid having a density above 1·06, preferably between 1·15 and 1·25. An electric current, of a density not less than 40 ampères per square foot, is passed to the metal as cathode from an anode of lead.—B. N.

Iron sulphate; Process of electrolytically removing scale and producing ——. C. J. Reed, Philadelphia, Pa. U.S. Pat. 827,180, July 31, 1906.

An electric current of sufficient density to remove the scale is passed to the metal as cathode, in an electrolyte consisting of a heated strong aqueous solution of sulphuric acid. A diaphragm is interposed between the cathode and anode, and sulphur dioxide is supplied at the anode. The cathode electrolyte is afterwards removed and cooled, ferrous sulphate being thus precipitated, and the residual solution is returned to the anode compartment of the electrolytic cell.—B. N.

Electro-plating cylindrical articles; Apparatus for ——. R. C. Totten, Pittsburg, Pa. U.S. Pat. 827,478, July 31, 1906.

The article is held by sockets carried on supports which are made to rotate in bearings fixed in the plating tank. The bearings are adjustable towards and from each other, but the supports are incapable of endwise motion, and are fixed opposite each other axially.—R. S. H.

Lead-refining [Electrolytic] apparatus. A. G. Betts, Troy, N.Y. U.S. Pat. 827,702, Aug. 7, 1906.

The electrolytic vat is provided with a "bus-bar," in which is a relatively wide trough-shaped cavity, and the latter has a number of wells of relatively small cross-sectional area, each containing a fluid metal. Several electrodes of unrefined cast lead in the form of plates are supported within the vat, each electrode having a lug overhanging the "bus-bar," and terminal pins, driven into sockets in the lugs, are immersed in the fluid metal in the respective wells. The under surface of each lug is inclined to the plane of the plate, and these inclined surfaces are received on upwardly-presented knife-edges supported on the electrolytic vat.—B. N.

French Patents.

Metal deposits; Formation of brilliant —— by electrolysis. A. Classen. First Addition, dated Feb. 1, 1906 (Under Int. Conv., Feb. 2, 1905), to Fr. Pat. 350,964, Jan 23, 1905.

To the bath for the deposition of the metal, substances belonging to the class of glucosides are added. These may be introduced either singly, or some mixture of different glucosides may be employed. (See this J., 1905, 806.) —B. S. H.

Metals from ores; Electrolytic process for the extraction of ——, *and treatment of copper residues.* L. M. Lafontaine. Fr. Pat. 363,701, Feb. 5, 1906.

As electrolyte, copper sulphate containing free sulphuric acid, hydrogen peroxide, and lampblack, is employed. The electrodes are arranged close together, the anodes consisting of the minerals either agglomerated or merely held in suitable containers. The hydrogen peroxide is intended to prevent iron going into solution, whilst the lampblack "ensures the conductivity of the electrolyte, and assists the molecular deposition of copper at the cathode."—R. S. H.

Tinning of lead; Electro-chemical ——. J. Reczka. Fr. Pat. 363,649, Feb. 27, 1906.

The lead sheet to be coated with tin is first mechanically freed from oxide, and then tinned by an electrolytic process.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 819.)

Acyl groups of esters of polyhydric alcohols; Kinetics of the splitting-off of —— by hydroxyl ions in an aqueous homogeneous system [Theory of saponification]. R. Kremann. Sitzungsber. kaiserl. Akad. Wissensch. in Wien, 1906, **115** [II. *b*], 349—368. Monatsh. Chem., 1906, **27**, 607—626.

In view of the discussion between Lewkowitsch and Balbiano as to whether the saponification of triglycerides proceeds in three stages, with formation of di- and monoglycerides as intermediate products, or in one stage, or, in other words, whether the reaction is bimolecular or polymolecular, the author determined the reaction-constants for the saponification of triacetin, glycol diacetate, and ethyl acetate by sodium hydroxide in aqueous solution at 0° and 19·8° C. The values obtained for the velocity of the reaction were approximately constant when calculated by the aid of the formula for bimolecular reactions, but increased with the duration of the reaction when calculated by the tried formulæ for tri- and quadrimolecular reactions. The results obtained for the reaction-constants show that the rates of saponification of the different acetyl groups differ so little, that the effect is the same as in the case of the saponification of an ester of a monohydric alcohol by an equivalent quantity of alkali. It was probably owing to this cause that Balbiano failed to recognise the formation of intermediate products. The author states that the results of his experiments show that there can no longer be any doubt that the saponification of esters of polyhydric alcohols is a bimolecular and not a polymolecular reaction. (See Lewkowitsch, this J., 1898, 1107; 1899, 1031; 1900, 254.)—A. S.

English Patents.

Grease or oil; Apparatus for rendering or reducing vegetable or animal matter capable of yielding ——. H. J. Haddan, London. From the Edson Reduction Machinery Co., Cleveland, Ohio, U.S.A. Eng. Pat. 22,241, Oct. 31, 1905.

See U.S. Pat. 803,050 of 1905; this J., 1905, 1243.—C.A.M.

Vegetable or animal matter from which oily or greasy matter has been extracted; Process for converting into a marketable product ——. H. J. Haddan, London. From The Edson Reduction Machinery Co., Cleveland, U.S.A. Eng. Pat. 22,242, Oct. 31, 1905.

See U.S. Pat. 803,051 of 1905; this J., 1905, 1243.—T.F.B.

Emulsifying mineral oils; Process for ——, *and for the manufacture of mineral oil soaps.* J. C. Fell, London. From E. Korndörfer, Asch, Bohemia. Eng. Pat. 14,294, July 11, 1905.

The inventor claims the compounding of a stable mixture (soluble in water) of mineral and other oils, by taking the following proportions of the materials: an alkaline-earth sulphoricinoleate, 10—30 parts; olein, oleic acid, or stearin, 10—30; mineral oil, vaseline oil, or spindle oil, 70—30; ammonia (sp. gr. about 0·910), 2½—10 parts. The sulphoricinoleates may be replaced by Turkey Red oil and calcined soda or potash, the proportions of the other ingredients being also subject to modification.

The process consists in treating the alkali compound of a sulphonated oil with any metallic oxide that furnishes a soluble compound with the sulphonated fatty acid, and incorporating the product with oil or fat and ammonia, followed by the mineral oil. The product is soluble in water containing about 3 per cent. (referred to the weight of said product) of calcined soda or potash. The soap claimed by the inventor is prepared by mixing approximately equal parts of strong alkali sulphoricinoleate and oleic acid, adding ammonia till the mixture is clear and alkaline, then adding mineral or tar oil, and a solution of calcined sodium carbonate, the mass being boiled until a clear soap is formed.—C. S.

UNITED STATES PATENT.

Oils and unsaturated organic compounds; Process of hardening and solidifying ——. A. Kronstein, Karlsruhe, Germany. U.S. Pat. 826,860, July 24, 1906.

SEE Eng. Pat. 17,378 of 1900; this J., 1901, 1123.—T. F.B.

FRENCH PATENTS.

Fish oil; Process for removing the odour from ——. A. de Hemptinne. Fr. Pat. 363,078, Feb. 8, 1906. Under Int. Conv., March 28, 1905.

SEE Eng. Pat. 12,525 of 1905; this J., 1906, 80.—T. F. B.

Emulsions from oils, fats, and fatty matters, stable when cold and when boiled; Process for preparing consistent or fluid aqueous ——. O. A. H. H. Kösters. Fr. Pat. 363,675, Feb. 28, 1906.

SEE Eng. Pat. 4688 of 1906; this J., 1906, 767.—T. F. B.

Soap particularly suitable for the removal of stains of oil, tar, &c. P. E. Parquin. Fr. Pat. 361,412. April 25, 1905.

A CERTAIN proportion (say 30 to 50 per cent.) of wood ash is incorporated with ordinary soap.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 821.)

(*A.*)—PIGMENTS, PAINTS.

Colouring matters; Prohibition of the use of injurious —— in Austria-Hungary. Bd. of Trade J., Aug. 23, 1906. [T.R.]

A GOVERNMENT Decree prohibits the use of injurious colouring materials in foodstuffs intended for sale, and the sale of the same. Colouring matters containing antimony, arsenic, barium, lead, cadmium, chrome, copper, mercury, uranium, tin, and zinc, are held to be injurious under this Decree, as well as picric acid and all its compounds, dinitrocresol and its metallic compounds, manchester and naphthalene yellow, orange II., aurantiæ, aurin, gorallin, gamboge, &c.

Further, the above-mentioned injurious colours must not be used in the preparation of eating, drinking, or cooking utensils; cosmetics; toys, picture books and water colours for children. In the finish of carpets, textiles, artificial flowers, leaves, and fruits, and similar articles, for use in connection with clothing, colouring matter must not be used which contains more arsenic than is technically unavoidable. Textiles containing more than 15 mgrms. of antimony per 100 sq. cm. must not be used for clothing purposes. The use of lead compounds in the weighting and dressing of textile goods of all kinds is forbidden, if the same are to be used as clothing.

The Decree comes into effect three months after date of publication, which was on July 20, 1906.

FRENCH PATENTS.

Pigment with silicon monoxide as its base. H. N. Potter. Fr. Pat. 363,168, Jan. 17, 1906. Under Int. Conv., Jan. 25, 1905.

SEE Eng. Pat. 1279 of 1906; this J., 1906, 434.—T. F. B.

White lead; Apparatus for the manufacture of ——. Union Lead and Oil Co. Fr. Pat. 363,833, March 5, 1906.

CLAIM is made for an apparatus provided with means for the mechanical introduction of the finely-divided lead into the different compartments of the oxidation chamber. There is a frame, moving on rails, and capable of being regulated in height so that the lead falls directly on to the trays, which are then carried on an endless chain or other mechanism into the chamber, where superposed supports are provided to receive them. The feeding device is suspended from upright supports, which can be raised or lowered telescopically, by means of a screw, the said screw and the endless chain being under independent control if required. The oxidation chamber is open at both ends, so that the introduction of one tray expels others in which the conversion of the lead is complete. Several such chambers may be worked in conjunction, with an open space between them, in which is placed a washing apparatus to receive the trays containing the white lead.—C. A. M.

Paint and varnish remover; Non-inflammable ——. C. Ellis. Fr. Pat. 363,506, Feb. 20, 1906.

SEE U.S. Pat. 817.141 of 1906; this J., 1906, 434.—T. F. B.

(*B.*)—RESINS, VARNISHES.

ENGLISH PATENT.

Phenol-alcohols; Manufacture of products of condensation of ——. Fabr. de Prod. de Chimie Organique de Laire, Paris. Eng. Pat. 15,517, July 28, 1905. Under Int. Conv., Sept. 16, 1904.

SEE Fr. Pat. 350,180 of 1904; this J., 1905, 1244.—T. F. B.

UNITED STATES PATENT.

Oil-cloth or linoleum; Substitute for ——. W. Melville, Manchester. U.S. Pat. 828,623, Aug. 14, 1906.

SEE Eng. Pat. 22,114 of 1904; this J., 1905, 1118.—T. F. B.

FRENCH PATENT.

Linoleum; Treatment of granular composition for ——. Rheinische Linoleumwerke Bedburg Actien-Ges. Fr. Pat. 363,253, Feb. 13, 1906.

THE composition is dusted with a fine vegetable flour, preferably rice or potato flour or other substances with the property of leaving the suppleness of the product intact, whilst themselves imparting a certain agglutinating power. The object of the addition is to destroy the external stickiness of the linoleum composition.—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

Rubber cultivation in Malay States. Bd. of Trade J., Aug. 23, 1906. [T.R.]

THE high price of rubber and the proved suitability of land in the Federated Malay States for its cultivation have led to numerous applications for land, more particularly in Selangor, where almost all the accessible land between the Klang and the Selangor Rivers has been taken up for rubber planting. Next to the coast districts of Selangor, the Sungei Ujong district of the Negri Sembilan appears to be the locality most in favour with rubber prospectors. The area alienated for the planting of Para rubber is some 100,000 acres, of which about 38,000 acres have already been planted. Most of the Para rubber trees of the age of five years or more have been planted 200 to the acre; some estates have as many as 300 to the acre. On the more recent clearings the average is probably 175 to the

acre. The number of trees of all ages in the Federated Malay States may perhaps be put at six to seven millions. The rubber production of 1905 is estimated to have been 300,000 lb.

ENGLISH PATENTS.

Rubber waste of all kinds; Process for regenerating ——. J. Neilson, Linden, Germany. Eng. Pat. 17,452, Aug. 29, 1905.

SEE Fr. Pat. 357,336 of 1905; this J., 1906, 83.—T. F. B.

India-rubber; Process for the devulcanising of vulcanised ——. M. Körner, Grünau, Germany. Eng. Pat. 22,504, Nov. 3, 1905.

SEE Fr. Pat. 358,635 of 1905; this J., 1906, 326.—T. F. B.

Skins and furs; Process of treating [waterproofing] ——. J. Klugmann, Riga, Russia. Eng. Pat. 25,957, Dec. 13, 1905.

A COATING of caoutchouc and other suitable substances, such as zinc oxide, chalk, and liquid hydrocarbons, with or without the addition of mineral colours or the like, is applied to the inside of the tanned skin, and then vulcanised by means of carbon bisulphide and sulphur chloride. Advantages claimed for this process are that the separate cloth covering can be dispensed with, and that the waterproof skins are cheaper and more supple than the ordinary "smoked" goods.—C. A. M.

FRENCH PATENT.

Caoutchouc, guttapercha, and analogous substances; Process and machine for purifying.——. F. C. Hood. Fr. Pat. 363,291, Feb. 16, 1906.

SEE U.S. Pats. 821,716 and 821,717 of 1906; this J., 1906, 646.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 822.)

Depilatory agents; The action of ——. E. Stiasny. Gerber, 1906, **32**, 200—202, 214—216, and 228—231.

THE usual depilatory agents such as lime, alkalis, sodium sulphide, &c., besides removing the hair also increase the weight and volume of the hide or skin, and more or less improve its elasticity. The author records the results of experiments undertaken with a view of ascertaining the course of the action of different depilatory solutions. The action is shown to be dependent on the concentration of the solution, but even in the same concentration, different alkaline solutions have very varying effects. For instance, when N/20 solutions are employed, sodium and barium hydroxides make the hide very elastic and increase the weight, but have little, if any, depilatory action, whilst calcium hydroxide and ammonia, which completely remove the hair, give comparatively little increase in the weight, and do not improve the elasticity. Although the depilatory action is dependent on the concentration of hydroxyl ions in the solutions, such is not the case with the increase of weight of the hide, and the elasticity diminishes as the depilatory action increases. Ammonia, however, differs considerably in its action from sodium hydroxide, in that, even in dilute solution, it completely removes the hair. Taking each alkali separately, the actual amount absorbed by the hide is proportional to the concentration of the solution, but from N/20 solutions more than twice as much lime is absorbed as soda. The quantity of hide substance going into solution is also proportional to the strength of the alkali solution, and sodium hydroxide and ammonia dissolve about twice as much as calcium and barium hydroxides.—W. P. S.

Tannery effluents; Biological purification of ——. W. Eitner. Gerber, 1906, **32**, 199—200, 213—214, and 227—228.

ALTHOUGH the effluents from tanning and leather works vary considerably in their composition, the biological treatment will, in most cases, effect their purification. It is necessary, should free acids be present, to treat the effluent with precipitants in a settling tank before it passes to the decomposition tank and filters. By careful construction of the plant and good supervision, effluents may be obtained which are free from tannin, colour, turbidity, and odour, and which develop no trace of odour even when kept in closed vessels for a considerable period of time. Effluents containing soluble arsenical compounds cannot be treated by the biological process. —W. P. S.

ENGLISH PATENT.

Skins and furs; Process of treating [waterproofing] ——. J. Klugmann. Eng. Pat. 25,957, 1905. XIIIC., see col. I, this page.

XV.—MANURES, &c.

(*Continued from page* 822.)

Soil; Phosphohumic constituents of the ——. J. Dumont. XXIV., page 871.

ENGLISH PATENT.

Nitrogen compositions [Fertiliser]; Production of ——. O. F. Carlson, Stockholm. Eng. Pat. 15,445, July 7, 1906. Under Int. Conv., Feb. 28, 1906.

THE nitrogen product (calcium cyanamide), obtained by passing nitrogen over highly heated, calcium carbide, is stated to be produced at a lower temperature if addition be made to the carbide before heating, of one or more fluorides of an alkali or alkaline-earth, with also, if desired, a sulphate of an alkaline-earth or of an alkali. The addition of calcium chloride to the carbide to be heated, as previously practised, is stated to be objectionable, and is deprecated, since the product is liable to get moist when stored, becomes thus difficult to spread as a fertiliser, and is especially difficult to pack.—E. S.

FRENCH PATENTS.

"Phospho-guano"; Manufacture of —— in part from bones. E. Guérif. First Addition, dated Feb. 2, 1906, to Fr. Pat. 355,374, Feb. 11, 1905 (this J., 1905, 1182).

THE process described in the main patent as applied to bones (treatment with sulphuric acid, followed by mixing with calcium phosphate) is herein extended to animal refuse, entire animals, leather cuttings, skins, feathers, night soil, &c.—E. S.

Septic tank effluents; Method for the distribution of —— for fertilising purposes. C. Harper. Fr. Pat. 363,297, Feb. 15, 1906. XVIIIB., page 863.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 823.)

Beetroots; High polarising substances in ——. K. C. Neumann. Z. Zuckerind. Böhmen, 1906, **30** [10, 11], 536—545.

IT has been frequently asked whether the high dextrorotatory polarisation of beetroot juice is due to sugar only, or whether such constituents as raffinose and complicated polysaccharides (dextrans) are present. The question usually arises when the output of sugar in the factory does not correspond with what would be expected from the polarisation of the beet, the undetermined losses appearing abnormally high. The past season in Bohemia was marked by beet products of high polarisation, so that in a factory making white sugar (cubes, granulated, &c.), and employing a saccharate process (separation), the runnings of the second product showed not only a high polarisation, but, as compared with the previous year, which was a normal one, a large quantity of raffinose

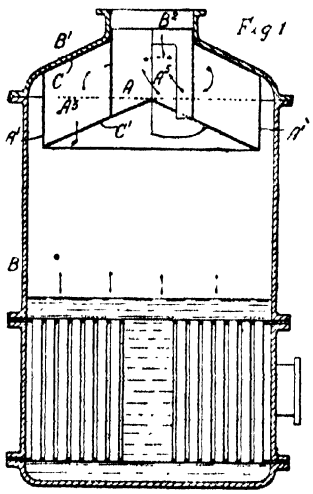
(up to 3 per cent.), or other substance of similar character the presence of which was indicated by inversion. Beets from different districts of Bohemia showed differences between direct polarisation and sugar as determined by the Clerget inversion of 0·35 to 0·47 per cent. when the juice of fully ripe beets polarised 18·9 to 22·3 per cent. The analyses were carried out so as to obviate errors due to the volume of lead precipitate during clarification, or quantity of acid used for inversion. The cause of the observed differences is, therefore, scarcely to be sought in the analytical procedure, but in the special character of the beetroots during the campaign 1905-6.—L. J. DE W.

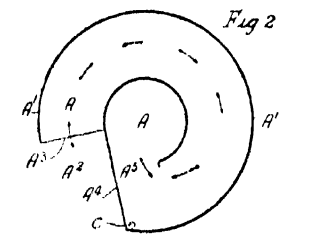
Starch [in Cereals]; Determination of ——. B. Gschwendner, XXIII., page 870.

Fermentable matter in grain; Determination of ——. Boidin and Lavallée, XXIII., page 870.

English Patents.

Evaporators for sugar. D. Stewart and Co., and T. Wishart, Glasgow. Eng. Pat. 16,269, Aug. 10, 1905.





Claim is made for an evaporator fitted with an entrainment preventer, which consists of an annular or approximately annular chamber, AA^1, closed at top and bottom, fitted in the dome or upper end, B^1, of the evaporator, B, and composed of cylindrical outer and inner shells, of which the outer one, A^1, has a segment cut out of it at A^2 (Fig. 2), so as to present an opening at A^3, between the inner and outer shells, outside a plate, A^4, which joins them, and extends tangentially from the inner shell to the outer one. On the inside of A^4, an opening is made at A^5 in the inner shell, so that a free passage is formed for the vapour from the evaporator entering the annular chamber round the inner shell, A, and passing thence through the opening, A^5, upwards through an outlet formed by a continuation of the inner shell, extending into the outlet funnel, B^2, at the top of the evaporator. The upper part of the entrainment chamber is formed by a plate, C, in contact with the domed top, B^1, of the evaporator, or the said dome may serve as the top plate of the chamber whose bottom or lower side is closed by a plate, C^1, of conical formation, having one or more draining holes, *c*, around the lowest edge. The path of the vapour is indicated by arrows; any particles of liquor carried by the vapour are caused by centrifugal force to strike the outer shell, A^1, whence they descend and drop through the orifices, *c*.—T. H. P.

Sugar juices; Purification of ——. C. H. Bertels, Brussels. Eng. Pat. 17,554, Aug. 30, 1905.

Claim is made for a process for the purification of sugar juices by means of hydrofluosilicic acid, according to which the sugar juice at about 22° B. is cooled, and the acid solution at about 32° B. is added in the requisite quantity, whilst the liquid is stirred, and after the precipitate has formed and settled, the clear liquid is decanted, whereby a liquid is obtained which is easy to filter; the neutralisation of the liquid is also rendered possible, and the recovery of the hydrofluosilicic acid is easy. This recovery of the acid from the alkali fluosilicate formed is carried out by adding an equivalent quantity of sulphuric acid and for every 140 parts of the latter, 35 parts of silica, and then applying heat as in the ordinary process for the manufacture of hydrofluosilicic acid; the alkalis present are transformed into sulphates which furnish a valuable manure. If the addition of silica be omitted in the recovery process, hydrofluoric acid is obtained.—T. H. P.

Sugar; Mechanical "blueing" apparatus for use in the treatment of ——. R. König, Brussels. Eng. Pat. 22,435, Nov. 2, 1905.

The apparatus consists of a closed tank of given capacity, having a vertical central pipe, the upper end of which is closed by a ball-valve. At the bottom of the tank are two openings, one under and in connection with the central tube, and the other a short distance from it. These openings lead to a three-way cock, by turning which the tank may be filled with steam; on again turning the cock, the steam is directed through a pipe to a tangential distributor containing the sugar to be treated; the steam supply being cut off from the tank, condensation takes place, and a supply of "blueing liquid" is drawn into the tank. On once again turning the cock, steam is admitted up the central pipe of the tank, and its contents forced out into the distributor.—W. P. S.

Sugar and similar materials; Centrifugal machines for clarifying and washing ——. C. Schüller, Grevenbroich, Germany. Eng. Pat. 10,278, May 2, 1906.

In the centrifugal machine described, there is arranged a series of moulds and clarifying chambers, the latter being pivoted by means of links to a frame in such a manner that, by moving the frame, the chambers may be pressed against or moved away from the moulds. The clarifying or washing liquid is supplied from a tank, arranged on the frame, to the chambers, and, as the lower portions are narrow, no accumulation of the liquids can take place at the said lower parts. In this way the layers of the material contained in the moulds are subjected to a uniform clarifying or washing.—W. P. S.

French Patents.

Liquids [Sugar solutions, &c.]; Evaporation, concentration, distillation, and drying of ——. A. Montupet and L. Jannin. First Addition, dated Feb. 7, 1906, to Fr. Pat. 339,177, Nov. 21, 1903. I., page 840.

Dextrin; Process and apparatus for adding moisture to ——. W. H. Uhland, G.m.b.H. Fr. Pat. 363,623, Feb. 26, 1906.

The dry dextrin falls down a vertical tower, the sides of which are fitted with inclined plates. In its zig-zag course down the tower, the dextrin encounters a current of moist air introduced at the bottom of the tower.—W.P.S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 824.)

Beer yeast; Comparative studies on three species of top-fermentation ——. P. Regensburger. Z. ges. Brauw., 1906, **29**, 430—433 and 440—442.

The author has submitted three races of top-fermentation beer yeasts to a close botanical study similar to that made by Will on four races of bottom yeasts (this J., 1904, 450). To a certain extent the microscopic form of the cells served to differentiate one race from another, but there was no specific difference between the cells of these yeasts and those of the bottom yeasts. Differences were recorded as regards the resistance of these three races to high temperatures, the time required to start fermentation, the character of the yeasty head, the intensity of spore formation, and the time elapsing before spores were formed in relation to variations in the temperature. As regards film formation, the fundamental observations recorded by Will for the bottom-fermentation yeasts, hold good for the top-fermentation yeasts. As a rule, the long chains of sausage-shaped cells belonging to the first generation of film cells were far more numerous in these top-fermentation yeasts than in Will's bottom yeasts, and the production of films was more intense. One of these yeasts was distinguished by its very slight tendency to form a yeast ring. The films on old cultures were mostly composed of resting cells [chlamydospores] differing from those of bottom yeasts only in their relative poverty in glycogen. The colonies developed from single cells on solid media belonged to the irregular types (Will's types 2 and 3), which are rarely observed in bottom yeasts, most of which develop according to the regular type 1 (mulberry type). With large sowings, the yeasts showed differences amongst themselves as regards the appearance of the colonies and the formation of streamers. The old colonies also differed in the time of formation as well as in the proportions of the constituent cells of the later generations. The chief difference between colonies from large sowings of these top yeasts and Will's bottom yeasts, was the relatively early appearance of resting cells amongst the delicate, elongated cells of the streamers, and the production of cells of the second generation from these resting cells. In the case of bottom yeast, Will never observed these cells amongst the streamers; he only observed them on the surface of the central portion of the colonies.

The author concludes that different races exist amongst the top-fermentation beer yeasts just as much as amongst the bottom beer yeasts, and that these races are capable of being differentiated by careful observations of their morphology and modes of development under various conditions, as well as by their physiological properties. The analogy between the life-history of the top yeasts and that of the bottom yeasts is complete. The only differences between the two classes are the greater rapidity and intensity of growth, budding, spore formation, and film development shown by the top yeasts as a rule. In addition, the spar-like growth of the budding chains, which also shows itself in the form of the colonies from single cells on solid media, and the non-secretion of the enzyme melibiase, are, with few exceptions, characteristic of the top-fermentation races.—J. F. B.

Yeast; Plasmolysis and turgor-regulation of ——. N. H. Swellengrebel. Centralbl. Bakt. Abth. 2, 1905, **14**, 374—388 and 481—492. Woch. f. Brau., 1906, **23**, 300—302.

When yeast is subjected to the osmotic pressure of a highly concentrated solution, the cells undergo plasmolysis. Very pronounced plasmolysis promptly occurs when the yeast is placed in undiluted glycerol. The behaviour of the protoplasm under these circumstances is variable; sometimes it shrinks entirely away from the cell-wall; at other times it remains attached thereto at various points; the vacuole becomes flattened and sometimes divided. With less concentrated solutions the effects are less marked, and a diminishing range of effects is observed as the concentration is lowered, until a minimum limit of concentration is reached at which no plasmolysis occurs. With dilute solutions of glycerol this minimum limit of concentration cannot be accurately determined in the case of old cells, but in young cells, with buds still adhering, an indication of incipient plasmolysis is afforded by the appearance of a narrow zone of separation on either side of the dividing wall between the mother and the daughter protoplasms. Yeast is sensitive to sudden changes in the osmotic pressure. If yeast be grown in a highly concentrated medium, and then be brought suddenly into water, many of the cells burst, whilst others develop elongated swellings with extremely thin walls. The plasma extruded by the burst cells, brings about the agglutination of the others. When the cells are killed by plasmolysis, the vacuole retains its vitality for a longer period than any other portion of the cell-contents. The minimum limit of pressure required to produce visible plasmolysis is taken as a measure of the turgor pressure of the yeast; it is the resultant of the osmotic pressure, the distension pressure of the plasma, and the surface tension. In the case of a young culture of yeast in Fischer's solution, the turgor pressure was equivalent to that of a solution of 0·24 grm.-mol. of sodium chloride per litre, = 8·4 atmospheres; that of pressed yeast straight from the factory was 0·4 grm.-mol. of sodium chloride, = 14 atmospheres; and that of yeast grown in grape-must was 0·6 grm.-mol. of sodium chloride, = 21 atmospheres. The yeast responds to changes in its surroundings by changes in its turgor pressure, but on the whole it is not so sensitive as the mould fungi are. Temperature and aëration are without effect. The turgor varies according to the nature of the carbonaceous and nitrogenous nutrients supplied to the yeast; the transference of yeast from a nutrient medium to a non-nutrient medium of the same osmotic pressure causes a considerable fall in its turgor pressure. Substances vary in their plasmolytic effects according to whether they penetrate the cell wall or not. A substance is described as "non-intrameate," *i.e.*, non-penetrating, if it cause visible plasmolysis at concentrations isosmotic with 0·25—0·33 grm.-mol. of sodium chloride per litre. Non-intrameate substances exert their full osmotic pressure on the yeast, but in the case of partially intrameate substances the osmotic pressure is partly balanced by the penetration of the dissolved substance through the membrane; such substances require higher concentrations for plasmolysis. Most of the salts of the alkali metals are non-intrameate, the sugars are intrameate; ethyl alcohol penetrates easily, glycerol with difficulty, and mannitol not at all; chloral hydrate is non-intrameate.

Yeast may be cultivated in solutions of increasing osmotic pressures up to 2·5 grm.-mols. of sodium chloride per litre.

Cultivation of the yeast in solutions of high osmotic pressure induces a corresponding rise in the turgor pressure; yeast can be grown in a 60 per cent. solution of cane sugar as soon as its turgor pressure has regulated itself to the high concentration. Conversely the turgor pressure is lowered by transference from a concentrated medium to a dilute one, provided the change is not so sudden as to burst the cells.—J. F. B.

Yeast; Behaviour of butyric and allied acids in presence of ——. T. Bokorny. Allgem. Brauer.- u. Hopfen.-Zeit., 1906; Z. Spiritusind., 1906, **29**, 292.

Ten grms. of yeast are killed by between 0·05 and 0·1 grm. of normal butyric acid, though a 0·05 per cent. solution of the acid does not prevent reproduction. Lactic acid of 2 per cent. strength will stop reproduction. In the case of isovaleric acid, 0·2 grm. does not kill 10 grms. of pressed yeast; the lethal dose is in excess of this figure. The lethal dose of normal valeric acid for 10 grms. of pressed yeast is between 0·25 and 0·5 grm., but nearer the former, a strength of 0·1 per cent. being sufficient if the quantity be large enough. For the same weight of yeast, 0·25 grm. of caproic acid is insufficient to produce fatal results; isocaproic acid is still less poisonous. The author also finds that the ortho compounds of the nitrotoluenes and nitrobenzaldehydes are more poisonous to vegetable and animal cells than the para compounds, the converse being the case with the toluidines.—C. S.

Beer, bottled; Bacterial flora of ——. *I. Pseudomonas cerevisiae.* F. Fuhrmann. Centralbl. Bakt. Abth. 2, 1906, 16, 309; Z. ges. Brau., 1906, 29, 466.

Pseudomonas cerevisiae, grown at 22° C. on neutral nutrient gelatin, agar-agar, boiled egg albumin, neutral nutrient broth, or peptone water, forms motile rods that show no tendency to unite to form chains. A tuft of 4—6 undulating flagellæ is present on one pole of the cell. Though 22° C. is the optimum temperature, growth proceeds at 0° C., and a thin film is formed on agar-agar at 35° C. In neutral broth, a greyish-white skin is formed, together with general haze and a whitish sediment, the liquid gradually turning pale yellow. Growth proceeds on similar lines, though less decidedly, in peptone water.

At higher temperatures, long rods, uniting to long filaments, are formed. The optimum alkalinity for the organism in broth is equivalent to a content of 1 per cent. of $N/1$ sodium hydroxide solution. The smallest trace of acetic acid prevents all growth. No gas is liberated in saccharine broth (grape sugar); no indole can be detected in cultures in peptone water or broth. The organism is facultatively anaërobic. Growth occurs in Mayer's mineral nutrient solution II., with special sources of carbon and nitrogen. On agar-agar the organism will stand heating to 60° C. for an hour, 1½ hours being necessary for sterilisation, but half an hour is sufficient in beer containing 4—5 per cent. (by vol.) of alcohol. In nutrient broth the addition of 1 per cent. of ethyl alcohol prevents growth. The bacterium grows badly in sterilised beer, and produces slight haze. In mineral nutrient solution containing 1 per cent. of ammonium chloride, the short rods grow longer, and generally unite in pairs, one member developing a pear-shaped terminal enlargement. The chains also throw out laterally a number of small warty excrescences, swelling up into globular bubbles that undergo constriction. These growths, when transferred to fresh nutrient solution, develop long, large, and also very small, short, motile cells. Large and small globules are also found, lying side by side, with a fine connecting filament between them, analogous to the formation of zygospores in higher fungi.—C. S.

Acetic ferment; Composition of an ——. E. Aliaire. Compt. rend., 1906, 143, 176—178

The bacteria were collected from the surface of about 2000 litres of liquid, which had been fermented with a technically pure culture, washed with water and alcohol, and dried; only about 5 grms. were obtained. The alcohol extracted 1·56 per cent. of fatty matter from the bacteria; this was composed, to the extent of from 50—60 per cent. of lecithin. The product free from fat gave 6·9 per cent. of nitrogen and 5·9 per cent. of ash, which consisted chiefly of phosphoric acid, potassium, calcium, magnesium, sodium, and iron oxides, and also contained 1·66 per cent. of copper and some silica. The author considers that the high proportion of copper and iron present, indicate that these metals play an important part in the phenomena of acetification.—E. F. A.

Fermentable matter in grain; Determination of ——. Boidin and de Lavallée. XXIII., page 870.

Fruit juices; Determination of malic acid and other fixed acids in ——. W. Mestrezat. XXIII., page 870.

Alcohol production in France. Times, Aug. 17, 1906. [T.R.]

According to statistics published in the "Journal des Débats," there were 24,038 "professional" distillers and 753,865 private distillers in France in 1905. The total production of alcohol, which was 2,181,362 hectolitres (about 48 million galls.) in 1904, rose to 2,530,116 hectolitres (about 55½ million galls.) in 1905, an increase of 348,754 hectolitres.

English Patents.

Beer, and other liquids; Apparatus for chilling and carbonating ——. E. A. Attuck, The Farringdon Works, and H. Pontifex and Sons, Ltd., all of London. Eng. Pat. 17,622, Aug. 31, 1905.

The apparatus consists of an open brine tank provided with a refrigerating coil; in this tank is placed a vertical closed cylinder, the ends of which are preferably concave, and the sides corrugated horizontally. The closed vessel is charged with carbon dioxide, and the beer then passed in at the top through a spraying device, so that it flows down the corrugated sides of the vessel. When the beer has filled the vessel to a certain height, the operation of drawing it off is commenced; this is done by means of a pipe at the bottom of the cylinder, by which the beer is conducted to the filter and bottling apparatus. Carbon dioxide may be pumped into the bottom of the closed vessel to obtain a higher carbonation of the beer.—W. P. S.

Filtering and washing apparatus, more particularly for use in brewing. A. Jacobs, Brussels, and L. Desenfans, Lille. Eng. Pat. 19,730, Sept. 29, 1905.

Claim is made for an improved apparatus for filtering worts and extraction of mash residues for brewery purposes, in which the bottom of the apparatus is provided with channels serving both for running off the worts and for the introduction of the washing water through the filter plates covered with filter-cloths into the mash residues, and in which a space, provided above the filter-plates serves as the mixing chamber in which the residues and the washing water are intimately mixed, for the purpose of securing the complete exhaustion of the said residues.—T. H. P.

Brewing; Process of ——. H. C. Lee, London. Eng. Pat. 26,274, Dec. 16, 1905.

Unmalted grain, previously gelatinised, is treated in a separate vessel, and at a higher temperature than the initial mash heat, with a portion of the wort obtained by mashing malt. Both the grain and the malt are treated preferably in a finely-ground condition. The two worts, after being drawn off, can then be treated separately with hops in the ordinary manner, or may be mixed together in any desired proportion for such treatment. The mash tun and the grain vessel are provided with the usual agitating, heating, and cooling arrangements.—W. P. S.

Carbohydrates in general; Process of treating [*Rendering soluble*] —— *principally for grain distillation.* A. Boidin, Seclin, France. Eng. Pat. 16,589, Aug. 15, 1905.

In order to remove alkali and magnesium phosphates, which have a retarding action on the solution of the starch, and thus to facilitate the boiling and solution of carbohydrates, chiefly in the distillation of grain, the obstructing phosphates are removed by washing or treatment with alkali or with salts of the heavy metals. The grain may also be treated by the addition of a quantity of mineral or organic acid not more than sufficient to convert the major part of the phosphates into the condition of monobasic phosphates. The solutions thus obtained contain only soluble starch and traces of glucose, the object being to manufacture soluble starch in a favourable condition for diastatic saccharification. It is stated that the final process of boiling (the process following that of removing the phosphates, &c.), now only needs to continue from three-quarters of an hour to an hour.—W. P. S.

United States Patent.

Malt house and apparatus. W. P. Rice, Chicago. U.S. Pat. 826,886, July 24, 1906.

See Eng. Pat. 14,103 of 1905; this J., 1905, 1318.—T. F. B.

French Patent.

Brandy from Algerian grapes; Process for making ——. E. A. Barbet. Fr. Pat. 361,428, May 1, 1905.

The juice obtained from the grapes is saturated with chalk, and then heated to a temperature of 65° to 75° C. in order to coagulate the albuminous matters present. A little ox-blood and milk of lime may also be added to ensure complete clarification, and the solution is then filtered. If the juice be slightly alkaline it is neutralised by the addition of phosphoric acid before filtering. Any excess of lime is thus precipitated. The clear juice is now

oncentrated, *in vacuo*, to a syrup of about 30° to 35° B. This is filtered through a mechanical filter and then through animal charcoal. It is then run into casks for exportation, or for brandy production.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 825.)

(*A.*)—FOODS.

Sodium sulphite recoverable from food products; The amount of —— as a basis for the determination of the amount originally present. C. D. Holley. J. Amer. Chem. Soc., 1906, **28**, 993—997.

THE results of a number of experiments are given, in which known amounts of sodium sulphite were added to meats, and the quantity of sulphurous acid recoverable determined after allowing the meats to stand for varying lengths of time. When the treated meat has stood for 36 hours, this quantity is shown to be approximately one-fourth of the amount added originally. From the results of analyses of sausage meats, &c., bought at butchers' shops, it is seen that the amount of sulphites mixed with meats to preserve them is much larger than is generally supposed. One sample yielded 0·361 per cent. of sodium sulphite (calculated from the sulphurous acid obtained), showing that about 1·44 per cent. had been added originally. The amount of unoxidised sulphite remaining in fried meats (sausages) is also about one-fourth of the quantity added. In the case of dried fruits which have been bleached with sulphurous acid, free or combined, the amount remaining unoxidised in the fruit is large, averaging 0·124 per cent. in 14 samples examined. From one sample as much as 0·226 per cent. was recovered, calculated as sodium sulphite.—W. P. S.

Butter; The Polenske method for the detection of cocoanut oil in ——. S. Rideal and H. G. Harrison. XXIII., page 870.

ENGLISH PATENTS.

Food; Sterilisation of articles of ——. C. C. L. G. Budde, Copenhagen. Eng. Pat. 15,304, July 25, 1905.

THE process consists in adding hydrogen peroxide with hydroxylamine, or hydrazine, to the food to be preserved, the quantity of hydrogen peroxide added being in excess of that required to decompose the hydroxylamine. An example is given in the case of milk:—0·15 grm. of hydrazine hydrate and 1·35 grms. of hydrogen peroxide are added to each litre of milk to be sterilised. The milk is then heated to from 50° to 55° C. for about three hours, when it will be found to be completely sterile." By using larger quantities of the preservatives, the heating may be omitted.—W. P. S.

Drying foodstuffs of vegetable origin; Process for ——. F. Zündel-Donati, Schirmensee, Switzerland. Eng. Pat. 15,597, July 29, 1905.

SEE Fr. Pat. 356,335 of 1905; this J., 1905, 1319.—T. F. B.

UNITED STATES PATENT.

Food products and method of making the same; Vegetable and other ——. J. E. Bloom, New York. U.S. Pat. 825,888, July 17, 1906.

THE food is prepared from seed meals, such as cornmeal, by adding to the same such proportions of olein, palmitin, and stearin as will cause the fatty content of the product to have the approximate composition of human fat. See also U.S. Pats. 782,820 and 782,821 of 1905; this J., 1905, 341.)—W. P. S.

FRENCH PATENT.

Animal tissues or mixtures thereof with other substances; Process of preserving ——, and products obtained thereby. J. R. Hatmaker. Fr. Pat. 363,679, Feb. 28, 1906.

SEE Eng. Pat. 4351 of 1905; this J., 1906, 332.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

ENGLISH PATENTS.

Water; Apparatus for purifying —— by distillation. W. Clark, London. From The American Water Purifying Co., Philadelphia. Eng. Pat. 16,177A, Aug. 8, 1905.

SEE Fr. Pat. 356,762 of 1905; this J., 1905, 1319.—T. F. B.

Water, or other liquids; Apparatus for purifying ——. E. Stephenson, London. Eng. Pat. 25,016, Dec. 2, 1905.

UPON the spindle of the hydraulic measurer, described in Eng. Pat. 3731 of 1886, a toothed wheel is secured and gears into another toothed wheel fixed to the spindle of the concave quadrant, described in Eng. Pat. 13,069 of 1901. To some convenient part of the apparatus two brackets are fixed, carrying screw bolts, by the setting of which the supply of the quantity of the reagent to the water can be regulated as required.—W. P. S.

UNITED STATES PATENTS.

Water; Process of purifying ——. A. Brown, Lorain, Ohio, Assignor to American Wire Co., New Jersey. U.S. Pat. 825,637, July 10, 1906.

FERROUS sulphate, copper sulphate, and calcium hydroxide are added to the water, and the precipitate formed allowed to settle, a germicidal layer being thus produced through which the water is filtered. The amount of copper sulphate added is relatively small.—W. P. S.

Sewage; Clearing vat for ——. B. Schmidt, Dresden, Germany. U.S. Pat. 828,515, Aug. 14, 1906.

SEE Eng. Pat. 24,402 of 1905; this J., 1906, 231.—T. F. B.

FRENCH PATENTS.

Water; Process for the purification of ——. G. Lambert. Fr. Pat. 361,435, May 3, 1905.

THE water is treated with potassium permanganate, and then with a quantity of manganese sulphate sufficient to decompose the excess of permanganate. The precipitation is rendered more complete and is hastened by the subsequent addition of a small quantity of sodium carbonate. After settling, the water may be either decanted or filtered from the precipitate.—W. P. S.

Water, sewage, &c.; Apparatus for the purification of ——. H. Riensch. Second Addition, dated Jan. 23, 1906, to Fr. Pat. 314,450, Sept. 24, 1901. (See this J., 1902, 1064.)

MEANS are provided by which the sedimentary matters, separated from the water by the apparatus described in the original patent, are carried off by lateral conduits, whilst the floating substances are removed from the revolving plate by means of brushes which work automatically.—W. P. S.

Water; Process and plant for the purification of ——. Grondel Frères. Fr. Pat. 363,073, Feb. 8, 1906. Under Int. Conv., Dec. 9, 1905.

THE water to be purified is led into a conduit where it is mixed with chemical reagents, such as lime, sodium carbonate, and aluminium sulphate, solutions of which are contained in tanks placed above the conduit. The treated water then passes into a second conduit extending across the top of a series of cemented settling tanks; over each tank is an opening in the conduit which allows the water to fall into

a vertical pipe reaching to the bottom of the tank, and provided with perforated radiating arms. The water, as it falls down the vertical pipe, carries with it a certain volume of air, which aids in stirring up a quantity of mud at the bottom of the tank, resulting from a previous treatment of a tankful of water. The openings leading to the vertical tubes are provided with valves. When sedimentation has taken place, the water is decanted from the tanks by means of floating pipes which collect the water at the surface, and carry it off through the bottom of the tanks. The réagent tanks are provided with water and steam supplies, and an arrangement of travelling buckets allows the sediment to be removed from the tanks when required.—W. P. S.

Effluents; Method for the distribution of septic tank ——, for fertilising purposes. C. Harper. Fr. Pat. 363,297, Feb. 15, 1906.

The effluent from the septic tank is led into a covered chamber and flows, or is pumped, thence into ordinary drain pipes set in cultivated ground at a convenient depth below the surface, so that the effluent at once comes into proximity with the roots of plants growing on the ground. If needed, a disinfecting tank may be placed between the septic tank and the closed chamber.—W. P. S.

(C.)—DISINFECTANTS.

English Patent.

Bacteria in the blood and tissues; Apparatus for destroying ——, by the influence of carbon monoxide. B. H. Thwaite, London. Eng. Pat. 18,492, Sept. 13, 1905.

To destroy tubercule bacilli and other organisms in the blood, the patient is treated with an atmosphere containing about 0·4 per cent. by volume of carbon monoxide, the treatment being regulated so as to be well within the safety limit. The carbon monoxide generator consists of a lined metallic furnace, in which a column of anthracite coal or charcoal is maintained at a certain height, and means for forcing or drawing a regulated quantity of air through the same. The gas issuing from the furnace is passed through filters and a cooling apparatus, and is then collected in a balanced gas-holder. Part of the air-supply is directed into a second holder, and both the volume of air admitted to the furnace and that leaving the second holder are regulated by valves actuated by the rising of the carbon monoxide gas-holder. The air leaving the second gas-holder is mixed with a portion of the carbon monoxide, and the mixed gases are conducted to a chamber from which they are drawn off for use. Finely-divided carbon, produced by the incomplete combustion of a hydrocarbon gas, may be introduced into the mixture of carbon monoxide and air.—W. P. S.

French Patent.

Antiseptic; A new —— [from petroleum], and method of making the same. C. Trocquenet. Fr. Pat. 362,990, Feb. 5, 1906.

Fossil shells are heated to redness, then mixed with a specially prepared petroleum oil, and the mixture distilled at a high temperature. The distillate forms the antiseptic claimed. The above-mentioned petroleum oil is obtained by emulsifying 6 litres of liquid paraffin with 1 litre of water containing from 60 to 80 grms. of potassium chloride, calcium phosphate, and calcium malate. The emulsion is heated, strained through metallic gauze while boiling, and finally filtered.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page 825.*)

Fibres and fibrous materials for papermaking; Philippine ——. G. F. Richmond. Philipp. J. Sci., 1906, 1, 433—462.

The author has carried out experiments on a semi-industrial scale in order to test the suitability of various Philippine fibre-materials for papermaking.

Abacá [Manila hemp], *Musa textilis.*—The cordage fibres are only taken in thin ribbons from the outer surface layers of the petioles. After these ribbons have been taken, the bulk of the stems, the outer sheaths, and the cut ends, (representing the greater portion of the plant) remain as a fertiliser on the land. For fertilising purposes it is sufficient if the juice of the plant (90 per cent.) be returned to the soil, and the solid waste is capable of yielding good papermaking fibres. This waste, after drying, was boiled under pressure with 25 per cent. of caustic soda, and yielded 20 per cent. of good paper-pulp. This semi-fibrous waste is quite distinct from the wholly fibrous waste obtained in stripping and cleaning the cordage fibres. This latter waste (machine-stripped) when boiled with 25—30 per cent. of caustic soda, yielded 30—33 per cent. of pulp. Hand-stripped waste yielded 38—42 per cent. of pulp. This class of pulp consumes 12—14 per cent. of bleaching powder, with a loss of 6—7 per cent. of fibre substance.

Plantain, M. sapientium, var. *paradisiaca.*—The banana and plantain fibres are inferior to abaca for cordage purposes, but yield a superior pulp, and the resolution of the fibres is more easily effected. The author has only experimented with the cleaned textile filaments obtained from the outer strips of the plantain. These yielded 65 per cent. of pulp when boiled with 20 per cent. of caustic soda.

Maguey [Sisal hemp], *Agave cantula.* The filaments are used for cordage, but the waste from the stripping and cleaning processes is available for paper-making. This waste, when boiled with lime without pressure, yields a brown half-stuff with a loss of about 30 per cent. of its weight. The product is not a paper-pulp, but merely a concentrated form of the raw material. When boiled with 10 per cent. of caustic soda, calculated on the original waste, it yields 31 per cent. of good pulp, also calculated on the original material. The crude waste can be boiled with lime under pressure, yielding 55 per cent. of pulp for coarse brown papers. With 25 per cent. of caustic soda, the crude waste gave 35 per cent. of good paper pulp.

Grasses.—Two important grasses are available in the Philippines for paper-making.

Cogon (*Imperata exaltata*) is broad-leaved, and grows in dry districts, attaining a height of 2—4 ft. It contains 50 per cent. of cellulose on the dry substance as compared with esparto with 55 per cent. Under industrial conditions this grass yields 44—47 per cent. of pulp with 15—10 per cent. of caustic soda. Lime is not suitable for the preparation of good pulp. The pulp consumed 15 per cent. of bleach with a loss of 5—6 per cent. in weight.

Talahib (*Saccharum spontaneum*) is a coarse-jointed grass growing to a height of 6—10 ft.; it springs in tufts from stout underground root-stalks, and thrives best in low-lying moist districts. If allowed to become too dry before cutting, the nodes harden and are not easily resolved. Boiled with 12·5 per cent. of caustic soda, it yielded 45·5 per cent. of pulp, which bleached easily with a consumption of 5·7 per cent. of bleach and a loss of only 2·2 per cent.

Dimensions of Philippine paper fibres.

	Length mm.			Diameter mm.		
	Max.	Aver.	Min.	Max.	Aver.	Min.
Abacá	6·00	3·93	2·45	0·021	0·017	—
Plantain	7·30	5·49	4·15	0·026	0·020	0·013
Maguey	4·93	2·38	1·00	0·026	0·018	0·015
Cogon grass	1·82	0·99	0·46	0·021	0·011	0·005
Talahib grass	2·82	1·89	0·89	0·020	0·015	0·012

—J. F. B.

Parchment paper; Action of weak alkaline solutions on ——. C. Bartsch. Papier-Zeit., 1906, 31, 2547.

The author has found that slightly alkaline solutions have a deleterious effect on the mechanical properties of parchment papers. Strips of the papers were steeped for 24 hours in 1 per cent. solutions of sodium carbonate, caustic soda, and potash soap; they were then removed, and

dried in the air, without washing; finally they were thoroughly washed and dried. Determinations of the tensile strength of the strips, as compared with that of similar strips treated with water only, showed diminutions in the breaking length and breaking elongation, amounting in extreme cases to 21 per cent. and 44 per cent. respectively. —J. F. B.

Celluloid. W. Will. Z. angew. Chem., 1906, 32, 1377—1387.

The author has made investigations with a number of specimens of celluloid and celluloid articles, as well as with celluloid prepared by himself from stabilised nitrocellulose, for the purpose of determining its liability to ignition and explosion. From the experimental results obtained, he concludes that celluloid of good quality is a comparatively insensitive substance. Shocks, blows, friction, electric sparks, or heating to 100° C. neither ignite it nor cause it to explode. Some samples, however, decompose or ignite at such temperatures as may readily obtain in the neighbourhood of electric arc lamps or other sources of heat. This defectiveness may be due either to the use of unstable nitrocellulose in making the celluloid, or to the employment of too high a temperature in moulding or pressing it into the desired shapes. The author suggests that it may be necessary, in order to ensure the production of stable articles, to adopt in the celluloid industry the precautionary methods prevailing in the manufacture of nitro-explosives. Celluloid which is liable to decompose at a comparatively low temperature, may be detected by the following test: 0·1 grm., in small pieces, is placed in a strong, lightly-corked test-tube, and immersed in an oil-bath previously heated to 100° C. The temperature of the bath is kept uniform by means of a stirrer, and is raised steadily at the rate of 5° per minute. The point at which the sample fumes off is observed. Samples which do not decompose below 160° C., when thus tested, may, in the author's opinion, be regarded as satisfactory; instances are quoted in which the decomposition point was as low as 124° C. Compact celluloid burns without explosion, but celluloid dust can be ignited by powerful electric sparks, and can explode when ignited. The explosions which sometimes occur during fires in which celluloid goods are involved, are most probably due to the gases given off by the burning material. Thus the author finds that when celluloid is heated in absence of air, or with an insufficient supply of air, the gases evolved are rich in carbon monoxide, methane, and hydrogen, and when mixed with widely varying proportions of air, form explosive mixtures. Burned with insufficient air, celluloid also evolves much nitric oxide, and a little hydrocyanic acid. In fire-extinguishing operations, the presence of these three poisonous gases must not be lost sight of.—H. B.

Incandescence mantles; New process of manufacturing ——, in which copper-cellulose is used as fabric. W. Bruno. II., page 840.

English Patents.

Peat-moss; Method and apparatus for manufacture of half-stuff for millboard and paper from ——. G. D. Beresford, London. Eng. Pat. 23,748, Nov. 17, 1905.

Sods of freshly-cut peat moss are disintegrated in a "devil," between fixed and rapidly revolving teeth. The material is then delivered into a store tank, in which it is immersed in water. Thence it passes by means of conveyors into a series of washing tanks, and is conducted through the whole series against a counter-current of water introduced at the discharge end. The washing tanks are provided with endless bands carrying stirring rakes and screens, which push the moss along, with a combing and disentangling action, over the perforated bottoms of the tanks. A discharge-conveyor at the end of each tank lifts the moss into the next tank, and, in the process, the moss is passed between pairs of horizontal rollers placed between each pair of tanks.—J. F. B.

Paper; Means for applying size to ——. J. Lockett and W. J. Baker. Eng. Pat. 15,417, July 27, 1905.

Size is applied in the form of a fine stream to the web of paper in the course of its manufacture, the point of application being at the delivery side of the couch-rolls, or at some point on the "wet felt." The size is maintained at a constant level in a trough of V-shaped section, arranged over the upper roll of what are known as the "Duxbury" rollers. At the point of the V there is an orifice extending the whole length of the trough, which can be opened or closed to any desired extent. A strip of felt extends from this orifice, and conveys a thin layer of size to the upper "Duxbury" roll, which in its turn transfers it to the web of paper.—J. F. B.

Absorbent materials, textiles, paper, or other lamellar materials; Improved method for treating or impregnating —— with resins, fatty acids, or the like. H. O. Brandt. Eng. Pat. 23,787, 1905. V., page 845.

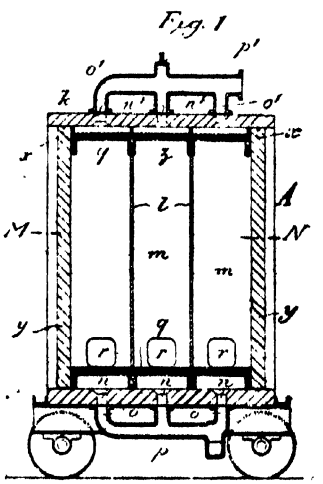
Paper, pasteboard, cardboard, and the like; Process of producing highly brilliant transparent coatings on ——. Kraemer und van Elsberg, G. m. b. H., and G. Kraemer, Cologne, Germany. Eng. Pat. 26,201, Dec. 16, 1905.

Brilliant, transparent coatings are produced by applying to paper, card, &c., a suitable collodion to which has been added a chlorhydrin and also a derivative of an aromatic sulphonic acid as specified in Eng. Pat. 25,434 of 1899 (this J., 1901, 62), the paper being subsequently pressed for a time with hot, polished surfaces. 50 to 60 parts of dichlorhydrin and 250 to 350 parts of *p*-toluenesulphochloride are added to a solution of 100 parts of nitrocellulose in 450 parts of alcohol and 350 parts of acetone, and the mixture is applied to the paper.—T. F. B.

Paper and card; Apparatus for impregnating —— in a paper-making machine during its manufacture. F. Dobler, Paris. Eng. Pat. 4304, Feb. 21, 1906.

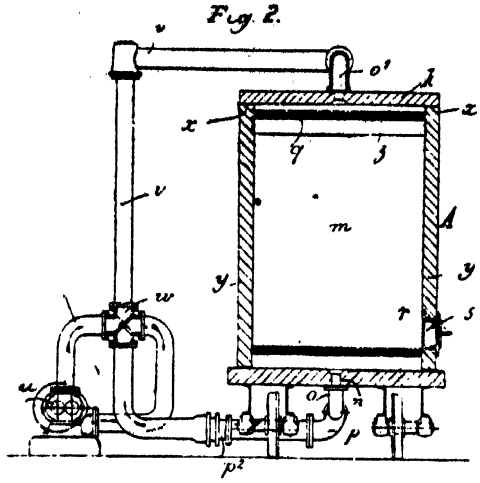
See Fr. Pat. 359,930 of 1905; this J., 1906, 441.—T. F. B.

Cellulose from vegetable fibres; Manufacture of ——. Sir W. Mather, Manchester. Eng. Pat. 8960, April 28, 1905.



Cellulose is prepared from raw vegetable fibrous materials by the chlorination process in an apparatus, working in a continuous manner, in which all the successive operations are conducted without handling the material from start to finish. These operations consist of boiling with dilute alkali, washing, cooling, and partially drying the material by the action of a current of air at a reduced pressure, chlorinating the moist fibre, washing out the by-products of chlorination, boiling the chlorinated fibre

Fig. 2.



with alkali, and finally washing the cellulose. The fibrous raw material is suitably packed in " vehicles " of resistant material which can be wheeled from one treating apparatus to another, and which are divided internally by vertical perforated partitions into a number of cells, *m*, (see Figs.). The vehicles are placed in connection with fixed circulatory systems providing the reagents, junctions being effected at the top and bottom by the pipes, *v*, p^1, *p*, with orifices leading to the separate cells. The liquid or gaseous reagent—alkali, water, air, or chlorine gas—is then circulated by means of a pump, *u*, in a vertical direction through the perforated distributing sieves, *q*, and through the masses of fibre in the cells, the course of the current being reversed from time to time. By providing a " battery " of circulating systems for each operation, the whole cycle of treatments can be effected with the complete utilisation of the chemicals employed. —J. F. B.

Cellulose derivatives and process of making the same. G. W. Miles, Belmont, Mass., U.S.A. Eng. Pat. 19,330, Sept. 25, 1905.

See Fr. Pat. 358,079 of 1905; this J., 1906, 195.—T. F. B.

Cellulose substitute. F. and A. van den Bosch, and O. Müller, Cologne, Germany. Eng. Pat. 3211, Feb. 9, 1906. Under Int. Conv., Feb. 10, 1905.

The non-fibrous constituents of the cotton-seed husk are utilised in addition to the fibrous constituents as a substitute for cellulose in its various applications. The non-fibrous constituents are isolated by a series of treatments comprising a treatment by a boiling dilute alkali solution, which extracts a useful red colouring matter, followed by treatments with bleaching powder solution, dilute acids, and boiling alkali. The process may be varied by oxidation treatments with permanganates followed by sulphurous acid. (See also this J., 1906, 775.)—J. F. B.

United States Patent.

Paper web; Apparatus for smoothing the —— in paper-making machines. C. Tittel, Gratwein, Austria-Hungary. U.S. Pat. 828,149, Aug. 7, 1906.

See Eng. Pat. 2795 of 1906; this J., 1906, 775.—T. F. B.

French Patents.

Strainers for paper-pulp. P. Billon. Fr. Pat. 363,279, Feb. 14, 1906.

In flat-strainers of the type in which the vibration is communicated to the central axis of the plate-cradle, the rods supporting the cradle on the cam-wheels are generally cast in a single piece. In this invention, these rods consist of two portions, the upper portion of the rod resting on the lower portion by means of an articulated cup-joint. The cup which forms the upper end of the lower portion of the rod can be raised or lowered on a screw-thread for adjusting the height of the cradle in the trough. It is claimed that the articulated joint mitigates the shock, and prevents the breakages which often occur in the usual form of rod.—J. F. B.

Celluloid; Manufacture of a substance resembling ——. C. Claessen. Fr. Pat. 363,090, Feb. 8, 1906.

A substance resembling celluloid is manufactured from nitrocellulose by replacing the whole or a portion of the camphor usually employed by benzylidene di- or mono-acetoacetic ester, prepared by the condensation of benzaldehyde, with acetoacetic ester in presence of an organic base. The nitrocellulose, 5 kilos., is treated with a solution of 3·5 kilos. of the benzylidene compound in 10 litres of alcohol, and the mass is rolled at a temperature between 60° and 90° C.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 827.)

Phaseolus lunatus; Cyanogenetic constituents of ——. Kohn-Abrest. Compt. rend., 1906, **142**, 182—184.

The author has obtained from *Pois de Java, Haricots de Java, &c.*, a colourless crystalline cyanogenetic glucoside, melting at 134°—136° C., which on crystallisation from ethyl acetate is resolved into three substances, melting at 132°—134° C., 125°—129° C., and 118°—119° C. respectively, and containing 8·3, 8·6, and 7·3 per cent. of hydrocyanic acid. They are all hydrolysed by an enzyme contained in the Java beans, which is destroyed by boiling with water, but has its activity only partially impaired by being heated at 78° C., or at 122° C. for two hours. This enzyme differs from the emulsin of bitter almonds in that its action on hydrogen peroxide is more vigorous, whilst it only feebly decomposes amygdalin. Emulsin is without action on the *Pois de Java* glucosides. The author disputes the presence of acetone in his glucosides, and finds that they yield small quantities of alcohol when hydrolysed. Analysis proves that they possess the formulæ $C_{10}H_{19}O_6N$ and $C_9H_{25}O_6N$, whereas Dunstan and Henry found $C_{10}H_{17}O_6N$; the author accordingly regards them as mixtures, and considers that a large variety of cyanogenetic glucosides occurs in *Phaseolus lunatus*.—E. F. A.

Oil from the fruit of Pittosporum undulatum; Constituents of the essential ——. F. B. Power and F. Tutin. Chem. Soc. Trans., 1906, **89**, 1083—1092.

The authors examined a freshly-distilled specimen of oil from the fruit of *Pittosporum undulatum*, Ventenat, a tree indigenous to south-eastern Australia, where it is known as " Native Laurel " and " Mock Orange "; 220 kilos. of the fruit yielded 960 grms. of oil having a pale yellow colour and an odour resembling that of orange oil. After being dried with anhydrous sodium sulphate, and filtered, the oil had the sp. gr. 0·8615 at 15°/15° C., and an optical rotation of +74° 4′ in a 100 mm. tube; it was insoluble in ten times its volume of 70 per cent. alcohol. Twenty grms. of the oil required 0·2 c.c. of N/2 alcoholic solution of potassium hydroxide for the neutralisation of the free acids, and 4 c.c. for the hydrolysis of the esters present. The oil was treated with dilute sulphuric acid, then extracted several times with a 5 per cent. solution of potassium hydroxide, and afterwards washed with water, dried with anhydrous sodium sulphate, and distilled under 60 mm. pressure. Fractionation of the distillate failed to reveal the presence of an olefinic or other unstable terpene. The whole of the oil distilling above 190° C. at the ordinary pressure, was hydrolysed with alcoholic potash, and the residual oil, after being washed and dried, was distilled under 60 mm. pressure, whereby a small quantity of non-volatile resinous matter was removed. The hydrolysed oil, together with the portion which had previously been separated under diminished pressure, was fractionated at the ordinary

pressure. The fractions distilling below 165° C. and between 165° and 169° C., consisted of a mixture of *d*-pinene and *d*-limonene, whilst that distilling between 173° and 180° C., representing by far the largest portion of the oil, consisted almost entirely of *d*-limonene. The fractions 205°—215° C. and 215°—225° C. consisted mainly of an oxygenated compound, and after oxidation with potassium bichromate and sulphuric acid, yielded a semicarbazone, $C_{10}H_{17}ON_3$, melting at 174° C. The oxygenated compound present in the oil, is probably an alcohol of the formula, $C_9H_{16}O$. From the fraction, 255°—270° C. an optically inactive sesquiterpene was isolated, boiling at 263°—264° C., sp. gr. 0·9100 at 15°/15° C., $n_D^{20°} = 1·5030$. The acids present in the oil in the form of esters consist mainly of valeric acid together with very small amounts of acids of a lower and a higher molecular weight. The constituents of the oil identified up to the present are:—About 4 per cent. of *d*-pinene, about 75 per cent. of *d*-limonene, small quantities of esters of valeric, formic, and other acids, about 15 per cent. of an optically inactive sesquiterpene, very small quantities of palmitic acid and an undetermined phenol, and apparently, a trace of salicylic acid.—A. S.

Hydrogen peroxide; Preservation of medicinal —— by means of sodium chloride or calcium chloride. Allain. J. Pharm. Chim., 1906, **24**, 162.

Sodium chloride and calcium chloride in the proportion of 1 per cent. are found to be more efficient as preservatives of medicinal hydrogen peroxide than phosphoric or sulphuric acid in the proportion of 1 per mille, or 95 per cent. alcohol, 2 to 3 per cent. The rate of decomposition with the two first-named salts is at least ten times slower, under like conditions, than with the other preservatives. They are, moreover, much less objectionable, from the therapeutic point of view.—J. O. B.

Colloidal precipitates; Washing of ——. J. Duclaux. Compt. rend., 1906, **143**, 296—298.

It is maintained by some that colloidal precipitates cannot be completely washed, because they form with the saline substances accompanying them, compounds not decomposed by water. Nicolardot and Wyrouboff, for example, consider that the compound $Fe_2(OH)_5Cl$ or Fe_2Cl_6, limits the possibility of removing chloride from colloidal ferric hydroxide. The author combats this. He has obtained by dialysis a ferric hydroxide containing less than one-third of the amount of chloride implied by the above formula, and sees no reason why the removal of chloride should not be carried further. It is, however, impossible practically to remove the whole, because of the extreme slowness of the process.—J. T. D.

Sodium-mercuric iodide and barium-mercuric iodide. A. Duboin. Compt. rend., 1906, **143**, 313—314.

These two compound iodides may be prepared as follows: Sodium iodide and mercuric iodide are dissolved alternately in a small quantity of water until no more of the substances are taken up (see this J., 1905, 988). After standing for some months in a dry atmosphere, the solution at first deposits mercuric iodide, and afterwards, flat crystals which have a composition corresponding with the formula, $2NaI,HgI_2,4H_2O$. The crystals are extremely deliquescent, and their sp. gr. is about 3 at a temperature of 0° C. The author has obtained a new barium-mercuric iodide by evaporating in a dry atmosphere during the hot summer months, a solution containing mercuric iodide and barium iodide, and having the composition, barium, 12·45; mercury, 22·53; iodine, 51·68; and water, 13·34 per cent. Large flat crystals were deposited. They had the composition, $BaI_2,HgI_2,5H_2O$, and a sp. gr. of about 4 at 0° C.—W. P. S.

English Patents.

Iodine preparations [from fatty acids]; Manufacture of new ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,874, Aug. 28, 1905.

See Fr. Pat. 362,370 of 1906; this J., 1906, 714.—T. F. B.

Eserine; Manufacture of a new salt of ——. G. B. Ellis, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 26,818, Dec. 22, 1905.

See Ger. Pat. 166,310 of 1905; this J., 1906, 443.—T. F. B.

Polychloramidines and alkyl derivatives thereof; Manufacture of ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,228, May 1, 1906.

Claim is made for the production of polychloramidines by the reduction of nitro-acylaminopolychlorbenzene, or an alkyl derivative thereof, the nitro-grouping being in the ortho position to the amino-grouping. If ring formation does not take place during the reduction, the product may be heated, or treated with a dehydrating agent. Polychloramidines produced in this way can be subsequently alkylated by the usual methods. The methods of preparation of the following are described. Ethenyltrichloramidine, m.pt. 285° C.; methenyltrichloramidine, m.pt. 303°—304° C.; methylmethenyltrichloramidine, m.pt. 159°—160° C.; ethylethenyltrichloramidine, m.pt. 116°—117° C.; ethenyltetrachloramidine; ethylethenyltetrachloramidine, m.pt. 149° C.; benzylethenyltetrachloramidine, m.pt. 176°—177° C.; benzenyltrichloramidine, m.pt. 268°—269° C.; methylethenyltrichloramidine.—(See this J., 1906, 608).

—F. Sheon.

Thorium; Process of obtaining ——, applicable for making incandescent lamp filaments. The British Thomson-Houston Co., Ltd., London. From the General Electric Co. of Schenectady, New York. Eng. Pat. 14,972, July 20, 1905.

A compound of thorium, in particular thorium dioxide, is heated in the vapour of sulphur monochloride to bright redness, to form thorium tetrachloride (thus, $ThO_2 + 2S_2Cl_2 = SO_2 + 3S + ThCl_4$), which remains behind when the sulphur and sulphur dioxide pass off. It is recommended to repeat the process on the powdered fixed residue, to eliminate impurities. The thorium tetrachloride, which is in small white hygroscopic crystals, is heated, preferably mixed with a certain proportion of potassium chloride, in a steel crucible, with an excess of sodium, in the vacuum furnace described in U.S. Pat. 785,535 of 1905 (this J., 1905, 446), and in Eng. Pat. 20,809 of 1904 (this J., 1905, 976). The gas formed during the heating is pumped out as it is formed. Towards the end of the reaction, the temperature is raised sufficiently to distil off the excess of alkali metal. The thorium remaining after the product is washed repeatedly with hot water, and is treated with hot dilute nitric acid to remove thorium hydroxide. The thorium is then washed successively with hot water, alcohol, and acetone, and is dried.

—E. S.

United States Patents.

Alkamine ester [of aminobenzoic acids]. F. Stolz and G. Korndörfer, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pats. 828,070 and 828,071, Aug. 7, 1906.

See Eng. Pat. 17,162 of 1905; this J., 1906, 607.—T. F. B.

Alkamines [Aminoalcohols]; Process of making ——. E. Fourneau, Paris. U.S. Pat. 828,846, Aug. 14, 1906.

See Fr. Pat. 339,131 of 1903; this J., 1905, 43.—T. F. B.

French Patents.

Amino-alcohols and their derivatives; Preparation of ——. J. Rousset, France. Fr. Pat. 361,471, May 13, 1905.

This patent relates to the production of α- or β-substituted amino tertiary alcohols of the fatty series. The preparation of dimethylaminodiphenylethanol $(CH_3)_2N.CH_2.C(C_6H_5)_2OH$ is given as a type. According to the method of Grignard, dimethylglycollic ethyl ester is treated with magnesium-phenyl bromide. On hydro-

lysing, a good yield of the amino-alcohol is obtained. All the bases formed by this method are soluble in water, and crystallise in long brilliant needles; they reduce permanganate and solutions of silver. α-Ethyldimethyl-aminobutanol, $\alpha(CH_3)_2N.CH_2.C(C_2H_5)_2OH$, boils at 57° C. at 23 mm.; the hydrochloride of its benzoyl derivative melts at 175° C. Claim is made for the process and the new products obtained by its means.—F. Sndn.

Hexamethylenetetramine borates; Preparation of ——. Act.-Ges. f. Anilinfabr., Germany. Fr. Pat. 363,764, March 1, 1906.

Claim is made for the production of hexamethylenetetramine borates by the action of an alcoholic or aqueous solution of boric acid on the base. Or, the necessary proportions of hexamethylenamine and boric acid may be mixed, and the product dried.—F. Sndn.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 828.)

Light; The chemical action of ——. F. E. Menter. Phot. Corr., 1906, 43, 311; Chem.-Zeit., 1906, 30, Rep. 260.

The author has studied the products obtained by the interaction of a number of organic oxidising and reducing agents in presence of light. The action of light on di-iodo-acetylene is particularly interesting, since it causes separation of carbon according to the equation: $2C_2I_2 = C_2I_4 + C_2$.—B. J. S.

English Patents.

Photographic papers; Process for making ——. I. Hoffsümmer, Düren, Germany. Eng. Pat. 2057, Jan. 26, 1906.

See First Addition to Fr. Pat. 357,453 of 1905; following these.—T. F. B.

Photography; Sensitive plate for colour ——. B. J. B. Mills, London. From Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 9100, April 19, 1906.

In Eng. Pats. 22,988 and 25,718 of 1904 (this J., 1905, 104 and 152), plates for colour photography are described in which the spaces between the coloured particles (between sensitive film and support) are filled with a black powder. This filling is obviated by the present invention, which consists in coating the support with an adhesive layer, and applying the coloured particles as before, and then bringing the particles of starch to a suitable hygrometric condition, whereby they can be submitted to direct pressure or to rolling, so as to form a coating covering the entire support, and to which the sensitive film is applied. —T. F. B.

Reproduction of pictures by aid of catalytic action. A. G. Bloxam, London. From Neue Photographische Ges., Steglitz, Germany. Eng. Pat. 10,078, April 30, 1906.

Hydrogen peroxide, which plays an important part in the "catatype" process, is very liable to cause damage to sensitive papers, or to adhere to negatives and cause damage thereby. This is prevented by enclosing the papers or negatives in casings or envelopes made of fabric impregnated with a substance which will decompose hydrogen peroxide. The parts of the copying apparatus employed, which come into contact with the negative, may also be similarly protected. For instance, a protective substance can be prepared by impregnating textile fabric with an alkaline solution of potassium permanganate, and then drying it.—T. F. B.

United States Patent.

Photographic papers; Process for making ——. I. Hoffsümmer, Düren, Germany. U.S. Pat. 828,652, Aug. 14, 1906.

See First Addition to Fr. Pat. 357,453 of 1905; following these.—T. F. B.

French Patents.

p-Hydroxyphenylglycineamide; Process of producing ——. [*Photographic developer*]. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,449, May 8, 1905.

Equimolecular proportions of *p*-aminophenol and monochloroacetamide are allowed to react in presence of sodium acetate, an alkali carbonate, or similar acid absorbing agent; the resulting *p*-hydroxyphenylglycineamide, when recrystallised from water, has a m.pt. of 151° C., and is soluble in alcohol and ether. It is an energetic photographic developer, being employed as described in Eng. Pat. 9537 of 1905 (this J., 1906, 224). —T. F. B.

Development of the latent photographic image; Process for the ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,451, May 9, 1905.

See Eng. Pat. 9537 of 1905; this J., 1906, 224.—T. F. B.

Photographic papers; Process of making ——. I. Hoffsümmer. First and Second Additions, dated Jan. 30, 1906, to Fr. Pat. 357,453, Sept. 2, 1905.

The first Addition describes how the protective action of the intermediate layer of paper, &c. (see Eng. Pat. 17,303 of 1905; this J., 1905, 1189) may be increased by addition of further thin layers of paper or fabric. The second addition deals with the preparation of prints on a support composed of the substance which is to constitute the intermediate layer of the final print, the print being subsequently attached to the support of cheaper material. —T. F. B.

Papers; Process for preparing sensitive printing ——. Photochemischefabrik R. Risse G.m.b.H. Fr. Pat. 363,086, Feb. 8, 1906.

It is stated that paper, card, and the like, can be made very sensitive to light by treatment with mineral acids or with solutions of certain salts, sensitive forms of hydrocellulose or nitrocellulose being produced, the latter if nitric acid has been employed. Paper may be immersed for a short time in sulphuric acid (56°—66°) B., thoroughly washed, treated with dilute alkali, dried, and calendered. A concentrated solution of zinc sulphate is said to give similar results.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 828.)

Safety explosives; A study of ——. From the Laboratory of the Dynamit-Aktien Gesellschaft. A. Nobel and Co., Hamburg. Monit. Scient., 1906, 20, 595—610.

A large number of closed-vessel measurements were carried out on various powders in a bomb specially constructed for high densities of charge. The results go to show that, for explosives such as carbonite which give solid products of decomposition, increased density causes an increase in the carbon dioxide and methane formed, and a diminution of the hydrogen and carbon monoxide. Tables are given showing the heat evolved, the volume and composition of the gaseous products, the calculated temperature of explosion, and the pressure obtained, on firing: *carbonite carbonite, carbonite I. and II., water-dynamite (Nobel) I. and II., nobelite, extralite, fulminite, antiextralite, antifulminite*. The following is a comparison of the results obtained with these powders,—

Explosive.	Heat evolved—calories per grm.		Calculated Temp. of explosion (from vol. and press. of gases).	Volume of gases.	Expansion of standard* Trauzl cylinder.	Expansion compared with gelatin dynamite.	Safety of a 1 grm. charge.
	Water liq.	Water vap.	°C.				
Gelatin dynamite 65% ..	1393	1242	2960	720·0	482	100	—
Carbonite carbonée	633	579	1773	465·0	185	42·8	1000
" I.	685	598	1933	560·6	195	45·1	1000
" II.	665	—	—	—	205	47·4	550
Wetterdynamite I.	705	615	1477	578·8	200	46·3	900
" II.	755	688	2003	616·0	220	50·9	800
Kobelite	946	768	2066	595·0	280	68·8	550
Wetter fulmenite	1062	855	2096	701·5	340	78·7	700
Wetter astralite	1070	868	2088	701·8	350	81·0	not yet determined.
Astralite	1236	967	2182	811·8	420	96·5	
Fulmenite	1206	944	2091	801·4	410	94·2	

* Standard suggested at the International Congress, Berlin, 1903.

—B. J. S.

Nitrocellulose; Decomposition of ——. O. Silberrad and R. C. Farmer. Chem. Soc. Trans., 1906, **89**, 1182—1186.

800 KILOS. of a gelatinised nitrocellulose were stored in a magazine which was maintained at a constant temperature of 54·4° C. by means of steam pipes, steam being also blown directly into the chamber in order to supply enough moisture to facilitate hydrolysis of the nitric ester. After 23 weeks, it was found that the tubes of nitrocellulose were in many instances filled with a crystalline deposit of oxalic acid. 100 kilos. of the explosive were now heated to 80° C. with an equal weight of water, and the solution filtered. The residue consisted of practically unaltered nitrocellulose. In the aqueous solution the presence of nitrous and nitric acids, ethyl nitrate and nitrite, excess of alcohol, ammonia, and also formic, acetic, butyric, dihydroxybutyric, oxalic, tartaric, isosaccharinic, and hydroxypyruvic acids, was detected. In another portion of the aqueous solution, after neutralising, and distilling off the alcohol, the presence of fermentable carbohydrates was detected by fermenting with yeast, when carbon dioxide was evolved, and the residue gave the iodoform reaction.—A. S.

Blasting explosives; Imports of ——, *into Great Britain.* Rept. of H.M. Inspector of Explosives for 1905 [T.R.]

THE imports of blasting explosives containing nitroglycerin into Great Britain in 1905 amounted to 3,234,485 lb., as against 2,244,723 lb. in 1904, an increase of about 44 per cent. There were also imported in 1905 a total of 278,736 lb. of blasting explosives not containing nitroglycerin. Of the total of 3,513,221 lb. of explosives imported in 1905, 2,883,267 lb., or about 82 per cent. was re-exported to other countries. The number of detonators imported during the year totalled 28,897,300, as against 15,279,412 in 1904, an increase of about 88 per cent. Of the 1905 imports there was re-exported 8,945,000.

Phosphorus; Detection of white —— *in match heads.* C. Van Eijk. XXIII., page 869.

ENGLISH PATENTS.

Explosives; Manufacture of ——. H. C. L. Bloxam and the Maganite Explosives Syndicate, Ltd, Cape Town. Eng. Pat. 3005, Feb. 7, 1906.

DINITROBENZENE and ammonium nitrate are fused and mixed together, and to the mixture a small quantity of ammonium carbonate is added. The following proportions have been found suitable:—82 parts of ammonium nitrate, 0·5 to 2·5 parts of ammonium carbonate, and 17 parts of dinitrobenzene.—B. J. S.

Explosives; Process and apparatus for distilling off and recovering the solvents used in the manufacture of ——. W. Nikolsky, St. Petersburg. Eng. Pat. 3661, Feb. 14, 1906.

IN order to recover the volatile solvents used in incorporating and pressing guncotton or similar materials into "cord," the explosive thus obtained is placed in a specially constructed chamber surrounded by a jacket of hot water. The vapour evolved is slowly pumped off and condensed, special care being exercised to prevent the formation of "blisters," which would interfere with the ballistic properties of the explosive.—B. J. S.

Guncotton; Process for imparting to —— *a greater intensity of explosive force.* T. Reishoff, Moscow. Eng. Pat. 10,927, May 10, 1906.

THE combustion of guncotton is rendered more complete by soaking it in a strong solution of metallic nitrates. The solution used contains 4 parts of potassium nitrate, 40 parts of ammonium nitrate, 1·7 parts of barium nitrate, 17 parts of sodium nitrate, 12·3 parts of strontium nitrate, and 25 parts of water by weight. Damp guncotton, 40 parts (containing about 15 per cent. of water) is soaked in 60 parts of the solution, or dry guncotton is used, and the requisite quantity of water added. In the case of compressed guncotton, sufficient solution is taken to fill all the pores, a much more powerful explosive being thus obtained.—B. J. S.

UNITED STATES PATENT.

Priming composition. K. W. Will, Grunewald, Berlin, Germany. U.S. Pat. 827,768, Aug. 7, 1906.

THE use of a mixture of certain specified proportions of tetranitromethylaniline and mercury fulminate is claimed.

—B. J. S.

FRENCH PATENT.

Powders; Process and apparatus for eliminating by distillation the solvent used in making smokeless ——, *or those giving little smoke.* W. Nikolsky. Fr. Pat. 363,519, Feb. 21, 1906.

SEE Eng. Pat. 3661 of 1906; preceding these.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 830.)

APPARATUS, &c.

Calibration of thermometers below 0° C.; New method for the ——. T. W. Richards and F. G. Jackson. Z. physik. Chem., 1906, **56**, 362—365.

THE undermentioned values are given for the depression of the freezing point of water by different proportions of hydrochloric acid, determined with a carefully standardised thermometer. By the use of a curve constructed from these values any thermometer can be readily calibrated. The method recommended for measuring the depression of freezing point is to immerse the thermometer, previously kept in ice for 24 hours, in a mixture of crushed ice and water, held in a cylindrical Dewar vacuum vessel. To the ice and water is added a solution of hydrochloric acid, and after well stirring, the thermometer is read, and

a 10 c.c. sample of the solution is taken with a pipette from the neighbourhood of the thermometer bulb, and submitted to analysis.

Depression of F.Pt.	Concentration, grm. equiv. per litre.	Weight of silver chloride per 10 c.c. of cold solution.
0·500°	0·139	0·199
1·000°	0·277	0·397
1·500°	0·469	0·557
2·000°	0·538	0·772
2·500°	0·663	0·951
3·000°	0·773	1·109
3·500°	0·886	1·271
4·000°	0·997	1·430

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ORGANIC—QUALITATIVE.

Butter; The Polenske method for the detection of cocoanut oil in ——. S. Rideal and H. G. Harrison. Analyst, 1906, **31**, 254—258.

The authors have examined by the Polenske method (this J., 1904, 387) a number of pure English butters, as well as butters of unknown origin. They find that the distillates from pure butters do not give "soluble" and "insoluble" figures in strict ratio, but that, starting with a pure butter fat, the admixture of cocoanut oil causes the relative increase in the "insoluble" figure to agree with Polenske's results. The figures obtained, are given in tabular form, and from them curves have been constructed, the "insoluble" figures being plotted against the "soluble." The English butters gave a curve lying considerably below that for Polenske's butters, whilst the curve for the butters of unknown origin, lay between the other two. Between the figures found by the authors and those of Polenske, there is such a divergence that an appreciable margin of possible adulteration may be inferred.—W. P. S.

ORGANIC—QUANTITATIVE.

Coals and lignites; Determination of volatile combustible matter in ——. E. E. Somermeier. J. Amer. Chem. Soc., 1906, **28**, 1002—1013.

With some samples of lignite the author has found it to be impossible to obtain closely-agreeing duplicate results when using the method recommended in the Report of the Committee on Coal Analysis appointed by the American Chemical Society, for the determination of volatile combustible matter (see this J., 1898, 608). The results of a considerable number of experiments, carried out with a view of explaining these discrepancies, show that the value obtained for volatile matter in coal is affected to an important degree by the method of heating the sample, by the fineness of the pulverisation, and by the amount of loosely held moisture present. In bituminous coals these differences do not exceed 3 or 4 per cent., and appear to be due entirely to the different breaking up of the hydrocarbon compounds under varying conditions of heating, fineness of the sample, and amount of moisture present. In the case of lignites, where the difference between duplicate determinations may be as high as 25 per cent., it is due largely to the mechanical loss in the sample during the rapid expulsion of the volatile matter. Finer ground samples give a somewhat lower amount of volatile matter than do coarser samples. Whilst the official method may be taken as giving correct results in cases where mechanical loss cannot be shown, it does not necessarily give a result approximating very closely the volatile matter as given off when the coal is burnt under a steam-boiler, where the conditions more nearly resemble a method described by the author, in which the coal is subjected to a preliminary heating at a low temperature before being heated as recommended in the official method. It is considered desirable that the latter method be modified in order to prevent mechanical loss in the case of lignites.—W. P. S.

Starch [in cereals]; Determination of ——. B. Gschwendner. Chem.-Zeit., 1906, **30**, 761—763.

The author proposes the following simplified method for the determination of starch in cereals: 5—7·5 grms. of meal are placed in a 50 c.c. measuring flask together with 25—30 c.c. of acidified brine, and the mixture is thoroughly shaken until the meal is uniformly suspended in the liquid. The acid brine is prepared by dissolving 100 grms. of salt in 400 c.c. of water and adding to the solution 50 c.c. of 23 per cent. hydrochloric acid. The flask is then attached to a reflux condensing tube, and is heated in a calcium chloride bath (b.pt., 107°—110° C.) for 1½ hour. At the end of that time 5 c.c. of basic lead acetate solution are added, the contents of the flask are cooled, and diluted to the mark. An excess of water corresponding to the volume of the undissolved residue is added, *viz.*, in the case of maize-flour, 0·7 c.c. per 5 grms. of flour. The solution is then filtered and polarised. The polarisation value is calculated as dextrose, and the result × 0·9 gives the quantity of starch. Reasonable variations in the concentration and time of heating have no influence on the results, but it is not advisable to hydrolyse solutions containing more than 20 per cent. of meal. The results are lower than those obtained by the high-pressure conversion method, but slightly higher than those found by the diastase method, in which traces of starch remain unconverted. The author has only investigated the method fully for the valuation of maize; the analysis is effected with the minimum expenditure of time and trouble.—J. F. B.

Fermentable matter in grain; Determination of ——. Boidin and de Lavallée. Bull. Assoc. Chim. Sucr. et Dist., 1906, **23**, 1383—1384.

The principal causes of error in starch determinations by chemical methods are: 1. Non-fermentable bodies are reckoned as starch; 2. During the acid hydrolysis of the dextrin a portion of the sucrose is destroyed. The authors suggest the following method, a process of determination by means of fermentation:—The whole or ground grain is boiled with an organic or mineral acid under a low pressure for a very short time (until the starch is liquefied). The pasty solution thus obtained is transferred to a flask, the neck of the latter is closed with a cotton-wool plug, and the whole sterilised. After cooling, the acid is neutralised with sterilised chalk, the neutralised solution then being treated with a saccharifying mucedina and pure yeast. This method, which is an exact copy of the commercial amylo process, possesses the following advantages:—

1. The inclusion of non-fermentable substances such as the pentoses as fermentable matter, is avoided.

2. By the use of mucedine in an aseptic medium, a fermented solution is obtained which contains neither reducing sugar nor starch.

3. Nearly the theoretical yield is obtained.

4. Analytical details may be modified to any degree, so that in the majority of cases the yield on the large scale may be calculated, thus rendering it possible to detect any faults in the manufacture.—L. E.

Malic acid and other fixed acids; Determination of —— *in fruit juices.* W. Mestrezat. Compt. rend., 1906, **143**, 185—186.

The method is based on the insolubility of barium malate, tartrate, and succinate in 75 per cent. alcohol. A known volume of the fruit juice is neutralised with barium hydroxide, a few drops of 3 per cent. acetic acid added, the whole concentrated *in vacuo*, 2 c.m. of a 30 per cent. barium acetate added and enough alcohol to bring the alcohol content to 80 per cent. The precipitate contains the barium salts of the acids, also the gums, pectins, albuminoids, and tannins; whilst the clear solution contains the sugar, glycerol, soluble barium salts, and other substances. The precipitate has enough sulphuric acid added to it to decompose the barium salts, along with 10—12 c.c. of water, and the whole is made up to 100 c.c. with alcohol, when the gums, pectins, and albuminoids are precipitated. Eighty c.c. of the filtered liquid are taken, potassium chloride and acetate added, and the volume made up to 100 c.c. with water, whereby the whole of the tartaric acid is precipitated. From the filtrate the barium malate and succinate are precipitated as above, dissolved in water, and the tannin removed by precipitation with Laborde's mercury acetate solution. The malic acid is estimated by oxidation with permanganate, the solution being then evaporated to dryness with sand, and the succinic acid extracted from the residue with ether.—E. F. A.

a 10 c.c. sample of the solution is taken with a pipette from the neighbourhood of the thermometer bulb, and submitted to analysis.

Depression of F.Pt.	Concentration, grm. equiv. per litre.	Weight of silver chloride per 10 c.c. of cold solution.
0·500°	0·139	0·199
1·000°	0·277	0·397
1·500°	0·469	0·557
2·000°	0·538	0·772
2·500°	0·663	0·951
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(1) These articles formerly paid also the duty on alcohol at the rate of 4·66 lire per kilo.
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(3) As sugar of the first class.
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(7) Crystallised.
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(10) Refined.
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DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 590 pages, was published in 1899; a few copies of this are still left, price 10s. A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform, in size, with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10s. each copy. A form of application for this purpose will shortly be issued.

CORRECTIONS FOR DECENNIAL INDEX.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

Changes of Address.

Allen, Wilfrid T.; all communications to Allington, Bexley, Kent.

Baron, Wm. Briscoe, l/o Warrington; c/o The Fuel Testing and Water Saving Co., Ltd., 2, Booth Street, Albert Square, Manchester.

Brunt, R. A., l/o Box 121; Box 71, Windsor, Ont., Canada.

Carpenter, H. C. H., l/o Teddington; 11, Oak Road, Withington, Manchester.

Craven, J. A., l/o The Hollies; 119, Town Street, Armley Leeds.

Eddy, Wm. C.; all communications to "Corner of" Glover and Penn Streets, Woodbury, N.J., U.S.A.

Enright, Bernard, l/o South Bethlehem; c/o St. Louis Portland Cement Co., St. Louis, Mo., U.S.A.

Fingland, Jno. J., l/o Glasgow; Rosebery, B.C., Canada.

Goetz, Isidore, l/o Northwood; 5, Brondesbury Park, London, N.W.

Grabfield, Dr. J. P., l/o Chicago; c/o Monds and Co., 35th Street and 11th Avenue, New York City, U.S.A.

Gries, Walter T., l/o London; 9, Dalhousie Square, Calcutta, India.

Haigh, Percy, l/o Cambridge; St. Catherine's, Hurst-pierpoint, Sussex.

Hall, Clarence A., l/o North American Building; 51, Allen Lane, Mount Airy, Philadelphia, Pa., U.S.A.

Imrie, John, l/o Glasgow; Station Road, Milton, Stoke-on-Trent.

Johnson, Chas. C.; Journals to 4734, Fairview Avenue, Windsor Place, Olds, U.S.A.

Joseph, A. F., l/o London; Royal College, Colombo, Ceylon.

Knecht, Dr. E., l/o Crumpsall; all communications to Beech Mount, Marple, Cheshire.
Lansley, Thomas Ley, c/o Chas. Harrington, c/o Waterbury Buckle Co., Waterbury, Conn., U.S.A.
Miller, Stuart B., l/o Birmingham; c/o Eastern Dynamite Co., Lewisburg, Ala., U.S.A.
Nash, L. Hyddelton, l/o Seven Sisters Road; Westlands, Princess Road, Finsbury Park, N.
Page, E. P., l/o Heath Street; 31, Market Street, Stourbridge.
Patterson, C. A., l/o Landing, N.J.; Washburn, Wis., U.S.A.
Powney, W. E. F., l/o Stroud Green; 10, Alexandra Villas, Finsbury Park, N.
Scholes, Geo. R.; all communications to Dépôt Général de la Liebig's Extract of Meat Co., Ltd., Antwerp, Belgium.
Shenstone, W. A., F.R.S., l/o St. Vincent Rocks; 46, College Road, Clifton, Bristol.
Turnbull, R. H., l/o Smyrna; c/o McAndrew and Forbes Co., Camden, N.J., U.S.A.
Twigg, G. F., l/o Abbey Street; 29, Fairfax Road, Derby.
Williams, Percy, l/o Higham; 33, Oakfield Road, Clapton, N.E.
Witt, Dr. Otto N., l/o Siegmundshof; Ebereschenallee, 10, Westend bei Berlin.
Wrampelmeier, T. J., l/o Emerson Street; 2253, Piedmont Avenue, Berkeley, Cal., U.S.A.
Young, Dr. Geo., l/o Isle of Man; 83, Harvard Court Mansions, Honeybourne Road, West Hampstead, N.W.

Change of Address Required.

Johnstone, W. G., l/o 5, Great Winchester Street, E.C.

Death.

Pierce, Ira L., Washburn, Wis., U.S.A. July 16.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (1) in the case of Applications for Patents, the dates of Application, and (2) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 19,193, Merrell, Gere, and Merrell-Soule Co. Process and apparatus for recovering in the form of dry powder solids contained in liquids or semi-liquids.* Aug. 28.
" 19,412. Cowper-Coles and Sharp. Filters. Aug. 30.
" 19,663. Epstein. Furnaces or heating apparatus. Sept. 4.
" 19,729. Haddan (Aktiebolaget Separator). Centrifugal machines for separating solids from liquids.* Sept. 4.
" 19,922. Grossmann. Retort for distilling by means of or with the aid of open steam. Sept. 7.
" 19,957. Schmitt. Heating apparatus.* Sept. 7.
" 20,345. Bennis and Bennis. Furnaces. Sept. 12.
[C.S.] 18,172 (1905). Ungleub. Method and apparatus for distilling and evaporating liquids *in vacuo*. Sept. 19.
" 20,699 (1905). Kastner. Centrifugal fans or machines for atomising liquids. Sept. 12.
" 24,630 (1905). Fulton. Smoke-consuming furnace. Sept. 5.
[C.S.] 10,788 (1906). Kammermann. Drying or condensing apparatus. Sept. 19.
" 11,948 (1906). Marks and Blake. Production of non-oxidising protective gas for use with petroleum and other combustible liquids. Sept. 19.
" 11,623. (1906). Ridgway. Filters for separating solutions from solids. Sept. 12.
" 14,096 (1906). Haskell. Funnels. Sept. 12.

II.—FUEL, GAS, AND LIGHT.

[A.] 19,113. Bloxam (Henkels). Manufacture of incandescence mantles. Aug. 27.
" 19,115. Sellers, Capel, and Wallis. Generation of steam for conversion into water-gas in suction and pressure gas producer plants.* Aug. 27.
" 19,146. Dofays. Regenerating coke ovens. Aug. 27.
" 19,332. Moores and Petrides. Manufacture of air gas. Aug. 29.
" 19,398. British Thomson-Houston Co. (General Electric Co.). Graphite filaments for electric lamps, furnaces, &c. Aug. 30.
" 19,401. Thompson. Combustion of coal and other combustible material. Aug. 30.
" 19,480. Coppée. Regenerative coke ovens.* Aug. 31.
" 19,513. Hubbard. *See under* XXIII.
" 19,624. Robertson, and Willans and Robinson, Ltd. Apparatus for filtering gas.* Sept. 3.
" 19,629. Collins. Manufacture of briquettes. Sept. 3.
" 19,780. De Veiga. Process for utilising close burning coal dust for making metallurgical or other coke. [Fr. Appl., Sept. 12, 1905.]* Sept. 5.
" 20,042. Still and Adamson. Manufacture of incandescent gas mantles. Sept. 8.
" 20,085. Ling and Henry. Treatment of boiler, flue, and similar waste gases, and their subsequent utilisation. Sept. 10.
" 20,281. Robertson and Graham. Manufacture of artificial fuel. Sept. 12.
" 20,359. Fritz. Method of producing gas and its by-products from coal, peat, and similar substances. Sept. 13.
" 20,454. Green. Apparatus for producing combustible gas for lighting and heating purposes. Sept. 14.
" 20,484. Masons Gas Power Co., Ltd., Hollis and Wright. Power gas producers. Sept. 15.
[C.S.] 11,281 (1905). Drury and Pulman. Production of a combustible charge from oil, alcohol, or other liquid, for internal combustion engines. Sept. 5.
" 15,818 (1905). Le Maître. Manufacture of agglomerates, paint material, fuel briquettes, and the like. Sept. 12.
" 19,416 (1905). Grice. Gas producing plants. Sept. 12.
" 20,175 and 20,175a (1905). Just, Hänaman, Landesberger, Salzmann, and Verein. Electricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Sept. 19.
" 21,124 (1905). Shadbolt and Tully. Gas manufacture. Sept. 19.
" 21,872 (1905). Stokes, and Stewart and Co. Gas calorimeter. Sept. 5.
" 22,974 (1905). Hutchins and Wilkie. Producer gas generators. Sept. 19.
" 23,902 (1905). Book. Manufacture of weather-proof briquettes with soluble binding materials. Sept. 12.
" 25,045 (1905). Hackert. Introduction of gas or steam into a gas retort. Sept. 12.
" 26,703 (1905). Tangye, Ltd., and Pain. Producer gas plants. Sept. 19.

[illegible] Sept. 5.

[illegible] Gas retorts. Sept. 19.

[illegible] (1906). Imray (Siemens und Halske A.-G.). Manufacture of incandescence bodies for electric lighting. Sept. 5.

6151 (1906). Boult (Soc. in Partecipazione per la Combustione Liquids). Hydrocarbon burners for furnaces. Sept. 19.

10,127 (1906). Hartenstein. Compositions for heating and maintaining the temperature of materials in the manufacture of carbide. Sept. 5.

10,159 and 10,160 (1906). Hartenstein. Carbide. Sept. 5.

12,127 (1906). Grünewald. Carburetting process and apparatus. Sept. 12.

12,128 (1906). Grünewald. Carburetting apparatus. Sept. 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 19,060. Gehre and Schultz. Process of preparing solvent naphtha.* Aug. 27.

" 19,477. Breda. *See under* XII.

" 19,761. Issakides and Deponte. Treatment of mineral oils used for lubricating and other purposes. Sept. 5.

" 19,811. Noad and Townsend. Refining mineral oil. Sept. 5.

[C.S.] 11,581 (1905). Drury and Pulman. *See under* II.

" 38 (1906). Stillesen. Manufacture of solidified petroleum for use as fuel. Sept. 19.

" 10,043 (1906). Martini and Huneke. *See under* I.

IV.—COLOURING MATTERS AND DYESTUFFS

[A.] 19,382. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. Aug. 29.

19,602. Bierzam (Act.-Ges. f. Anilinfabr.). Manufacture of arylated derivatives of 2-amino-5-naphthol-7-sulphonic acid. Sept. 7.

19,736. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new dyestuffs of the triphenylmethane series. Sept. 10.

19,738. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Sept. 10.

19,807. Imray (Dyeworks, formerly Durand, Huguenin et Cie). Manufacture of condensation products from gallic acid or a derivative thereof and an alkylated amidoarylthioarsinic acid, and [illegible] thereof.* Sept. 11.

V.—FIBRES, YARNS, FABRICS, PAPER, PRINTING, AND [illegible] AND FIBROUS MATERIALS.

[A.] 19,195. Eichler. [illegible] of fabrics.* Aug. 23.

" 19,241 Wolman. *See under* IX.

" 20,000. Trevor. Colouring cloth. Sept. 5.

" 20,005. De Perini. Production [illegible] and paper pulp.* Sept. 5.

" 20,029. Stone. Dye tubs [illegible] Nov. 8, 1905.]* Sept. 5.

" 20,219. Ingham. Manufacture of [illegible] ing, stiffening or waterproofing [illegible] textile and like fabrics. Sept. 11.

" 20,220. Ingham. Manufacture of [illegible] Sept. 11.

" 20,460. Becker. Composition for [illegible] and rendering them non-inflammable.

" 20,494. Hunt and Mosses. [illegible] dyeing, scouring or otherwise treating [illegible] the open condition. Sept. 13.

" 20,519. Miller. Mercerising [illegible]

[C.S.] 20,279 (1905). Farnworth. [illegible] cloth or other fabrics. Sept. 12.

" 22,391 (1905). Calico Printers' Association and Warr. Production from certain [illegible] thickening suitable for calico printing and other purposes. Sept. 5.

" 6166 (1906). Gorrand. Manufacture of artificial silk. Sept. 5.

" 6671 (1906). Dydynski. Weaving [illegible] textile fabrics. Sept. 19.

VI.—COLOURING WOOD, LEATHER, PAPER, &c.

[A.] 20,119. Schwalbe. Process [illegible] colours fast to light and to [illegible]

VII.—ACIDS, ALKALIS, AND [illegible]

[A.] 19,172. Clarkson. Purification [illegible]

" 19,465. Wedekind und Co. [illegible] ammonium nitrate from [illegible] and ammonium sulphate. [Ger. appl. Nov. 28, 1905.]* Aug. 31.

" 19,649. Bamberger. [illegible] ide from dilute gases.

" 19,713. Tuells. Production [illegible] lead.* Sept. 6.

" 19,732. Kenyon. Production [illegible] insoluble in water.* Sept. 7.

" 20,037. Thomson. Utilising [illegible] galvanising iron. Sept. 8.

" 20,383. Lambert. Process [illegible] chlorine. Sept. 12.

" 20,498. Farnworth. [illegible]

[C.S.] 915 (1906). Digby and Marshall. Means for manufacturing hypochlorite solutions. Sept. 19.
,, 2047 (1906). Cooper. Production of cyanogen by products and compounds from humus. Sept. 19.
,, 2823 (1906). Teichner and Askenasy. *See under* XI.
,, 3905 (1906). Applegarth and Quain. Production of ozone. Sept. 12.
,, 4063 (1906). Krell. Tubes for concentrating acid. Sept. 5.
,, 9183 (1906). Newton (Dr. Wolters Phosphat Ges.). *See under* XV.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 20,507. Menzel. Process and apparatus for drawing window or plate glass.* Sept. 15.
[C.S.] 12,159 (1906). Slingluff. Glass furnaces. Sept. 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 19,070. Collins. Manufacture of imitation marble, stone, and the like. Aug. 27.
,, 19,186. Rauhoff. Rendering cement or concrete blocks waterproof.* Aug. 28.
,, 19,233. Kollen. Artificial stone.* Aug. 28.
,, 19,241. Wolman. Solutions for preserving wood and other fibrous material.* Aug. 28.
,, 19,349. Rigby and Roberts. Maturing Portland cement. Aug. 30.
,, 19,723. Yates. Manufacture of cement. Sept. 4.
,, 19,973. Matcham. Furnaces or kilns for preparing cement-making materials and the like.* Sept. 7.
,, 20,125. Schnell, Mayer, and Hartwich. Manufacture of a substitute for wood. Sept. 10.
,, 20,298. South, Payne, and Payne. Cement.* Sept. 12.
[C.S.] 3655 (1906). Jeroch, and Deutsche Ferrit-Cement Ges. Manufacture of cement. Sept. 5.
,, 3749 (1906). Bohmer. Materials for forming roadways. Sept. 19.
,, 7464 (1906). Price. Brick and like kilns. Sept. 5.
,, 8627 (1906). Crowley and Payne. Fireproof or heat-resisting surfacing composition or cement. Sept. 5.
,, 13,218 (1906). Wingfield. Bricks and the like. Sept. 12.

X.—METALLURGY.

[A.] 19,087. Brooks. Recovery of gold and silver from zinc-box slimes. Aug. 27.
,, 19,130. McIvor and Fradd. Treatment of sulphide ores containing zinc. Aug. 27.
,, 19,170. Churchward. Quenching or tempering baths for castings from steel alloys. Aug. 28.
,, 19,229. Clawson. Ore roasting and volatilising furnaces. Aug. 28.
,, 19,451. Lipscombe and Thoms. Metallic alloys. Aug. 31.
,, 19,452. Lipscombe and Thoms. Metallic alloys. Aug. 31.
,, 19,493. Hodgkinson. Treatment of iron or steel. Aug. 31.
,, 19,509. Swinburne. Treatment of sulphide or oxide ores. Sept. 1.
,, 19,554. Maunder. Smelting and treatment of complex, refractory, and other ores. Sept. 1.
,, 19,616. Drain. Open hearth furnaces.* Sept. 3.
[A.] 19,712. Snyder. Treatment of ores.* Sept. 4.
,, 19,813. Welch and Giddens. Aluminium solders. Sept. 6.
,, 19,815. Cowper-Coles. Recovery of gold from cyanide solutions. Sept. 6.
,, 19,944. Sulman. Ore concentration. Sept. 7.
,, 20,015. Fitzmaurice. Treatment of ores. Sept. 8.
,, 20,445. Crompton. Hardening steel. Sept. 14.
,, 20,452. Kelsall. Manufacture of high per cent. content manganese steel. Sept. 14.
,, 20,545. Maschinenbau-Anstalt Humboldt, and Metallurgische Ges. Separation of substances having different magnetic excitabilities. [Ger. Appl., Jan. 26, 1906.]* Sept. 15.
[C.S.] 10,943 (1905). Mac Ivor and Fradd. Process for extracting tin from ore. Sept. 5.
,, 17,449 (1905). Chance. Process for purifying metals. Sept. 5.
,, 17,839 (1905). Blackmore and Howard. Treatment of pyritic ores containing gold, silver, or other valuable metals. Sept. 5.
,, 23,408 (1905). Asbeck. Process for obtaining lead and silver from their ores. Sept. 19.
,, 26,277 (1905). Heberlein. Treatment of metalliferous ores or compounds preparatory to smelting. Sept. 19.
,, 60 (1906). King. Desulphurising and nodulising substances containing iron compounds. Sept. 12.
,, 4999 (1906). Hodgkinson. Treatment of small mine or waste products of calcined iron ores for the more complete extraction of iron. Sept. 12.
,, 8507 (1906). Hunter. Conversion of cast iron into steel or malleable iron. Sept. 12.
,, 12,599 (1906). Gruber. Soldering aluminium or its alloys, and solder therefor. Sept. 5.
,, 13,931 (1906). Cattaneo and Faggian. Preparation for converting iron into steel and for tempering steel. Sept. 12.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 19,398. British Thomson-Houston Co. (General Electric Co.). *See under* II.
,, 19,411. Cowper-Coles. Electrodeposition of alloys. Aug. 30.
,, 20,054. Mackenzie (Bolle und Co.). Production of metallic salts by electrolysis.* Sept. 8.
,, 20,380. Cowper-Coles. Electrolytes for the electrodeposition of copper. Sept. 13.
[C.S.] 17,727 (1905). Lewis and Corey. Electrodeposition of metals. Sept. 12.
,, 18,513 (1905). Lederer. Process of making emulsions of mercury or other conducting substances. Sept. 19.
,, 19,111 (1905). Hess. Manufacture of a substance for electrical insulation. Sept. 12.
,, 25,771 (1905). Frick. Electric transformer furnaces. Sept. 12.
,, 52 (1906). Jeantaud. Special active material for accumulators. Sept. 12.
,, 1019 (1906). Gin. Electric furnaces. Sept. 12.
,, 2823 (1906). Teichner and Askenasy. Electrolytic production of persulphates. Sept. 12.
,, 3345 (1906). Connolly. Manufacture of insulating material. Sept. 12.
,, 4716 (1906). McDonald. Electrolytic apparatus. Sept. 19.
,, 7869 (1906). Pauling. Production of voltaic strong-current arcs. Sept. 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 19,477. Breda. Process of obtaining fatty acids from petroleum residues.* Aug. 31.

,, 19,605. Agostini. *See under* XIV.

,, 20,540. Rosa. Oils and greases, particularly for lubricating purposes. Sept. 15.

[C.S.] 4116 (1906). Wallbaum. Preparation of easily and durably emulsifiable fatty preparations. Sept. 12.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

[A.] 20,552. Brindley. Manufacture of the pigment oxide of iron from waste liquors. Sept. 15.

[C.S.] 15,818 (1905). Le Maitre. *See under* II.

,, 27,252 (1905). Imray. (Meister, Lucius, und Brüning). Manufacture of colour lakes. Sept. 5.

(*B.*)—Resins, Varnishes.

[A.] 19,870. Snyder. Process of treating wood for the extraction of turpentine. [U.S. Appl., Dec. 1, 1905.]* Sept. 6.

,, 20,019. Joly. Gums, resins, and the like. Sept. 8.

,, 20,497. Lewkowitsch. Manufacture of varnish. Sept. 15.

[C.S.] 21,954 (1905). Harrison. Treating turpentine to render it uninflammable. Sept. 12.

(*C.*)—India-Rubber.

[A.] 19,886. Bonnefin. Process for extracting rubber from plants or parts of plants. Sept. 7.

,, 19,894. Gare. Process of reclaiming waste vulcanised india-rubber. Sept. 7.

,, 20,404. Olsson. Artificial gum or caoutchouc. Sept. 13.

[C.S.] 4692 (1906). Grätz. Processes for obtaining pure caoutchouc and the like. Sept. 5.

,, 8953 (1906). Beresin. Process of manufacturing artificial india-rubber. Sept. 5.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 19,495. Lund. Process of fixing tanning fat in leather. [Appl. in Norway, Sept. 1, 1905.]* Aug. 31.

,, 19,557. Bernstein. Manufacture of an adhesive material from casein. Sept. 1.

,, 19,605. Agostini. Process for obtaining soap size.* Sept. 3.

,, 19,725. Ellis (Stoney and Wetherell). Adhesives. Sept. 4.

,, 19,848. Schneider. Process and apparatus for obtaining glue and gelatine from glue-materials in the form of powder or grits.* Sept. 6.

,, 20,548. Helbronner and Vallee. Treatment of ossein. [Fr. Appl., Sept. 26, 1905.]* Sept. 15.

[C.S.] 18,500 (1905). Smith. Apparatus for treating hides and leather. Sept. 19.

,, 14,602 (1906). Kohl. Manufacture of leather. Sept. 5.

XV.—MANURES, &c.

[C.S.] 9183 (1906). Newton (Dr. Wolters Phosphat Ges.). Process for rendering mixed combinations of phosphoric and silicic acid easily soluble. Sept. 19.

XVI.—SUGAR, STARCH, GUM, &c.

[A.] 19,464. Shaw. Process of extracting sugar from cane stalks. Aug. 31.

,, 20,488. Fielding. Production of soluble starch and dextrine. Sept. 15.

[C.S.] 10,822 (1905). Castle. Manufacture of gum tragasol from locust bean kernels. Sept. 5.

,, 18,138 (1905). Monti. *See under* XVII.

,, 16,535 (1906). W. H. Uhland Ges. Apparatus for moistening dextrine. Sept. 12.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 19,140. Sleeman. Apparatus for malting grain. Aug. 29.

,, 19,324. Reul and Grund. Production of yeast. Aug. 29.

,, 20,144. Mackenzie (Deckebach). Process of treating and ageing wort.* Sept. 10.

[C.S.] 18,138 (1905). Monti. Treatment of wine must, beer, beetroot juice, and the like. Sept. 19.

,, 367 (1906). Somló. Preparation of grain for brewing and the like. Sept. 5.

,, 6640 (1906) Ehrlich. Process for making fusel oil and components of fusel oil. Sept. 19.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 19,321. Ransford (Lallemand). Substitutes for butter, lard, cream, and the like. Aug. 29.

,, 19,796. Goodall. Purifying and clarifying flour. Sept. 5.

[C.S.] 827 (1906). Driver. Beverages. Sept. 19.

,, 7936 (1906). Soc. "Le Lait." Process for preserving liquid foods. Sept. 19.

(*B.*)—Sanitation; Water Purification.

[A.] 19,727. Haddan (Edson Reduction Machinery Co.). Process for reducing garbage and sewage.* Sept. 4.

,, 19,728. Haddan (Edson Reduction Machinery Co.). Apparatus for reducing garbage and sewage.* Sept. 4.

,, 20,103. Candy. Manufactures for use in the purification and hardening of water. Sept. 10.

,, 20,112. Lipscombe. Apparatus for water softening and purifying. Sept. 10.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 19,454. Tadman and Broughton. Blotting or filter paper. Aug. 31.

,, 19,625. Luck. Treatment of flax-straw, &c., for making fibrous material for use in the manufacture of paper pulp. Sept. 3.

,, 20,005. De Perini. *See under* V.

[A.] 20,037. Claessen. Manufacture of celluloid.* Sept. 8.

[C.S.] 25,480 (1905). Post. Copying paper. Sept. 19.

„ 6590 (1906). Fritsch. Process for rendering paper moisture-proof and durable. Sept. 19.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 19,960. Basler Chemische Fabrik. Manufacture of camphene. [Ger. Appl., May 3, 1906.]* Sept. 7.

„ 19,961. Basler Chemischer Fabrik. Manufacture of isobornyl oxalates. [Ger. Appl., May 5, 1906.] Sept. 7.

„ 20,246. Ewan and Young. Manufacture of guanidine salts. Sept. 12.

„ 20,526. Shukoff. Process of manufacturing esters of alcohols of terpenes. Sept. 15.

C.S.] 23,718 (1905). Cooper (Bayer und Co.). Manufacture of dialkylbarbituric acids. Sept. 12.

„ 7125 (1906). Wellcome, Jowett, and Pyman. Manufacture of a salicylic acid derivative. Sept. 19.

„ 9707 (1906). Wolff. Process for the production of an anæsthetic. Sept. 5.

„ 10,407 (1906). Ellis (Chem. Fabr. von Heyden A.-G.). Manufacture of camphor from isoborneol. Sept. 19.

[C.S.] 17,167 (1906). Imray (Basle Chemical Works). Manufacture of carbamic esters of the pyrogallol-1.3-dialkyl ethers. Sept. 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 22,580 (1905). Browne. Photographic printing process for obtaining coloured prints. Sept. 19.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 19,215. Bichel. Increasing the density of fusible explosive nitro-substances. Aug. 28.

„ 19,408. Duttenhofer. Manufacture of explosives.* Aug. 30.

„ 19,791. Silberrad. Explosives.* Sept. 5.

„ 20,309. Reschke. Explosive compounds.* Sept. 12.

„ 20,365. Jones. Apparatus for thawing or tempering explosives. Sept. 13.

[C.S.] 25,781 (1905). Reschke. Explosives. Sept. 5.

„ 12,716 (1906). Reschke. Manufacture of safety explosives. Sept. 5.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 19,513. Hubbard. Apparatus for automatically analysing mixed gases and recording the percentage therein of one of the gases. Sept. 1.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 840.)

English Patents.

Retorts or other appliances for heating or cooling solid, granular, or pasty materials, with or without simultaneous chemical treatment of the same with gases. J. Wetter, London. From E. R. Besemfelder, Charlottenburg, Germany. Eng. Pat. 18,593, Sept. 14, 1905.

The claim is for improvements in the apparatus described in Eng. Pat. 13,830 of 1899 (this J., 1900, 725). The coal or other material is moved through the heat-interchanging apparatus by imparting to the trough or retort an oscillating or vibratory movement, instead of turning the inclined retort on its axis.—W. H. C.

Drying apparatus. K. Reyscher, Bielefeld, Germany. Eng. Pat. 18,596, Sept. 14, 1905.

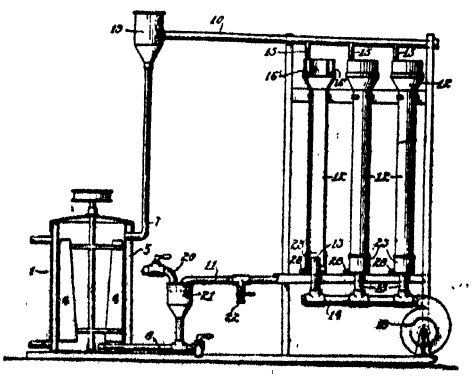
The apparatus consists of a long chamber or tunnel, through which the materials to be dried are caused to pass. There is a primary heating chamber under the centre of the tunnel, and a secondary heating chamber under each end. Air is drawn from the open ends of the tunnel, over the materials, and through the secondary heating chambers by fans, and is delivered into shallow chambers above the tunnel, from which it flows again over the materials to be dried. Air is also drawn from the centre of the tunnel by a compressor driven by an external motor; it is heated by the compression, and issues through the primary heating chamber to an air motor which drives the fans. It is thereby cooled, and the liquid which it has absorbed from the wet materials is condensed, and, if valuable, recovered. The only source of heat employed is the energy of the motor which heats the air by compression.—W. H. C.

Filter presses. M. Ekenberg, Stockholm. Eng. Pat. 6363, March 16, 1906.

See U.S. Pat. 818,154 of 1906; this J., 1906, 462.—T. F. B.

United States Patents.

Evaporating apparatus. F. D. Smith, Los Angeles, Cal. U.S. Pat. 828,343, Aug. 14, 1906.

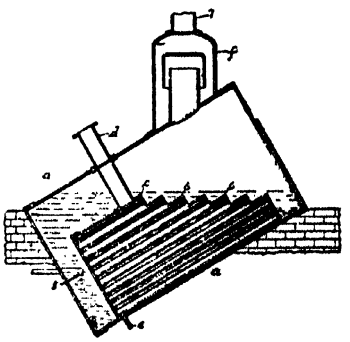


The liquid to be evaporated is fed from the tap, 20, into the tank, 21, from which it flows by the pipe, 6, into the cylinder, 1, provided with a heating jacket, 5. An agitator, 4, drives the liquid from the inlet, 6, to the outlet, 7, and to the tank, 19. From 19, the liquid flows along the pipe, 10, out of the tubes, 15, into the annular cups, 16¹, of the evaporator tubes, 12, down which it flows and meets an ascending current of air delivered through the tubes, 14, 13, by the fan, 18. The concentrated liquid flows from the annular cups, 23, at the bottom of the pipes, by the tubes, 28, into the main, 11, from which it is either drawn off by the tap, 22, or is returned to the tank, 21, for circulation over again.—W. H. C.

Evaporating apparatus. J. A. Warren, Westbrook, Me., Assignor to S. D. Warren, W. B. Mason, and F. Warren, Boston, Mass. U.S. Pat. 828,524, Aug. 14, 1906.

An evaporator, having a supply chamber below and a vapour chamber above, connected by vertical evaporator pipes which pass through a steam chamber, has a discharge pipe provided with an overflow bend, which has a telescopic joint to regulate and determine the "hydrostatic level" of the liquid in the tubes. The vapour and supply chambers are connected by a return pipe, and the overflow of the vapour chamber has a siphon-breaking pipe with a telescopic joint.—W. H. C.

Evaporator. F. Scherr, Roosevelt, N.Y. U.S. Pat. 828,085, Aug. 14, 1906.



A cylindrical outer shell, *a*, is set at an angle as shown, and has an interior cylinder, *c*, placed eccentrically within it. The inner cell, *c*, has a straight lower end, and a stepped or "staggered" upper one, so that the upper ends of the tubes which pass through it are approximately in the same horizontal plane. The liquid to be evaporated enters by the pipe, 8, and passes through the tubes of the inner cylinder, *c*, and the vapour given off escapes through the dome, *f*, and the pipe, 7. Steam enters the space round the tubes through the pipe, *d*, and the condensed water escapes through the pipe, *e*.—W. H. C.

Drying-machine; Continuous roller ——. B. Cohnen, Grevenbroich, Germany. U.S. Pat. 829,141, Aug. 21, 1906.

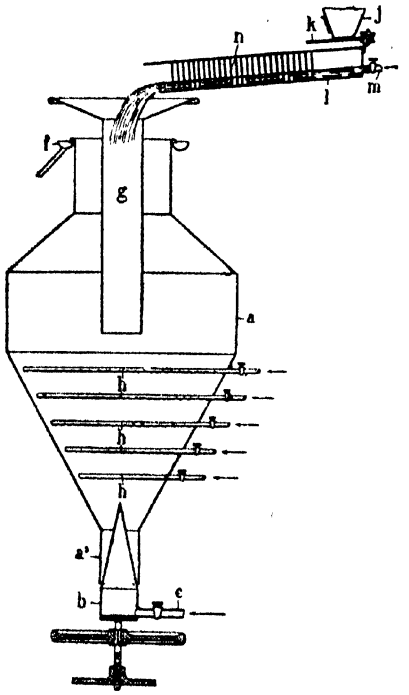
A vertical series of shelves, formed of a number of rollers placed close together in horizontal rows, is enclosed in a casing through which a current of warm air or other suitable drying medium is circulated. Alternate rows of rollers are rotated in opposite directions, so that the material which is fed on the top row is moved forward, and dropped on to the second row at the other end through a space left between the shelf and the end of the case at the opposite ends of alternate shelves. The material is moved alternately backwards and forwards until it reaches the bottom shelf, from the end of which it is discharged.—W. H. C.

Filter. C. Sellenscheidt, Assignor to Filter und Brautechnischen Maschinenfabrik A.-G., vorm. L. A. Enzinger, Berlin. U.S. Pat. 829,807, Aug. 28, 1906.

SEE Eng. Pat. 11,979 of 1904; this J., 1905, 268.—T. F. B.

FRENCH PATENTS.

Purification, methodical classification, and concentration of all kinds of materials; Process and apparatus for ——. L. A. Morel. Fr. Pat. 361,513, May 26, 1905.



THE materials to be treated, previously brought into a fine state of division, are delivered from the hopper, *j*, on to the distributor, *k*, and are mixed with water or other suitable liquid from the pipe, *m*, in the shoot, *l*, down which the mixture flows through the gratings, *n*, into the funnel tube, *g*. The mixture enters the vessel, *a*, which is full of water, and separates into two portions, one lighter and the other heavier than water. A current of water forced in through the tube, *c*, and the hollow plug, *b*, agitates the mixture, and facilitates the separation. The lighter particles are carried to the top of the vessel, *a*, and flow over the lip into the trough, *f*, and the heavier portions sink and collect at the bottom at a^2. They are removed from time to time by loosening the hollow plug, *b*. The agitation and separation are further assisted by injecting water and air through the pipes, *h*. —W. H. C.

Evaporation; New apparatus for ——. J. F. P. Kestner. Fr. Pat. 361,524, May 29, 1905.

IN the apparatus described by the author in Fr. Pat. 315,978 of 1901, and in the addition thereto of 1902 (this J. 1903, 768), the ascent of the liquid in the tubes known as "grimpage" has been found to work well in the earlier stages of a multiple effect system. It is different, however, with the later stages, in which, owing to the high vacuum and consequent low density of the vapour and high relative density of the liquid, and its viscosity, the "grimpage" only takes place partially. This defect is obviated in the apparatus described in the present specification by causing a mixture of liquid and vapour to flow down instead of up the tubes. An effect, which the author calls "descendage," is obtained, and the liquid passes down in a thin film on the sides of the tubes. A number of long tubes is arranged vertically in concentric rings in a heating jacket, and the liquid enters the outer ring of tubes from below. It passes upwards, and is partially vaporised, and on reaching the top, the mixture of vapour and liquid descends through the inner tubes to the bottom, where the separator is placed, instead of at the top as formerly. The mixture enters a "centrifugal separator," where the vapour is separated from the liquid, which is drawn off from below, while the vapour is conducted by another opening to the vacuum condenser. —W. H. C.

Evaporator; Single effect —— with auto-condensation by continuous compression of the vapour. C. L. Prache and C. G. V. Bouillon. Fr. Pat. 364,408, March 19, 1906.

A CYLINDRICAL vessel has its lower part divided into several separate compartments, through which the liquid flows in succession. Each compartment is formed of a number of vertical evaporator tubes grouped round a larger, central return tube, under which there is a deflecting plate. The tubes pass through and are held in position by upper and lower tube-plates, which are common to all the divisions. The liquid flows up the evaporator tubes, and returns by the central tube, from the centre of which, about half-way down, a somewhat smaller tube conveys a portion of the concentrated liquid into the bottom chamber of the next compartment. The vapour given off collects in the upper part of the cylinder, which is common to all the compartments, and it is drawn off by a rotary compressor and returned, after its temperature has been raised by compression, to the space around the tubes, which forms a common heating chamber. The liquid is fed through a special float valve, and tubes are provided to conduct away the finished liquid and the uncondensed gases separately.—W. H. C.

Cold for industrial purposes; Process for the production of ——, by the use of volatile liquids such as ammonia, and the recovery of such liquids. R. A. Grimoin-Sanson. Fr. Pat. 363,978, March 8, 1906.

Two reservoirs for the volatile liquid (ammonia) are each connected on the one hand with a refrigerator-coil, and on the other, with the delivery of an aspirating and compressing pump. The connections are controlled by cocks, actuated by a tappet carried on a rod, which is from time to time moved backwards and forwards by mechanism worked from the piston rod of the pump. Starting with one of the reservoirs full and the other empty, the pump aspirates a charge of ammonia from the first reservoir into the refrigerator-coil, where it is expanded, and does work in cooling the space round the coil. The pump then compresses the charge, and delivers it into the second reservoir. After a certain number of strokes, the first reservoir is emptied, and the second filled with liquid; then the rod carrying the tappet moves, and the cocks are reversed so that the pump now draws from the second reservoir and delivers into the first. This cycle is repeated so long as it is desired to work the apparatus, which is provided with a valve to regulate the rate of flow of the ammonia into the coil.—W. H. C.

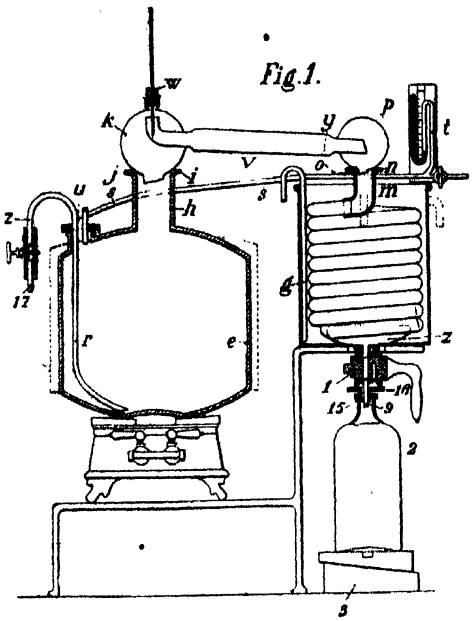
Liquid separator; Centrifugal ——. G. de Laval and E. E. F. Fagerström. Fr. Pat. 364,385, March 17, 1906.

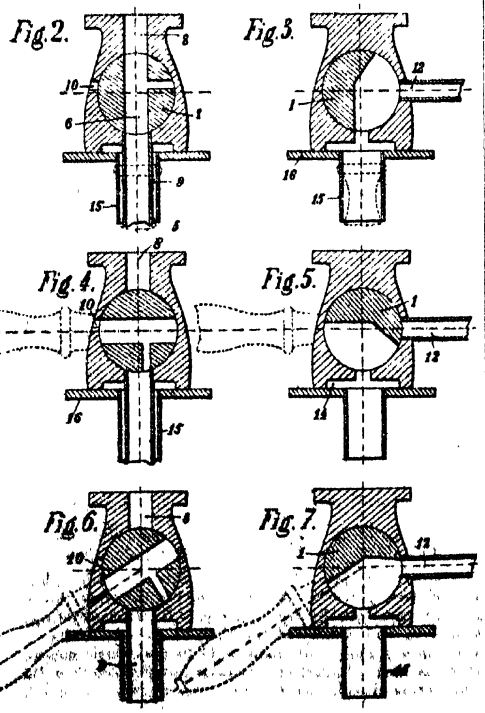
SEE Eng. Pat. 5859 of 1906; this J., 1906, 554.—T. F. B.

Vacuum distilling apparatus, with automatic cut-off. J. Robert. Fr. Pat. 364,491, March 22, 1906.

THE apparatus claimed, Fig. 1, consists of a still, *e*, and a condenser, *g*, which are connected by two glass globes, *k*, and *p*, resting in the cups, *i*, and *n*, of the bronze castings, *h*, and *m*, and connected together by the glass tube, *v*. The joints, *j*, and *o*, are made tight by cork rings smeared with vaseline. Liquid may be added to or taken from the still during distillation by the pipe, *r*, and the still is

connected to a vacuum-gauge, *t*, by the pipe, *s*. Thermometers are inserted at *u* and *w*. The condenser, *g*, terminates in a reservoir, *z*, for use during the change of receivers, 2, to which it is connected by a special tap, 1.





This tap is shown in detail in Figs. 2—7; 2, 4, and 6 being sections through one plane and showing the connection between the coil, the receiver, and the atmosphere, and 3, 5, and 7 being sections in another plane and showing the connection between the receiver and the vacuum pump. During the progress of the distillation the plug of the tap is in the position shown in Figs. 2 and 3; 8 being the connection to the coil; 9 to the receiver; and 12 to the pump through the annular space between the tubes, 9 and 15. The joint between the receiver, 2, and the flange, 16, is made by a rubber ring.



When it is desired to change the receiver, the tap, 1, is turned into the position indicated in Figs. 4 and 5, when the connections to the coil and to the vacuum, 12, are closed and the receiver, 2, is in communication with the air through 10. The vacuum in 2 is broken and the latter can be removed and replaced by a fresh receiver. The liquid distilling during the time occupied in the change, which is only a few seconds, collects in *z*. When the fresh receiver is in position, the tap is turned into the position shown in Figs. 6 and 7, when the receiver is cut off from both the coil at 8, and from the air at 10, but is in communication with the pump through 12. As soon as the receiver, 2, is exhausted the tap is turned into the first position (Figs. 2 and 3), and the distillate is once more collected in the receiver, 2. When it is necessary to withdraw a portion of liquid from the still, *e*, during distillation, the apparatus shown in Fig. 8 is used. It consists of two concentric tubes, 17 and 18, which pass through a cork, 20, which is placed in the neck of a suitable vessel. It is connected by 17 to the tube, *r*, and by 19 to the pump. When it is exhausted the tap, 1, is turned into the position shown in Figs. 4 and 5, and the tap, *z*, is opened. The progress of the distillation is watched in the glass globe, *p*, and as there are always a few drops of liquid at the point, *y*, in the tube, *v*, any discoloration due to spurting can be at once seen.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 843.)

Coal production of the world. Eng. and Mining J., Sept. 1, 1906. [T.R.]

THE increase in coal production is steady in most of the world's fields. The production given in the following table is taken from statistics compiled for "The Mineral Industry":—

Countries.	1904.	1905.
	Metric tons.	
Asia:		
India	7,682,310	7,921,000
Japan	11,600,000	11,895,000
Australasia:		
New South Wales	6,116,126	6,035,250
New Zealand	1,562,442	1,415,000
Other parts of Australia	769,723	805,000
Europe:		
Austria Hungary	40,334,681	40,725,000
Belgium	23,380,025	21,844,200
France	34,502,289	36,048,264
Germany	169,448,272	173,663,774
Italy	359,456	307,500
Russia	19,316,000	17,120,000
Spain	3,123,540	3,199,911
Sweden	320,984	331,509
United Kingdom	236,147,125	239,885,228
North America:		
Canada—		
Western	2,619,816	3,133,000
Eastern	4,194,939	4,775,802
United States	318,275,939	352,994,410
South Africa	3,615,000	3,215,000
All other countries	4,250,000	4,550,000
Total	867,020,658	929,622,643

In most cases these reports are from official sources; in others they are estimated as closely as possible from shipping returns and other data.

Oxygen containing hydrogen; Influence of —— in determining calorific values [of fuels]. E. Graefe. J. Gasbeleucht, 1906, **49**, 666—667.

In burning oils of known calorific power in oxygen to which hydrogen has been added, higher calorific values were obtained, the increase depending on the quantity of hydrogen used. Thus, with an oil yielding 10,020 calories, the addition of 1 per cent. of hydrogen brought about an increase of 107 cals.; 2 per cent. a further rise of 309 cals.; and 3 per cent., 523 cals. It was found that, on an average, 1 per cent. of hydrogen raised the calorific value by 180 calories, equal to 1·8 per cent.—D. B.

Non-luminous flames coloured by metal salts; Temperatures of ——. F. Kurlbaum and G. Schulze. Ber. Deutsch. physik. Ges., 1906, **4**, 239—247. Chem. Centr., 1906, **2**, 486.

The radiation from a black body behind a small number of thin, luminous strata of the same temperature, is exactly the same as it would be if such luminous strata were absent. The authors measured the temperature of spirit, Bunsen and hydrogen flames (between the outer edge and the cone) rendered luminous by different salts, by so adjusting the temperature of a Nernst electrode (by regulating the current), that its radiation was not modified on passing through the coloured flame. In the case of sodium salts, the effect is influenced by the nature of the acid radical. Different salts give different temperatures for the same flame, *e.g.*, from 1409° C. for sodium carbonate, up to 1476° C. for thallium chloride, in the spirit flame; from 1660° C. for sodium carbonate, up to 1812° C. for rubidium chloride, in the Bunsen flame; and from 1844° C. for lithium chloride, up to 1954° C. for potassium chloride (blue line) in the hydrogen flame. The temperature rises on passing from longer to shorter wave lengths; the temperature measured with a given spectrum-line of one salt rises on addition of a second salt, the increase being more the greater the difference between the wave-lengths of the rays from the two salts. A similar effect is observed in the case of two spectrum-lines of one and the same salt. The actual temperature of the flame is lowered by the introduction of salts. Salts which give the highest temperatures are those which are the more strongly ionised.—A. S.

Tungsten [Incandescence electric] lamp. F. Uppenborn. J. Gasbeleucht., 1906, **49**, 756—759.

The tungsten-filament incandescent lamp, which is now being placed upon the market by a number of firms, using various methods of manufacture, is the newest of the metallic-filament lamps. Its efficiency is high, varying from about 1·0 to 1·2 watts per Hefner candle (1 Hefner candle = 0·88 English standard candle), and it is claimed that the average life of the lamps is over 1000 hours, no substantial change in the lighting power occurring during that period. The author has compared the tungsten-filament lamp with the carbon-, tantalum-, and osmium-filament lamps, to ascertain their behaviour under variations in the voltage of the current used. The lamps were all designed for 110 volts, and their efficiencies at the start, stated in watts per Hefner candle, were as follows:—carbon filament, 3·53; tantalum filament, 1·61; osmium filament, 1·76; tungsten filament, 1·00. The voltages during the test were caused to vary over a wide range, photometric tests and measurements of the current being made at various points. It was found that the tungsten lamp was, comparatively, very insensitive to alterations in the voltage, the consumption of current increasing but slightly with increase of voltage. By means of this lamp, it is stated, electric lighting is so much cheapened that it can compete more favourably than hitherto with gas lighting.—H. B.

Alkali, &c., works; Forty-second annual report on ——, by the Chief Inspector. VII., page 881.

Erratum.

This J., 1906, page 803, col. 1, l. 26 from bottom: *for* "(2348°)" *read* "(2348° C.)"; also l. 24 from bottom: *for* "1819°" *read* "1819° C."

English Patents.

[Fuel] Briquettes; Manufacture of ——. Lord Armstrong, Rothbury, Northumberland. Eng. Pat. 19,212, Sept. 22, 1905.

"Brewers' bottoms," i.e., the liquid found at the bottom of casks returned by publicans to the breweries, is evaporated to the consistency of treacle, and then, whilst hot, is mixed with small coal, and moulded as usual. The briquettes obtained may be given any convenient coating to make them waterproof, if desired. Or else, ingredients may be mixed with the syrup before the briquettes are made, to make them waterproof throughout. Thus, 1 lb. of resin may be dissolved in ½ oz. of linseed oil foots, and this added to 9 or 10 lb. of the syrup. A good but expensive mixture is obtained by mixing 8 to 10 lb. of the syrup, 9 lb. of resin, 1 lb. of linseed foots, and 2 lb. of glucose.—A. G. L.

Fuel; Artificial ——, and method of making the same. W. P. Thompson, London. From A. Engle, Metz and T. Cahill, Stuart, Iowa, U.S.A. Eng. Pat. 21,644, Oct. 24, 1905.

See Fr. Pat. 358,831 of 1905; this J., 1906, 308.—T. F. B.

Furnaces for burning pulverulent fuel and for treating pulverulent ores. A. M. Robeson, Johannesburg, and C. A. Bettington, Boston, U.S.A. Eng. Pat. 16,226, Aug. 9, 1905.

See U.S. Pats. 817,989 and 817,990 of 1906; this J., 1906, 465.—T. F. B.

Retort ovens; Vertical ——. J. Bueb, Dessau, Germany. Eng. Pat. 16,579, Aug. 15, 1905.

See Fr. Pat. 356,974 of 1905; this J., 1906, 11.—T. F. B.

Furnaces for vertical gas retorts. E. Derval, Paris. Eng. Pat. 2040, Jan. 26, 1906.

See Fr. Pat. 362,501 of 1906; this J., 1906, 747.—T. F. B.

Gas for illuminating and heating purposes; Apparatus for producing —— from petrol or other suitable spirit or oil. B. K. Green and H. Mieville, Great Malvern. Eng. Pat. 26,847, Dec. 23, 1905.

A current of warm, dry air is divided into two portions, and the main stream is blown through a carburetter, charged with petrol, and provided with transverse wick-like screens, which dip into the petrol. The latter is kept at a constant level by means of a ball-float device. A number of perforated pipes is arranged along the bottom of the carburetter and immersed in the petrol; through these pipes the second portion of the air supply is blown, producing a spray of petrol, which falls partly upon the transverse screens. The bell of the gas-holder, in which the carburetted air is stored, operates the valve controlling the air supply, so that the gas production varies automatically with the consumption.—H. B.

Carbides for acetylene lamps, generators, and the like; Prepared ——. Sir C. S. Forbes, Bart., London. Eng. Pat. 16,298, Aug. 10, 1905.

The carbide to be treated is placed under vacuum in an air-tight vessel, and a suitable retarding solution (preferably a solution of resin in petroleum) is then run in, the impregnated carbide being subsequently removed. —H. B.

Explosive fluids or fluids under pressure [Acetylene]; Means for storing ——. C. Hubert, New York. Eng. Pat. 20,079, Oct. 4, 1905.

The explosive fluid (acetylene) is stored in a cylinder filled with finely-granulated, compressed cocoa-nut shell charcoal. The cylinder is closed by a conical plug valve, which has a delivery pipe, a narrow duct or passage

through the plug leading to a fixed pressure gauge, and a relief duct leading to a chamber closed by a screw cap, with a thin central portion that will give way if a dangerous pressure occurs within the cylinder. The valve is actuated by a worm-wheel, and has a filter chamber, filled with cotton, on the duct leading to the interior of the cylinder. A number of fusible metal plugs are inserted in various parts of the cylinder, which will melt, and give relief to the pressure if the contents become dangerously heated.—W. H. C.

Mantles; Method of producing incandescent ——. H. C. Albrecht, Berlin. Eng. Pat. 15,295, July 5, 1906.

Fabrics are impregnated as usual with a solution of the nitrates of thorium and cerium, then dried, impregnated with hydrogen peroxide, dried, and finally burned off. The hydrogen peroxide converts the thorium salt into hydroxide, and it is stated that the finished mantle contains thorium in a higher degree of oxidation than thorium dioxide, ThO_2 (see this J., 1906, 840).—H. B.

Filaments for incandescent lamps. S. Iseki, Kanagawa-Ken, Japan. Eng. Pat. 3509, Feb. 13, 1906.

A carbon filament is coated with tungsten, by depositing the metal from tungsten chloride vapour "according to the process used for making ordinary carbon filaments." The coated filament is then fixed in an exhausted bulb. It is stated that on starting the current, the metal combines with any oxygen remaining in the bulb, forming a hard, protective shield about the filament, and producing a more perfect vacuum.—H. B.

United States Patents.

Briquettes; Process for preparing a mass for making ——. B. Wagner, Berlin. U.S. Pat. 829,042, Aug. 21, 1906.

See Fr. Pat. 350,579 of 1905; this J., 1905, 794.—T.F.B.

Briquettes; Apparatus for coking ——. B. Wagner, Berlin. U.S. Pat. 829,448, Aug. 28, 1906.

See Fr. Pat. 350,536 of 1905; this J., 1905, 721.—T.F.B.

Gas producers; Process of regulating the temperature of combustion in ——. H. L. Doherty, Madison, Wis., Assignor to Combustion Utilities Co., New York. U.S. Pat. 829,105, Aug. 21, 1906.

The claim is for the process of making producer-gas by passing a current of gas consisting of free oxygen or air mixed with from 5 to 15 per cent. of carbon dioxide through a deep bed of fuel, and conducting the resulting gas, unburnt, to the place where it is to be used. The percentage of carbon dioxide is adjusted in such manner that the heat-producing or exothermic reaction, $C+O=CO_2$, and the heat-absorbing or endothermic reaction, $CO_2+C=2CO$, are so balanced, that the resulting temperature is sufficiently high to completely burn the fuel to an ash, but not high enough to allow of the formation of troublesome clinkers.—W. H. C.

Gas producer. J. G. Nash, Adelaide. U.S. Pat. 829,541, Aug. 28, 1906.

See Eng. Pat. 17,712 of 1904; this J., 1904, 1081.—T.F.B.

Gas; Apparatus for producing power ——. L. Hertzog, Berlin-Südende, Assignor to A. Saurer, Arbon, Switzerland. U.S. Pat. 829,919, Aug. 28, 1906.

See Fr. Pat. 346,526 of 1904; this J., 1905, 191.—T.F.B.

Gases; Apparatus for subjecting —— to the action of liquids. W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 829,261, Aug. 21, 1906.

See Fr. Pat. 360,373 of 1905; this J., 1906, 107.—T.F.B.

Gas purifying apparatus. M. Dross, Aplerbeck, Germany. U.S. Pat. 829,700, Aug. 28, 1906.

See Eng. Pat. 1228 of 1905; this J., 1906, 212.—T.F.B.

Electrode for arc-lights. F. J. Gerard, Assignor to L. Fiedler, London. U.S. Pat. 828,544, Aug. 14, 1906.

The electrode is composed of an intimate mixture of carbon and an alloy of magnesium with aluminium or another metal, to which may be added a small percentage of cerium nitrate, or a salt of a rare earth.—W. H. C.

French Patents.

Gas-retort furnace. P. V. Parsy. First Addition, dated March 10, 1906, to Fr. Pat. 360,070, Feb. 11, 1905 (this J., 1906, 466).

The retort setting described in the principal patent is provided centrally with a generator and recuperator, placed end to end, parallel with the retorts, so as to occupy the entire depth of the setting, and having their gas-distributing outlets at the top.—H. B.

Producer for coal slack, &c. Maschinenfab. und Mühlenbauans. G. Luther A.-G. Fr. Pat. 364,116, Feb. 21, 1906.

The producer, which is designed for utilising coal-slack and other finely-divided combustibles, is provided internally with two or more horizontally superposed series of baffles, which support the fuel to a considerable extent, and prevent the obstruction due to the pressure of the superincumbent mass. Preferably there are two series of baffles, the tops of which are Λ-shaped, the air supply being admitted beneath those of the upper series, which are perforated, whilst the gas produced is drawn off beneath the lower series.—H. B.

Gas; Process of carburetting ——. [*Carburetted water-gas*]. F. Dannert. Fr. Pat. 364,210. March 13, 1906.

A producer, which is charged with solid fuel, and is provided as usual with a gas outlet at the top and steam and air inlets at the bottom, is also fitted at one side with a vertical channel or pipe in the masonry, the lower end of which opens into the reducing zone of the fuel, whilst the upper end is fitted with a siphon tube for the admission of liquid hydrocarbon. The oil becomes vaporised on dropping down the channel, and on issuing into the reducing zone is converted completely into incondensable gas, without undergoing combustion.—H. B.

Filaments for incandescence electric lamps. Soc. Zirkon-Glühlampenwerk, Dr. Hollefreund & Co. Fr. Pat. 364,181, Jan 30, 1906.

"Hydrogenised" and "nitrogenised" compounds of chromium, molybdenum, tungsten, and other metals of the iron group may be obtained by proceeding, according to Fr. Pat. 342,581 of 1904 (this J., 1904, 942), the magnesium, aluminium, potassium, or sodium formerly used as reducing metal being replaced by powdered zinc, or some other metal which does not react violently with oxidised compounds. Or, the four above-named metals may be used safely for the reduction, if they are employed in large excess (say five times the amount theoretically required). The reduction may also be effected in two stages: first with zinc powder, and then with magnesium, &c. In any case, the pulverulent product is purified with acids, dried, mixed with an agglutinant such as tar, and formed into threads. The filaments are then heated at 1000°—1500° C. in an indifferent gas for several hours; or, preferably, they are kept incandescent by means of a strong electric current for several hours in an atmosphere of nitrogen at 180 mm. pressure. In the latter case they become denser, and ultimately yield nitrogenised filaments of very high efficiency.—H. B.

Filaments for incandescence lamps. A. Just and F. Hanaman. Fifth Addition, dated Feb. 19, 1906, to Fr. Pat. 347,661, Nov. 4, 1904 (this J., 1905, 431 and 1220).

In making a filament of tungsten or molybdenum, the process described in the principal patent (wherein the metal is first deposited upon a core of carbon) is modified by constructing the core of carbon and tungsten or molybdenum, instead of carbon only. The filament, whether made of carbon, or of carbon *plus* metal, is then

coated with metal, and heated to a high temperature under reduced pressure, in an atmosphere of hydrogen containing a small proportion of an oxidising gas, such as steam. This modification of the process expedites the elimination of the carbon.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 843.)

Fuels; Decomposition of solid —— at gradually increasing temperatures. E. Börnstein. J. Gasbeleucht, 1906, **49**, 627—630, 648—652, 667—671.

SPECIMENS of wood, peat, lignite, and coal were each subjected to fractional distillation, the temperature being kept constant at certain points until the decomposition at such temperature was complete, the highest temperature in the experiments being 450° C. The distillations were effected in an iron retort fitted with a Liebig's condenser, the distillates being collected in a series of U-tubes and towers for the retention of tarry products, whilst the sulphur compounds were absorbed in tubes containing anhydrous copper sulphate.

One kilo. of fir wood containing carbon, 48·75; hydrogen, 6·48; nitrogen, 0·63; oxygen, 40·75; sulphur, 0·08; water, 3·21; and ash 0·10 per cent., gave the following results:—

Temp.	Water.	Tar.	Gas.	Sulphur compounds.
	grms.	grms.	litres.	grms.
250° C.	65·0	—	6·1	
250—300° C.	65·3	4·9	11·1	
300—350° C.	145·7	32·3	41·0	1·3
350—400° C.	71·2	24·0	29·2	
400—450° C.	20·9	20·6	29·2	

Composition of the gas:—

Temp.	CO_2.	Heavy hydrocarbons.	CO.	H.	CH_4.
300—350° C.	53·5	0·2	27·7	3·7	14·9
350—400° C.	55·0	1·5	32·6	3·0	7·9
400—450° C.	28·0	5·0	29·0	17·3	20·6

One kilo of peat containing carbon, 43·76; hydrogen, 4·16; nitrogen, 2·30; oxygen, 24·57; sulphur, 0·24; water, 17·03; and ash, 7·94 per cent., gave:—

Temp.	Water.	Tar	Gas	Sulphur compounds.
	grms.	grms.	litres.	grms.
250° C.	91·1	—	3·0	—
250—300° C.	56·4	traces	4·6	—
300—350° C.	173·7	2·5	11·4	—
350—400° C.	44·1	9·6	33·2	2·0
400—450° C.	42·5	31·2	42·0	

Composition of the gas:—

Temp.	CO_2.	Heavy hydrocarbons.	CO.	H.	CH_4.
300—350° C.	89·2	0·3	10·1	0·3	—
350—400° C.	62·3	0·4	7·2	3·1	25·5
400—450° C.	55·4	3·7	12·3	3·1	25·4

One kilo. of Bohemian lignite containing carbon, 63·94; hydrogen, 5·05; nitrogen, 0·83; oxygen, 21·70; sulphur, 0·45; water, 1·81; and ash, 6·22 per cent., gave:—

Temp.	Water.	Tar.	Gas.	Sulphur compounds.
	grms.	grms.	litres.	grms.
250° C.	55·6	—	1·9	—
250—300° C.	44·9	—	3·3	—
300—350° C.	50·4	0·9	8·1	0·7
350—400° C.	36·5	8·3	16·7	0·5
400—450° C.	40·5e	34·9	29·5	0·4

Composition of the gas:—

Temp.	CO_2.	Heavy hydrocarbons.	CO.	H.	CH_4.
300° C.	91·4	0·7	6·4	0·3	1·1
300—350° C.	90·9	1·0	7·6	0·5	—
350—400° C.	69·6	2·5	15·8	8·8	3·2
400—450° C.	47·8	3·9	15·1	11·9	21·2

The experiments with different kinds of coal have already been referred to in previous communications (this J., 1906, 213 and 583).—D. B.

Petroleums of North America; A comparison of the character of those of the older and newer fields. C. Richardson. J. Franklin Inst., 1906, **162**, 57—70, 81—128.

THE author has collected the results obtained in the examination of American petroleums, and compares the oils from the older and newer fields. The subject is treated under the following headings:—Development of petroleum as an industrial product in North America; character of the petroleums of North America; Appalachian field, Ohio-Indiana field, Canadian field, Colorado field, Wyoming field, California field, Texas field, other fields, Kansas field, Louisiana field, Alaska field, Cuban field, Mexican field; Comparison of North American petroleums.—A. S.

Asphaltum industry of the United States. U.S. Geol. Survey. Oil, Paint, and Drug Rep., Aug. 13, 1906. [T.R.]

THE output of bituminous sandstone has decreased from 46,641 short tons, valued at $138,465, in 1904, to 39,273 short tons, valued at $94,972, in 1905. More than 90 per cent. of the bituminous sandstone produced in the United States is quarried in California, and the decrease in production and value was probably due to the keen competition of the "oil asphaltum" of the same State.

The production of bituminous limestone, which is practically confined to the State of Kentucky, increased from 1798 short tons ($4495) in 1904 to 6029 short tons ($42,000) in 1905. The marked increase of price in 1905 has not been explained. The production of mastic from Kentucky bituminous sandstone increased from 1200 short tons ($10,800) in 1904 to 2200 short tons ($22,000) in 1905.

Hard and refined or gum asphaltum decreased in production from 6637 short tons, valued at $141,446, in 1904, to 3036 short tons, valued at $41,438, in 1905. During 1905 the hard natural asphaltum of California brought $12.07 per short ton at the mines, whilst that of the Indian Territory brought $15. The more valuable grahamite, important veins of which are known in the Indian Territory, was not produced at all in 1905, on account of litigation over the ownership of the property.

The production of natural liquid asphaltum, or maltha, which is confined to California, decreased from 3363 short tons, valued at $36,320, in 1904, to 3139 short tons, valued at $34,292, in 1905.

The production of wurtzilite decreased from 550 short tons, valued at $50,000, in 1904, to 500 short tons, valued at $44,000, in 1905.

The production of gilsonite increased from 2978 short tons in 1904 to 10,916 short tons in 1905. The value increased from $14,175 in 1904 to $47,900 in 1905, but the average price per short ton decreased from $4.76 in 1904 to $4.31 in 1905.

The production of "oil asphaltum" has increased from 44,405 short tons, valued at $459,135, to 50,169 short

tons, valued at $430,911. If, however, the 1300 short tons of road oil (a liquid oil asphaltum), valued at $1495, be eliminated from the oil asphaltum, there will remain 48,869 short tons of hard or "D" grade oil asphaltum, valued at $429,416, giving an average value of $8.78 per short ton. The production of oil asphaltum is an industry peculiar to California, and most of the material is made as a by-product in the distilling of lubricating and illuminating oils and lighter products from crude petroleum of asphaltic base.

Exports.—During the fiscal year ending June, 1905, asphaltum and manufactures of asphaltic material to the value of $291,120 were exported from the United States to other countries. The most important receivers of these products were in the order named:—Brazil, United Kingdom, Canada, Germany, Chile, Mexico, and Argentina. The chief features of the trade were the opening of important markets in Mexico and the three South American countries named, a marked increase of exports to the United Kingdom, and decrease, as compared with 1904, of more than 36 per cent. in the value of exports to Canada. The total value of the exports for the fiscal year ending June 30, 1904, amounted to $160,186.

The imports of crude asphaltum in 1905 amounted to 109,596 short tons, valued at $479,296, as compared with 133,941 short tons, valued at $590,890, in 1904. About two-thirds of the asphaltum which is imported into the United States from foreign countries comes from the Island of Trinidad, off the coast of Venezuela. Other important sources are Bermudez (Venezuela), Cuba, and Italy.

Mould fungus capable of decomposing paraffin wax. O. Rahn. Centralbl. Bakt., 1906, [II.], 16, 382; Z. ges. Brauw., 1906, 29, 478.

The organism in question, a species of *Penicillium*, was found to decompose two kinds of paraffin wax to the extent of 77—79 per cent., when the experiments were conducted on a large scale, the mycelium then containing a light brown colouring substance, soluble in alcohol, that did not appear when only small quantities of the paraffin were present. The same phenomenon had been previously observed in the case of mould fungi that decompose fats. On ordinary nutrient media the same *Penicillium* forms a white, luxuriant growth; in gelatin it forms numerous small crystals producing turbidity. It also grows well on palm oil agar-agar, but not on the same fat in presence of mineral salts of ammonium, though in a solution of ammonium salts and stearic acid it grows with vigour, and forms very thin coremia, 3 cm. in length. It does not decompose yellow vaseline, and grows but sparsely on white vaseline. On paraffin wax it forms large, white, dished growths, the edges of the floating mycelium thrusting themselves up into the air.—C. S.

Alkali, &c., works; Forty-second annual report on ——, by the Chief Inspector. VII., page 881.

English Patents.

Waste heat in coke; Utilisation of ——. A. Waddell, Dunfermline, and F. Waddell, South Queensferry. Eng. Pat. 18,216, Sept. 9, 1905.

The hot coke is drawn from the ovens or retorts into a vessel, open at the top, and supported on a carriage. It is then wheeled under a cover, which is allowed to rest on the vessel so that a tight joint is formed. Ammoniacal liquor is then run on to the hot coke through a pipe which passes through the cover, and the steam and ammonia given off are conveyed by another pipe, which also passes through the cover, to a still, where their heat is utilised to distil off the ammonia from a further quantity of liquor.—W. H. C.

Coke from fuel containing a large proportion of water, such as peat, lignite, and the like; Method of and apparatus for producing ——. W. Wielandt, Zwischenahn, and Torfkoks, G.m.b.H., Berlin. Eng. Pat. 968, Jan. 13, 1906.

The vapours or gases generated by the material in the coke oven are drawn off from the colder upper zone, through suction pipes, either apart from the gaseous distillation products formed in the coking zone, or after being drawn through the latter zone. Means are provided for varying the level at which the suction takes place, so as to modify the extent of the zone influenced by the suction-pipe removing the distillation products, and to form a neutral zone from which the gases and vapours separate in opposite directions.—C. S.

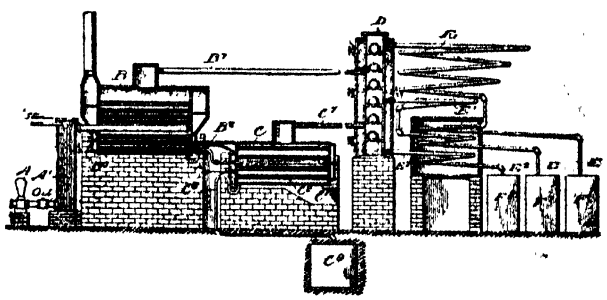
United States Patents.

Coking-oven [for peat]. H. J. Wickham, Manchester, and F. C. Rockwell and W. L. Shepard, Hartford, Conn. U.S. Pat. 827,707, Aug. 7, 1906.

The coking-oven consists of a vertical, cylindrical chamber, closed at the upper end, and having a screen extending across it, near the open lower end. Below the oven is a circular base-plate, the outer edge of which is turned first downwards and then upwards, forming an annular trough in which the lower open end of the coking-oven rests.—A. S.

Distillation apparatus [Oils, &c.]; Automatic and continuous film ——. F. J. Clemenger, Beaumont, Tex. U.S. Pat. 829,258, Aug. 21, 1906.

The oil, or other liquid to be distilled, is fed by the pump, A, through a "comminuter," A^1, and delivered as a film



upon the flues, B^3, of the primary heating chamber, B. The residual oil from B, flows by the trapped pipe, B^6, on to the flues, C^2, of the secondary heating chamber, C. The residual oil flows from the chamber, C, by the pipe, C^6, into the reservoir, C^9. The chamber, C, is heated by the furnace, C^1, the gases from which pass on and heat the other chamber, B. The vapours given off in each chamber are conducted by separate pipes, B^7, C^7, to an air-jacketed separator, D, provided with air cooling pipes and with superposed "resisting plates." From the separator the vapours are conducted by separate pipes, E, E^1, E^2, placed at different heights to the receivers, F, F^1, F^2.—W. H. C.

French Patent.

Mineral oils; Process and apparatus for refining ——. The Alcohol Syndicate, Ltd. First Addition, dated Nov. 30, 1905, to Fr. Pat. 325,836, Oct. 21, 1902.

See Eng. Pat. 28,243 of 1904; this J., 1905, 1294.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 844.)

Fluorescence: Theory of ——. G. Woker. J. of Physical Chem., 1906, **10**, 370—391. Chem. Centr., 1906, **2**, 485—486.

It is known that fluorescence and colour often occur simultaneously, and the author has found that fluorescent solutions lose their fluorescence on addition of a dyestuff: for instance, quinine sulphate solution on addition of picric acid, and petroleum on addition of methyl orange. The following explanation of these facts is offered. The fluorescence of a substance can be diminished or destroyed by a complementary colour. Visible fluorescence is diminished by the introduction of chromophor groups into the molecule, because the absorption bands are thereby displaced towards the red end of the spectrum, and the possibility of fluorescence is thus lessened. Salt-forming groups usually have a similar effect, and indeed greater, the nearer they are to the chromophor groups. The latent fluorescence that all benzene derivatives possess can be rendered visible by the same means that diminish visible fluorescence, *viz.*, by the introduction of chromophor and salt-forming groups, especially by the introduction of two phenol residues in ortho positions with respect to one another.—A. S.

United States Patent.

Dyestuff; Bordeaux-red sulphur [*Sulphide*] ——, *and process of making same.* A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 829,740, Aug. 28, 1906.

See Eng. Pat. 14,543 of 1905, this J., 1906, 260.—T. F. B.

French Patents.

Dyestuffs; Process of making concentrated liquid solutions or easily liquifiable pastes from sulphide ——. Farbwerke vorm. Meister, Lucius, and Brüning. Fr. Pat. 361,481, May 17, 1905.

See Eng. Pat. 9883 of 1905, this J., 1906, 584.—T. F. B.

Dyestuffs; Process of making yellow sulphide ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,502, May 23, 1905.

See Eng. Pat. 27,292 of 1904; this J., 1905, 1167.—T. F. B.

German Patents.

Dyestuffs; Process for preparing blue-black monoazo ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 169,826, Oct. 14, 1904.

Blue-black dyestuffs are produced by combining diazotised 2.8-aminonaphthol-3.6-disulphonic acid with the acidyl compounds of diaminocresol ethers ($CH_3:NH_2:OCH_3:NH_2 = 1:2:4:5$), or of *p*-amino-*o*-anisidine, and removing the acidyl groups from the resulting dyestuffs; the same dyestuffs are also obtained by combining the diazotised aminonaphtholsulphonic acid with nitro-aminocresol ethers ($CH_3:NH_2:OCH_3:NO_2 = 1:2:4:5$) or with *p*-nitro-*o*-anisidine, and then reducing the nitro-group by an alkaline reducing agent. These dyestuffs are said to be faster to light and of better shade than those derived from *p*-nitraniline or *p*-nitro-*o*-toluidine and 1.4-nitronaphthylamine.—T. F. B.

Dyestuffs; Process for preparing red or bluish-red monoazo —— susceptible to chroming. Anilinfarben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 168,128, March 4, 1905. Addition to Ger. Pat. 165,743, July 9, 1904.

Instead of combining 1-phenyl-3-methyl-5-pyrazolone with 1-diazo-2-hydroxynaphthalene-4-sulphonic acid or its nitro-derivatives, as in the principal patent (see Eng. Pat. 17,274 of 1904; this J., 1905, 725), the following diazo-compounds may be used:—1-Diazo-2-hydroxynaphthalene-6- or -7-sulphonic acid, 2-diazo-1-hydroxynaphthalene-4- or -5-sulphonic acid; 1-diazo-2-hydroxynaphthalene-3.6-, 4.6-, or 4.7-disulphonic acids, or 2-diazo-1-hydroxynaphthalene-3.6-, 4.7-, or 4.8-disulphonic acid, or the anhydrides of any of these. Combination takes place best in presence of alkali hydroxide. As a rule, the *a*-naphthol derivatives are brown, and the *β*-naphthol derivatives orange, becoming red and bluish-red after chroming. The dyestuffs produce cochineal-coloured aluminium lakes, and are all capable of dyeing on chromed wool.—T. F. B.

Dyestuff: Process for preparing a monoazo —— susceptible to chroming. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 168,610, March 14, 1905.

Diazotised *p*-chloro-*o*-aminophenol is combined with 1.8.3.6-dihydroxynaphthalene-disulphonic acid in presence of excess of alkali hydroxide. This dyestuff is characterised by its fastness, and the production of indigo-blue shades on chrome mordants, distinguishing it from the dyestuffs obtained from *p*-chloroaminophenol and 1.8-aminonaphthol-3.6-disulphonic acid on the one hand, or nitro-*p*-chloro-*o*-aminophenol and chromotrope acid on the other hand.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 845.)

Fabrics: Stripping of dyed ——. E. Hibbert. J. Soc. Dyers and Col., 1906, **22**, 276—278.

To ascertain the comparative stripping power of sodium hyposulphite (hydrosulphite) and titanous chloride they were tried, the former in alkaline and the latter in acid solution, on cotton dyed with 2 per cent. of Benzopurpurin 4B. The amount of titanous chloride necessary to destroy the colour was about one-third in excess of that required by theory. With an equivalent amount of hyposulphite only slight reduction took place; with twice the quantity the bulk of the colour was discharged, though a distinct pink shade remained; whilst even with four times the amount, the white was less perfect than that yielded by titanous chloride. A similar result was obtained with cotton dyed with 2 per cent. of Chrysophenine. A disadvantage to the use of titanous salts is that frequently a certain amount of titanic hydroxide is deposited on the fibre, which is not easily removed, and occasions trouble if the fabric is to be subsequently dyed with basic dyestuffs. This difficulty may, however, be overcome by adding potassium oxalate to the discharging bath.—D. B.

English Patents.

Hemp-bast and the like; Process for the manufacture of artificial ——. Vereinigte Kunstseidefabr. A.-G., Kelsterbach a/M., Germany. Eng. Pat. 7520, March 28, 1906. Under Int. Conv., Jan. 2, 1906.

See Fr. Pat. 363,782 of 1906; following these.—T. F. B.

Steaming fibres and fabrics; Process of and apparatus for ——. E. Simon, Villefranche, and J. B. Weckerlin, Lyons, France. Eng. Pat. 2830, Feb. 5, 1906. Under Int. Conv., May 22, 1905.

See Fr. Pat. 355,081 of 1905; this J., 1905, 1226.—T. F. B.

United States Patents.

Textile fabrics; Apparatus for treating [*washing, dyeing, &c.*] ——. W. D. West and V. Mauck, Conshohocken, Pa. U.S. Pat. 823,834, June 19, 1906.

This invention relates to an apparatus for subjecting

textile fabrics to successive operations, such as washing, dyeing, carbonising, &c., without removing the material from the apparatus. The latter consists of a treating tank, which is provided with a perforated drum for carrying the material to be treated. Two conduits connect the interior of the drum and the space between the exterior of the drum, and the inner surface of the treating tank, respectively, with a four-way valve. By means of the valve the direction of the liquid in the conduits may be reversed, so that it may be passed to the interior of the drum or to the outside of the fabric, until both drum and treating tank are filled with liquid. Two supply-conduits lead from the valve, and in one of the conduits is a pressure-regulator, working automatically. A heater, for liquid or air, is placed in a by-pass connected with one of the supply-conduits, and a cooler in a by-pass in the other, valves controlling the passage of fluid through the supply conduits and the by-passes. The supply-conduits are connected to separate chambers in a "manifold," the latter being connected by conduits and a four-way valve to two separate supply tanks. The manifold may have several supply-conduits for introducing compressed air or different liquors.—B. N.

Dry cleaning [Textile fabrics]; Process of ——. J. Doux, Utica, N.Y. U.S. Pat. 828,644, Aug. 14, 1906.

THE material is washed in an alkaline bath composed of benzene and anhydrous ammonia.—B. N.

Wool; Apparatus for the extraction of grease from ——. A. H. Burt, Mosman, H. Jackson and C. A. Finch, Sydney. U.S. Pat. 829,763, Aug. 28, 1906.

SEE Fr. Pat. 354,667 of 1905; this J., 1905, 1107.—T. F. B.

Wool: Extraction of grease from ——. A. H. Burt, Mosman, H. Jackson and C. A. Finch, Sydney. U.S. Pat. 829,764, Aug. 28, 1906.

SEE Fr. Pat. 354,667 of 1905; this J., 1905, 1107.—T. F. B.

FRENCH PATENTS.

Hemp [bast]; Process for producing artificial ——, *by tightly sticking together brilliant threads into the form of a ribbon.* Vereinigte Kunstseidefabriken A.-G. Fr. Pat. 363,782, March 2, 1906.

THIS invention relates to a process for producing ribbons, or continuous thongs of artificial hemp, from silk, artificial silk, or mercerised cotton. A flexible material, or "glue," such as collodion, a solution of cellulose or viscose, &c., is employed to stick together the threads, and produce a continuous ribbon, without knots. By adding to the glue a substance such as powdered chalk, zinc white, &c., the threads may be partially covered, and the lustre removed, this process being carried out either during or after the production of the ribbon. The lustre may also be removed by chemical treatment, a covering substance being precipitated on the threads at the same time that the latter are fixed by the glue. Thus, by using an aqueous solution of viscose, which is not in the "ripe" state, and then afterwards passing the threads through a bath of mineral acid, the threads receive the required suppleness, and have their lustre removed by a precipitate of amorphous sulphur which is formed on the material.—B. N.

Wool on bobbins; Machine for washing ——. J. Ernoult et Cie. First Addition, dated Jan. 26, 1906, to Fr. Pat. 356,277, July 13, 1905 (this J., 1906, 16).

THE title of the main patent should also be interpreted: "Machine for bleaching wool on bobbins."—B. N.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 843.)

FRENCH PATENT.

Dyeing skins; Continuous machine for ——. R. Martinet and A. Dulac. First Addition, dated Jan. 29, 1906, to Fr. Pat. 352,095, Feb. 7, 1905 (this J., 1905, 921).

INSTEAD of an endless band, as described in the main patent, the machine is provided with a rotating circular table, divided into compartments, and intermittently turning a fraction of a circle. The mordant, dye-liquor, &c., are sprayed and distributed as described in the main patent.—B. N.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 847.)

Alkali, &c., works; Forty-second annual report on ——, *by the Chief Inspector.* Proceedings during the year 1905, &c. May 17, 1906. Price 8d.

THE Alkali, &c., Works Bill, 1905, was withdrawn at the end of July, 1905, and has been re-introduced in the present year. The number of alkali works registered in 1905, is 73, the same as in the preceding year, but the (other) scheduled and registered works are 995 as against 967 in the former year. The principal increase in separate processes registered, as distinct from works registered, is under the headings of ammonium sulphate and muriate of ammonia (ammonium chloride). There has been one prosecution, with exaction of penalty and costs, for infraction of the rules respecting the escape of acid gases. Considerable increase of activity took place in the autumn of 1905 in the larger alkali and wet copper works, and in the majority of works full production was carried on.

The nitric acid process for the manufacture of chlorine is no longer in operation. In the Widnes and Runcorn district (No. 3A), in which the Weldon, Deacon, and electrolytic processes for making chlorine and its products are all represented, considerable difficulty arose from escapes of chlorine in the fan draught exits of the bleach chambers, nuisance being caused in the neighbourhood (the volume of gases to be finally dealt with were not less than 100,000 cb. ft. per hour), but the difficulty was met by the use of absorbing plant consisting of pipe towers packed with horizontal earthenware bars of triangular section, and fed with a strong solution of caustic soda, through which the residual gases of the bleach chambers were discharged by means of flues. This system proved so effective as to almost completely free the discharged gases from chlorine.

The active demand for products of the Leblanc process, especially in the latter part of the past year, led to increased production of alkali waste. In several instances the acidity of the chimney gases in works employing this process, showed an increase, and demanded close supervision. Experiments having for their object the lessening of the escape of sulphur in gaseous states of combination in the Claus kiln are still in progress. Mr. Hemingway's suggestion to use ferrous sulphite as an absorbent for residual gases containing sulphuretted hydrogen was subjected to close laboratory investigation, followed by a prolonged series of experiments conducted by the United Alkali Co. The results obtained (shown in tabular form) were, however, not found encouraging. With regard to the employment of ferrous sulphite as an absorbent, it is remarked that "this reagent only makes one journey, not being regenerated during the progress of subsequent reactions." This is because one of the products of the reaction, ferrous thiosulphate, reacts in hot solution to produce iron disulphide, which is inert to further action,

and in cold solution does not appreciably act on sulphuretted hydrogen; and so the "cycle of reactions" breaks down.

In the chamber process for making sulphuric acid, the use of mechanical means for creating the necessary draught has given satisfaction when adopted, especially as local escapes from the burners are thereby more readily avoided. With respect to the replacement of steam by water sprays in the earlier chambers of a series, minute precautions are found necessary to ensure a continuous supply; in the back chambers, steam is found more advantageous than atomised water, on account of the temperature requirements. Reference is made to Inglis's second paper on the loss of nitre in the chamber process, contributed to this Society (this J., 1906, 149—154), wherein it is held that about half of the total loss of nitre is due to incomplete absorption of nitrogen peroxide and trioxide in the Gay-Lussac tower, a view upheld by most of the authorities dealing with the question.

With respect to the "acid mist" occurring in the chambers, Raschig's researches are referred to, according to which the nitroso-sulphonic acid, regarded as formed by the interaction of nitrous and sulphurous acids, is acted upon by a further molecule of the former to produce the newly named "nitrosisulphonic acid," thus: (1), $ON.OH + SO_2 = ON.SO_3H$ (nitroso-sulphonic acid), and (2), $ON.SO_3H + ON.OH = NO + OH.ONSO_3H$ (nitrosisulphonic acid); which latter splits up under the influence of heat into nitric oxide and sulphuric acid ($OH.ONSO_3H = NO + H_2SO_4$), nitrous acid, ON.OH, being regenerated from the nitric oxide by steam and oxygen in the air present in the chamber. This nitrosisulphonic acid (called also peroxylaminesulphonic acid, and known to vitriol makers as "purple acid") occurring fugitively in "chamber drips," is so unstable as to be a difficult subject for investigation; but Raschig's studies have led him to make the suggestion that the addition of nitric acid should be effected in the acid fed upon the Gay-Lussac tower instead of at the usually adopted spot, viz., to the gases in the Glover tower before entering the first chamber. He advises also using some excess of sulphurous acid in the last chamber. The unstable purple acid is thus oxidised into the stable familiar nitro-sulphuric acid, the nitric acid itself being converted into the same compound by the action upon it of such excess of sulphurous acid in solution of strong sulphuric acid as escaped reaction with the nitrous vitriol. (This J., 1905, 923.) The chief inspector suggests certain difficulties attending the practical working of such changes; but sums up the conditions that should regulate the procedure.

For concentrating and rectifying sulphuric acid, the Kessler process continues in favour with the manufacturers as well as with the inspectors.

The number of works engaged in catalytic or contact processes for the manufacture of sulphuric acid remains the same as in the previous year, and generally, somewhat lower figures are recorded as to the acidity of the residual gases, several minor improvements having been made in steadying the operation of the plants.

Chemical manure works are entirely dependent for the manufacture of superphosphate on imported material. The following table gives the amounts imported in tons:—

	1905.	1904.	1903.
Guano	29,223	24,276	28,000
Mineral phosphates ..	421,026	419,221	392,714
Nitrate of soda ..	104,436	120,528	115,000

The exports of sulphate of ammonia in 1904 were 177,280 tons, as against 189,350 tons in 1905; and the estimated home consumption, including use in manure manufacture, was 68,500 tons and 68,000 tons respectively. The large quantities of superphosphate produced in Belgium as a by-product of the spelter industry, and exported to this country, have induced depression of trade, with low prices here.

In sulphate and muriate of ammonia and gas liquor works, in which the "combustion neutralisation" method for dealing with the foul gases is applied (chiefly in large works), a clear effluent, satisfactory to the local authorities, is not always supplied. The effluent is sometimes of a pale green colour, due to reactions on the phenoloid bodies present, and the presence of these bodies and of sulphocyanides (thiocyanates), is supposed to retard bacterial activity in bacterial filter-beds. The matter is of such importance that objections to such effluents, if maintained, might eventuate in discontinuance of the local manufacture of ammonia products. Experiments dealing with the subject have been conducted for some time past, with some success, in the direction of reducing the oxygen-consuming power of the effluent. In one instance, a gas company has adopted a process designed to remove sulphocyanide (thiocyanate) from the spent liquor, and thus to yield a clear colourless effluent. On purification by iron oxide, as usually practised in the smaller works, it is preferred to introduce the foul gases below a conical heap of the oxide, on a concrete floor, by a simple gas-distributing device.

The conditions under which ammonium cyanide is a notable constituent of ammoniacal gas-liquor have been carefully investigated. When hydrocyanic acid is present in the gases from the ammonia saturator, and these gases are passed into contact with iron oxide, some means must be applied to remove the acid. But as ammonium cyanide reacts with polysulphide, with formation of ammonium thiocyanate (sulphocyanide), it is possible to exclude cyanide by maintaining polysulphide always in excess in the liquor sent to the stills. In coke-oven works, owing to the high temperature reached in the ovens, cyanogen is liable to occur in relatively large proportion, and it is urged that, in all such cases, the liquors should be specially treated for removal of cyanides before undergoing distillation. Even in works where the Claus process is in operation on the foul gases, and conversion of hydrocyanic acid into ammonia may be anticipated, a prior removal of cyanide is recommended. E. Linder presents a memorandum on the analysis of ammoniacal liquors from various sources, giving the result of his extensive study of the subject, especially dealing with the presence of cyanogen and its compounds in ammoniacal liquors (results being given in tabular form), and giving methods of analysis, which the chief inspector considers "may now be considered as perfected."

The chief inspector, having made special inquiries of medical authorities as to the effects produced by the absorption of hydrocyanic acid by the blood, is able to state that "hydrocyanic acid forms a compound with hæmoglobin, to which the name cyanmethæmoglobin has been given. The spectrum of this body does not resemble that of carboxyhæmoglobin (the compound formed in cases of carbonic oxide poisoning), but there is frequently found a peculiar bright red colour of the blood and mucous surfaces, which might suggest the peculiar colour of the blood in carbonic oxide poisoning. This characteristic colour is by some observers attributed to the cyanmethæmoglobin itself; by others to the direct effect of hydrocyanic acid interfering with the tissues taking up oxygen from the blood, so that the whole of the blood, both arterial and venous, becomes brightly coloured."

Under the heading of the "Recovery and production of ammonia," the following table is given, showing the amount of sulphate of ammonia produced in the United Kingdom:—

	1905.	1904.	1903.
Gas works	155,957	150,208	149,489
Iron works	20,376	19,568	19,119
Shale works	46,344	42,486	37,353
Coke oven works	30,732	20,848	17,438
Producer gas and carbonising works (bone and coal) ..	15,705	12,880	10,265
Total	269,114	246,990	233,664

The increase under the last sub-heading arises entirely from the operation of producer gas plants, still more of which will, it is stated, be in operation during the current year (1906).

The occurrence of "blue salt" in sulphate of ammonia saturators, in some cases to such an extent as to render the product unsaleable, was the subject of an interchange of views between the inspectors at a staff meeting held by them in October. The discoloration occurs not infrequently in works where sulphate of ammonia is manufactured by the distillation of ammoniacal liquor containing cyanogen compounds, and is attributable to a minute quantity of an oxidisable ferrous ferrocyanide, formed by interaction between ammonium ferrocyanide and iron salts. According to one view, the impurity is due to priming over of the gas liquor containing it from the still. E. Linder, however, in his elaborate investigation of the subject, gives reasons for preferring, as a working hypothesis, that the ammonium ferrocyanide concerned is formed by interaction between ammonium cyanide volatilised from the still, with ferrous oxide or sulphide separated in the saturator through deficiency of acid. As this separation only occurs in a neutral or alkaline liquid, it follows that the "blue salt" should not appear from a saturator in which acid is always maintained in excess. There are three stages to the formation of "blue salt": first, the formation of ammonium ferrocyanide; second, of ferrous ferrocyanide; and lastly, the oxidation of ferrous ferrocyanide to Prussian blue. Experiments on the subject, conducted by Sutton and Linder, at the East Greenwich Works of the South Metropolitan Gas Co., are given in detail. J. W. Young has contributed the following interesting facts in respect to the sporadic appearance of "blue salt" in his district: "Last autumn the larger still and saturator consistently made 'blue salt' for a few days: a most unusual occurrence here. No reason could be given, till, on stopping the plant for examination, an iron stay within the saturator, which normally was protected by lead, was found to have lost its lead covering, and to be almost entirely eaten away by the vitriol. There was, therefore, an exceptional amount of sulphate of iron in the saturator bath. After remedying this, 'blue salt' ceased to be formed. When the larger plant was stopped, the smaller was set working, at first with good results, but later on, 'blue salt' was formed here too. On testing, ammonia was found to be passing away with the foul gas, and it was also noticed that there was much less 'boil' than usual in the saturator. On stopping, it was found that the delivery pipe from the still had broken off near the elbow at the bottom of the saturator, so that ammonia vapour was not getting its usual intimate admixture with vitriol. After remedying this, 'blue salt' ceased to be formed."

The number of salt works is now 53, as compared with 52 in 1904. The introduction of Mond producer gas at one of these works is favourably referred to. The total output of white salt produced from brine and salt contained in brine used for making alkali by the ammonia soda process was, in 1904 (the latest date for which returns are issued), 1,703,805 tons, as compared with 1,719,223 tons in 1903. There was again an increase in the county of Lancashire; in Durham, however, a decrease of 21,659 tons is recorded. In the counties of Chester and Stafford (grouped together in these returns), there was a further decrease of production of 11,266 tons, whilst Worcestershire showed an increase of 9,719 tons. In one salt works a new departure has been introduced in brine concentration. Several closed circular pans, mechanically worked and discharged, were erected in front of the old open pans, and fired by Mond producer gas, the waste heat from which passed on to the open pans behind them. A considerable saving of fuel is thus said to have been made in the case of a plant firing with Mond gas, and the number of these closed pans is being increased.

The recent enhanced price of white arsenic has favoured the output, which was 1528 tons in 1905, as compared with 976 tons in 1904, and 902 tons in 1903. The prospects of the associated industry of tin-smelting are encouraging. The ores have to be calcined before smelting, whatever may be the proportion of arsenic present, and when the proportion is small, the volatile products of calcination deposit so little arsenic as to be unsaleable under former conditions, whereas now, with increased value, such poorer qualities of "arsenic soot" may prove marketable.

Cement works have fallen off from the number registered in the preceding year, low prices and keen competition having necessitated much idleness of the older class of kiln. The use of rotary kilns is extending, and high chimneys (of 200 to 250 feet) are being built to serve batteries of rotary kilns; by the use of these chimneys much relief is expected as to discharge of black soot.

In Scotland there has been increased production of sulphate of ammonia and gas liquor. The works registered there during the past year comprise iron works, shale works, coke-, producer gas-, and carbonising works, and gas liquor works, the largest increase relatively, but not absolutely, being in the coke and producer gas works, due to the extended use of coke ovens, and to the extension of Mond gas plants with recovery plant attached. A further increase in these is anticipated in the near future. The total shale mined in the United Kingdom for 1904 was 2,333,062 tons; the total sulphate of ammonia recovered from the same 42,486 tons, and the yield in lb. per ton of shale mined was 40·8; the corresponding numbers for 1905 were 2,496,785 tons, 46,344 tons, and yield, 41·6 lb. per ton of shale. In 1896, the yield per ton of shale mined was only 35 lb.

The Report consists of 158 pages, of which 10 pages are devoted to Scotland.—E. S.

Alkaline-earth oxalates; Decomposition of —— by aqueous solutions of alkali sulphates. H. Cantoni. Arch. Sc. phys. nat. Gènéve, 1906, **21** [4], 308—380, 469—494. Chem. Centr., 1906, **2**, 419.

Calcium oxalate is practically unaffected by potassium sulphate solution at the ordinary temperature, and is only slightly attacked by solutions of sodium sulphate and ammonium sulphate. Barium oxalate, on the other hand, is attacked to a considerable extent by alkali sulphate solutions, whilst strontium oxalate occupies an intermediate position in this respect. It appears, therefore, that the affinity of the alkaline-earths for oxalic acid diminishes, and for sulphuric acid increases, with rise of atomic weight. (Compare Watson Smith, J. Chem. Soc., 1877 [2], 245.)—A. S.

Bismuth peroxides. IV. Oxidation of bismuth oxide by potassium ferricyanide in presence of caustic potash, and the so-called bismuth tetroxide. A. Guthier and R. Buenz. Z. anorg. Chem., 1906, **50**, 210—214.

In continuation of their previous work (this J., 1906, 263, 264, 695), the authors have repeated the experiments of Hauser and Vanino (Z. anorg. Chem., 1904, **39**, 381). They find, in opposition to those authors, that alkaline solutions of potassium ferricyanide have the same action on bismuth oxide as the other oxidising agents examined previously, and that there is no evidence of the formation of a "bismuth tetroxide" or a hydrate of the same. —A. S.

Ammonium vanadate and sodium uranate; Preparation of ——. J. Ohly. Osterr. Z. Berg.- u. Hüttenwesen, 1906, **54**, 232—234. Chem. Centr., 1906, **2**, 465—466.

The author describes the process of preparation of ammonium vanadate and sodium uranate from carnotite-containing sandstone from Utah, U.S.A. The raw material is powdered, screened, treated with hydrochloric acid (or sulphuric or nitric acid), and the mixture agitated until it acquires a reddish colour. It is then heated until the vanadium and uranium compounds are dissolved. The insoluble residue is used for the manufacture of artificial fullers' earth. A determined quantity of ammonium chloride is added to the solution, and the latter then evaporated to one-third of its volume, and allowed to stand overnight. The separated ammonium metavanadate is recrystallised from a concentrated solution of ammonium chloride, and washed with alcohol. A further crop of ammonium vanadate is obtained from the mother-liquors by evaporation and crystallisation.

The solution is treated with excess of sodium carbonate, boiled for half an hour, the precipitate filtered off, and sodium uranate precipitated from the filtrate by means of caustic soda.

The ammonium vanadate may be converted into

vanadium pentoxide by igniting it. If the pentoxide be heated to 440° C., it melts to a yellowish-brown mass, which crystallises on cooling. If the crystals be heated with gas-coke in an electric crucible furnace, a regulus of vanadium containing vanadium carbide is obtained, which can be employed in the manufacture of vanadium steel. —A. S.

Liquefaction of air; Preliminary cooling in the ——. W. P. Bradley and G. P. O. Fenwick. J. of Physical Chem., 1906, 10, 275—289. Chem. Centr., 1906, 2, 486—487.

THE decrease of temperature on the adiabatic expansion of a gas, owing to the Joule-Thomson effect is, according to Schroetter's formula: $D=\frac{P_2-P_1}{4}\left(\frac{289}{T}\right)^2$, where T is the temperature of the expansion-valve, and P_1 and P_2 are the respective pressures before and after expansion. Preliminary cooling of the air should, therefore, cause an increase in the yield of liquid air. The authors determined the effect of: (1) cooling the air before its entry into the liquefying apparatus; and (2) cooling the air inside the apparatus, before expansion, by means of previously formed liquid air. In the first case, a preliminary cooling of the air from 30° to 2° caused an increase of yield from 1·94 to 2·80 litres of liquid air, or about twice as great as that calculated by Schroetter's formula. Cooling the air, before expansion, in the interior of the liquefying apparatus had no effect on the yield of liquid air.—A. S.

Potassium chlorate; Simple continuous electrolytic preparation of ——. A. Wallach. XIA., page 890.

Oxidising substances [Potassium permanganate, potassium bichromate]; Determination of —— by means of hydrazine sulphate. L. Medri. XXIII., page 911.

Hydrogen peroxide, and ferrous salts and other reducing agents [Sodium nitrite]; Determination of ——. W. E. Mathewson and J. W. Calvin. XXIII., page 912.

ENGLISH PATENTS.

Oxygen; Preparation of —— by the decomposition of oxygenated salts. G. F. Jaubert, Paris. Eng. Pat. 24,330, Nov. 24, 1905. Under Int. Conv., Dec. 7, 1904.

SEE Fr. Pat. 350,377 of 1904; this J., 1906, 180.—T.F.B.

Gas purifying materials; Treatment of spent —— for the extraction of sulphur, and apparatus therefor. J. J. M. Bécigneul, Nantes, France. Eng. Pat. 9800, April 26, 1906. Under Int. Conv., April 26, 1905.

SEE addition of April 26, 1905, to Fr. Pat. 345,071 of 1904; this J., 1905, 1067.—T. F. B.

FRENCH PATENTS.

Sulphuric acid; Process and apparatus for purifying [arsenical] ——. The United Alkali Co., Ltd. Fr. Pat. 363,947, March 7, 1906.

THE purification of the sulphuric acid is carried out as described in Eng. Pats. 7916 and 16,929 of 1905 (this J., 1906, 477). The arsenious chloride thus produced is mixed with just sufficient water to precipitate the selenium, and filtered; a larger quantity of water is then added to precipitate the arsenious oxide.—T. F. B.

Lithium; Extraction of —— as lithium carbonate from amblygonite and other ores of lithium. Poulenc Frères. Fr. Pat. 361,517, May 27, 1905.

POWDERED amblygonite (or other lithium-containing ore) is intimately mixed with powdered sodium bisulphate (nitre cake), and the mixture is heated in cast-iron retorts, the hydrofluoric acid and silicon fluoride disengaged, being collected. The mass is then transferred to a refractory earthen vessel, which is heated to redness. The product is lixiviated, and the solution should be neutral, and contain but small quantities of aluminium, calcium, or iron, which latter are precipitated by a small proportion of sodium carbonate. The cleared liquor is then treated with the same reagent, to precipitate lithium carbonate. Sodium sulphate is recovered from the waste liquors. The insoluble residue of the lixiviated product is stated to be rich in phosphorus, and utilisable as a manure.—E. S.

Ammonia; Process of making ——. H. C. Wolterbeck. First Addition, dated March 9, 1906, to Fr. Pat. 345,899, Aug. 6, 1904.

SEE Eng. Pat. 8358 of 1905; this J., 1906, 535.—T. F. B.

Bauxite and an alkali sulphate; Treatment of mixtures of —— for transformation into alumina and alkali sulphur compounds [Thiosulphates]. A. Clemm. Fr. Pat. 363,893, March 6, 1906.

BAUXITE, or other aluminous ore, is mixed with a large excess of an alkali sulphate and carbon, and the mixture is furnaced. The solution obtained on lixiviating the mass containing alkali sulphide and aluminate, is treated with sulphurous acid to precipitate aluminium hydroxide, and to form a thiosulphate, and the filtrate therefrom is concentrated to crystallise out the thiosulphate. The residue left on lixiviating the roasted mass is exposed to the air, with addition of milk of lime, and the solution obtained by further washing is concentrated to recover the alkali, &c., as a thiosulphate. Hydrogen sulphide may be used as the precipitant, in place of sulphurous acid, in which case the filtered solution contains sodium sulphide and hydrosulphide (Ger. Pats. 62,265 of 1891 and 93,952 of 1895 are referred to).—E. S.

Aluminium and potassium sulphates; Process for separating —— from solutions obtained by decomposing aluminium and potassium silicates or alunite by acid sulphates of the alkalis or by sulphuric acid. A. Pezzolato and M. T. de Felice. Fr. Pat. 364,265, March 15, 1906.

SEE Eng. Pat. 6122 of 1906; this J., 1906, 759.—T. F. B

Salts of the oxy-halogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.-G. First Addition, dated March 9, 1906, to Fr. Pat. 362,737, Jan. 10, 1906. XIA., page 891.

Peroxidised compounds; Manufacture of ——. Kirchhoff and Neirath. Fr. Pat. 364,249, March 14, 1906. Under Int. Conv., May 2, 1905.

AN acid solution, *e.g.*, of hydrochloric acid, is neutralised with sodium peroxide, and the saline solution of hydrogen peroxide resulting is used in obtaining metal and organic peroxides. For example, magnesium chloride solution is added, and then ammonia, to such a solution of hydrogen peroxide, with precautions against rise of temperature, to obtain a precipitate of magnesium peroxide. Zinc peroxide and calcium peroxide are similarly obtained. To obtain sodium perborate, the strong, cooled solution of hydrogen peroxide is poured into a cooled solution of borax, and a solution of sodium hydroxide is agitated with it; the sodium perborate slowly crystallises out, and is collected, and washed with iced water. Benzoyl peroxide is obtained by adding an ethereal solution of benzoic anhydride, in molecular proportion, to the crude hydrogen peroxide solution contained in a closed vessel provided with an agitator, and cooled during prolonged agitation, or until the aqueous portion of a sample withdrawn shows, on testing, only a feeble peroxide reaction. The ethereal portion of the product, when withdrawn, is distilled for recovery of the ether, and the benzoyl peroxide is crystallised out of the residue.—E. S.

Iodine; Rapid process for the extraction of —— from liquids containing iodine compounds. Soc. Française la Norgine. Fr. Pat. 361,499, May 23, 1905.

THE iodine compounds are extracted from seaweed and its ashes, and the iodine is liberated, as usual. The iodine is then extracted by systematic treatment of the liquids with "oil of vaseline," in the proportion of 60 litres of this solvent to 1000 of the liquid. From the "oil of vaseline" the iodine is recovered by heating this in a current of steam, the iodine subliming, and being condensed as usual.—A. G. L.

Oxygen; Preparation of —— by the decomposition of oxygenated salts. G. F. Jaubert. First Addition, dated May 29, 1905, to Fr. Pat. 350,377 of Dec. 7, 1904 (this J., 1906, 180).

Potassium perchlorate (preferably), or another perchlorate or a nitrate, is mixed with a small proportion of a powdered combustible, such as carbon, in presence of water, to form a composition, which is moulded into blocks or briquettes, and dried. The use of water in the manufacture of the briquettes, enabling the materials to be more intimately mingled, constitutes the salient feature of this Addition.—E. S.

Oxygen briquettes and their manufacture. G. F. Jaubert. Fr. Pat. 361,522, May 29, 1905.

This patent is substantially the same as the First Addition to Fr. Pat. 350,377 (see preceding abstract). The advantages to be derived from the addition of water in the manufacture of the briquettes having an oxygenated salt as base, are described in detail.—E. S.

Hydrogen; Process and apparatus for the manufacture of ——. E. Geisenberger. Fr. Pat. 361,492, Dec. 21, 1905.

The hydrogen is generated, alone or mixed with carbon monoxide or carbon dioxide, by the action of heat alone, or of heat and steam, on light hydrocarbons, *e.g.*, benzine, petrol, or on other materials containing hydrogen and carbon, *e.g.*, bitumen, shale, beeswax, turpentine, &c. The organic substance is heated in a retort, to which steam may be admitted, to its point of decomposition. The hydrogen is separated from the other gases in the mixture obtained, either by physical means depending on the differences in density, or by chemical means, such as absorbing the carbon dioxide by means of sodium carbonate or hydroxide solution. The whole apparatus, which is designed mainly for the filling of military balloons, is mounted on wheels so as to be easily movable.—A. G. L.

Sulphur; Manufacture of flowers of ——. J. Lagache. Fr. Pat. 364,279, March 15, 1906.

The condensation chambers for preparing flowers of sulphur are made of concrete, reinforced with metal, or with a lattice-work of metal, or of bricks resting on a metallic net, or entirely of metal. In this way the thickness of the walls can be very much reduced. The gases in the interior of the chamber are agitated by means of a powerful fan, placed either inside the chamber or outside it.—A. G. L.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 848.)

Glass; A simple method for piercing ——. P. N. Raikow. Chem.-Zeit., 1906, **30**, 867.

Holes of any desired size may be readily made in glass of any thickness up to 4 mm. by piercing the heated glass with a red-hot needle. The needle should be as pointed and as hot as possible; the glass, on the other hand, must not be warmed too much. The best procedure is to heat the needle in a Bunsen flame in such a position that its red-hot end penetrates just outside the flame; the previously-warmed glass is then pushed up against the point, and gradually brought into the flame, the needle being at the same time twisted to and fro, until it penetrates the softened glass. Before allowing the glass to cool, it should be well covered with soot to prevent cracking. Any number of holes may thus be made in a test-tube, flask, &c. For convenience in handling, the needle may be fused into a glass holder; an old thermometer forms the best holder for this purpose, as other glass usually cracks on cooling in contact with the steel needle. —A. G. L.

United States Patents.

Glass-furnace. D. J. Ghrist, Assignor to S. I. Ghrist, Hites, Pa. U.S. Pat. 828,283, Aug. 7, 1906.

The furnace described comprises a melting chamber, below and parallel to which are pairs of regenerating chambers, separated one from another, and closed at adjacent ends by a transverse wall. Each pair of regenerating chambers is connected by a flue with a port at each end of the melting chamber, fuel-discharging devices being arranged "so as to project through the end-walls at the upper ends of the flues and arranged in line with the ports, to discharge longitudinally into the melting chamber." A cave is situated on one side of the regenerating chambers, near the centre, and formed partly by one wall of the latter. The furnace is also provided with a stack, and flues arranged one above the other, on opposite sides of the transverse wall, and formed partly by it, communicate each with a separate regenerating chamber, and by vertically extending conduits with the cave. At the upper ends of the conduits are valves for controlling the supply of air from the cave to the flues, and there are also independently controlled valves in the conduits for regulating the supply of air from the cave to the regenerating chambers, and the discharge of the products of combustion from the latter to the stack. —W. C. H.

Ceramic product. M. M. Méran, Paris. U.S. Pat. 827,550, July 31, 1906.

A plastic paste is made by mixing a double silicate of lime and magnesia with a trisilicate of magnesia, or by mixing asbestos and steatite, and the paste is fired at a temperature below the vitrifying point, to yield the ceramic product.—W. C. H.

French Patent.

Glass; Apparatus for pouring molten —— direct from the furnace. P. T. Sievert. Fr. Pat. 364,151, March 8, 1906. Under Int. Conv., March 11, 1905.

See Eng. Pat. 5605 of 1906; this J., 1906, 760.—T.F.B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 848.)

English Patents.

Wood; Preservation of ——. W. Hoettger, Wesel a/Rhein, Germany. Eng. Pat. 26,993, Dec 27, 1905. Under Int. Conv., March 22, 1905.

See Fr. Pat. 352,615 of 1905; this J., 1905, 971.—T.F.B.

Portland cement; Manufacture of ——. H. Peters, Rochester, Kent. Eng. Pat. 19,180, Sept. 22, 1905.

Slurry containing about 40 per cent. of moisture is mixed with coal slack in the proportion of 4½ cwt. of coal per ton of slurry. The mixture is dried, and broken into lumps, which are charged into a vertical kiln without the addition of any other fuel except a layer of faggots and another of coke at the bottom of the kiln. In working a charge, the faggots are fired, and when the coke above them has become thoroughly ignited, the kiln door is closed, and an air blast forced in from below the fire-bars.—A. G. L.

United States Patents.

Dust; Method of and agent for laying ——. C. E. Dolbear, Longbeach, Cal., Assignor to G. N. Phelps, Boston, Mass. U.S. Pat. 828,643, Aug. 14, 1906.

"Bittern," or a liquid containing an excess of magnesium chloride, is applied to the roads to render them dustless. —B. N.

Bricks and other articles formed or constructed of clay; Process for treating ——. J. Simons, Los Angeles, Cal. U.S. Pat. 829,177, Aug. 21, 1906.

Whilst the kiln containing the bricks, &c., is at its highest temperature, the air and steam passages leading to it are shut, so that only carbonaceous gases are evolved within

the kiln. The kiln is then allowed to cool whilst its contents are exposed to the action of these carbonaceous gases.—A. G. L.

Magnesia cement. E. Büttel, Assignor to the American Hydrolite Co., Hoboken, N.J. U.S. Pat. 827,286, July 31, 1906.

The cement described consists of 36 parts by weight of an absorbent filler, such as sawdust, 85 parts of magnesium chloride solution (36·8° B.), 25 parts of infusorial earth, 75 parts of pulverised burnt magnesite, and 43½ parts of water.—W. C. H.

Cement; Process for rapid hardening of ——. H. Schneider, Cincinnati, O. U.S. Pat. 828,976, Aug. 21, 1906.

Cement is rapidly hardened by passing a current of electricity through the cement mixed with water until or after the mass has set permanently. The current must be sufficiently strong to heat the mass so much as to prevent the water from freezing.—A. G. L.

French Patents.

Marble; Process for the manufacture of artificial ——. J. Pasero. Fr. Pat. 361,494, May 20, 1905.

Portland cement is mixed with mineral colours, and moulded into objects with water containing sodium silicate and potassium silicate. After allowing the mass to dry for several days, it is placed in a mixture of 5 litres of "silicious" water and 1 litre of potassium silicate solution, which is then heated and kept boiling for 24 hours. The mass obtained is dried and polished as usual. —A. G. L.

Ceramic bricks; Burning of ——. Soc. des Céramiques de Pignans, J. Ardisson and A. Barthélémy. Fr. Pat. 363,918, Feb. 5, 1906.

The ceramic bricks, as they come from the hydraulic press, are at once surrounded by a porous mass of refractory material, previously burnt perfectly dry, the whole being carried on trucks which move along a furnace in the form of a tunnel, 50 metres in length.—A. G. L.

Portland cement from blast-furnace slag; Process for making ——. K. Zulkowsky. Fr. Pat. 364,022, March 10, 1906.

A calcareous material, preferably good limestone or quicklime, is heated in a basic hearth furnace. The molten blast-furnace slag is then run in in suitable proportion, the whole is well mixed, and then rapidly cooled. —A. G. L.

X.—METALLURGY.

(*Continued from page* 852.)

Fine iron ores and pyrites cinder; Nodulising and desulphurisation of ——. A. L. Colby. Iron and Steel Inst., July, 1906. [Advance proof.]

The author gives a description of several large plants in the United States, where there has been successfully worked, on a large scale, a process for the conversion of fine ferruginous ores and of by-products, such as pyrites cinder, into "nodules" suitable for further treatment in blast-furnaces. It is stated that since last summer over 24,000 tons of such fine materials have been successfully and economically treated. The process is essentially that described in U.S. Pat. 794,673 of 1904 (this J., 1905, 894).

The plant at Newark, New Jersey, is under the control of the National Metallurgic Co., one of the constituent companies of the Newfoundland Syndicate. At the present time there are three kilns, one for the nodulising process, one for either nodulising, or roasting with salt as a preliminary to the Henderson copper-leaching process, and one intended entirely for the latter purpose. Two more nodulising kilns will be in operation by next autumn. It is stated that the Newfoundland Syndicate control, for the next five years, 80 per cent. of the cinder made in the U.S.A. by the roasting of pyrites or copper-bearing pyrites. At the present time 250 tons of nodulised pyrites-cinder are being produced per day of 24 hours. At Aspinwall, near Pittsburgh, Pa., two large kilns, with an output of 250 tons in 24 hours, are in operation, chiefly for the working up of blast-furnace flue-dust and pyrites-cinder. At Steelton, Pa., one kiln is working, and three others are about to be built. The improvement in the composition of the nodules from the magnetic concentrates treated at Steelton is shown by the following figures, of which the first set refer to the raw material, and the second to the nodules:—Iron, 59·64, 61·25; sulphur, 1·15, 0·13; phosphorus, 0·01, 0·01; and silica, 8·50, 8·61 per cent. At Hazard, Pa., the New Jersey Zinc Co. have erected a plant for nodulising fine franklinite, a trial run on 300 tons having proved successful. From fine ore containing 17·40 per cent. of zinc, nodules containing 20·4 per cent. were obtained, with little or no loss. A description of various labour-saving devices used in connection with the process is also given. A bibliography is appended to the paper.—A. S.

Copper steels. P. Breuil. Compt. rend., 1906, **143**, 346—348.

The author has investigated the singular points in copper steels containing from 0·56 to 0·79 per cent. of carbon. From 0·5 to 20 per cent. of copper, the point Ar, lies between 575° and 600° C., 80° to 100° C. below its value for a similar carbon steel. The phenomenon of recalescence at this point becomes more marked as the percentage of copper increases. Slight separation of copper takes place when as little as 3 per cent. is present, but in such minute globules that sensibly uniform ingots can be cast, even up to 10 per cent. of copper. The metal becomes brittle only when 10 per cent. is exceeded. Mechanical tests show that copper increases the tenacity and lowers the ductility of steel, but to extents which vary greatly with the treatment of the metal.—J. T. D.

Copper steels. P. Breuil. Compt. rend., 1906, **143**, 377—380.

The effect of shock on notched bars was tried with both low- and high-carbon steels, containing various percentages of copper, up to 4 per cent. The fragility of the steel is increased, when the carbon is 0·15 to 0·18 per cent., by proportions of copper above 0·5 per cent.; but in the case of the higher carbon steels no definite effect due to the presence of the copper could be clearly detected. Torsion experiments gave similar results to those on tensile strength; in all the steels, when the copper exceeds 2 per cent., it increases considerably the elastic limit and the moment of rupture. Similar results were shown by determinations of the hardness by Brinell's method; copper steels were found to be usually superior to the corresponding nickel steels. Corrosion trials with dilute sulphuric acid showed that copper has a very powerful effect in lessening the rate of corrosion. Micrographic examination of these steels confirms the conclusions of Stead. The utilisable steels (below 4 per cent. of copper) show an extreme fineness of structure. They contain more granulo-sorbitic pearlite as the proportion of copper is increased, and the effect of this is to produce a steel with the hardness, but without the brittleness, of a steel of higher carbon content. Copper steels seem in many respects as promising industrially as those containing nickel or other elements much more costly than copper.—J. T. D.

Manganese; Compounds of —— with silicon. F. Doerinckel. Z. anorg. Chem., 1906, **50**, 117—126.

A study of the heating and cooling curves of manganese-silicon alloys, together with examination of their micro-structure, showed that two well-defined compounds are formed, Mn_2Si and MnSi. In the alloys poor in silicon there is a series of mixed crystals, ranging from pure manganese to the saturated crystals containing 17·7 atoms per cent. of silicon. In the alloys containing 37·5 per cent. by weight of silicon, or more, microscopic examination revealed the presence of parallel bands or stripes, due to a structural element of which the composition

could not be determined. Starting from manganese, melting at 1244° C., the addition of silicon causes a lowering of the melting point, and a series of mixed crystals containing from 0 to 10 per cent. of silicon separates The curve representing the beginning of crystallisation of the alloys with from 10 to 30 per cent. of silicon has a maximum at about 21·3 per cent. of silicon and a temperature of 1320° C., corresponding to the compound, Mn_2Si. Microscopic examination of alloys with from 10—20 per cent. of silicon revealed the presence of an eutectic, and from the proportions of this eutectic and of the primary crystals of the compound, Mn_2Si, the eutectic point was found to correspond to about 12 per cent. of silicon and a temperature of 1075° C. Between 30 and 50 per cent. of silicon the curve has a second maximum, at about 34 per cent. of silicon and 1280° C., corresponding to the compound, MnSi. Between the two maxima there is a second eutectic point at 1239° C., and 30 per cent. of silicon. When the percentage of silicon in the alloys rises above 37·5 per cent., the amount of the crystals of the compound, MnSi, gradually diminishes, and another structural element, indicated by parallel markings, makes its appearance, covering almost the whole surface of the section of the alloy containing 45 per cent. of silicon. With 50 per cent. and upwards of silicon, first silicon separates from the melts, and afterwards, at 1136° C., the structural element of unknown composition crystallises. (See also Vigouroux, this J., 1896, 141; 1905, 1235; and Lebeau, this J., 1903, 168, 214.)—A. S.

Zinc-gold slimes; Proposed process for treatment of —— before smelting. C. E. Meyer. J. Chem. Met. and Mining Soc., S. Africa, 1906, **6**, 361—364.

Instead of decomposing the complex cyanides with sulphuric acid, the zinc-gold slimes are placed in a vat, and dried by means of steam, any incomplete oxidation being perfected by moistening the slimes with a small quantity of nitric acid. Any excess of acid is expelled by the heating, but as little as possible should be used. This treatment will oxidise all easily decomposable cyanides. The difficultly-decomposable cyanides are then destroyed by acting on the slimes with ten times their volume of a saturated solution of ammonium carbonate, which dissolves compounds of silver, zinc, and copper. The solution obtained is filtered off, and distilled with limestone or dolomite, to recover the ammonium carbonate, the residue left in the still being worked up for silver. The residual slime left is very rich in gold, containing, in addition to the gold, only silica, ferric hydroxide, and lead carbonate. It should be fluxed with a little borax. The process is at present only in the experimental stage.

A. G. L.

Gold; Alloys of —— with bismuth and antimony. R. Vogel. Z. anorg. Chem., 1906, **50**, 145—157.

The melting-point curve of gold-bismuth alloys consists of two branches intersecting at an eutectic point (240° C., 82 per cent. of bismuth). No compound of the two metals is formed, the eutectic crystallisation of all of the alloys with from 4 to 100 per cent. of bismuth taking place at the same temperature. The alloys with from 0 to 4 per cent. of bismuth crystallise as solid solutions of bismuth in gold. With from 4 to 82 per cent. of bismuth, saturated mixed crystals, containing 4 per cent. of bismuth, separate first, until the residual melt attains the composition of the eutectic, which solidifies at 240° C. With from 82 to 100 per cent. of bismuth, the alloys consist of crystals of bismuth embedded in the eutectic, which is a mixture of saturated mixed crystals and bismuth. Microscopic examination of the alloy containing 4 per cent. of bismuth showed that this did not consist entirely of mixed crystals, as would have been expected; this is due to the incomplete diffusion of the bismuth into the gold. After heating at 400°, 500°, 700°, and 800° C. respectively, the structure of the alloy was found to be quite different, consisting of crystals of gold embedded in the eutectic. It appears therefore that at high temperatures the diffusion of bismuth into gold is very small, but is much greater at temperatures below 400° C.

In the case of gold-antimony alloys, the melting point of gold is lowered considerably by addition of antimony; the alloy containing 24 per cent. of antimony still remains liquid above 360° C. The melting-point curve of the alloys consists of three branches. Starting from the melting point of gold, it falls rapidly to the eutectic point (360° C., 24 per cent. of antimony), then rises to a point at 460° C., corresponding to the compound, $AuSb_2$ (55 per cent. of antimony), and then again rises to the melting point of bismuth. From the melts containing less than 24 per cent. of antimony, crystals of gold separate out first, and the residual melt solidifies at the eutectic point; the eutectic consists of a mixture of gold and the compound $AuSb_2$. With from 24 and 55 per cent. of antimony, the alloys consist of crystals of the compound, $AuSb_2$, embedded in the eutectic; whilst with from 55 to 100 per cent. of antimony, the alloys consist of crystals of antimony surrounded by the eutectic. The compound, $AuSb_2$, crystallises in cubes; it is harder than antimony and gold, very brittle, and more resistant to acids than antimony is.—A. S.

Silver; Alloys of — with thallium, bismuth, and antimony. G. I. Petrenko. Z. anorg. Chem., 1906, **50**, 133—144.

The melting-point curve of silver-thallium alloys consists of two branches starting from the melting points of silver and thallium respectively, and intersecting at an eutectic point (287° C., 2·5 per cent. of silver). The melts containing 0—10 per cent. of thallium solidify as mixed crystals of thallium and silver. As the percentage of thallium rises from 10 per cent. upwards, the amount of mixed crystals decreases, whilst the eutectic is formed in gradually increasing quantities. The alloy with 95 per cent. of thallium consists of star-shaped mixed crystals embedded in the eutectic, but at 97·5 per cent. of thallium, the alloy consists entirely of eutectic. With more than 97·5 per cent. of thallium the alloys consist of primary crystals of α-thallium embedded in the eutectic; crystals of β-thallium separate from the melt, but are transformed into α-thallium at 226° C.

The melting-point curve of silver-bismuth alloys has a somewhat unusual form; it consists of two branches intersecting at an eutectic point (262° C., 2·5 per cent. of silver), but the branch beginning at the melting point of silver is distinctly concave at the part corresponding to about 40 per cent. of bismuth. Microscopic examination showed that the alloys containing 17 to 95 per cent. of bismuth consist of two structural elements, *viz.*, white mixed crystals rich in silver, embedded in the grey, microcrystalline eutectic. The alloy with 2·5 per cent. of silver consists entirely of the eutectic, whilst that with 1 per cent. of silver consists of crystals of bismuth embedded in the eutectic. The melts containing more than 95 per cent. of silver solidify, on cooling, as a solid solution of bismuth in silver, but it was not found possible to determine exactly the composition of the saturated mixed crystals.

The melting-point curve of antimony-silver alloys falls rapidly from the melting point of silver to a point at 560° C., corresponding to the compound, Ag_3Sb, and then less rapidly to the eutectic point (485° C., 45 per cent of antimony), from which it rises to the melting point of antimony. With from 0 to 15 per cent. of antimony the alloys consist of mixed crystals containing up to 15 to 16 per cent. of antimony. From 15 to 25 per cent. of antimony, two structural elements are observed in the alloys: saturated mixed crystals and the compound Ag_3Sb (27·07 per cent. of antimony, 559° C.). With from 27·07 to 45 per cent. of antimony, the compound, Ag_3Sb, separates first, and then at 485° C. the eutectic (45 per cent. of antimony) crystallises. Between 45 and 100 per cent. of antimony the alloys contain two constituents, metallic antimony and the eutectic. (See also Laurie, this J., 1894, 1204.)—A. S.

Copper mining in Chile. For. Off. Ann. Ser., No. 3698. [T.R.]

There was an increase in the shipments of fine copper from Chile to the amount of 9,601 met. quintals, the total amount being 296,313 met. quintals. 238,934 quintals of bar copper were exported; of this amount 179,560 quintals were shipped to the United Kingdom, and 47,104 quintals to France. The total export of this article showed an increase of 17,070 quintals over 1904.

In copper regulus the total amount exported amounted to 15,683 met. quintals of fine copper, as compared with 6,654 met. quintals in 1904. There was an increase in export to the United Kingdom. The total amount of ores exported equalled 41,696 quintals of fine copper, or 1,560 met. quintals less than during the year 1904. Of the total export of this article, the United Kingdom took 38,454 quintals.

Copper alloys; Microscopic structure of ——. J. Jacobsen. Bull. Soc. Chim. Belg., 1906, **20**, 214–230.

The author has examined and gives plates of the microscopic structure of pure copper and of a number of bronzes and brasses. Mechanical tests were also made of each sample examined. The work is still in a preliminary stage, but already permits the following conclusions to be drawn:—1. Alloys giving good results in both tensional and shock tests show a homogeneous and regular structure (by regular is meant that the crystal axes are all in the same direction). 2. Alloys giving poor results both in tensional and shock tests show a structure neither homogeneous nor regular. 3. Alloys giving poor tensional results, but having a high resistance to shock, show a homogeneous but irregular structure.—J. T. D.

Barium; Preparation of —— from its suboxide. Guntz. Compt. rend., 1906, **139**, 339—340.

When metallic magnesium and barium oxide are heated to 1100° C., the reaction $2BaO+2Mg=Ba_2O+MgO+Mg$ occurs, half of the magnesium volatilising. If a larger proportion of magnesium be used, an alloy of barium and magnesium may be condensed in the apparatus; and if for the magnesium be substituted a non-volatile metal such as aluminium, the dissociation of the barium suboxide gives rise to pure barium. Barium suboxide decomposes water in the cold. At a red heat it also absorbs nitrogen, giving a nitride; and hydrogen, yielding a hydride.

Strontium behaves in all these respects similarly to barium.—J. T. D.

Antimony-thallium alloys. R. S. Williams. Z. anorg. Chem., 1906, **50**, 127–132.

Molten antimony and thallium are miscible in all proportions. From the melts containing from 22 to 100 atoms per cent. of antimony there separate, on cooling, either crystals of antimony, or saturated mixed crystals of antimony in α-thallium, containing about 22 atoms per cent. of antimony, until the residual melt attains the composition of the eutectic (29·8 atoms per cent. of antimony), which solidifies at 195° C. From the melts containing 0 to 22 atoms per cent. of antimony, on cooling, crystals of β-thallium separate; at 225° C. these are transformed into α-thallium, whilst at 195° C. the remainder of the melt solidifies as the eutectic. In all of the solid alloys, at 187° C., or 8° below the eutectic point, crystals of the compound, $SbTl_3$, are formed according to the following equations:—(1) Alloys with from 22 to 100 atoms per cent. of antimony:—

1 mol. $SbTl_3 \rightleftarrows$ 0·961 mol. of mixed crystals (22 atoms per cent. of antimony) + 0·154 mol. Sb.

(2) Alloys with from 0 to 22 atoms per cent. of antimony:—

1 mol. $SbTl_3 \rightleftarrows x$ mols. of mixed crystals + y mols. Tl.

Micrographic examination of the alloys showed that the alloys containing from 29·8 to 100 atoms per cent. of antimony consist of three structural elements, *viz.*, primary crystals of antimony; a homogeneous straw-yellow compound, $SbTl_3$, of ill-defined crystalline structure; and a mixture of this compound with very small, somewhat bent rods of antimony, derived from the eutectic. The alloy, with 29·8 atoms per cent. of antimony, consists of the compound, $SbTl_3$, and the small rods of antimony. With from 29·8 to 25 atoms per cent. of antimony, the quantity of the compound, $SbTl_3$, increases, and that of the rods of antimony decreases. As the amount of antimony is reduced below 25 atoms per cent., the amount of the small rods of antimony decreases rapidly (disappearing altogether at about 22 atoms per cent. of antimony), that of the compound, $SbTl_3$, decreases slowly, and that of the mixed crystals of antimony in α-thallium increases. —A. S.

Thorium; Preparation of [metallic] ——. H. Moissan and O. Hönigschmid. Monatsh. Chem., 1906, **27**, 685—696.

Thorium has never hitherto been obtained free from oxide, the purest specimen having been that prepared by Nilson, which contained 19·85 per cent. of thorium dioxide. The authors endeavoured to obtain a purer preparation by first heating thorium carbide in a stream of chlorine, and re-subliming the product in a current of hydrogen, to obtain anhydrous, oxygen-free thorium chloride; the chloride was then placed in an iron crucible, along with alternate layers of sodium and sodium chloride; and the crucible was closed tightly and heated. The product so obtained, however, contained over 15 per cent. of thorium dioxide, the oxygen having evidently been derived from moisture absorbed by the hygroscopic thorium chloride during its transference to the crucible. To meet this difficulty, the experiments were repeated in glass tubes, in such a way that the sublimation of the chloride, and the reduction with sodium were conducted *in vacuo*. The glass of the tubes was found to be attacked, however, with formation of some silicon chloride, so that some thorium oxide was produced; nevertheless, the metal obtained was found to contain as little as 3·08 per cent. of oxide. Attempts were made to improve upon this result by electrolysing anhydrous thorium-potassium chloride in an atmosphere of nitrogen. Experiments showed that only porcelain vessels were available for the purpose, but the porcelain was always found to be more or less attacked, with consequent formation of oxide. The best product contained 5·1 per cent. of oxide. Some of the metal so obtained was packed in a cavity in a tightly-rammed block of thoria, contained in a carbon crucible, and the whole was heated in an electric flaming-arc furnace. On opening up the mass at the conclusion of the experiment, the metal was found to have volatilised partly; but a few small metallic beads were encountered, and these proved to consist of perfectly fused thorium, free from oxide.—H. B.

Mineral industry of Austria. Mining World, Sept. 1, 1906. [T.R.]

In 1905 there were employed 136,316 men in the mining industry; 8,289 men worked at the smelters, and 7,210 men and women were employed at the salt plants.

The output in the last two years compares as below, in metric tons, unless otherwise specified:—

	1904.	1905.
Antimony ore	103	1,673
Antimony	36	90
Coal (bituminous)	11,868,245	12,585,263
Coal (lignite)	21,987,651	22,692,076
Copper ore	10,701	10,677
Copper	889	870
Gold ore	12,653	35,937
Gold (kilos.)	71	204
Graphite	28,020	34,416
Iron ore	1,719,219	1,913,782
Iron, pig	820,055	947,035
Iron, cast	168,309	172,579
Lead ore	22,514	23,339
Lead	12,645	12,968
Litharge	783	865
Manganese ore	10,189	13,788
Mercury ore	88,279	86,856
Mercury	536	520
Salt	369,877	343,375
Silver ore	21,048	21,047
Silver (kilos.)	39,032	38,453
Tin ore	77	52
Tin	38	53
Zinc ore	29,226	29,983
Zinc	9,159	9,326

The output of 1905 was valued at £15,276,000, of which £11,128,000 represented minerals, and £4,128,000 metallurgical products.

Mineral industry of Sweden. Mining World, Sept. 1, 1906. [T.R.]

During the past year there has been marked activity in mining, notably in iron mining. There were employed in

1905 a total of 14,574 men in the mines and quarries, and 16,648 at metallurgical works making in all 31,222, who have produced approximately £665,300 worth of minerals and metallurgical products. There were 591 accidents in the mines and quarries, of which 24 were fatal, and 518 accidents in the metallurgical industry, of which 6 were fatal. The ratio of accidents to the number of employés is comparatively small, since there were in operation in 1905, 404 mines and quarries, and 186 metallurgical plants.

The production in the last two years compares as follows, in metric tons, unless otherwise specified :—

	1904.	1905.
Coal	320,984	322,384
Copper ore	36,834	39,255
Copper	533	1,385
Copper sulphate	1,248	1,029
Felspar	18,021	19,224
Fireclay	166,888	119,947
Gold (kilos.)	61	55
Iron ore	4,083,945	4,304,833
Pig iron	528,525	530,437
Wrought iron, crude	189,246	182,640
Bessemer ingots	78,577	78,204
Basic ingots	252,832	288,075
Crucible ingots	1,162	1,319
Bars, &c., of iron and steel	252,888	284,380
Wire rods	31,863	36,009
Tubes, steel	23,594	21,809
Sheets, iron and steel	16,331	14,700
Lead	589	576
Manganese ore	2,297	1,992
Pyrites	15,957	20,762
Silver (kilos.)	651	606
Silver-lead ore	8,187	8,397
Zinc	333	305
Zinc ore	57,634	56,885

In 1905 the iron industry had 24 magnetic separating plants and 9 concentrators, which produced 221,744 tons of clean iron ore. The 139 blast furnaces worked an average of 270 days each.

Ammonium vanadate and sodium uranate ; Preparation of —. J. Ohly. VII., page 883.

English Patents.

Iron and steel ; Hardening and toughening of —. J. Churchward, New York. Eng. Pat. 15,423, July 27, 1905.

Small percentages of chromium, nickel, and manganese are mixed with the metal, which is cast into ingots, in contact with a surface containing manganese ; the ingots, after being reduced in thickness by pressure, are plunged whilst hot into a liquid bath containing fatty substance and phenol.—J. H. C.

Iron ore ; Process for reducing —. P. A. Newton, London. From Westman Process Co., Jersey City, U.S.A. Eng. Pat. 2988, Feb. 7, 1906.

See U.S. Pat. 812,247 of 1906 ; this J., 1906, 269.—T. F. B.

Magnetic materials ; Treatment of —. R. A. Hadfield, Sheffield. Eng. Pat. 6426, March 16, 1906.

The permeability of an alloy, low in carbon and manganese, in which a magnetic body (iron) and silicon, or its equivalent, form the principal constituents, is increased, and its hysteresis action reduced by heating within the range of temperature of "gamma iron" or above the critical point of the alloy (about 1050° C.), and then cooling at the rate of about 10° per hour.—J. H. C.

Sulphide and other ores [Galena] ; Treatment of —. G. E. Kingsley, Toronto, Canada. Eng. Pat. 16,374, Aug. 11, 1905.

The ores are treated in a closed solution tank, provided with a filter bottom, with a solution of nitric acid of a strength not exceeding 7½ per cent., and preferably heated (as described in Eng. Pat. 23,909 of 1904 ; this J., 1905, 681), whereby the lead is entirely dissolved, the formation of lead sulphate being entirely prevented.—J. H. C.

Ores ; Treatment of sulphide and other —. A. J. Boult, London. From H. F. Brown, Chicago. Eng. Pat. 25,371, Dec. 6, 1905.

See U.S. Pats. 817,414 and 817,415 of 1906 ; this J., 1906, 481.—T. F. B.

Silver ; Selective solvents for —. F. J. Hobson, Guanajuato, Mexico. Eng. Pat. 17,310, Aug. 26, 1905.

See U.S. Pat. 827,368 of 1906 ; this J., 1906, 851.—T.F.B.

Alloys. C. H. Birmingham, Baltimore, Md., U.S.A. Eng. Pat. 13,186, June 7, 1906.

An alloy designed to replace platinum in electrical appliances, having a high melting point and high induction and resistance, is composed as follows : Silver, 16½ oz. troy ; nickel, 4½ lb. ; bismuth, ½ oz. ; gold, 53 dwt.—A. G. L.

United States Patents.

Copper and other metals ; Process of treating [deoxidising] —. J. A. Yunck, South Orange, N.J. U.S. Pat. 825,100, July 3, 1906.

Instead of using an alkali metal for the deoxidation of copper, the patentee uses a mixture of an alkali carbonate with free carbon, which, it is claimed, is reduced at the temperature of the molten metal, with evolution of the vapour of the alkali metal. In order to prevent the too rapid evolution of the alkali metal vapour, a small quantity of a "retarder" is added, *viz.*, calcium carbonate when sodium carbonate is employed, or cream of tartar when potassium carbonate is used. In carrying out the process, 30 parts of powdered carbon and 5 parts of granular carbon are mixed with 5 parts of calcium carbonate and 60 parts of sodium carbonate, sufficient water is added to dissolve the sodium carbonate, the mixture is evaporated to dryness, and the residue is crushed. This product is added to the copper to be deoxidised in the proportion of 1 part to 19 parts of copper. Ten per cent. of the required quantity of the deoxidising mixture is added to the copper, the mixture is fused, and then the remaining 90 per cent. of the mixture is added, and the whole is well stirred before pouring the copper. —A. S.

Vanadium ores ; Process of treating —. J. H. Haynes and W. D. Engle, Denver, Colo. U.S. Pat. 828,350, Aug. 14, 1906.

The ore is crushed, boiled with a solution of alkali carbonate until the vanadium is dissolved, the solution drawn off, and the vanadium precipitated as calcium vanadate by the addition of slaked lime.—A. S.

Metal or metallic compound ; Deposition of — *upon metals or metallic articles.* S. O. Cowper-Coles, London. U.S. Pat. 829,386, Aug. 28, 1906.

See Eng. Pat. 13,579 of 1904 ; this J., 1905, 804.—T.F.B.

Crucible furnace. M. Harvey, Cannock. U.S. Pat. 829,471, Aug. 28, 1906.

See Eng. Pat. 23,909 of 1903 ; this J., 1904, 753.—T.F.B.

French Patents.

Steel alloys for armour plates. Schneider and Co. Fr. Pat. 351,411, April 25, 1905.

The new alloys have the following composition :—

1. Steel-nickel-molybdenum contains carbon not exceeding 0·25 per cent., nickel about 3½ per cent., molybdenum at least 0·5 per cent.

2. Steel-nickel-chrome-molybdenum contains carbon not exceeding 0·25 per cent., nickel about 3 per cent., chromium about 0·5 per cent., molybdenum at least 0·5 per cent.

3. Steel-nickel-tungsten contains carbon at most 0·25 per cent., nickel about 3·5 per cent., tungsten at least 1 per cent.

4. Steel-nickel-chrome-tungsten contains carbon at most 0·25 per cent., nickel about 3 per cent., chromium about 0·5 per cent., tungsten at least 1 per cent.—J.H.C.

Iron, steel, &c. ; Process for preventing the rusting of ——. F. Montefredini. Fr. Pat. 364,082, Jan. 13, 1906.

The metal is heated to 538°—760° C., and treated under pressure with suitable "protective gases or vapours" (*e.g.*, calcium vapour, or the vapour from litharge, either alone or mixed with turpentine). After cooling, the metal may be coated with vaseline. In carrying out the invention, the metal is cleaned, and heated in a closed retort into which a suitable quantity of quicklime and of litharge, preferably mixed with turpentine, is introduced.—A. S.

Iron and steel ; Manufacture of ——. Hasper Iron and Steel Works. Fr. Pat 365,282, Feb. 14, 1906.

The addition of ferro-manganese in the converter is rendered unnecessary, and the production of good steel facilitated, by blowing finely-divided graphite or other carbon powder into the molten iron during the whole period of dephosphorisation.—J. H. C.

Iron ; Process for the partial or complete transformation of —— into steel. A. Darracq and Co. Fr. Pat. 364,112, Feb. 16, 1906. Under Int Conv , Dec. 24, 1905.

The process for the partial or complete transformation of iron into steel consists in heating the metal, whilst it is coated with a mixture of powdered horn, potassium ferrocyanide, potassium bichromate, and ammonium chloride in variable proportions, and then cooling it by immersion in cold water. A. S.

Bronze ; Unoxidisable —— of high resistance. C. J. M. Lagatinerie. Fr. Pat. 361,460, May 11, 1905.

The principal characters of this new bronze are that it offers great resistance to oxidation, has great tensile strength, is very hard, ductile, and malleable It consists of copper 57·4 per cent., tin 0·4 per cent., zinc 40·5 per cent., aluminium 0·1 per cent., manganese 0·1 per cent., and mild steel 1·5 per cent.—J. H. C.

Gilding objects of metal, other than copper, by simple immersion. A. Weil. Fr. Pat. 363,092, Feb. 8, 1906.

A band of zinc is placed around the object to be gilded ; it is then immersed in the bath of potassium cyanide and gold chloride so as to more or less completely cover the zinc.—J. H. C.

Minerals ; Concentration of ——. H. L. Sulman, H. F. K. Picard, and J. Ballot. Fr. Pat. 363,418, Feb 19, 1906.

Finely-divided mineral while suspended in water, preferably acidulated, is submitted to the intermittent action of gas under pressure, whereby on the pressure being relaxed, certain particles are floated to the surface by the escaping gas.—J. H. C.

Minerals ; Separation of ——. H. L. Sulman, H. F. K. Picard, and J. Ballot. Fr. Pat. 363,419, Feb. 19, 1906.

Certain finely-divided minerals may be separated from each other by being brought into alternate contact with air and the surface of a liquid. The minerals are placed in a cylinder which rotates on a horizontal axis. The cylinder is furnished with an internal helix whereby the bulk of the mineral is gradually pushed forward. A shallow stream of water is made to flow in an opposite direction, and certain particles which float to the surface of this current are carried off to a separate receiver. —J. H. C.

Minerals ; Process for reducing ——. C. P. Townsend. Fr. Pat. 364,379, March 17, 1906.

See U.S. Pat. 815,881 of 1906 ; this J., 1906, 381.—T.F.B.

Furnace ; Rotating ——, *for the treatment of ores and of combustible substances.* A. Ducco. Fr. Pat. 364,366, March 10, 1906. Under Int. Conv., April 18, 1905.

The invention relates to a rotating furnace, intended more especially for the treatment of pyritic ores. The furnace consists of a long cylindrical chamber, horizontal or slightly inclined, and supported, so as to rotate, on friction wheels. The chamber is provided at either end with an opening—one for the introduction of the material under treatment, and the escape of the products of combustion, and the other for the discharge of the roasted material, and the introduction of air. The inner surface of the cylinder has helical grooves or channels cut in it, so that as the cylinder rotates, the charge is moved gradually from one end to the other. The charging device is fixed to the cylinder and rotates with it ; in successive positions of the device, material is taken up from a receptacle, and is dropped (1) through a flap-door, which closes after it; (2) through a second flap-door which is closed whilst the first is open, and *vice versâ*; and (3) into the cylinder.—A. S.

Metals, metalloids, and alloys ; Process for the manufacture of ——. K. A. Kuhne. Fr. Pat. 364,329, March 17, 1906. Under Int. Conv., Oct. 14, 1905.

The invention relates to a method of obtaining metals or metalloids, or alloys of the same with aluminium, which cannot be prepared by Goldschmidt's "thermite" process. The oxide or hydroxide of the metal or metalloid is mixed with aluminium and potassium chlorate or an analogous substance, all in a finely divided condition, and the mixture is ignited as in the "thermite" process. For example, three parts of an oxygenated compound of boron are mixed with nine parts of aluminium and five parts of potassium chlorate, and the mixture is ignited by means of a red hot iron rod. The mixture burns, and fuses. After solidifying, the residue consists of two layers which can be easily separated—the upper one of slag, and the lower one of aluminium containing crystals of boron. —A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 856.)

(*A.*)—ELECTRO-CHEMISTRY.

Potassium chlorate ; Simple continuous electrolytic preparation of ——. A. Wallach. Z. Elektrochem., 1906, 12, 667—668.

The electrolyte consisted of a 25 per cent. potassium chloride solution containing 0·2 grm. of potassium bichromate per 100 c.c. From time to time small quantities of concentrated hydrochloric acid were added, in all some 0·8 c.c. per 100 c.c. of electrolyte. The electrolysis was effected between platinum gauze electrodes with a current density of 0·15 amps. per sq. cm., the temperature attaining 70° C. The experiments lasted from 24 to 90 hours, the electrolyte being stirred, and a concentrated solution of potassium chloride being continuously added in proportion sufficient to make up for the converted salt and evaporation. In some of the experiments, the crystals of potassium chlorate, which settled at the bottom of the cell, were removed at intervals. The current yield varied between 85 and 92 per cent. of the theoretical, and the chlorate obtained was practically pure, and scarcely coloured by the chromate.—R. S. H.

Silver ; The galvanometer as indicator in the volumetric determination of ——. M. Drapier. XXIII., page 911.

Tungsten [Incandescence electric] lamp ; The ——. F. Uppenborn. II., page 876.

English Patents.

Arcs ; Impts. in and means for the production of long, stable electric ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,955, July 20, 1905.

See Fr. Pat. 357,358 of 1905 ; this J., 1906, 79.—T. F. B

Filaments for incandescent lamps ; Impts. in ——. S. Iseki. Eng. Pat. 3503, Feb. 13, 1906. II., page 877.

Ozone; Apparatus for the generation of ——. J. Harris, London. Eng. Pat. 24,849, Nov. 30, 1905.

WITHIN a closed chamber are contained a number of pairs of elements, *e.g.*, of aluminium, provided with sparking points as described in Eng. Pat. 17,805 of 1901, with a suitable dielectric, *e.g.*, an enamelled iron plate between the two plates. A pipe discharges air on to each element through a number of perforations, which gradually increase in size with the distance from the air-inlet.
—A. G. L.

Metallic films or flakes for use with active materials in alkaline storage batteries; [Electrolytic] Process of making ——. T. A. Edison, Llewellyn Park, U.S.A. Eng. Pat. 1926, Jan. 25, 1906. Under Int. Conv., March 30, 1905.

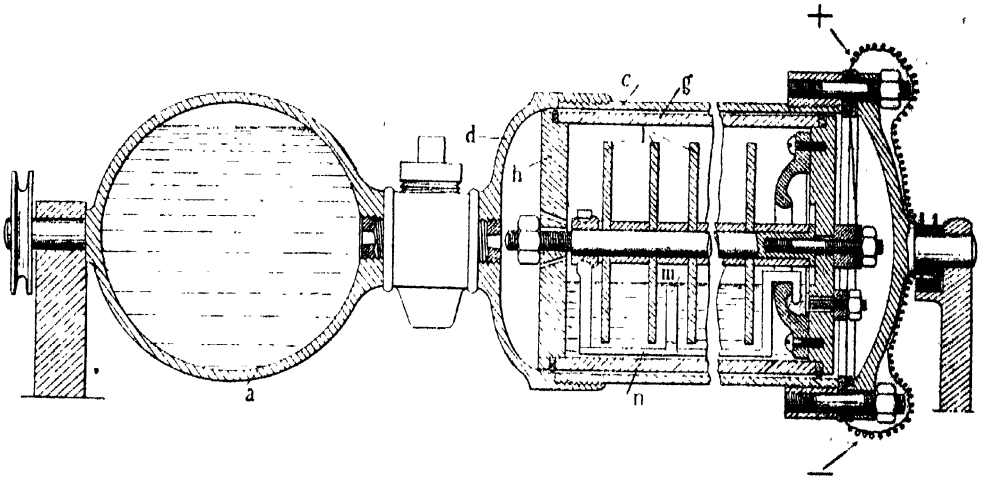
SEE U.S. Pat. 821,626 of 1906; this J., 1906, 643.—T. F. B.

Cellulose; Nitration of —— by acids concentrated by electricity. G. C. de Brisilles. Fr. Pat. 364,349, Jan. 25, 1906. XXII., page 911.

Filament for incandescence electric lamps. Zirkon-Glühlampenwerk, Dr. Hollefreund and Co. Fr. Pat 364,181, Jan. 30, 1906. II., page 877.

Filaments for incandescence lamps. A. Just and F. Hanaman. Fifth addition dated Feb. 19, 1906, to Fr. Pat. 347,661, Nov. 4, 1904. II., page 877.

Battery; Electric —— with liquid chlorine. E. Buhot, First Addition, dated March 2, 1906, to Fr. Pat. 354,551, May 23, 1905 (this J., 1905, 1115).



UNITED STATES PATENTS.

Liquids; [Electrolytic] Apparatus for treating ——. [*Water purification*]. L. Dion, Assignor to the American Electro-Hermatic Co. U.S. Pat. 820,482, May 15, 1906. XVIII*B*., page 904.

Metals and other substances; [Electrolytic] Apparatus for separating — — from liquids. L. Dion, Assignor to the American Electro-Hermatic Co. U.S. Pat. 820,483, May 15, 1906. XVIII*B*., page 905.

Electrode for arc-lights. F. J. Gerard, Assignor to L. Fiedler. U.S. Pat. 828,544, Aug. 14, 1906. II., page 877.

Milk; Process of electrolytically treating — — [Separation of proteids]. C. T. Willson, Assignor to W. H. Sheffield and L. C. Raegener. U.S. Pat. 829,308, Aug. 21, 1905. XVIII*A*., page 903.

Copper sulphate and caustic alkalis; Manufacture of —— [by electrolysis]. H. M. Granier, Villemomble, France. U.S. Pat. 829,778, Aug. 28, 1906.

SEE Fr. Pat. 330,963 of 1903; this J., 1903, 1086.—T. F. B.

Ozonising atmospheric air; Apparatus for ——. E. L. Joseph, London. U.S. Pat. 829,790, Aug. 28, 1906.

SEE Eng. Pat. 16,392 of 1905; this J., 1905, 1115.—T. F. B.

FRENCH PATENTS.

Salts of the oxy-halogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.G. First Addition dated March 9, 1906, to Fr. Pat. 362,737, Jan. 10, 1906 (this J., 1906, 766).

SOLUBLE salts of titanium or iron are added to the solution of alkali or alkaline-earth halogen compound, with a view to suppressing the cathodic reduction during the electrolysis.—R. S. H.

THE positive electrode is formed of a number of discs, *l*, partially immersed in the electrolyte, and connected electrically in parallel. The negative electrodes (*m,n,*) consist of a number of plates which are completely immersed in the electrolyte, and are so arranged as not to take part in the rotatory movement which is applied to the apparatus. The cell proper, is contained in a vessel (*h,g,*) of insulating material (glass, &c.), which is enclosed in a steel chamber (*c,d,*) and is placed in connection with a store of liquid chlorine in a subsidiary vessel (*a*), by means of a valve.—R. S. H.

Oils and similar organic substances; [Electrical] hydrolysis of —— . E. T. B. Simpson. Fr. Pat. 364,587, March 26, 1906. XII., page 894.

(*B.*)—ELECTRO-METALLURGY.

Silver and gold; Electro-chemical processes for extraction of ——. M. Vaygouny. Electrochem. and Met. Ind., 1906, **4**, 314—316.

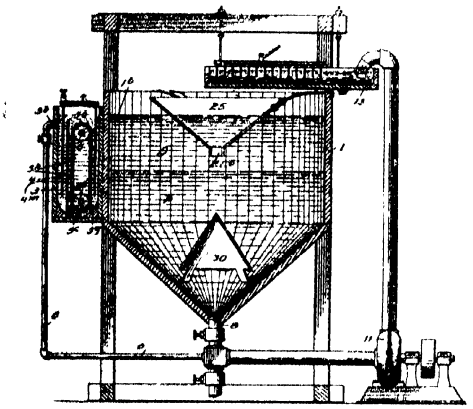
Two processes are described, in the first of which a chlorination method of extraction is adopted. The leaching solution contains a small percentage of ferric chloride, 15—20 per cent. of sodium chloride, and some free acid. The extraction of silver from sulphide and other ores was over 95 per cent., that of gold 60—88 per cent., but the extraction of the latter metal decreases if the ferrous salt be allowed to accumulate. The regeneration of the ferric salts can be accomplished by electrolysis without a diaphragm, and the silver and gold can be recovered electrolytically.

The second method relies on the use of persulphates, which not only dissolve gold, but oxidise sulphide ores, converting the silver present into sulphate, which is soluble in the sodium chloride used along with the persulphate. The solution recommended contains 2 per cent. of potas-

sium persulphate, 5 per cent. of sulphuric acid, and 20 per cent. of sodium chloride. It is stated that the difficulty of regenerating the persulphate can be satisfactorily overcome by crystallising out the potassium sulphate from the spent solvent, and separately electrolysing this to obtain the persulphate.—R. S. H.

United States Patents.

Precious metals; Apparatus for recovering ——. E. J. Garvin, Assignor to the Garvin Cyanide Extraction Co., Portland, Oregon. U.S. Pat. 822,940, June 12, 1906.



The patent relates to improvements in the apparatus described in U.S. Pat. 809,939 of 1906 (this J., 1906, 187), the chief novel features being improved means for feeding the material to the main tank, and for spreading it on the bottom thereof, and also in the arrangement of the precipitating tank. In the figure, 13 is the amalgamating tank, which discharges into the funnel, 25, suspended within the main tank, 1. The material falls from the funnel through the opening, 25*b*, and is spread over the bottom of the main tank by the distributor, 30. In the main tank the material separates into two layers—of pulp, P, and solvent, S, respectively. The solvent passes through the pipe, 1*b*, situated above the discharge opening of the funnel, into the rectangular precipitating tank, 3. In the precipitating tank are mounted two shafts, 5, 5*a*, carrying sprocket-wheels, 5*b*, 5*c*, round which pass endless chains, 5*g*, formed of suitably spaced copper strips, 5*h*. The endless chains act as cathodes, and dip into mercury, contained in the concave bottom of the tank. The tank also contains anode plates, 4, and a supplementary cathode plate, 4*m*, which form a tortuous passage for the liquid. From the precipitating tank, after separation of dissolved precious metals by electrolysis and amalgamation, the solution passes away through the outlet, 3*b*, and the pipe, 6, mixes with pulp issuing from the main tank through the opening, 8, and is returned by the pump, 11, to the amalgamating tank, 13.—A. S.

French Patents.

Copper; Metallurgical and electro-metallurgical process for obtaining pure ——. L. Jumau. Fr. Pat. 364,430, March 20, 1906.

A solution containing copper, obtained by any ordinary process, is submitted to the following treatment:—A precipitate of cuprous sulphite is first formed by the action of sulphur dioxide or a sulphite; or, if desired, a double sulphite, with ammonia, is produced. The precipitated cuprous sulphite is either directly formed into bars or rods, on a core formed of a suitable conductor, such as metallic copper, and is made the anode in an ordinary electrolytic copper-refining vat; or is decomposed with some acid incapable of forming cuprous salts, *e.g.*, sulphuric acid. In this latter method, for example, sulphuric acid precipitates metallic copper ($Cu_2SO_3 + H_2SO_4 = Cu + CuSO_4 + SO_2 + H_2O$), which, after either compression or fusion, may be employed in the ordinary electrolytic refining process.—R. S. H.

Copper from old bronzes; Regeneration of electrolyte serving for the extraction of ——. A. J. M. Thirot and L. A. Mage *dit* Nonguier. Fr. Pat. 364,588, March 26, 1906.

In the electrolytic recovery of copper from old bronze, the electrolyte gradually becomes poorer and poorer in copper sulphate, owing to the solution of foreign metals. To remedy this, the patentee proposes to add to the electrolyte sulphuric acid and copper oxide from time to time, whereby fresh quantities are formed. The copper oxide is obtained by heating metallic copper, or the bronze itself, in a current of air.—R. S. H.

Furnaces; Electric ——. A. G. Betts. Fr. Pat. 364,476, Feb. 8, 1906.

See U.S. Pat. 816,554 of 1906; this J., 1906, 433.—T. F. B.

Induction furnace; New form of electric ——. Soc. des Procédés Gin pour la Métallurgie Electrique. Fr. Pat. 363,937, March 7, 1906

The crucible or containing vessel consists of a series of uncovered channels, the bottoms of which are inclined towards closed conduits, which form the lateral connections between the several channels. In this way the deepest portion of each channel is put into communication with the top of the succeeding channel. The whole series forms a closed electrical circuit, and the heating causes a general and continuous circulation of the molten charge.—R. S. H.

Depolarisation of electrodes; Arrangements employed in electrolysis for the ——. A. Levy. Fr. Pat. 363,931, March 1, 1906.

The depositing vat is supplied with a system of pipes, and a pump, enabling the electrolyte and the bubbles of gas to be withdrawn from near the bottom of the vessel. The electrolyte is forced back again in a fine shower, which falls upon the articles undergoing plating.—R. S. H.

Aluminium; [Electrolytic] Process for reducing ——. A. G. Betts. Fr. Pat. 364,521, March 23, 1906. Under Int. Conv., April 1, 1905.

See U.S. Pat 795,886 of 1905; this J., 1905, 932.—T. F. B.

Celluloid, horn, &c.; Decoration of —— with metallic deposits of gold, silver, &c. L. Schwob and G. H. Dilette. Fr. Pat. 364,559, March 24, 1906. XIX., page 906.

Metallic tin; Production of —— in a pure and adherent form by electrolysis. A. J. M. Thirot and L. A. Mage *dit* Nonguier. Fr. Pat. 364,589, March 26, 1906.

Hydrated tin oxides, obtained in the electrolytic recovery of copper from bronze, or otherwise, are dissolved in a 10 to 12 per cent. solution of sodium hydroxide; the solution is then purified by addition of the quantity of sodium sulphide requisite to precipitate the foreign metals in solution. The solution of sodium stannate, containing 45 to 50 grms. of tin per litre, is submitted to electrolysis at 80° C., employing iron anodes and thin sheet-tin cathodes. The current density should be 300—400 ampères per sq. m. at 2·4 volts. The electrolyte, after the content of tin has been reduced to about 10 grms. per litre, is employed for extracting a fresh quantity of hydrated tin oxide.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 857.)

Linseed oil; Examination of ——. H. Thoms and G. Fendler. Chem.-Zeit., 1906, **30**, 832.

Various conclusions arrived at by Niegemann (Chem.-Zeit., 1904, 724) with regard to the unsaponifiable matter have been critically examined by the authors. They find

that linseed oil, left in contact with its deposited sediment, does not show a considerable increase in the proportion of its unsaponifiable matter with a decrease in the iodine value of the unsaponifiable matter. For example, a sample of fresh oil, yielding 1·08 per cent. of unsaponifiable matter, with iodine value 95·24, was left in contact, with constant stirring, with the deposited sediment from another oil, and filtered after six weeks, and it then gave 1·08 per cent. of unsaponifiable matter, with iodine value 95·56. Again, the authors deny that the amount of unsaponifiable matter is increased by auto-oxidation of a linseed oil. Thus, the above-named sample of oil from Archangel seed (with 1·08 per cent. of unsaponifiable matter), after being exposed to air and light for three months in a shallow dish, until it had dried to a varnish, gave 1·12 per cent. of unsaponifiable matter, with iodine value 60·13. The proportion of unsaponifiable matter is not materially decreased by the "breaking" of the oil, for the same oil, heated over a naked flame till "breaking" occurred, and then filtered, gave 1·055 per cent. of unsaponifiable matter, with iodine value 86·78. Normally the amount of unsaponifiable matter does not exceed 2 per cent., and although Niegemann (this J., 1904, 207) has found higher values, the authors attribute them to errors in his method of determination, or to his linseed oils not being pure. There is no great variation in the iodine values of the unsaponifiable matter from different linseed oils, and the determination of that value is a good test for the detection of small quantities of mineral oil. Under normal conditions the iodine value of the unsaponifiable matter does not show any material decrease, even when the linseed oil has been exposed in small quantities to the air for a month in the dark, although it is appreciably lowered when the oil has also been subjected to the action of light. Yet, even then, the decrease does not destroy the value of this test for mineral oil, and it is only when the linseed oil has been allowed to dry to a varnish that there is any marked reduction in the iodine value. The consistency of the unsaponifiable matter and its solubility in hot 90 per cent. alcohol have also some value for the detection of mineral oil. The proportion of unsaponifiable matter in extracted linseed oil is not less than in the case of expressed oil, although the contrary was asserted by Niegemann. Thus, a sample of freshly expressed oil contained 1·09 per cent. of unsaponifiable matter, whilst oil extracted with ether from the same seeds yielded 1·24 per cent.—C. A. M.

Castor oil and ground nut [arachis] oil from Southern Rhodesia. Bull. Imp. Inst., 1906, **4**, 97—98.

THE castor oil was of good quality, but was slightly turbid. After filtration, its value would be £26—£28 per ton. It gave the following analytical figures:—Sp. gr. at 15·5° C., 0·959; acid value, 1·2; saponification value, 179·6; iodine value, 87. One part of the oil dissolved in five parts of 90 per cent. alcohol to a clear solution.

The specimen of arachis (ground nut) oil was found to be of a quality probably superior to that of the highest grade oil met with in this country; it would be worth about £40 per ton. The following analytical figures were obtained for the oil: Sp. gr. at 15·5° C., 0·916; acid value, 2·0; saponification value, 188·1; iodine value, 93.—A S.

Java olives; Oil of ——. K. Wedemeyer. Z. Untersuch. Nahr.- u. Genussm., 1906, **12**, 210—212.

THE Java olive is the seed of a plant belonging to the *Sterculiaceæ*, and is not at all like the fruit of the S. European olive. The specimen of the fruit examined by the author was exported from Java as an experimental shipment. The black parchment-like hulls contained no oil, but the shells yielded 9·8 per cent. of a white butter-like fat, and the cotyledons 46·6 per cent. of a pale yellow fluid oil. The whole fruit (hulls, shells, and cotyledons) gave 30·3 per cent. of a similar fluid oil. The Java olives before extraction of the oil contained 29·3 per cent. of proteids. The oil is used by the natives of Java for food, and as a lamp oil. That expressed by the author resembled olive oil in appearance, and had a pleasant taste, but slightly rancid odour. It was miscible in all proportions with ether and petroleum spirit, but was insoluble in 95 per cent. alcohol. It remained fluid at the ordinary temperature, and did not give any solid deposit. It gave the following results:—Free fatty acids, 2·6 per cent.; sp. gr at 15° C., 0·9260; refractive index, 1·4654 at 40° C.; viscosity in Engler's viscosimeter, 16·52 at 20° C.; iodine value, 70·6; saponification value, 187·9; Hehner value, 95·6; Reichert-Meissl value, 0·8; acetyl value (Benedikt-Ulzer), 23·5; and unsaponifiable matter, 0·17 per cent. The fatty acids became thick and viscous when dried at a moderately high temperature, whilst at a higher temperature they were converted into a sticky, gum-like mass. The oil, too, behaved in a characteristic manner when heated to 240°—245° C., being suddenly transformed into a gelatinous mass, whilst the temperature meanwhile became spontaneously higher. When a larger quantity (1 kilo.) of the oil was used, the spontaneous heating became so great that the gelatinised oil took fire. On heating the oil for a short time at 240° C., and taking precautions to prevent the temperature rising above 250° C., a tough gum-like mass was left, which was soluble in none of the known solvents. This product did not resinify on exposure to the air, but remained elastic.—C. A. M.

Owala oil. K. Wedemeyer. Chem. Rev. Fett- u. Harz-Ind., 1906 **13**, 210—211.

THE seeds of *Pentaclethra macrophylla*, a tree growing on the west coast of Africa, are termed "Owala" by the natives. They vary in weight from 8 to 20 grms., and have the flat oval shape of a fresh-water mussel. One kilo. of the fruit yielded, in the mean, 20·6 per cent. of shells and 79·4 per cent. of kernels. The whole fruit was found to contain 30·4 per cent. of oil and 29·39 per cent. of proteid matter, whilst the kernels alone gave, on extraction with ether, 41·6 per cent. of oil and left 48·25 per cent. of proteid matter. The pale yellow oil, which, save for a slight deposit, was fluid at the ordinary temperature, had an aromatic smell and a pleasant flavour with a bitter after-taste. In the author's opinion, it would be suitable as a food after being refined. It became semi-solid at 4° C. The following analytical values were obtained:—Sp. gr. at 25° C., 0·9119; refractometer reading (Zeiss) at 40° C., 59·2°; acid value, 9·0; saponification value, 186·0; Reichert-Meissl value, 0·6; Hehner value, 95·6; iodine value, 99·3; melting point of fatty acids, 53·9° C.; solidification point of fatty acids, 52·1° C.; acetyl value, 37·1; and unsaponifiable matter, 0·54 per cent.—C. A. M.

Volatile fatty acids; Determination of soluble and insoluble —— *[in butter].* J. Delaite and J. Legrand. XXIII., page 913.

Mould fungus capable of decomposing paraffin. O. Rahn. III., page 879.

ENGLISH PATENTS.

Oils; Process of and apparatus for extracting ——. W. H. Gesner, Brooklyn, and A. R. Brandly, New York. Eng. Pat. 16,371, Aug. 11, 1905.

SEE Fr. Pat. 357,329 of 1905; this J., 1906, 81.—T. F. B.

Butter; Process for the manufacture of artificial ——. D. Müller. Eng. Pat. 12,916, June 2, 1906. XVIIIA., page 903.

Soaps, ointments, and the like. J. Kessler, Berlin. Eng. Pat. 25,204, Dec. 5, 1905.

SEE Fr. Pat. 360,174 of 1905; this J., 1906, 493.—T. F. B.

FRENCH PATENTS.

Fatty matter; Apparatus for recovering —— *from water.* Ges. f. Abwässerklärung. Fr. Pat. 364,068, March 12, 1906.

SEE Eng. Pat. 24,030 of 1905; this J., 1906, 992.—T. F. B.

Oils or fats, notably those resembling karité butter, Treatment of ——, to obtain a gummy material. Soc. Rocca, Tassy, and de Roux. Fr. Pat. 364,368, March 12, 1906.

The oil or fat is left in contact with a strong acid (*e.g.* 5 per cent. of sulphuric acid of 63° B.) for a sufficient time, say two days, at a temperature of about 50° C., and the gummy matter then separated by the addition of, say, three times the volume of hot water. Claim is also made for the special gums thus obtained from karité and shea butters, and other analogous fats. They can be purified by washing with water and with a solvent for fats, or by other suitable means.—C. A. M.

Oils and similar organic substances; [Electrical] Hydrolysis of ——. E. T. B. Simpson. Fr. Pat. 364,587, March 26, 1906. Under Int. Conv., Jan. 2, 1906.

The oils, &c., are submitted to the action of an electric current whilst being simultaneously acted upon by heat (superheated steam) *in vacuo* or under reduced pressure. It is stated that the process is accelerated, and that the products are purer than those obtained by the ordinary methods. It is preferred to plunge both electrodes into the oil, and to connect them with a dynamo or with an electric battery, the temperature not being allowed to exceed 270° C. during the process. C. A. M.

Wax substitute to be used in the production of coloured papers; Manufacture of ——. F. M. Winter. Fr. Pat. 364,069, March 13, 1906.

Neutral or slightly alkaline sulpholeates or sulphonated fats are melted with oleic acid or fatty acids of high melting point, and with hydrocarbons of high molecular weight. The resulting product gives with hot water and without saponification a lasting emulsion which does not injure delicate colours.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 857.)

(*A.*)—PIGMENTS, PAINTS.

Paints; U.S. Production of mineral and lead . U.S. Geol. Survey Oil, Paint. and Drug Rep., Aug. 27, 1906. [T.R.]

The materials grouped under the head of mineral paints include such iron ores as are ground and used in the manufacture of metallic paints; ochres and other clays rich in iron, which are used for the yellow and brown pigments (ochre, umber, sienna), and which are occasionally roasted to give red pigments; and fine-grained slates and shales of attractive colours, which are ground for use as paints.

The following table shows the production of the various mineral paints in 1905 as compared with 1904:—

Kind.	1904. Short tons.	1905. Short tons.	1904 Value	1905 Value
			$	$
Ochre	16,826	13,402	110,602	126,351
Umber }	522	689	12,960	17,004
Sienna }				
Metallic paint ..	19,857	16,489	204,377	176,722
Mortar colour ..	7,525	10,494	84,426	120,430
Zinc white	63,363	68,603	4,808,482	5,520,240
Slate	5,370	5,181	53,709	44,108
Other pigments ..	2,786	10,344	27,360	240,318
Totals.....	115,699	125,202	5,301,916	6,245,173

The imports of ochre in 1905 aggregated 10,632,481 lb., valued at $92,553, of which 10,616,496 lb., valued at $91,673, were imported in a dry state, and 15,985 lb., valued at $880, were ground in oil.

The imports of umber in 1905 aggregated 2,587,284 lb., valued at $21,224, of which 2,580,507 lb. were recorded as "dry-crude and powdered, washed or pulverised," while 6783 lb. were ground in oil. The relative values of the dry umber and umber ground in oil are not given.

The imports of sienna in 1905 aggregated 1,740,995 lb., valued at $26,324, of which 1,737,909 lb., valued at $26,097, were imported in a dry state, while 2886 lb. were ground in oil.

France is the largest producer of ochre, and its output usually amounts to more than the combined production of the United States and Great Britain, which usually rank second and third in the output of these pigments. In 1904, the latest year for which statistics are available, France produced 58,520 short tons of ochre, while the output of Great Britain was 17,976 tons.

Lead paints and Venetian red.—The pigments which have been noted are true mineral paints, made directly from a crude mineral. In the following table the production of certain other paints in 1905 is given:—

	Quantity.	Value.
White lead—	lb.	$
In oil	125,534,000	7,577,437
Dry	147,818,000	8,261,212
Sublimed lead	13,954,000	732,585
Zinc lead	13,558,000	474,530
Red lead	32,756,000	2,049,888
Litharge	39,756,000	2,307,233
Litharge, orange mineral	39,756,000	2,307,233
Venetian red	13,758,000	137,541

The imports of the above-named products in 1905 were as follows:—White lead, 597,510 lb., valued at $34,722; red lead, 704,402 lb., valued at $26,553; litharge, 177,757 lb., valued at $4139; and orange mineral, 628,003 lb., valued at $31,106.

French Patents.

Lakes [from azo dyestuffs], Process for preparing fast ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,506, May 24, 1905.

See Eng. Pat. 27,490 of 1904; this J., 1905, 1243.—T.F.B.

Lakes derived from monoazo dyestuffs; Series of ——, and process of making them. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,532, June 2, 1905.

See Eng. Pat. 27,093 of 1904; this J., 1905, 1180.—T.F.B.

Carbon; Process and apparatus for the manufacture of amorphous ——. J. Machtolf. Fr. Pat. 364,034, March 10, 1906. Under Int. Conv., March 13, 1905.

The amorphous carbon is obtained by the dissociation of hydrocarbons, previously heated, under suitable pressure, by means of a spark. Almost any gaseous hydrocarbon may be used, but the best qualities of carbon are obtained from ethylene, or from ethylene mixed with acetylene. Just before sparking the gas, a little air may be admitted to it to increase the heating effect. The carbon obtained is collected by suitable means, and used as pigment, or compressed into pencils for arc-lamps, &c. The hydrogen liberated is also collected in a suitable holder.—A. G. L.

(*B.*)—RESINS, VARNISHES.

Dammar resins from the Federated Malay States. Bull. Imp. Inst., 1906, 4, 100—102.

The results of the examination of nine specimens of resins are shown in the following table:—

	Dammar Penak.	Dammar Kumus.	Dammar Mata Kuching(1).	Dammar Soongyi.	Dammar Meranti.	Dammar Mata Kuching(2)	Dammar Rengkong?	Dainbar Merawan.	Dammar Strayak.
Botanical source	*Balanocarpus [Maximus or Wrayi]*	*Shorea species*	—	—	*Shorea species*	—	—	*Shorea species*	—
Melting point	90° C.	94° C.	87° C.	180° C	185° C	92° C.	200° C.	97° C.	190° C.
Ash, per cent.	0·26	0·08	0·05	0·52	0·03	0·06	0·04	0·25	0·09
Saponification value	46·7	72·0	38·5	34·3	72·0	33·0	46·7	38·5	55·0
Acid value	45·3	72·0	38·5	33·0	72·0	33·0	46·5	38·5	55·0
Commercial description..	" clean, pale yellow "	" black "	" pale drop "	" black "	" chalky"	" bold pale "	" green,like Ceylon "	" white "	" chalky inferior "
Commercial value, per cwt.	55s.—60s.	20s.	70s	15s.	10s	60s.	35s.	35s.	5s.—6s

(1) From Port Dickson (2) From Jempol

It will be seen that the specimens exhibit considerable differences in chemical composition and properties, but they were all partially soluble in alcohol, and completely soluble in oil of turpentine, forming fairly light-coloured varnishes.—A. S.

United States Patents.

Turpentine; Digester for extracting spirits of ——. F. D. McMillan, Atlanta, Ga. U.S. Pat. 827,554, July 31, 1906.

The digester consists of a vertical cylindrical vessel provided with inlet and outlet pipes, and a perforated false bottom at its lower end. Inside the vessel is suspended a sectional retort constructed of movable plates, and open at the top and bottom. The size of the retort may be increased by means of adjusting screws and rods passing through stuffing-boxes in the side of the outer vessel. The retort is suspended from turnscrews fixed to the top of the vessel.—W. P. S

Turpentine, rosin, &c., from wood; Process of obtaining ——. W. K. Hale, Catskill, N.Y., and C. W. Kürsteiner, Englewood, N.J. U.S. Pat. 828,474, Aug. 14, 1906.

The wood is subjected to the action of hot water in a suitable bath or vessel. The initial temperature of the water should be about 130° F., and it is raised slowly to about 210° F. Water is added to the bath from time to time to cause the oils which rise to the surface to float or flow off into a still. The contents of the latter are raised to a temperature of about 215° F., and the volatile matters condensed. Finally, the residue in the still is heated to a higher temperature in order to separate the rosin oil from the rosin, whilst the water may be removed from the water-bath, and the wood subjected to destructive distillation.—W. P. S.

French Patent.

Resinous oils; Process of making resinous products easily soluble in dilute alkalis from ——. Chem. Fabrik Flörsheim, Dr. H. Noerdlinger. Fr. Pat. 364,398. March 19, 1906. Under Int Conv., March 20, 1905.

See Eng. Pat. 8590A of 1905; this J., 1906, 529.—T.F.B

(C.)—INDIA-RUBBER, &c.

English Patents.

Rubber; Manufacture of tubes, bars, felt, cable coverings, or the like from regenerated ——. B. Roux, Paris. Eng. Pat. 16,389, Aug. 11, 1905.

Claim is made for apparatus in which waste powdered rubber is regenerated by means of heat and pressure. In the manufacture of tubing, for instance, the waste rubber is placed in a cylinder into which a piston can be driven by hydraulic or other pressure. Near the closed end of the cylinder is the opening of a tube of the required diameter, and in the centre of this is a metal core. The rubber is forced by the pressure into the annular space between this core and the tube, the heat required for the regeneration being supplied by an apparatus on the outside, whilst lower down there is a cooling device to bring the rubber tubing to the required temperature before its removal. Means are also provided for the injection of some lubricating fluid, or of chalk, &c., into the tube. Cables, &c., are coated with rubber by letting them take the place of the core, and when a solid rubber roll is required, the core is omitted, and the drawhole made of any shape desired. If necessary, the material may be mixed with a volatile or vulcanisable solvent. For felting the rubber, the powder is driven through longitudinal holes in a mandrel, so as to form filaments, which then striking on suitable obstacles become interwoven or felted together.—C.A.M.

Rubber; Method of and means for purifying crude or reclaimed ——, *applicable as well to gutta-percha and similar materials.* F. C. Hood, Boston, U.S.A. Eng. Pat. 3416, Feb. 12, 1906.

See U.S. Pat. 821,717 of 1906; this J., 1906, 646.—T.F.B.

French Patents.

Caoutchouc, gutta-percha, and analogous substances; Process for obtaining —— *in a pure state.* B. Graetz. Fr. Pat. 363,339. Feb. 16, 1906. Under Int. Conv., Feb. 1, 1906

Substances containing caoutchouc are extracted, at a temperature below the melting point of caoutchouc, with aniline or an alkyl-aniline, which dissolves resinous, fatty, and waxy matters. Water, acetone, or an alcohol may be added to the aniline to depress its boiling point. In the case of substances containing gutta-percha, the latter is dissolved, along with the resins, by the hot aniline, but can be recovered by cooling, or by precipitation with water, acetone, or an alcohol.—A. S.

Caoutchouc; Process for the production of pure —— *from substances containing it.* B. Graetz. Fr. Pat. 363,340, Feb. 16, 1906. Under Int. Conv., Feb. 2, 1906.

The caoutchouc and resins are extracted by a suitable solvent, such as carbon bisulphide, benzene, oil of turpentine, or ether, and the caoutchouc is precipitated from the solution by methyl, ethyl, or amyl alcohol, or acetone. —A. S.

Rubber; Process for the preparation of —— *for vulcanisation.* B. Graetz. Fr. Pat. 363,341, Feb. 16, 1906. Under Int. Conv., Feb. 2 and Feb. 5, 1906.

The rubber is prepared for vulcanisation by treating it with substances which dissolve out the resins, but leave the caoutchouc unaffected. For example, the rubber is heated, under a reflux condenser, with amyl alcohol, to which water has been added for the purpose of lowering its boiling point.—A. S.

Elastic substance analogous to caoutchouc, and its process of manufacture. L. Roland. Fr. Pat. 364,075, March 13, 1906.

A substitute for caoutchouc is prepared by the action of chromic acid, or a chromate, on a mixture of gelatin and glycerin in a liquid condition. For example, 8 kilos. of glue and 6 kilos. of gelatin are soaked in cold water for from 2 to 24 hours, and well mixed with about 15 kilos. of glycerin at 28° B.; the mixture should weigh from 30—35 kilos. A hot solution of 560 grms. of potassium bichromate and 140 grms. of sodium bichromate in 1200 grms. of water is then added. On cooling, an elastic material is obtained, which is said to be specially suitable for the manufacture of tyres.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 858.)

Tanning materials of the Sudan. Bull. Imp. Inst., 1906, **4**, 95—97.

FOUR products used as tanning materials by the natives in the Sudan have been examined, *viz.*, the barks of "Mudus" (*Parkia filicoidea*) and of "Abu Surug" (*Prosopis oblonga*), and the pods and bark of the "Sant" tree (*Acacia arabica*). The following results were obtained, the tanning experiments being made on "limed" calf-skin:—

	Mudus bark	Abu Surug bark.	Sant bark	Sant pods.
Moisture, per cent.	12·2	11·1	11·5	10·6
Ash, per cent.	6·1	2·7	6·8	3·7
Total extractive matter, per cent. on dry substance	17·4	23·8	13·5	55·5
Tannin per cent. on dry substance	14·6	16·2	9·9	39·4
Nature of leather produced	(1)	(2)	(3)	(4)
Commercial value, per ton	£2 10s.	£2 10s	£2	£6

(1) Harsh dark reddish-brown leather.
(2) Firm reddish-brown leather
(3) Harsh dark-brown leather
(4) Soft light-coloured leather.

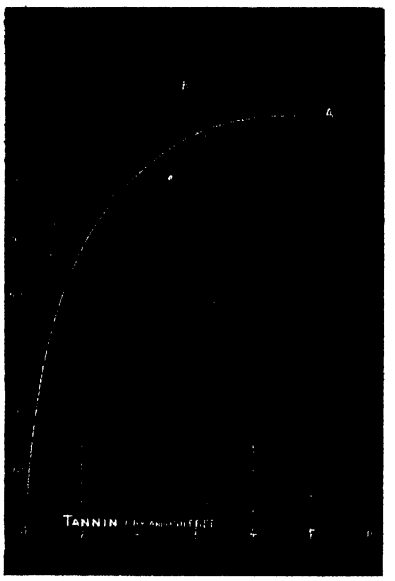
—A. S.

Quebracho tannin. II. M. Nierenstein. Collegium, 1906, 141—142. (See this J., 1905, 907.)

ONE grm. of quebracho tannin was dissolved in 500 c.c. of water, and the solution, in one case mixed with 100 grms. of sodium acetate (see Perkin and Yoshitake, Chem. Soc. Trans., 1902, **81**, 1164), and in another case without such addition (see Etti, Monats. Chem., **2**, 548), was cooled with ice, and a 0·5 per cent. solution of diazobenzene chloride added drop by drop until a turbidity was no longer produced. After standing for 24 hours, the deep red precipitate was filtered off, and repeatedly boiled with acetone, the colour changing to light red during this treatment. The azo compound thus obtained was insoluble in alcohol and other solvents, and did not melt below 360° C. It contains 52·2—59·9 per cent. of carbon, 2·97—4 per cent. of hydrogen, and 13·17—14·55 per cent. of nitrogen. By extracting the reaction product with absolute alcohol, and evaporating the solution, a red powder was obtained, which had all the properties of a catechol-tannin, but was optically inactive, whereas quebracho tannin has, according to Trimble, a rotatory power of from + 11° to + 26°. This indicates that the optical activity of a tanning substance may be due to the accompanying sugar, rather than to the tannin.—A. S.

Chromed skin; Absorptive properties of —— for tannin. J. T. Wood and W. E. Holmes. Collegium, 1906, 301—303.

THE authors confirm Kopecky's statement (Collegium, 1906, 100) that chromed box-calf shavings, neutralised, and washed free from soluble matter, when pressed free from excess of water absorb tannin better than specially prepared dried chromed powder, since the drying seems to make it impossible to completely wet down the skin-fibres. Five grms. of such shavings, containing 78 per cent. of water and 7·4 per cent. of ash (5·7 per cent. of chromic oxide), were stirred for an hour with 500 c.c. of a solution of Hastings' tannin, and left for 15 hours. After straining off the leather, the soluble matter in the filtrate was determined. This deducted from the total soluble matter, after allowing for the moisture contained in the added shavings, gives the matter absorbed by the skin. Since chromic oxide does not absorb tannin, the results were calculated on dry ash-free skin, and plotted on a curve, A, side by side with a second curve, B, representing amount of tannin absorbed per 100 parts of dry skin substance free from ash, from von Schroeder and Passler's figures for pure skin substance (v. Schroeder's



Gerberei Chemie, p. 396; this J., 1903, 1138). The curves show that the absorption by chromed skin, though reaching a lower maximum than that of pure skin, is much more regular.—S. R. T.

Leather formation; Theory of ——. W. Fahrion. Collegium, 1906, 286—287.

LUMIERE and Seyewetz (this J., 1906, 704) have observed that when phenol is employed as a developer in photography, the presence of air is necessary to render the gelatin completely insoluble. They argue that oxygen must play a similar part in the process of tanning. The author points out that he has already (this J., 1903, 919) advanced this theory. It is not the tannic acids, but their primary oxidation products that are in the first instance concerned in the formation of leather, these being of the nature of peroxides, and containing available oxygen, which they give up to the skin fibre during the tanning. Heating or a prolonged contact with water changes these peroxidised compounds into phlobaphenes, which contain no available oxygen. Hence, the ready formed primary oxidation products are only very incompletely used up in many cases, such as liquor tanning [Brühengerbung], but a new formation of primary oxidation products may take place during the drumming and other processes in which air is present. In layer tanning, where the access of air is much more completely excluded, no oxidation can take place, but in this case the ready formed oxidation products are completely used up, since the extraction takes place at ordinary temperature and in the presence of the skin fibre.

It is known that there is a close relationship between quinones and peroxides, and hence the observation of Lumière and Seyewetz (this J., 1906, 496), that an aqueous solution of quinone has the power of rendering gelatin insoluble in the absence of air, may be regarded as a confirmation of the author's oxidation theory.

The case of sumac, which shows no tendency to oxidation, may be urged against this theory, but the explanation is, according to the author, to be found in the fact that the tannin in this case is entirely derived from leaves which offer a large surface to the air. The supposition that the tannic acid is already oxidised is confirmed by the oxygen content of 44 per cent. against 36 in the case of oak tannin. In Turkey, sumac is used in the following way:—The skins, having been made into water-tight bags with the flesh side inwards, are filled with water and a quantity

of sumac leaves, and hung up, when the tanning proceeds of its own accord in a manner somewhat analogous to that of pit tanning.—S. R. T.

Leather drying; Principles of ——. F. H. Haenlein. Lecture given before the meeting of the Union of the Leather Makers of Saxony held in Dresden, Oct. 23, 1905. Collegium, 1906, 212.

By means of a series of experiments, the author shows that a current of moderately warm air should be employed for drying leather, for if the temperature be raised above a certain point the quality of the leather is damaged. The maximum temperature that can be employed without danger depends upon the kind of leather, varying from about 20° C. to 35° C., although, in certain factories, still higher temperatures are successfully used. A mistake commonly made in the arrangement of temperature and ventilation is that the latter is either too great or too small. If the drying process be badly managed, the leather will be unequal. Thus, for instance, if too quickly dried, the upper layers often become hard, whilst the inner ones are still wet, and the leather which is apparently dry gradually becomes damp when kept, owing to the water in the interior working its way to the surface.

The water content of non-fatted tanned leather may be taken at about 18 per cent., whilst in fatted leather it is somewhat lower, namely, about 15·4 per cent.

The variations which take place on account of the varying condition of the atmosphere are about 2·5 per cent. in fat-free, and 2 per cent. in fatted leathers. Fat-free air-dried leather may contain as much as 20·5 per cent. of water during exceptionally damp weather, and under contrary conditions as little as 15·5 per cent.

In order to avoid differences between buyer and seller it is advisable not to use a store which is subject to irregular conditions as to temperature and ventilation.

Experiments by Von Schröder have shown that the so-called horn leather can take up and hold more water than ordinary tanned leather, ranging from 19 to 28 per cent. So far as is at present known, the power of retaining water gradually diminishes with the degree of tanning.

Experiments carried out with Valdivia leather (Collegium, 1902, 5—6) gave the following results:—

Percentage of water.

	Valdivia leather	German leather according to different systems of tanning		
		Rhenish	New	North.
Maximum	21·7	20·4	19·8	18·2
Mean	19·5	18·0	17·8	16·8
Minimum	15·1	15·0	14·5	14·2
Variation	6·6	5·4	5·3	4·0

The influence of the tannage is much more marked with chrome leather, the water content being in non-fatted leather about 6½ per cent. higher than in bark-tanned leather. The maximum is quite 10 per cent. higher and occasionally reaches 29 per cent. The variations are also correspondingly greater, being about 9 as against 5 per cent.—S. R. T.

Tanning matters; Qualitative analysis of ——. M. Nierenstein. XXIII., page 912.

Tannin analysis; Use of chromed hide powder in ——. E. Nihoul. XXIII., page 912.

Leather; Determination of sulphuric acid in ——. L. Meunier. XXIII., page 912.

Desamido-caseïn. Z. H. Skraup and P. Hoernes. XXIV., page 913.

Desamido-glutin. Z. H. Skraup. XXIV., page 913.

Caseïn; Some peptones from ——. Z. H. Skraup and R. Witt. XXIV., page 913.

English Patents.

Skins; Process for treating —— for the manufacture of fur. A. Granville, London. Eng. Pat. 16,887, Aug. 21, 1905.

The skins as imported are soaked for about 10 hours in cold water, and then rinsed, and soaked for two or three hours in dilute hydrochloric acid (say 5 to 7 per cent.), after which they are drained, rinsed in alkaline water, drained, scoured cold, tanned, dressed, and dyed. Finally, the upper wool or hair is removed by any suitable means, leaving intact the short, curly underlayer of wool upon the skin, the resulting fur having the appearance of astrachan, especially in the case of lambs' skins and the like.—C. A. M.

Leather; Process of hardening ——. D. Bryan, Liverpool. Eng. Pat. 1787, Jan. 24, 1906.

The leather is steeped in cold water for about 24 hours, then slowly dried in the air for about the same time, and, after being hammered, left in a dry place to set hard. —C. S.

French Patents.

Leather; Process for the manufacture of a product for the impregnation of ——. J. A. Jensen. Fr. Pat. 363,588, Feb. 24, 1906.

For rendering leather impervious to water, it is impregnated with a composition prepared by adding to dégras (4 parts), a mixture of rosin and shellac in scales, for example, "linoleum cement" (14 parts), and treating the resulting mass with any suitable lac (4 parts), which has been previously mixed with a solution of rosin (1 part), and a small quantity of "carbolineum." The product is rendered more or less liquid by adding varnish or the like (16 parts).—A. S.

Gelatin; Process for rendering —— more resistant to the action of moisture and of heat. E. Ohr and O. Schlegel. Fr. Pat. 363,592, Feb. 24, 1906.

Gelatin and objects made of the same are rendered more resistant to the action of moisture and of heat by coating them with a kind of varnish composed entirely or in part of ether, alcohol, amyl acetate, benzene, camphor, oil of turpentine, and lavender oil, with pyroxylin, shellac, sandarac resin, borax, dammar resin, and similar substances.—A. S.

Catgut threads; Process for sterilising ——. H. Schmidt. Fr. Pat. 364,535, March 24, 1906.

See Eng. Pat. 7825 of 1906; this J., 1906, 770.—T. F. B.

Norgine [Ammonium tangate]; Process for obtaining soluble —— in a dry and neutral condition. Soc. Franç. La Norgine. Fr. Pat. 361,498, May 23, 1905.

Tang acid, obtained according to processes previously described (Fr. Pats. 278,749, 278,785, 278,862, 283,432, and 283,433 of 1898, and 287,964 of 1899; see Eng. Pats. 12,275 and 12,277 of 1898; this J., 1898, 794), and dried as far as possible by heating and pressing, is subjected to the action of ammonia gas in order to produce directly norgine or ammonium tangate, which is obtained, after drying, as a neutral powder, completely soluble in water. (Compare Fr. Pat. 358,398 of 1905; this J., 1906, 233.)—A. S.

Celluloid, horn, &c.; Decoration of —— with metallic deposits of gold, silver, &c. L. Schwob and G. H. Dilette. Fr. Pat. 364,559, March 24, 1906. XIX., page 906.

XV.—MANURES, &c.

(*Continued from page 868.*)

Phosphoric acid; Cause of error in determining —— in natural phosphates and basic slags by the "Citro-mechanical" method. E. Guerry and E. Toussaint. XXIII., page 912.

Alkali, &c., works; Forty-second annual report on —— by the Chief Inspector. VII., page 881.

FRENCH PATENTS.

Manure; Manufacture of a ——. V. D. Steyaert. Fr. Pat. 364,272, March 15, 1906.

FÆCAL liquids and matters, together with finely-powdered vegetable matter, are submitted to fermentation, at first anaërobic and then aërobic. The mass becomes heated, and in the course of several months dries up "progressively and spontaneously," so as to form a powder. It is stated that a portion of the nitrogen present is converted into ammonia and nitric nitrogen, and that the germinative power of the spores present (including "spores d'ustilaginées") is destroyed.—E. S.

Drying-drum [for manures]. E. Vial. Fr. Pat. 364,291, March 16, 1906.

A HORIZONTAL metal cylinder is supported on roller-wheels, and rotated in a casing. It is provided with manholes on either side for the introduction and removal of the materials treated, which are dried by a current of heated gas entering through an axial opening at one end of the cylinder, and leaving, along with the vapour given off, by a similar opening at the other end. A shaft, driven by mechanism from without, passes axially through the cylinder, and is provided with a series of radial arms, attached to the shaft, and connected at intervals by rods. The arms carry at their extremities, and nearly touching the inner surface of the cylinder, a number of doubly inclined sheet-iron scrapers, each of which extends the whole length of the cylinder. The arms are rotated independently of the cylinder, and have additional scrapers at each end to clean the end plates of the cylinder. To further assist in agitating the contents of the dryer, a number of chains are fastened at one end to the scrapers, and, after passing round the connecting rod on the next arm, are attached to the third arm at the point where it is fixed to the shaft.—W. H. C.

Fertiliser and method of manufacturing it. W. B. Chisolm. Fr. Pat. 364,460, March 21, 1906.

SEE Eng. Pat. 6429 of 1906; this J., 1906, 647.—T. F. B.

GERMAN PATENT.

Potash minerals, insoluble and soluble with difficulty; Process for the utilisation of —— for fertilising purposes. C. Plock and H. Mehner. Ger. Pat. 167,246, March 17, 1904.

POTASH minerals, insoluble or soluble with difficulty, especially "Phonolith" waste, are utilised in place of sand, as an addition to molten Thomas slag.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 859.)

Starch paste; Influence of certain mineral compounds on the liquefaction of ——. J. Wolff and A. Fernbach. Compt. rend., 1906, **143**, 363–365.

To ascertain the influence of bases on the viscosity of starch paste heated under pressure, the authors have made use of starch either thoroughly washed with distilled water, or treated with 0·1 per cent. hydrochloric acid solution and subsequently washed with distilled water. The starch was converted into a paste, treated with the basic substance, and then heated under pressure. Alumina is found to have no influence on the viscosity of the starch paste, which, however, is increased to about the same extent by magnesia, lime, ammonia, or sodium carbonate. If the paste prepared from an impure starch containing bases be made approximately neutral to methyl orange by the addition of a strong acid, such as sulphuric or phosphoric acid, it readily loses its viscosity when heated under pressure, the presence of the salts formed with the acid being without influence. With starch free from lime, the viscosity of the paste is considerably changed by a very slight modification of the reaction on either side of neutrality towards methyl orange; for instance, the viscosity of a 5 per cent starch paste is observed to increase or diminish if sodium carbonate or sulphuric acid be added in the proportion of 0·16 part per 100 parts of starch.—T. H. P.

Starch paste; Influence of acids, bases, and salts on the liquefaction of ——. A. Fernbach and J. Wolff. Compt. rend., 1906, **148**, 380—383.

SALTS which are neutral to methyl orange exert no influence on the loss of viscosity suffered by starch paste heated under pressure (calcium sulphate, magnesium sulphate, sodium dihydrogen phosphate); salts alkaline to methyl orange (disodium hydrogen phosphate) retard it considerably, and mere traces of alkalis prevent it altogether. No doubt the liquefaction of starch paste by diastase is subject to similar influences.—J. T. D.

Manganese; Determination of small quantities of ——, *and a new method of formation of glycerose.* N. Tarugi. XXIII., page 911.

ENGLISH PATENT.

Sugar solutions obtained from wood that contains tannin; Process for facilitating the fermentation of ——. A. Classen, Aix-la-Chapelle, Germany. Eng. Pat. 22,709, Nov. 6 1905. Under Int. Conv., Nov. 21, 1904.

SEE Ger. Pat. 161,644 of 1904; this J., 1905, 1078.—T. F. B.

UNITED STATES PATENTS.

Sugar from bagasse; Method of recovering ——. C. C. Cromwell, New Orleans, and F. T. Maxwell, Baton Rouge, La. U.S. Pat. 828,198, Aug. 7, 1906.

THE scums from the settling tanks are diluted with water, calcium hydroxide is added, and the mixture steamed, and allowed to settle; the unsettled juice is also diluted, treated with calcium hydroxide, steamed, the products mixed, and filter-pressed. The filter-press cake is washed, and the crushed cane or bagasse saturated with the wash-water; the juice is then expressed from the bagasse, and evaporated.—W. P. S.

Caramel, Production of ——. T. D. Lichtenstein, Silvertown. U.S. Pat. 829,478, Aug. 28, 1906.

SEE Eng. Pat. 28,547 of 1904; this J., 1906, 130.—T. F. B.

FRENCH PATENTS.

Diffuser [Sugar manufacture]. F. Closs. Fr. Pat. 364,223, March 13, 1906.

THE apparatus consists of a vertical cylinder in which is suspended at about half its height a perforated plate. This plate is placed horizontally, and concentrically to the sides of the cylinder, and its object is to prevent the accumulation or heaping of the beetroot chips. When the diffuser is emptied, the plate is tilted by means of a chain so that the chips above the plate fall towards the man-hole at the bottom of the cylinder. One or more of these plates may be provided in each diffuser, or annular rings may be used in their place.—W. P. S.

Beet chips and other moist substances; Mechanical drying of ——. J. C. F. Lafeuille. Second Addition, dated March 14, 1906, to Fr. Pat. 334,411, Aug. 4, 1903.

THE drying apparatus consists of a cylindrical vessel, inside which is a rotary strainer. A current of hot air is passed into the end of the two cylinders, the current being divided into two portions by means of a diaphragm provided with openings fitted with regulators. One current is directed into the rotary strainer, and the other passes between the latter and the outer casing. The rate of drying is thus increased, and the chips do not adhere to the strainer.—W. P. S.

Sugar ; Plant for the crystallisation of ——. V. Glovinkovski. Fr. Pat. 364,422, March 20, 1906.

THE installation consists of three cylindrical vessels each of which is divided into horizontal compartments by a number of plates. The plates are pierced by pipes which are bent in opposite directions below the plates, thus causing the liquid to be mixed as it flows from one compartment to another. An internal pipe rises from near the bottom of the first cylinder, and enters the top of the second, which in turn is in connection with the third cylinder by means of a pipe entering the sides of the two cylinders at about half their height, the ends of the pipe reaching to the bottoms of the cylinders. Means are provided for cutting off the connection between the first and second cylinders. Inside the third cylinder is a ball-float, which actuates the valves on pipes connecting the cylinders with vacuum and force pumps respectively. When the third cylinder is full of liquid, air under pressure is admitted, and at the same time the first and second cylinders are automatically placed in connection with the air-pump. The ball-float falls when the third cylinder is emptied, and the process, and current of the liquid, are changed to the opposite direction.—W. P. S.

Sugar [for brewing] ; Process for denaturing ——. P. Landouzy. Fr. Pat. 364,072, March 13, 1906. XVII., page 901.

Oils or fats, notably those resembling karité butter ; Treatment of - - -, to obtain a gummy matter. Soc. Rocca, Tassy, and de Roux. Fr. Pat. 364,368, March 12, 1906. XII., page 894

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 862.)

Yeast ; Division of the cell-nucleus of pressed ——. W. Swellengrebel. Ann. de l'Inst. Pasteur, **19**, 503; Z. Spiritusind, 1906, **29**, 231.

IN order to observe the process of division of the cell-nucleus, the pressed yeast is grown on must-gelatin for 24 hours ; a few cells are then placed on a drop of gelatin solution which is semi-fluid at the temperature of the room, and the mixture is spread on a cover-glass. This glass is then placed, without drying, into a fixing solution, the most suitable mixture being composed of water, 20 parts ; alcohol, 3 ; formaline, 3 ; and glacial acetic acid, 0·5 part. For staining the nucleus the fixed preparation is steeped for three hours in a 10·1 per cent. solution of acetic acid, and is then placed in a solution of the dyestuff, 3 parts in 200 of water, where it is allowed to remain for 12—18 hours, finally being mounted in xylol-balsam. The author gives the following description of the process of division in this variety of yeast : The nucleus, in the quiescent state, is round or slightly flattened, and generally lies close to the vacuole ; a nucleolus is also observable. In the "pro-phase" of nuclear division the contour of the nucleus becomes less distinct, and the chromatic substance splits up into four parts —the chromosomes. The latter are situated in the equator of the nucleus in the form of a ring (the mono-branched phase) ; this is especially apparent in the vigorous budding cells of young cultures. The ring has not a homogeneous structure, but appears to be made up of innumerable and varied elements. The development of the spindle-shaped figure, though only rarely, can be made apparent by staining. The "meta-phase" begins with the division of the chromosomes and the grouping of these into small branches, which are directed on both sides of the ring towards the poles. Finally the chromosomes collect at the two poles (the di-branched phase), but the two polar nuclei are not equal. In the "ana-phase" the migration of one-half of the nucleus into the daughter-cell is observed, but a connecting thread can still be discerned. The completion of the division of the nucleus is not coincident with that of the cell ; it may proceed as far as the meta-phase before any signs of budding are apparent. The nuclear division of pressed yeast shows many points of resemblance to the division of the micro-nucleolus of *Paramœcia*, in which also the daughter nuclei remain united by a connecting thread for a long time after the division.—J. F. B.

Yeast ; Influence of mycoderma on the reproduction and fermentation of ——. A. Kossowicz. Z. landw. Versuchsw. Oesterr., 1906. Z. ges. Brau., 1906, **29**, 406.

PENICILLIUM greatly assists the fermentative action of small quantities of yeast in mineral nutrient solutions otherwise left unacted upon, but the presence of over a million yeast cells is apparently an essential condition. The addition of a few mycoderma cells sets up rapid reproduction and fermentation on the part of a few yeast cells that otherwise remain apparently stagnant. Such contamination by traces of mycoderma or budding fungi is held to account for the difference between the results of Pasteur and Liebig, on which Wildiers seeks to rely, in support of his "Bios" theory, these extraneous organisms being capable of directly assimilating ammoniacal nitrogen without assistance from other substances. (See this J., 1906, 823.)—C. S.

Yeast ; Use of "stone square" —— in the dropping system of fermentation. F. Rogerson. J. Inst. Brewing, 1906, **12**, 518—527.

THE author gives an account of his experiences in the application of "stone square" yeasts to fermentations carried out on the dropping and cleansing system, instead of the ordinary London type of yeast. At first he found considerable difficulty in keeping the yeast in a healthy and normal condition for any length of time. This was found to be due to the fact that the open wooden fermentation vessels of 150 barrels capacity were too large to be conveniently pumped and roused in such a manner that sufficient wort could be continually brought in contact with the yeast, and the cells were starved. When smaller tuns of 40 barrels were used, the wort could be easily manipulated. In working "stone square" yeast on the dropping system, it is desirable to have a certain number of stone squares, and to pass the pitching yeast through these, on the usual stone square system, from time to time. The beers prepared by "stone square" yeasts are remarkable for their freedom from "frets," and their perfect condition, and it is stated that these beers "taste 1 lb. heavier than any other," owing probably to their being saturated with gas.—J. F. B.

Diastases ; A property of ——. J. Duclaux. Compt. rend., 1906, **139**, 344—346.

CATALYTIC actions of weak acids, say of acetic acid, are due not to the whole of the acid present but to the portion electrolytically dissociated, the amount of which depends upon other factors, besides that of the dilution. Similarly, colloids (to which class diastases appear to belong) react in virtue of the variable active part—colloidal ferric hydroxide, for example, $Fe_2(OH)_6$,$mFeCl_3$, in virtue of the ferric chloride present—and this active part depends on many circumstances besides the concentration of the whole. It is very probable, then, that diastases react under similar conditions, and it can only lead to error to assume that doubling the amount of a diastase present in a reaction should necessarily double the effective working concentration.—J. T. D.

Starch paste ; Influence of acids, bases and salts on the liquefaction of ——. A. Fernbach and J. Wolff. XVI., page 898.

Extracts [Brewery] ; A study on —— II. W. S. Smith. J. Inst. Brewing, 1906, **12**, 572—588. (See also this J., 1906, 438.)

ONE of the most important developments in brewery practice in the near future will be the general adoption of grists ground to a state of fine meal. The use of this fine grist necessitates, first, the most careful mashing, and, secondly, scientific and systematic sparging. As regards mashing, attention must be devoted to the manipulation of the

mashing machine and mash-tun rakes, and to the area of the mash-tun. As regards sparging, the principle to be aimed at is a fairly constant ratio of liquor to malt residues. From the first moment of setting the taps, a gradual decrease in the volume of the malt contents begins, and the lowering of the level does not necessarily mean a lower proportion of liquid; a definite and regular rate in the fall of the level should be aimed at. The difficulties of drainage, which have always been associated with fine mashes, can be overcome by good sparging. In the first place, the rate of discharge of water through the sprinkler must be carefully gauged. The main object is to get the water into the finest possible state of sub-division, in order to avoid any definite streams of liquid. For this object the holes should be only 0·032 inch in diameter. The number of holes should increase towards the further end of the sparge-arm, corresponding to the greater path of travel. The exact ratio of sparge-arms to mash-tun area must be determined by experiment in each case. The author gives a table showing the quantity of water delivered per hour by sparge-arms of different lengths and different numbers of holes under different pressures. In actual practice the author finds it an advantage to provide two sets of sparge-arms, one delivering twice as much water as the other in a given time. In this brewery it is the custom to draw off the worts into two or three coppers. The first copper is made up very slowly, using the sparge-arms which deliver only half a barrel of water per minute. After gentle raking and 30 minutes' stand, the second copper is made up twice as rapidly as the first, using sparge-arms discharging one barrel of water per minute. The goods, not being called upon to bear any appreciable weight of liquor at any time, remain buoyant. The gain of extract obtained by fine grinding is about 3 per cent., and most of this increase is in the form of extract which is not easily fermented.—J. F. B.

Wort infection on the cooler and refrigerator. A. C. Chapman. J. Inst. Brewing, 1906, **12**, 549–560.

The author strongly recommends that the cooler and refrigerator rooms should be situated at the highest point of the building, since his experiments prove that at an altitude of 45—60 feet, the air is very much freer from germs than near the ground level. The exposed area of the cooler should also be reduced considerably, and the depth increased to a corresponding extent. The work of cooling the wort should be thrown more on the refrigerator-system than on the cooler, the latter serving chiefly for the aeration of the hot wort. The aeration in the deeper form of cooler recommended should be effected by injecting filtered air through the hot wort, or else by delivering the wort in the form of a spray. The windows of the cooler-room should be fitted with frames, over which linen sheets can be hung on the side from which the wind is blowing, and the linen should be moistened with an antiseptic solution. With ordinary precautions, wort leaving the cooler at temperatures above 140° F. is very nearly sterile, and by far the most numerous cases of infection are to be traced to the refrigerators. Those forms of refrigerator which consist of pipes packed very close together are condemned. Growths of infecting organisms lodge between the pipes, in places where they cannot be touched by a brush. Chemical disinfectants only sterilise the outer layers of these growths, and do not penetrate to the interior. Such growths, being acclimatised to beer wort, are far more virulent than most of the air-borne germs. The cooling surfaces of the refrigerators should be perfectly continuous, and accessible to brushes at every point. The refrigerator rooms should be closely boxed in, and protected from the entry of all but filtered air.—J. F. B.

Vinegar bacteria; Studies on the "quick" vinegar and wine ——. W. Henneberg. Woch. f. Brau., 1906, **23**, 267—272, 277—280, 289—291, 305—307, 321—323, 337—339, and 353—356.

The author has made an exhaustive study of the various species of vinegar bacteria found in the acetifiers of the "quick" vinegar process, and describes three new species of these bacteria and two new species of wine-vinegar bacteria. The species isolated from the "quick" vinegar process were: *B. Schüzenbachi*, *B. orleanense*, and *B. curvum*.

B. Schüzenbachi exists as longish oval cells, sometimes slightly curved; the optimum temperatures for its development are 28°—30° C. on wort-agar, and 25°—27·5° C. in vinegar wort. The films formed on liquids are non-coherent.

B. curvum occurs as oval or elongated cells, with pronounced curvature; the films are non-coherent; the optimum temperature for growth is 30° C.

B. orleanense occurs as spherical cells or elongated rodlets; the films on liquids are nearly always coherent; the optimum temperature for growth is about 30° C.

The new species of wine-vinegar bacteria were *B. xylinoïdes*, which closely resembles *B. xylinum*, and *B. vini acetati*. *B. xylinoïdes* occurs as roundish cells or short or long rodlets; the films are tough, but are distinguished from those of *B. xylinum* by the fact that when grown on wort-agar they are slimy, with specks of yellow, whereas those of *B. xylinum* are hard and yellowish-brown. The optimum temperature for growth is 28°—30° C. The cells of *B. xylinum* are generally elongated and sometimes assume characteristic spiral forms. *B. vini acetati* occurs as round or oval cells, seldom elongated; the films on liquids are non-coherent; the optimum temperature for growth is 28°—33° C.

The various species show different requirements as regards nutrition. The bacteria grow best with a supply of organic nitrogen, and plentiful carbohydrate nutrients; a little alcohol is favourable; beer-wort, beer, and grain-mash are good media. All these species are capable of producing acid from arabinose, dextrose, erythritol, glycerol, and propyl alcohol. All, except *B. curvum*, produce acid from galactose; all, except *B. curvum* and *B. xylinum*, acidify maltose; all, except *B. xylinoïdes*, produce acid from dextrin. Lævulose is acidified only by *B. Schüzenbachi* and *B. vini acetati*; cane sugar only by *B. xylinoïdes*, *B. xylinum*, and *B. vini acetati*. In certain cases a growth of bacteria takes place without the production of acid; in other cases the acid which is produced is consumed. The bacteria are somewhat sensitive to free acetic acid when it is present in the culture medium from the beginning; the presence of 1·5 per cent., however, does not retard growth. The bacteria appear to be able to develop in the presence of alcohol up to a concentration of 10 per cent. The maximum proportions of acetic acid produced in wine-vinegar worts by the various species were: *B. Schüzenbachi*, 10·9 per cent.; *B. xylinoïdes*, 9·3 per cent.; *B. orleanense*, 9 per cent.; and *B. vini acetati*, 8 per cent. Cultures should be started in diluted wine-vinegar worts, and the films should then be transferred to the undiluted wort. The author gives results of experiments on the small and large scale obtained by the use of pure cultures of *B. Schüzenbachi* in "quick" vinegar acetifiers, showing the gradual increase of acid strength up to 11·49 per cent. of acetic acid after 85 days' working.—J. F. B.

Whisky: The distillation of —. P. Schidrowitz and F. Kaye. J. Inst. Brewing, 1906, **12**, 486–511.

The authors describe the apparatus and methods employed in the distillation of whisky according to the "pot still" and "patent still" processes. In Scotland, the method generally followed in carrying out distillation in pot stills is to submit the wash to a preliminary distillation, in which it is separated into an alcohol-free residue, "pot ale," and a distillate containing the whole of the alcohol, called the "low wines." The "low wines" are then re-distilled, and the distillate is collected in three fractions, leaving a non-alcoholic residue called "spent lees." The relative quantities and the alcoholic strengths of the fractions vary according to the character of the "low wines," the judgment of the distiller, and the district. In a typical case (Scotch, all malt) cited by the authors, 3868 galls. of wash yielded 1403 galls. of "low wines" at 66·3 U.P. In the second distillation, 1323 galls. of "low wines" yielded 110 galls. of "foreshots" at 21 O.P., 172 galls. of "whisky" at 19·4 O.P., and 340 galls. of "feints" at 41·5 U.P. The residues from the two distil-

lations consisted of 2645 galls. of "pot ale" and 651 galls. of "spent lees." The foreshots and feints are mixed with the "low wines" of a subsequent distillation. The authors have made analyses of each of these products on similar lines to whisky analyses, and have thereby traced the distribution of the "impurities." The results show that a considerable proportion of these "volatile impurities" is eliminated not only in the "spent lees" of the second distillation, but even in the "pot ale" from the wash distillation. They are highly concentrated in the "foreshots," and occur to some extent in the "feints," and are returned with these fractions to the "low wines" still. In the case referred to, it is shown that of the total "volatile impurities" of the wash, 63 per cent. were eliminated in the "pot ale," 37 per cent. passed into the "low wines," and only 10 per cent. appeared in the whisky. Thus, the authors prove that a very considerable degree of rectification of the spirit is effected by the ordinary "pot still" process. The "patent still" is simply an economical means of effecting continuously in one operation chemical separations of a similar nature to those produced in the "pot still" by two or more operations; the methods are fundamentally identical. Incidentally, it is shown that a partial hydrolysis of the compound ethers, particularly of the heavy oily ethers, takes place whenever a spirit is distilled.—J. F. B.

Alcohol in industry. Eng. and Min. J., Aug. 4, 1906. [T.R.]

As a result of the passage of the Bill allowing the sale of alcohol without the Internal revenue tax in the United States, the Department of Agriculture has decided to publish a bulletin on January 1, 1907, when the law comes into effect, giving a collection of the best obtainable data on the use of alcohol in small engines. For this purpose Charles E. Lucke has been retained by the Department as expert to conduct these investigations in the laboratories of Columbia University. The scope of the work being extensive, it is desired to secure the co-operation of everybody interested, by first giving the fullest publicity to the investigations. Inventors having patents on the subject, or having vaporisers, carburetters or complete engines, are invited to submit the data, or pieces of apparatus to test. These tests will be conducted without any expense, except the transportation of the apparatus. Any data or shipments should be addressed to Prof. Chas. E. Lucke, at Columbia University, New York.

UNITED STATES PATENTS.

Diastatic substance and method of making the same ——. J. Takamine, New York. U.S. Pat. 826,699, July 24, 1906.

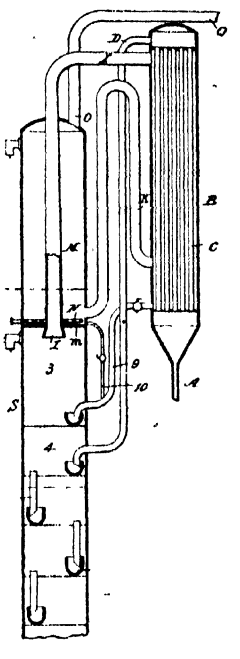
A SACCHARIFYING substance, having practically no liquefying action on starch, but a marked saccharifying action on liquefied or gelatinised starch, may be prepared by making an aqueous extract of grains or roots after the whole or part of their starchy constituents has been removed. The extract is subjected to acid fermentation, the precipitate formed is removed, the liquid portion is treated with alcohol, and the precipitate thus obtained collected and dried.—W. P. S.

Strainer-tub for brewers. J. Schneible, Weehawken, N.J. U.S. Pat. 826,891, July 24, 1906

THE apparatus comprises a rectangular tub having a strainer bottom, and a gate or door across one end for the discharge of grains from the strainer. An endless chain conveyor, mounted on wheels in the tub, carries the grains towards the door which is opened automatically by the movements of the conveyor.—W. P. S.

Distillation [Whisky, &c.]; Apparatus for ——. J. J. Brennan, Assignor to T. J. Hines, Louisville, Ky. U.S. Pat. 822,574, June 5, 1906.

THE liquid to be distilled enters through the pipe, A, and passes upwards through the tubes, C, of the heater, B. The warmed liquid leaves, B, by the pipe, D, and enters the compartment, 4, of the still, S. The construction of the still, S, is not claimed, and is described in U.S. Pat. 822,573 of 1906 (this J., 1906, 650), but the claims extend to all else. The liquid flows down the still, and is vaporised by steam, which is passed into the boiler at the bottom of the column, and by the ascending vapours from the liquid treated. The mixed vapours leave the compartment, 3, by the pipe, I, and enter the top of the heater, B. They circulate round the pipes, C, warm the incoming liquid, and are partially condensed. The weak condensate returns by the pipe, 9, into the compartment, 3, of the still, and the uncondensed



vapours pass through the pipe, K, into the "doubler," M. This is a separate chamber at the top of the column, S, from which it is completely isolated by the partition, *m*. In the "doubler," M, the vapours are rectified by the heat from the pipe, I, assisted, if necessary, by the steam coil, N. The vapour escapes by the pipe, O, to the condenser, where high-strength spirit is obtained, and any low-strength condensed liquid is returned to the compartment, 3, of the still, S, by the pipe, 10. It is stated that the use of the "doubler," M, enables a distillate of high strength and purity to be easily obtained.—W. H. C.

Brewers' and distillers' slop; Treating ——. [*Recovery of glycerol, dextrin, lactic acid, &c.*]. C. J. Roehr, Philadelphia, Pa. U.S. Pat. 823,366, June 12, 1906.

THE slop is heated to a temperature of about 200° F., and treated with a solution of sodium silicate, or alkaline solutions of aluminium, zinc, copper, nickel, cobalt, or silver hydroxides. The precipitate formed is separated by means of a filter-press, and the filtrate evaporated to a syrup, which may be added to sizing compounds for textile purposes, dye solutions, pastes, soaps, &c., or if desired, the component parts of the liquid, namely, glycerol, dextrin, and lactic acid, may be separated. Partial neutralisation of the slop, before precipitation, may be effected by passing the liquid over zinc scraps.—W. P. S.

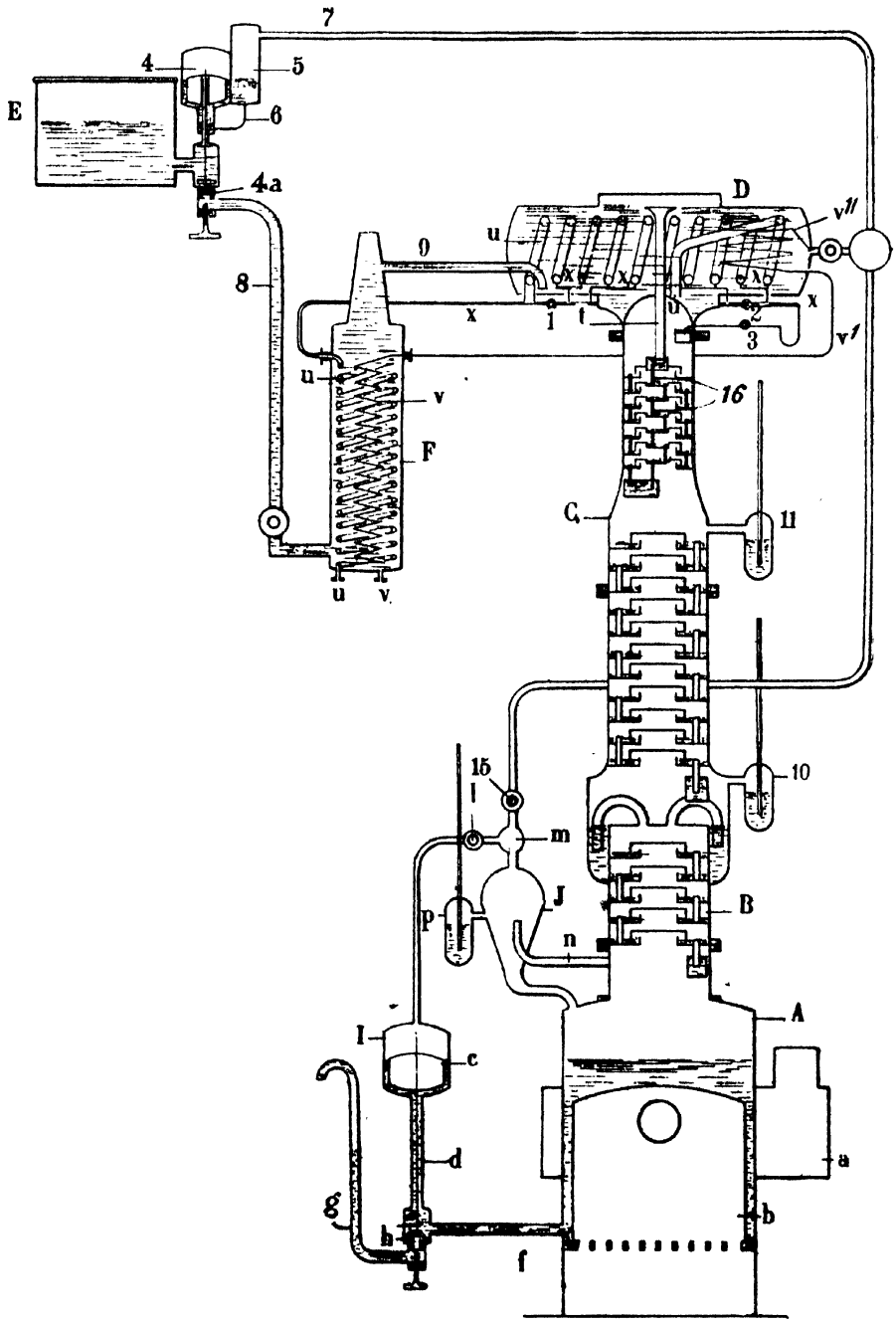
FRENCH PATENTS.

Sugar [for brewing]; Process for denaturing ——. P. Landouzy. Fr. Pat. 364,072, March 13, 1906.

FROM 2 to 10 grms. of tannin, preferably derived from oak-bark, are added to each kilo. of the inverted sugar used for brewing purposes.—W. P. S.

[*Spirit*] *Distilling apparatus.* M. Artaud. Fr. Pat. 364,130, March 1, 1906.

The apparatus consists of a boiler, A, with a very large heating surface, *b*, and surrounded by a flue, *a*; a distilling column, B; a rectifying column, C; a rectifying condenser, D; a condenser, F; and a reservoir for the liquid to be distilled, E. It has also two float-valves, 4, and *d*, controlling respectively the feed and the withdrawal of the exhausted liquid; a vapour chamber, J; and three pressure indicators, *p*, 10, and 11, which serve to indicate how the process is going on in different parts of the apparatus. The liquid from the reservoir, E, flows through the valve, 4, and the pipe, 8, into the condenser shell, F, where it serves to cool and condense the distillate, and becomes heated. It passes on by the pipe, 9, to the condenser-rectifier, D, where it is further heated, and then overflows by the pipe, *t*, into the centre overflow cups, 16, of the column, C. It continues to flow downwards by the



overflow pipes shown, and meets the ascending vapours, and becomes gradually exhausted, so that little else than waste liquor reaches the boiler, A. The ascending vapours bubble up through the bonnets of the columns, B, and C, and finally reach the coil, *u*, in the vessel, D. The lower parts of the turns of this coil are connected, as shown at *x*, to a pipe provided with several taps, 1, 2, 3, so that any desired proportion of the liquid condensing here can be run either to the coil, *u*, in condenser, F, together with the uncondensed vapours, or back to the column, C, by the pipe, 3. The condenser, F, has two coils, one, *u*, for the distillate proper and another, *v* connected by the pipe, *v'*, to the coil, *v''*, in D, which is in direct communication by the pipes, 15, J, *n*, with the boiler, A. When it is desired to test the exhaustion of the liquid in the boiler, A, a portion of the vapour is allowed to pass to the coil, *v*, from the end of which it is collected and tested. The feed of liquid is controlled by the float, 4, in the following manner: the vessel, 5, contains a liquid, and is in communication with 4 by the pipe, 6, and with the boiler, A, by the pipes, 7, 15, J, *n*. When the pressure in the boiler increases, owing to a greater evolution of vapour the liquid in 5 is forced into 4, and the float rises and opens the valve, 4*a*, allowing liquid to enter the still; if the pressure in A falls, the float sinks, and closes the valve. The float, *c*, in the vessel, I, connected by *l*, *m*, J, *n* with the boiler, A, is under the same pressure as A, and when the level of the liquid in A rises, the float, *c*, also rises and opens the valve, *h*, and allows the liquid to escape from A by the pipes, *f*, *g*. When the level of the liquid in A falls, the float, *c*, sinks, and closes the outlet valve.

—W. H. C.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 863.)

(A.)—FOODS.

Cyanogenesis in plants. J. W. Leather. Agric. J. of India, 1906, 1, 220—223.

A SAMPLE of immature sorghum fodder that had proved poisonous when fed to bullocks, was found to yield 1·28 grain of hydrocyanic acid per lb. of the green fodder, and another variety, grown in the same district, furnished 2·5 grains from the leaves, 1·1 grain from the stalks, and 0·25 grain per lb. from the flowers. On the other hand, samples of the first-named variety, left to mature, were harmless, the glucoside (*dhurrin*) present decreasing as maturity advanced. Sun-drying the fodder does not decrease the amount of the glucoside.

All the varieties of the tapioca plant contain a cyanogenetic glucoside, associated with an enzyme which decomposes it with formation of hydrocyanic acid, when steeped in water, though the free acid cannot be detected in the plant. The amount of acid formed ranges from 0·15 to 1·5 grain per lb. of root. The enzyme is destroyed by boiling the root in water, and probably also by frying it in butter (ghee), as is practised in Indian native cookery. When the acid is once formed, it is not dissipated by exposing the sliced root to the air; but, since the acid is soluble in water, there is considered to be no risk of it being left in the tapioca starch.

Hydrocyanic acid has also been obtained by steeping the seeds of Rangoon beans (*Phaseolus lunatus*) and Val (*Dolichos lablab*), as well as from a sample of immature linseed that had poisoned cattle in the Banda district, the amount of acid furnished in this latter case being 1·4 grain per lb.—C. S.

Owala oil. K. Wedemeyer. XII., page 893.

Volatile fatty acids; Determination of soluble and insoluble —— [in butter]. J. Delaite and J. Legrand. XXIII., page 913.

Desamido-casein. Z. H. Skraup and P. Hoernes. XXIV., page 913.

Desamido-glutin. Z. H. Skraup. XXIV., page 913.

Casein; Some peptones from ——. Z. H. Skraup and R. Witt. XXIV., page 913.

ENGLISH PATENTS.

Milk; Process of treating milk to produce artificial human ——. L. O. Holgate, Leeds, and J. A. Jessop, Shipley. Eng. Pat. 19,521, Sept. 27, 1905.

Two equal quantities of new full milk are taken; one quantity is set aside, whilst the other is skimmed or separated, and the skimmed milk treated with rennet. After removing the curd, the cream which was separated is remixed with the whey, an additional quantity of lactose, or whey, being added if necessary (as seen from an analysis of the milk), and the mixture is incorporated with the quantity of full milk set aside in the first place. The preparation may be dried to a powder by means of any suitable process.—W. P. S.

Malt preparations; Process of manufacturing ——. S. Felix, Dresden, Germany. Eng. Pat. 2584, Feb. 2, 1906.

SEE Fr. Pat. 362,773 of 1906; this J., 1906, 774.—T.F.B.

Coffee; Preparation or treatment of —— J. F. Meyer, Lesum, Germany. Eng. Pat. 6375, March 16, 1906.

SEE Fr. Pat. 364,389 of 1906, following these.—T.F.B.

Butter; Process for the manufacture of artificial ——. D. Müller, Cracow, Austria. Eng. Pat. 12,916, June 2, 1906.

A QUANTITY of neutral fat, such as cocoanut oil, margarine, &c., is heated with whey obtained in the manufacture of cheese. The heating at a temperature of from 40° to 60° C. is continued until the surface of the fat has become covered with a flaky or curdy layer; the aqueous portion is then run off, and the fat worked up in the usual manner. During, or after, the heating process, the fat may receive the addition of milk, cream, and colouring matters.

—W. P. S.

UNITED STATES PATENTS.

Middlings [of flour]; Process of utilising the nutritive properties of ——. S. B. Apostoloff, London. U.S. Pat. 826,824, July 24, 1906.

THE process consists in dissolving out the soluble portion of "middlings" by means of water, adding yeast to the solution, stirring during the resulting fermentation, and then straining the mixture. The strained liquid is added to flour in a kneading apparatus for the purpose of making dough for the manufacture of bread.—W. P. S.

Milk; Process of electrolytically treating ——. [*Separation of proteids.*] C. T. Willson, Amenia, N.Y., Assignor to W. H. Sheffield, Hobart, N.Y., and L. C. Raegener, New York. U.S. Pat. 829,308, Aug. 21, 1906.

SKIMMED milk is continuously passed through an electrolytic tank, and, during its passage through the latter, is subjected to the action of a direct current of electricity. The separated curd resulting from this treatment rises to the surface of the liquid, and is removed.—W. P. S.

Food products; Method of manufacturing ——. A. I. da Silva Braga, Sao Paulo, Brazil. U.S. Pats. 829,253 and 829,254, Aug. 21, 1906.

SEE Eng. Pats. 7896 and 7895 of 1904; this J., 1904, 724 and 619.—T. F. B.

FRENCH PATENTS.

Coffee free from caffeine; Preparation of ——. J. F. Meyer. Fr. Pat. 364,389, March 19, 1906.

COFFEE beans are first subjected in a closed vessel to the action of dry steam at a pressure of 1·5 to 2 atmospheres.

This treatment causes the beans to swell, and loosens the tissue. Ammonia, sulphur dioxide, or hydrochloric acid gas is then introduced into the vessel, and the liberated caffeine extracted by means of suitable solvents such as benzene or, preferably, a mixture of benzene and alcohol. The beans are boiled in the solvent, and, after the removal of the latter, are further subjected to the action of dry steam, preferably in a rotating drum.—W. P. S.

Milk powder; Process of making ——. L. Dupont, H. Passéga, and J. Lehmann. Fr. Pat. 364,565, March 26, 1906. Under Int. Conv., April 4, 1905.

Milk is heated nearly to boiling, and then poured into a receptacle which delivers it on to a horizontal, circular, revolving plate. This plate is hollow, and its interior is supplied with steam under pressure through the hollow central shaft on which it is fixed. The dried film of milk is removed from the plate by means of a screw conveyor and a scraper, the former also serving the purpose of conveying the dried milk to a receiver placed at the circumference of the plate.—W. P. S.

German Patent.

Ligneous substances, such as straw, wood, and the like; Process for working up —— for the preparation of a cattle-food. F. Lehmann. Ger. Pat. 169,880, March 26, 1905.

Straw, wood, or the like is converted into a cattle-food by heating it under pressure with ammonia, expelling the ammonia by steam, and treating the residue with quicklime. The ammonia is recovered for use again in the process.—A. S.

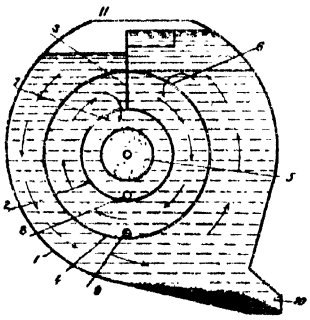
(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Water, sewage, and other liquids; Machines for the filtration of ——. A. J. Bell and P. A. G. Bell, Manchester. Eng. Pat. 22,645, Nov. 6, 1905.

To prevent clogging of the filtering material between the hollow shaft and the faces of the footstep-bearing of the apparatus described in Eng. Pat. 2384 of 1897 (this J., 1898, 178), the patentees now dispense with the ball or roller-bearings, and provide a bearing for the hollow shaft by forming a conical support at the top of the outlet pipe, a case-hardened steel block being inserted therein on which to rest the hollow shaft which carries the radial arms. The base of the shaft is fitted with a curved or conical block having a small recess in which the cone of the outlet pipe rests. The shaft is prevented from moving sideways by means of set screws passing through lugs or projections around the conical support.—W. P. S.

Clarification of fluids [Water]; Apparatus for the mechanical —— W. Rottmann, A. Miller, and P. Filler, Berlin, Germany. Eng. Pat. 7878, April 2, 1906.



The apparatus is shown in a diagrammatic section in the figure, and consists of an outer cylindrical vessel, 1, and an inner eccentrically arranged cylinder, 2, with or without one or more intermediate vessels, 4, and a dividing wall, 3. The water to be clarified either in its natural condition, or after suitable treatment with chemicals and by heat, enters at 11, and flows round the space between 1 and 4 in a "bow" as shown by the arrows. It then enters the space between 4 and 2, through the opening, 6, again flows round, and enters the inner cylinder, 2, through the opening, 7. It is finally drawn off through the filter, 5, which is attached to one side of the vessel. The deposited solids are removed from time to time through the openings, 8, 9, and 10, which are provided with suitable flap doors. The apparatus can be cleaned by reversing the flow.

—W. H. C.

Water; Process for purifying ——. G. J. Lambert, Lille, France. Eng. Pat. 10,080, April 30, 1906. Under Int. Conv., May 3, 1905.

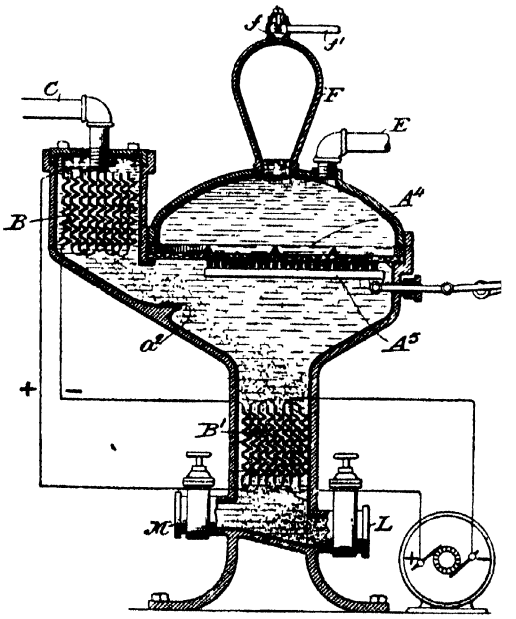
See Fr. Pat. 361,435 of 1905; this J., 1906, 862.—T.F.B.

Water purifying apparatus. E. Declercq, Lille, France. Eng. Pat. 10,206, May 1, 1906. Under Int. Conv., May 13, 1905.

The water enters an upper reservoir through a ball-tap, and then flows through a pipe on to a water-wheel mounted in a lower reservoir. This wheel also carries two series of lifting buckets, one set of which delivers definite quantities of the water from the lower reservoir into a reaction tank, whilst the other series lifts the water, and conducts it to a lime-saturator. The level of the water in the lower reservoir is maintained at a constant level, by means of a ball-tap fixed on a pipe connecting the two reservoirs, which pipe is capable of passing more water than can enter the upper reservoir through the first ball-tap; an overflow pipe is also provided. The shaft of the water-wheel is prolonged on one side in order that it may actuate the stirring device of the lime-saturator, and on the other side so that it may operate a chain of buckets arranged in a tank containing sodium hydroxide solution. These buckets raise definite volumes of the solution, and deliver it into a conduit leading to the reaction tank. An automatic brake may also be fixed on the water-wheel.—W. P. S.

United States Patents.

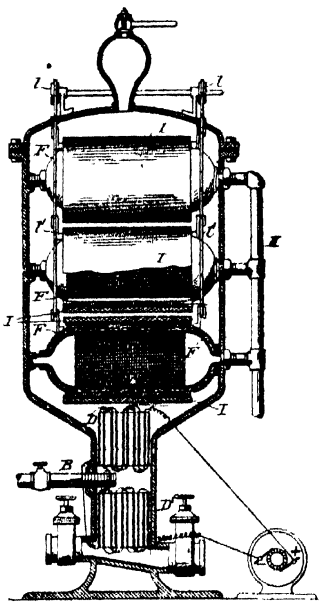
Liquids; [Electrolytic] Apparatus for treating ——. [*Water purification*]. L. Dion, Assignor to the Americus Electro-Hermatic Co., New York. U.S. Pat. 820,482, May 15, 1906.



THE liquid to be treated is supplied through the pipe, C, and passes between the group of positive and negative electrodes, B, the latter being made in the form of corrugated plates, the negative plates being placed alternately, and nesting with the positive so as to form a sinuous passage-way between them. The purified liquid passes away by the pipe, E, being filtered during its passage through the apparatus by the filter, A^4, which is cleansed by the reciprocating brush, A^5. Any gas liberated passes out through F, which is provided with a discharge pipe, f^1, and a pressure-valve, f. The particles of metal or other substance liberated from the water, fall by gravity, and are deflected by the projection, a^2, so that they are distributed over a second similar series of electrodes, B^1. The particles are further acted upon by the electric current, and are caused to aggregate into masses of larger magnitude, being finally removed through the discharge pipe, L. If the latter is choked, the material may be forced out by opening the hand-hole, M, and introducing a suitable implement.—B. N.

Metals and other substances; [Electrolytic] Apparatus for separating —— from liquids. L. Dion, Assignor to The Americus Electro-Hermatic Co., New York. U.S. Pat., 820,483, May 15, 1906.

THE apparatus is a modification of the one described in the previous abstract (see U.S. Pat. 820,482, above). D and D^1 are the upper and lower sets of electrodes, the liquid being introduced through B, and the purified liquid discharged through H. The liquid, passing from the electrodes, D, flows upward and around a number of horizontally-disposed filter-cages, F, arranged in vertical rows, with filtering material applied to their surfaces. Each cage is provided with a cylindrical brush, I, which is



oscillated by a pin and slot arrangement connecting the brush with a rod, l^1, the latter receiving an up and down motion by the cam, l.—B. N.

Water; Apparatus for purifying ——. L. Sheuerman and J. F. Hand, Des Moines, Iowa. M. N. Baker, administrator of said J. F. Hand. U.S. Pat. 827,399, July 31, 1906.

THE water to be purified is delivered alternately by means of an oscillating receiver into two tanks, above which is placed a reagent tank. A pair of oppositely inclined gutters lead from the reagent tank to the water tanks, and to the top of each gutter is pivoted a bucket for raising a quantity of the reagent to the gutter. The buckets are raised and lowered by the movements of the oscillating receiver. Means are provided for agitating the contents of the reagent tank, and at the bottom of each water-tank is an outlet pipe closed by a valve operated by the receiver. —W. P. S.

Water; Apparatus for purifying and softening ——. S. L. Sheuerman and J. F. Hand, Des Moines, Iowa. M. N. Baker, administrator of said J. F. Hand, deceased. U.S. Pat. 827,400, July 31, 1906.

THE apparatus consists of a vertical cylinder having a conical bottom, and divided into three compartments by means of two vertical partitions. One of these partitions extends from the top of the cylinder to a point near its bottom, and the second reaches from the top to the bottom. A filter composed of a number of plates is fixed at the top of the cylinder between the outer wall of the latter and the second partition, and a pipe, passing through the filter, pierces the top of the partition, whilst the lower end of the pipe reaches nearly to the bottom of the cylinder.—W. P. S.

Water; Process of removing impurities from ——. B. Kniffler, Assignor to the Vera Chemical Co., Milwaukee, Wis. U.S. Pat. 828,938, Aug. 21, 1906.

AN emulsion of saponified rosin is thoroughly mixed with the water, and a quantity of alum is afterwards added. The precipitate formed is said to carry down the suspended particles of solid matter in the water.—W. P. S.

FRENCH PATENT.

Waste waters [sewage, &c.]; Process and apparatus for separating the solid matter contained in ——. Ges. f. Abwässerklärung. Fr. Pat. 364,362, March 5, 1906.

SEE Eng. Pat. 5908 of 1906; this J., 1906, 711.—T. F. B.

(C.)—DISINFECTANTS.

FRENCH PATENT.

Disinfection by means of a new gaseous mixture; Process and apparatus for ——, and for the destruction of parasites and vermin. G. Gauthier Fr. Pat. 364,086, Jan. 23, 1906.

A MIXTURE of powdered sulphur, potassium nitrate, wood charcoal, sodium phenolate, trioxymethylene, and formaldehyde solution is heated in a metal chamber. The gas produced is forced by means of a pump through a cooling vessel and a filter, and is discharged into the room to be disinfected, &c. Pipes are provided by means of which the gas may be pumped back again from the room to the heating chamber, and maintained in continuous circulation until the charge of materials in the chamber is exhausted. —W. P. S.

GERMAN PATENT.

Weeds in corn-fields; Process for destroying ——. F. Guichard. Ger. Pat. 167,529, Feb. 11, 1903.

FOR destroying weeds in corn-fields, the patentee claims the use of ferrous sulphate, which is converted into an extremely light powder containing about one molecule of water of crystallisation by carefully heating it in a current of air. By means of a spraying apparatus, 50 kilos. of this powder can be distributed over 1 hectare of land.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 865.)

Paper; Determination of the hardness of the sizing of ——. L. Kollmann. Centr. oest.-ung. Papierind.; Papier-Zeit. 1906, **31**, 2714.

FOR the determination of the hardness of the sizing of paper, the author recommends two solutions: (*a*) a 1 per

cent. solution of caustic soda, and (*b*) a solution of 0·5 grm. of phenolphthalein in 10 c.c. of alcohol, 1 c.c of this being then diluted to 40 c.c. by water. A square piece of the paper is pinned across a wooden frame, and a drop of the diluted phenolphthalein solution is placed upon it by means of a glass rod The frame is then turned over, and a drop of the caustic soda solution is placed on the other side of the paper, exactly over the phenolphthalein At the instant of dropping the caustic soda on the paper, a stop-watch is started, and the frame is then again reversed. When the red coloration first appears, the watch is stopped, and the number of seconds which have elapsed gives the absolute resistance of the size The relative resistance is calculated by dividing the absolute value by the weight of the paper in grms. per sq metre. Papers with an absolute resistance below 20 are soft-sized and unsuitable for writing; good writing papers should show an absolute resistance of 30—40 seconds.—J. F. B.

Wood pulp; Reagent for detecting mechanical ——. A. Bergé XXIII., page 912

ENGLISH PATENTS.

Papers [*Mordanted*] *for typewriting, copying, &c* J. Hawke, New Barnet. Eng. Pat. 16,623, Aug. 16, 1905.

IN order to make the press-copies of typewriting and other fugitive inks more permanent, the paper is impregnated with a salt of tin, such as stannous chloride, in the proportion of 1—1·5 parts of tin salt to 1000 parts of paper, in the course of manufacture.—J F B

Paper-making machines [*Control of drying*]. G. Harrison, London. From L. P. Strickland, Brooklyn, U.S.A. Eng. Pat. 17,249, Aug. 25, 1905.

THIS invention relates to a mechanism which is adjusted on the last drying cylinder of the paper machine, in order to regulate the dryness of the web of paper. The attachment consists of a tension roller, which is connected with a reversible transmission mechanism by means of a rock-shaft, levers, pendulum and spur-wheels. When the web is passing away at the correct degree of dryness, the tension roller is adjusted so that the pendulum carrying the spur-wheels is out of gear When the web becomes either too damp or too dry, the pressure on the tension roller is either relaxed or increased, and the pendulum swings either to the right or left, throwing the spur-wheels into gear with a mechanism which supplies either more or less steam to the drying cylinders.—J. F. B.

[*Cardboard, &c.*] *Substances; Rendering* —— *non-conductive, waterproof, and acid-proof.* H. D. Haigh, P. Wheeler, and W. Appleyard, all of Sheffield. Eng. Pat. 1804, Jan 24, 1906.

CARDBOARD, paper, or other suitable porous material, or articles made therefrom, are treated in a closed vessel, under the exhaust action of an air-pump, with a hot solution of 3 parts of asphaltum or bitumen and 1 part of resin.—J. F. B.

Parchment paper; Manufacture of ——. G. Sachsenröder, Barmen-Unterbarmen, Germany. Eng. Pat. 6123, March 13, 1906. Under Int. Conv., June 5, 1905.

SEE Fr. Pat. 362,463 of 1906; this J., 1906, 712.—T. F. B.

UNITED STATES PATENT.

Paper; Grease- and moisture-proof ——. A Weingaertner, Assignor to the National Biscuit Co., Chicago, Ill. U.S Pat. 828,004, Aug. 7, 1906.

THE paper is prepared by soaking it in a solution containing casein, sulphurous acid, ammonia, and a fluoride or free hydrofluoric acid. The impregnated paper is then coated on one side with a film of paraffin.—W. P. S.

FRENCH PATENTS.

Wax substitute to be used in the production of coloured papers; Manufacture of ——. F. M. Winter. Fr. Pat. 364,069, March 13, 1906. XII., page 894.

Celluloid, horn, &c.; Decoration of —— *with metallic deposits of gold, silver, &c.* L. Schwob and G. H. Dilette. Fr. Pat. 364,559. March 24, 1906.

ARTICLES of celluloid or horn are coated with a deposit of silver by a special method (Fr. Pat. 359,001; this J., 1906, 323), then the space on which the design is to appear is covered with a protective varnish, and the excess of silver is removed by means of an acid. The varnish is now removed by a solvent, and the details of the design are executed in *réponssé* work. The portions of the design which are not to be gilded are again covered with varnish, and gold is deposited electrolytically on the exposed surfaces of silver, and the varnish is again removed. If a portion of the silver is to be "oxidised," the remainder is covered with varnish, and the articles are immersed in a bath of ammonium sulphide.—J. F. B.

Celluloid, Manufacture of materials resembling ——. C. Claessen. Fr. Pat. 364,604, March 26, 1906.

IN the manufacture of substances resembling celluloid, either the whole or a part of the camphor usually employed is replaced by compounds belonging to the group of tetra-substituted ureas, in which all the hydrogen atoms of the amino groups are replaced by organic radicals.—J. F B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 867.)

Ergot alkaloids. G. Barger and F. H. Carr. British Association (Section B), York, 1906. Chem. News, 1906, **94**, 89.

AS a result of analyses and molecular weight determinations, the authors give $C_{28}H_{32}O_4N_4$ as the formula for the crystalline ergotinine. No crystalline derivatives could be obtained. It contains no phenolic or methoxy-groups. From the mother-liquors an amorphous alkaloid was obtained in a state of purity, for which the authors suggest the name *ergotoxine*. It forms crystalline salts with oxalic, tartaric, and phosphoric acids, and probably contains a phenolic hydroxyl. The analytical data point to a formula differing but slightly from that of ergotinine Ergotoxine produces, in doses of a few mgrms., all the typical effects of ergot. It is probable that ergotoxine is the one essential active principle, whilst pure crystalline ergotinine is physiologically almost inactive.—F. SHDN.

Columbo root; Alkaloids of ——. E. Günzel. Arch. Pharm., 1906, **244**, 257—269.

THE Columbo root (*Jateorrhiza palmata*) was ground and extracted with alcohol. The alcoholic extract was taken up with water, and shaken out with ether, to remove the columbin The aqueous portion was treated with potassium iodide. The precipitate was boiled with alcohol, leaving behind the iodide of a base, columbamine. From the alcohol there was obtained the iodide of another base, melting at 210° C., and designated as alkaloid "B." From alcohol, columbamine iodide can be crystallised in orange-coloured needles, with a bitter taste and strong tinctorial properties. The iodide melts at 224° C. It contains apparently four methoxyl groups. If the iodide be digested with silver chloride, columbamine chloride is obtained, which crystallises from water in two forms, *viz*, dark brown columns, containing 4 mols. of water, and melting at 184° C., and yellow needles, melting at 194° C. Analyses of air-dried and anhydrous specimens of the chloride point to $C_{21}H_{22}NO_5Cl$ as the formula. An acid sulphate was obtained by treating columbamine iodide with silver sulphate. This crystallises from alcohol in yellow tablets, melting at 220°—222° C. On treating an ammoniacal solution of the iodide with ammonium sulphide, a pentasulphide was formed, melting at 139° C. The iodide when reduced with zinc and sulphuric acid yields tetrahydrocolumbamine, $C_{21}H_{25}NO_5$. This crystallises from methyl alcohol in white transparent leaflets, melting at 142° C. The base contains four methoxyl groups and a free phenolic hydroxyl. The

gold salt melts at 201° C., and the platinum salt at 228° C. Columbamine acid sulphate was reduced electrolytically. (See also Gadamer, this J., 1902, 1294.)—F. Shdn.

Ephedrine and pseudoephedrine. H. Emde. Arch. Pharm., 1906, **244**, 241—255.

By means of crystallographic measurements and determinations of the optical rotation, the author proves the identity of natural pseudoephedrine and that prepared from ephedrine. Ephedrine and pseudoephedrine when treated with methyl iodide give methyl derivatives which are not identical. On prolonged boiling, methylpseudoephedrine methyl hydroxide decomposes into trimethylamine and an alcohol, C_9H_9OH, boiling at 197°- 199° C., and isomeric with cinnamic alcohol. A similar alcohol can be obtained from ephedrine Methylephedrine methyl iodide treated with moist silver oxide yields methylephedrine. The gold salt, $C_{10}H_{14}(CH_3)ON,HCl,AuCl_3$, melted at 126° C., and the platinum double salt, $(B,HCl)_2PtCl_4$, decomposed at 198° C. The alcohol obtained by the decomposition of dimethylephedrine hydroxide boils at 214° C., and appears to be identical with *a*-phenylallyl alcohol, $C_6H_5.CH(OH).CH:CH_2$. The author considers that the difference between ephedrine and pseudoephedrine is due to the hydroxyl grouping being attached to different carbon atoms. The following formula is suggested for ephedrine: $C_6H_5.CH(OH).CH(NH.CH_3).CH_3$ (See this J., 1906, 606.)
—F. Shdn.

Essential oil; Formation and distribution of —— *in a perennial plant.* Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils. 1906, **3**, [2], 5—19. Chem. Centr., 1906, **2**, 533.

The formation and distribution of the essential oil in the wormwood (absinthe) plant, *Artemesia absanthium*, was investigated, the plants being examined at four different stages: (1) in the first year, a considerable time before flowering; (2) at the beginning of flowering; (3) towards the end of flowering; and (4) at the end of the flowering period. The results are set out in tabular form. They show that up to the beginning of the flowering period, there is a vigorous formation of essential oil, but immediately the flowers have fulfilled their function, a considerable quantity of oil is found to have disappeared, being consumed in the process of fertilisation. There is thus a loss of essential oil if the crop be gathered only after the fertilisation of the flowers. Towards the end of the period of growth of the plant, the quantity of oil increases again to some extent, but this is due to the formation of young shoots, and does not affect the loss of essential oil mentioned. In young wormwood shrubs the roots, as a rule, contain no essential oil, and the stems only very little, the main quantity being contained in the leaves. Later, at the beginning of the flowering period, the oil makes its appearance in the root, wherein its quantity then increases up to the end, the loss of oil during the fertilisation of the flowers being borne by the stems, leaves, and flowers.
—A. S.

Terpenic compounds; Gradual distribution of —— *between the different organs of a perennial plant.* Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils, 1906, **3**, [2], 19—35. Chem. Centr., 1906, **2**, 534.

Examination of the essential oil from different organs of the wormwood shrub at different periods of growth (see preceding abstract) gave the following results:—Essential oil is found in the plant a long time before the appearance of the first flowers; this oil contains only traces of thujone, and the oil from the stems is less soluble than that from the leaves. The oil contained in the first blossoms immediately after their appearance is less soluble than the oil from the leaves, but this relation does not hold at a later period. The essential oil from the roots contains the largest proportion of esters, after which follow, in the order given, the oil from the stems, from the blossoms, and from the leaves. No considerable differences with respect to the content of free thujol were observed. Thujone, which is less soluble, is present most abundantly in the oil from the leaves, whilst the oil from the stems contains only traces of it. With the approach of the flowering period, the esters accumulate, chiefly in the roots, whilst simultaneously, a considerable quantity of thujone makes its appearance. At this stage, the total increase in weight of the essential oil is greater than that of the thujol. The consumption of essential oil during the fertilisation of the blossoms proceeds in the flowers themselves. Although the consumption of terpenic compounds during this stage is chiefly at the expense of the thujol, the weight of this easily soluble constituent in the blossoms increases, notwithstanding a slight decrease in the total quantity of oil. It is probable that a relatively easily soluble mixture of terpenic compounds migrates from the leaves to the blossoms, where certain of the compounds are consumed so rapidly during the fertilisation period, that a loss of essential oil takes place, notwithstanding the inflow from the leaves. After the completion of the fertilisation period, fresh quantities of oil are formed in the young shoots, whilst the quantity of oil in the blossoms continually decreases.—A. S.

Essential oils; Contribution to the study of ——. Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils, 1906, **3** [2], 35—40. Chem. Centr., 1906, **2**, 534—535.

Wormwood (Absinthe) oil.—Three specimens of oil were examined, two, distilled respectively in 1900 (I.) and 1905 (II.), from wild wormwood (from the mountains near Caussols, Maritime Alps), and one (III.) from a plant cultivated at Grasse. The figures given in the following table relate to the oil separated directly from the aqueous distillate:—

	I.	II.	III.
	Per cent.	Per cent.	Per cent.
Esters	9·0	5·5	35·6
Combined alcohol	7·0	4·3	27·9
Free alcohol	71·9	76·3	12·3
Thujone	8·4	3·0	7·6

These oils thus contain relatively less thujone but much more thujol than those obtained from America and from the neighbourhood of Paris.

Verbena oil.—The oil from plants of *Verbena triphylla* L., cultivated at Grasse, was examined. The esters and alcohols were determined in a sample of the oil which had been freed from citral by shaking with a dilute solution of sodium sulphite and sodium bicarbonate. The following results were obtained, I. representing the oil from the leaves, and II., that from the blossoms:—

	I			II.
	Decanted oil	Extracted oil.	Total oil.	Total oil.
Yield, per cent. of the fresh plant	—	—	0·195	0·132
$[\alpha]_D$	—18° 20′	—3° 28′	—14° 16′	—8° 24′
Esters, per cent.	3·4	3·6	3·5	3·2
Combined alcohol, per cent.	2·7	2·8	2·8	2·5
Free alcohol, per cent	13·6	24·2	16·5	13·8
Citral, per cent	32·5	43·2	35·4	29·6

The roots yielded 0·014 per cent., and the stems 0·007 per cent. of oil including that obtained by extraction of the aqueous distillate.

Clary oil.—Two specimens of oil extracted from the aqueous distillate obtained from the clary plant, *Salvia sclarea*, L., (from the neighbourhood of Grasse), by distil-

lation with steam, were examined with the following results :—

	1904.	1905
$[\alpha]_D$	−25° 54′	−62° 30′
$[\alpha]_D$ after saponification	−0° 10′	+7° 8′
Sp. gr at 15° C	0·930	0·906
Saponification value	123·2	73·3
Esters, as linalyl acetate, per cent	43·1	25·7
Saponification value after acetylation	147·7	114·7
Free alcohols, as $C_{10}H_{18}O$, per cent	7·6	12·4
Total alcohols, per cent	41·5	32·6

—A. S.

Otto of rose. E. J. Parry. Chem. and Drug., 1906, **69**, 230.

THE author states that adulteration of otto of rose is now practised to a greater extent than at any time since the product has been regularly submitted to chemical analysis. Otto of rose distilled *in vacuo* contains a large amount of phenyl-ethyl alcohol, and is also abnormal in other respects, and this has led to the sale of products, largely adulterated with geraniol and other substances, as otto of rose "distilled by a special process." The author states that pure otto of rose distilled in the normal Bulgarian fashion, never has a specific gravity over 0·855 ; the figure usually falls between the limits, 0·850 and 0·853 at 30° C., and all specimens having high specific gravity, but not containing phenyl-ethyl alcohol, should be rejected.—A. S.

Ether ; Rectification of ——. P. Guigues. J. Pharm. Chim., 1906, **24**, 204.

ETHER containing a small percentage of alcohol may be purified by distilling with about 0·5 per cent. of colophony, which retains the alcohol, so that the last fractions of the distillate maintain a sp. gr. of 0·720. The method affords an economical means of obtaining absolute ether, but is only applicable to a product containing no other impurity than alcohol.—J. O. B.

Acetic anhydride ; Stability of aqueous and alcoholic solutions of ——. A. and L. Lumière and H. Barbier. Bull. Soc. Chim., 1906, **35**, 625–629.

THE authors have previously shown that acetic anhydride can be dissolved in water without hydrolysing completely ; 12 parts of the anhydride dissolve in 100 parts of cold water on merely shaking. Two solutions of acetic anhydride were made up, the strengths being 5 and 10 per cent. respectively. At intervals of 10 minutes 10 c.c. were withdrawn, shaken with aniline, and the free acetic acid titrated. The following table shows some of the results, the figures giving the percentage of acetic anhydride hydrolysed.

Time.	5 per cent		10 per cent	
	15° C	0° C	15° C	0° C
Immediately	9·2	4·6	11·5	9·8
10 mins.	52·5	35·0	58·2	34·6
50 ,,	100·0	76·2	91·7	73·3
100 ,,	—	96·9	100·0	92·8
110 ,,	—	100·0	—	94·8
160 ,,	—	—	—	100·0

Two solutions of acetic anhydride in alcohol were prepared, one equimolecular, the other containing 10 per cent. of the anhydride. 10 c.c. were removed at intervals of a day, and the free acid titrated. It was found necessary to dilute the solution freely with water, before the titration, to secure accurate results. At the end of 30 days, 91·6 per cent. of the acetic anhydride was hydrolysed in the 10 per cent. solution, while in the equimolecular solution, 95·6 per cent. was hydrolysed.—F. SHDN.

Bismuth salts ; Formation of —— by means of bismuth nitrate-mannitol solution. L. Vanino and F. Hartl. J. prakt. Chem., 1906, **74**, 142—152.

MOLECULAR proportions of crystalline bismuth nitrate and mannitol are ground together, and the mass dissolved in water. If acetone be added a hard crystalline substance is produced, having the composition, $C_6H_{14}O_6.2Bi(NO_3)_3$. By a similar reaction, the compound, $C_6H_{14}O_6.Bi(NO_3)_3$, can be obtained from sorbitol and bismuth nitrate. If dulcitol and bismuth nitrate be ground together, the mass does not entirely dissolve in water. On adding acetone, a basic bismuth-dulcitol compound is produced, $C_6H_{14}O_6.BiO.NO_3$. Salts of bismuth can be obtained by mixing together, in solution, molecular proportions of the bismuth mannitol compound and the required acid or its sodium salt. The following were prepared. Bismuth salicylate, $Bi(C_6H_4OH\,COO)_3.2H_2O$. Bismuth camphorate, $Bi_2[C_8H_{14}(COO)_2]_3.C_8H_{14}(COOH)_2$. Bismuth phthalate, $Bi[C_6H_4(COOH)(COO)]_3$. Bismuth citrate, $BiC_6H_5O_7$. Bismuth benzoate $Bi(C_6H_5COO)_3$. Bismuth oxalate, $Bi_2(C_2O_4)_3.H_2O$. Bismuth nitrite, $BiO.NO_2.\frac{1}{2}H_2O$. Bismuth hypophosphite $Bi(H_2PO_2)_3$. Bismuth phosphite $Bi_2(HPO_3)_3.3H_2O$. Bismuth phosphate, $BiPO_4.3H_2O$. Bismuth borate, $BiBO_3.2H_2O$. Bismuth ferrocyanide, $Bi_4[Fe(CN)_6]_3.2K_4Fe(CN)_6$.—F. SHDN.

Thebaine ; Reactions of ——. C. Reichard. XXIII, page 912.

ENGLISH PATENTS.

Seaweed ; Manufacture of products from ——. The British Algin Co. and T. Ingham, Holywell, Flint. Eng. Pat. 25,187, Dec. 5, 1905.

CLAIM is made for a method of preparing soluble double salts of alginic acid, sufficiently pure for technical purposes, by neutralising the extract from the seaweed, and adding a soluble salt of a metal (*e.g.* zinc, aluminium, iron, cadmium, copper, &c.), the alginate of which is insoluble in sufficient quantity to precipitate the whole of the alginic acid, separating the insoluble compound, and dissolving it in a solution of an alkali hydroxide or carbonate. Or, a solution of a soluble alginate (*e.g.* of potassium, sodium, ammonium, or magnesium) may be treated with a soluble salt of zinc, aluminium, &c., and caustic alkali or alkali carbonate added to bring the precipitated mass into solution.—C. A. M.

Formates ; Process for the production of ——. Nitritfabrik G.m.b.H., Copenick, Germany. Eng. Pat. 9008, April 14, 1906. Under Int. Conv., April 15, 1905.

IN order to facilitate the commencement of the action of carbon monoxide on alkali or alkaline-earth hydroxides, a small quantity of water is added, or of some substance which will generate water and heat when added to the hydroxide (*e.g.* formic acid). Twelve to 15 kilos. of water are added to 1000 kilos. of sodium hydroxide contained in a digester, and carbon monoxide is introduced into the mass either during, or directly after the addition of the water ; the carbon monoxide is preferably heated, but care is necessary that the temperature of the mass does not rise to the point at which sodium formate decomposes, *i.e.*, it should not rise much above 200° C.—T. F. B.

Oxyquinoline salts ; Process for the manufacture of neutral ——. F. F. Fritzsche and L. Ostermann, Hamburg, Germany. Eng. Pat. 11,725, May 19, 1906. Under Int. Conv., June 2, 1905.

NEUTRAL salts of *o*-hydroxyquinoline may be obtained by mixing solutions of the quinoline derivative and the acid in molecular proportions, and in presence of only such quantity of the solvent (water, alcohol, or ether) that the salt is precipitated directly, without evaporation. For example, the neutral sulphate is prepared by mixing together 10·6 parts of sulphuric acid (65·5° B.), 29 parts of *o*-hydroxyquinoline and 100 parts of 96 per cent. alcohol, and allowing to stand until the salt has separated out ; the sulphate thus obtained is a yellow, crystalline powder, of m.pt. 177·5° C. The phosphate and salts of organic acids are obtained similarly.—T. F. B.

gold salt melts at 201° C., and the platinum salt at 228° C. Columbamine acid sulphate was reduced electrolytically. (See also Gadamer, this J., 1902, 1294.)—F. Shdn.

Ephedrine and pseudoephedrine. H. Emde. Arch. Pharm., 1906, **244**, 241—255.

By means of crystallographic measurements and determinations of the optical rotation, the author proves the identity of natural pseudoephedrine and that prepared from ephedrine. Ephedrine and pseudoephedrine when treated with methyl iodide give methyl derivatives which are not identical. On prolonged boiling, methylpseudoephedrine methyl hydroxide decomposes into trimethylamine and an alcohol, C_9H_9OH, boiling at 197°- 199° C., and isomeric with cinnamic alcohol. A similar alcohol can be obtained from ephedrine Methylephedrine methyl iodide treated with moist silver oxide yields methylephedrine. The gold salt, $C_{10}H_{14}(CH_3)ON,HCl,AuCl_3$, melted at 126° C., and the platinum double salt, $(B,HCl)_2PtCl_4$, decomposed at 198° C. The alcohol obtained by the decomposition of dimethylephedrine hydroxide boils at 214° C., and appears to be identical with *a*-phenylallyl alcohol, $C_6H_5.CH(OH).CH:CH_2$. The author considers that the difference between ephedrine and pseudoephedrine is due to the hydroxyl grouping being attached to different carbon atoms. The following formula is suggested for ephedrine: $C_6H_5.CH(OH).CH(NH.CH_3).CH_3$ (See this J., 1906, 606.)
—F. Shdn.

Essential oil; Formation and distribution of —— *in a perennial plant.* Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils. 1906, **3**, [2], 5—19. Chem. Centr., 1906, **2**, 533.

The formation and distribution of the essential oil in the wormwood (absinthe) plant, *Artemesia absanthium*, was investigated, the plants being examined at four different stages: (1) in the first year, a considerable time before flowering; (2) at the beginning of flowering; (3) towards the end of flowering; and (4) at the end of the flowering period. The results are set out in tabular form. They show that up to the beginning of the flowering period, there is a vigorous formation of essential oil, but immediately the flowers have fulfilled their function, a considerable quantity of oil is found to have disappeared, being consumed in the process of fertilisation. There is thus a loss of essential oil if the crop be gathered only after the fertilisation of the flowers. Towards the end of the period of growth of the plant, the quantity of oil increases again to some extent, but this is due to the formation of young shoots, and does not affect the loss of essential oil mentioned. In young wormwood shrubs the roots, as a rule, contain no essential oil, and the stems only very little, the main quantity being contained in the leaves. Later, at the beginning of the flowering period, the oil makes its appearance in the root, wherein its quantity then increases up to the end, the loss of oil during the fertilisation of the flowers being borne by the stems, leaves, and flowers.
—A. S.

Terpenic compounds; Gradual distribution of —— *between the different organs of a perennial plant.* Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils, 1906, **3**, [2], 19—35. Chem. Centr., 1906, **2**, 534.

Examination of the essential oil from different organs of the wormwood shrub at different periods of growth (see preceding abstract) gave the following results:—Essential oil is found in the plant a long time before the appearance of the first flowers; this oil contains only traces of thujone, and the oil from the stems is less soluble than that from the leaves. The oil contained in the first blossoms immediately after their appearance is less soluble than the oil from the leaves, but this relation does not hold at a later period. The essential oil from the roots contains the largest proportion of esters, after which follow, in the order given, the oil from the stems, from the blossoms, and from the leaves. No considerable differences with respect to the content of free thujol were observed. Thujone, which is less soluble, is present most abundantly in the oil from the leaves, whilst the oil from the stems contains only traces of it. With the approach of the flowering period, the esters accumulate, chiefly in the roots, whilst simultaneously, a considerable quantity of thujone makes its appearance. At this stage, the total increase in weight of the essential oil is greater than that of the thujol. The consumption of essential oil during the fertilisation of the blossoms proceeds in the flowers themselves. Although the consumption of terpenic compounds during this stage is chiefly at the expense of the thujol, the weight of this easily soluble constituent in the blossoms increases, notwithstanding a slight decrease in the total quantity of oil. It is probable that a relatively easily soluble mixture of terpenic compounds migrates from the leaves to the blossoms, where certain of the compounds are consumed so rapidly during the fertilisation period, that a loss of essential oil takes place, notwithstanding the inflow from the leaves. After the completion of the fertilisation period, fresh quantities of oil are formed in the young shoots, whilst the quantity of oil in the blossoms continually decreases.—A. S.

Essential oils; Contribution to the study of ——. Roure-Bertrand, fils. Wiss. u. ind. Ber. von Roure-Bertrand, fils, 1906, **3** [2], 35—40. Chem. Centr., 1906, **2**, 534—535.

Wormwood (Absinthe) oil.—Three specimens of oil were examined, two, distilled respectively in 1900 (I.) and 1905 (II.), from wild wormwood (from the mountains near Caussols, Maritime Alps), and one (III.) from a plant cultivated at Grasse. The figures given in the following table relate to the oil separated directly from the aqueous distillate:—

	I.	II.	III.
	Per cent.	Per cent.	Per cent.
Esters	9·0	5·5	35·6
Combined alcohol	7·0	4·3	27·9
Free alcohol	71·9	76·3	12·3
Thujone	8·4	3·0	7·6

These oils thus contain relatively less thujone but much more thujol than those obtained from America and from the neighbourhood of Paris.

Verbena oil.—The oil from plants of *Verbena triphylla* L., cultivated at Grasse, was examined. The esters and alcohols were determined in a sample of the oil which had been freed from citral by shaking with a dilute solution of sodium sulphite and sodium bicarbonate. The following results were obtained, I. representing the oil from the leaves, and II., that from the blossoms:—

	I			II.
	Decanted oil	Extracted oil.	Total oil.	Total oil.
Yield, per cent. of the fresh plant	—	—	0·195	0·132
$[\alpha]_D$	—18° 20′	—3° 28′	—14° 16′	—8° 24′
Esters, per cent.	3·4	3·6	3·5	3·2
Combined alcohol, per cent.	2·7	2·8	2·8	2·5
Free alcohol, per cent	13·6	24·2	16·5	13·8
Citral, per cent	32·5	43·2	35·4	29·6

The roots yielded 0·014 per cent., and the stems 0·007 per cent. of oil including that obtained by extraction of the aqueous distillate.

Clary oil.—Two specimens of oil extracted from the aqueous distillate obtained from the clary plant, *Salvia sclarea*, L., (from the neighbourhood of Grasse), by distil-

formula $R_1R_2C(OH)CH_2X$, where X is a halogen atom; the amino-alcohols are of value in that their benzoyl derivatives possess local anæsthetic properties; the process of preparation above given is stated to be impossible technically, owing to the difficulty of preparing the necessary halohydrins.—T. F. B.

Aminoalkyl esters, Process for preparing ——. J. D. Riedel, Akt.-Ges. Ger. Pat. 169,787, Oct. 8, 1903.

By acidylation of the amino-alcohols described in Ger. Pats. 169,746 and 169,819, containing a tertiary amino-group, aminoalkyl esters of the composition $R_1R_2C(OR).CH_2.NR_3R_4$ are obtained, R being an acidyl group, R_1 and R_2 aryl or alkyl, and R_3 and R_4 alkyl radicals; all these esters are stated to possess the property of producing powerful and permanent anæsthesia; their salts are soluble in water. It thus appears that the acidyl derivatives of the majority of amino-alcohols produce anæsthesia, not excepting those which do not contain the piperidine nucleus. This property is possessed in the highest degree by the esters in which the alcohol group is a tertiary one and the amino-group is in close proximity to the alcohol group.—T. F. B.

Amino-alcohols, Process for preparing ——. J. D. Riedel, Akt.-Ges. Ger. Pat. 169,819, Oct. 8, 1903.

Amino-alcohols of the same composition as that given in Ger. Pat. 169,746 (above), save that R_4 is an alkyl radical, are obtained by the action of organomagnesium halides on aminoacetone or the esters of amino-acids containing a tertiary amino-group; the process is stated to give practically theoretical yields. The following is an example of the various stages of the reaction:—$CH_3MgI + CH_3.CO.CH_2.N(CH_3)_2 = (CH_3)_2C(OMgI)CH_2.N(CH_3)_2$: on adding water, this is decomposed into $MgI(OH)$ and $(CH_3)_2C(OH).CH_2.N(CH_3)_2$.—T. F. B.

Suprarenal glands; Process for preparing stable solutions of the active principle of ——. W. Straub. Ger. Pat. 169,446, May 25, 1904.

The only known method of preparing stable solutions of the active principle of the suprarenal gland has been by the use of its hydrochloride in presence of free hydrochloric acid; it is now found that stable solutions can also be obtained by the use of aldehyde- or ketone-alkali bisulphite compounds, with or without addition of cocaïne.—T. F. B.

Diethylacetyldiethylamide; Process for preparing ——. Kalle und Co. Ger. Pat. 168,451, Aug. 19, 1904.

Diethylacetyldiethylamide is obtained by the action of diethylacetyl chloride on diethylamine; it is of medicinal value, among its properties being that of raising the temperature of the blood, a property not possessed by diethylacetylmonoethylamide.—T. F. B.

1-Ethyl-3.7-dimethylxanthine and the alkali salts of benzoic acid or salicylic acid; Process for preparing easily soluble double salts from ——. J. D. Riedel, Akt.-Ges. Ger. Pat. 170,302, Sept. 29, 1904

Aqueous solutions of equimolecular parts of 1-ethyl-3.7-dimethylxanthine and an alkali salt of benzoic acid or salicylic acid are mixed together, and the double salt which forms is isolated, either by evaporation to dryness, or by precipitation from its aqueous solution with alcohol or acetone. The products are stated to be easily soluble in water, and without the bitter taste possessed by the corresponding salts from 1.3.7-trimethylxanthine.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 867.)

Silicic acid emulsions; Experiments with ——. K. Schaum and E. Schloemann. Z. wissen. Phot.; Brit. J. Phot., 1906, **53**, 687—688.

A silicic acid emulsion was prepared by adding a solution of silicic acid (purified by dialysis) containing potassium bromide to a solution of silicic acid containing silver nitrate, filtering off the coarse-grained silver bromide, and coating on plates; the dried films were found to separate partially from the glass, so wet films were employed for the experiments; the speed of the emulsion was found to be very much smaller than that of a "transparency" plate, as measured in a tube sensitometer. Solarisation was very marked on over-exposed films, thus showing that it is not due to "tanning" of the vehicle of the emulsion, but to some modification of the silver salt. Further, it was found that the plates, fixed immediately after exposure, could be afterwards developed; secondary development was also found to take place after the fixed plates had been treated with nitric acid (sp. gr. 1·3) for one hour, the density being less in the plates treated with acid. The portion of the latent image stable to thiosulphate and nitric acid has frequently been ascribed to an organic compound, but from the above experiments it appears that Eder's view is the correct one, *viz.*, that the latent image consists partly of a silver subbromide stable to thiosulphate and to nitric acid.—T. F. B.

Emulsion of silver erythrosinate, A panchromatic ——. C. E. K. Mees and S. H. Wratten. Phot. J., 1906, **46**, 300.

An emulsion containing silver erythrosinate in place of a silver halide was prepared by slowly adding silver nitrate solution to a mixture of gelatin and excess of erythrosin, and subsequently digesting for 40 minutes at 150° F.; after further addition of gelatin, the mixture is allowed to set and washed, and digested again for 30 minutes. It proved to be exceedingly slow, but gave a strong black image with ordinary alkaline developers, without fogging. It also proved to be almost panchromatic, giving approximately equal densities on exposure behind the three-colour screens.—T. F. B.

French Patent.

Reducing agent for photographic negatives; Product constituting a ——, *and method of using it.* H. E. Smith. Fr. Pat. 364,531, March 24, 1906. Under Int. Conv., March 24, 1905.

See Eng. Pat. 6276 of 1905; this J., 1905, 751.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 868.)

English Patents.

Explosives; Impts. in ——. C. E. Bichel, Hamburg. Eng. Pat. 5259, March 3, 1906.

To increase the power of resistance of explosives to shock and disintegration, they are covered with elastic fabric of the stockinette kind, and coated over with lac, varnish, or the like.—C. S.

United States Patent.

Explosive. L. Barthélemy, Paris. U.S. Pat. 829,362, Aug. 21, 1906.

See Fr. Pat. 351,289 of 1905; this J., 1905, 858.—T. F. B.

FRENCH PATENTS.

Cellulose; Nitration of —— by acids concentrated by electricity. G. C. de Briailles. Fr. Pat. 364,349, Jan. 25, 1906.

THE mixture of sulphuric and nitric acids used for the nitration of cellulose becomes diluted by the water separated from the cellulose as a result of the nitration. This water is eliminated from the acids by electrolysis, under an electrical pressure of 3—4 volts. The electrodes are made of platinum or gilded-platinum wire, and the evolution of the hydrogen is assisted by the application of a vacuum. An apparatus is described, in which the nitration of the cellulose and the decomposition of the water can be effected in the same vessel, the latter being divided by a perforated plate into two chambers, the upper chamber containing the cellulose and the lower chamber the acids in the course of concentration. The gases are collected separately for use.—J. F. B

Chlorate explosive for mines. S. Laszczynski. Fr. Pat. 363,919, Feb. 5, 1906

CLAIM is made for an explosive consisting of petroleum (kerosene) with the theoretical quantity of sodium or potassium chlorate. The mixture requires 0·5 grm. of fulminate to cause detonation, and when exploded in a Trauzl lead cylinder it gives an expansion equal to two-thirds that of dynamite containing 75 per cent. of nitroglycerin.—B. J. S.

Explosive; Flameless ——, for guns; C. Duttenhofer. Fr. Pat. 364,413, March 19, 1906.

INDIFFERENT bodies such as vaseline and camphor when introduced into propellants, cause a lowering of the temperature of explosion, and hence prevent the formation of a flame. With explosives having a very high temperature of explosion, such as nitroglycerin and nitrocellulose, the quantity of vaseline required would be so large as to interfere with the ballistics of the powder. In this case, it is found advisable to introduce in addition a small quantity of an alkali carbonate, 1—2 per cent., with 5 per cent. of vaseline. The resulting powder has, it is stated, improved keeping qualities.—B. J. S.

Explosive, and apparatus for its practical use. W. Venier. Fr. Pat. 364,461, March 21, 1906.

A NEW detonator, prepared by passing acetylene or ethylene through an ammoniacal solution of mercury nitrate, is claimed for use in cap compositions. It is used in admixture with potassium chlorate and sulphur, or with aluminium, mercury fulminate, and potassium chlorate, owing to the fact that when used alone, the explosion is very local in character. Detailed drawings are given of the arrangements most suitable for the practical application of this explosive in caps.—B. J. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 870.)

APPARATUS, &c.

UNITED STATES PATENT.

Crucibles; Method of protecting ——. R. A. McDonald, Pittsburg, Pa. U.S. Pat. 828,954, Aug. 21, 1906.

ORDINARY plumbago or carbon crucibles are protected by applying a film or coating of clay or other non-carbonaceous material to their inner surfaces.—W. H. C.

INORGANIC—QUANTITATIVE.

Silver; The galvanometer as indicator in the volumetric determination of ——. M. Drapier. Bull. Soc. Chim. Belg., 1906, **20**, 148—149.

THE E.M.F. of a cell (lead—silver nitrate solution—silver) rises as the concentration of the silver salt decreases by the addition of hydrobromic acid, and a well-marked maximum is reached at the moment of complete precipitation. This indication of the end of the reaction is much sharper and easier to observe than the exact moment when another drop of precipitant fails to produce further turbidity. The silver electrode should be electrolytically coated with silver deposited from a cyanide solution.—J. T. D.

Zinc; Titration of ——, by the Schaffner process. Influence of ammonia and ammonium salts. A. Deckers. Bull. Soc. Chim. Belg., 1906, **20**, 164—167.

AMMONIUM salts in neutral or ammoniacal solution decompose sodium sulphide with evolution of hydrogen sulphide. They react similarly on freshly precipitated zinc sulphide, the intensity of the reaction increasing with the concentration of free ammonia. In the titration of zinc by sodium sulphide, therefore, not only must the assay and the known zinc solution contain equal amounts of ammonia and ammonium salts, but the amount of the latter must not be too considerable.—J. T. D.

Manganese; Determination of small quantities of ——, and a new method of formation of glycerose. N. Tarugi. Gaz. Chim. Ital., 1906, **36** [1], 332—347.

A COLORIMETRIC method for the determination of manganese may be based on the fact that manganous hydroxide is soluble in glycerol, and that the solution is oxidised by the air, or more rapidly by oxygen or sodium hypochlorite, with formation of a red coloration, the intensity of which depends upon the amount of manganese present. Five c.c. of a 1·1 per 1000 solution of manganese are treated with 3 c.c. of glycerol and 1 c.c. of a 50 per cent. solution of sodium hydroxide, and then a slow current of oxygen is passed through for 10 minutes, or 10 c.c. of a solution of sodium hypochlorite containing 3 per cent. of available chlorine are added. The colour is matched by means of standards prepared in a similar manner from a 3·16 per cent. solution of potassium permanganate. Iron and nickel have no influence on the reaction, and cobalt and copper interfere only when the concentration of the manganese is less than 1 per 1000. If sodium hypochlorite be used, it must not be too rich in available chlorine, otherwise the smallest traces of cobalt will interfere with the test.

The author has also observed that glycerol is converted into glycerose by sodium hypochlorite in presence of a drop of a 1 per 1000 solution of a cobalt salt. This is stated to be due not to a catalytic action of the cobalt salt, but to the formation of an unstable peroxide-like compound of cobalt as an intermediate product, recognised by the transient blue coloration produced. A similar formation of a peroxidised compound occurs even in absence of sodium hypochlorite with solutions of cobalt salts of over 2 per cent. strength; in presence of such solutions the red coloration of manganese salts with glycerol, caustic soda, and oxygen is not produced. The presence of copper salts in quantities of less than 1 per 1000 has no influence on the manganese reaction. If chromium, copper, and cobalt be present, however, it is best to heat the solution with ammonia and ammonium persulphate, when these metals remain in solution; the manganese precipitate can be filtered off, washed, dissolved in hydrochloric acid, and examined as described above.—A. S.

Oxidising substances [Potassium permanganate, potassium bichromate]; Determination of —— by means of hydrazine sulphate. L. Medri. Gaz. Chim. Ital., 1906, **36** [1], 373—378.

THE author is unable to confirm the statement of Roberto and Roncali (this J., 1904, 911), according to which 5 mols. of nitrogen are liberated for every 4 mols. of potassium permanganate, when the latter is heated with hydrazine sulphate (see also Petersen, this J., 1895, 772). Experiments in which 5 per cent. and 16·14 per 1000 solutions of permanganate were added to excess of 3 per cent. hydrazine sulphate solution in presence of 10 and of 50 per cent. sulphuric acid, gave the following results:—By the action of potassium permanganate solution on hydrazine sulphate solution acidified with sulphuric acid, the hydrazine is not completely oxidised; nitrogen is evolved in accordance with the equation: $17N_2H_4,H_2SO_4+13O=13H_2O+7(NH_4)_2SO_4+10N_2+10H_2SO_4$. The amount of sulphuric acid may be varied within wide limits, without

affecting the results. In absence of free sulphuric acid, the oxidation of the hydrazine sulphate proceeds further, but not to the extent stated by Roberto and Roncali (*loc. cit.*). The author states that hydrazine cannot be determined by means of permanganate, nor *vice versa*. Potassium bichromate, on the other hand, oxidises hydrazine completely (see Purgotti, Gaz. Chim. Ital., **26** [2], 559).—A. S.

Hydrogen peroxide and ferrous salts and other reducing agents [Sodium nitrite] ; Determination of ——. W. E. Mathewson and J. W. Calvin. Amer. Chem. J., 1906, **36**, 113—116.

THE solution of hydrogen peroxide is diluted with a known amount of water, so that its strength is reduced to about 0·2 *N* (0·3 per cent.). About 2 grms. of ferrous ammonium sulphate are weighed out, dissolved in a little water, and a few grms. of ammonium sulphate and some phosphoric acid added. A solution of titanium potassium sulphate, prepared by fusing the dioxide with potassium hydrogen sulphate, dissolving in cold dilute sulphuric acid, and filtering, is then added as indicator, and the mixture titrated with the hydrogen peroxide solution. The appearance of the deep yellow titanium trioxide marks the completion of the reaction.

The method may be employed for the determination of sodium nitrite, using a solution of hydrogen peroxide already standardised by this salt. To prevent loss of nitrous acid the approximate quantity of hydrogen peroxide, ascertained by a rough preliminary titration, should be added before the indicator.—F. SODN.

Phosphoric acid ; Causes of error in determining —— in natural phosphates and basic slags by the "citro-mechanical" method. E. Guerry and E. Toussaint. Bull. Soc. Chim. Belg., 1906, **20**, 167—198.

THE citric acid method is always liable to error through the co-precipitation of silica where it is present, and in all accurate analyses the silica should be first removed. The authors find, however, that the presence of ferric salts greatly retards the precipitation of silica, and for technical purposes the following method gives sufficiently accurate results :—2·5 grms. of the substance are mixed with 100 c.c. of water, 30 c.c. of nitro-hydrochloric acid are added, the liquid is boiled for half an hour, cooled, and made up to 250 c.c. To 25 c.c. of this solution are added 25 c.c. of solution of ferric chloride (4 grms. per litre), 50 c.c. of water, 30 c.c. of ammonium citrate solution (containing 10 grms. of citric acid), and 15 c.c. of ammonia (0·910). This is mechanically agitated for half an hour, whilst 50 c.c. of magnesia mixture are added drop by drop The precipitate is allowed to settle for an hour, filtered off, the beaker rinsed with water containing 10 per cent. of ammonia and 10 per cent. of the citrate solution, and the precipitate washed once with this liquid and afterwards with dilute ammonia as usual.

As a general method of decomposition, the use of sulphuric acid is recommended, which expels hydrofluoric acid, and renders the silica insoluble. The substance (2·5 grms.) is heated in a Jena flask or a platinum basin with 10 c.c. of concentrated sulphuric acid, shaking or stirring from time to time, till white fumes are evolved. After cooling, water is cautiously added to make the volume 100 c.c., then 25 c.c. of nitro-hydrochloric acid, the liquid boiled for 10 minutes, cooled, made up to 250 c.c., and filtered through a dry filter. Of this solution 25 c.c. are taken, 5—10 c.c. of the ferric chloride solution are added, the liquid nearly neutralised by ammonia, 30 c.c. of citrate solution and 15 c.c. of ammonia added, and the phosphate precipitated by 25 c.c. of magnesia mixture added during half an hour while mechanical agitation goes on.—J. T. D.

ORGANIC—QUALITATIVE.

Tanning matters ; Qualitative analysis of ——. M. Nierenstein. Chem.-Zeit., 1906, **30**, 868.

NOT only quebracho tannin, as previously reported (see page 898), but all pyrocatechol tanning matters yield a precipitate with diazobenzene chloride, whereas no pyrogallol-tannin gives the reaction. The reaction is carried out by adding to the cold solution of the tanning material, drop by drop, a ½-per cent. solution of diazobenzene chloride. The precipitate appears at once. The solution of the reagent may be kept unchanged for months in a brown glass bottle.—A. G. L.

Wood pulp ; Reagent for detecting mechanical ——. A. Bergé. Bull. Soc. Chim. Belg., 1906, **20**, 158—159.

THE author recommends the following reagent for the detection of mechanical wood pulp [lignocellulose] : *p*-nitraniline 0·2 grm. ; sulphuric acid at 66° B., 20 grms. ; water, 80 grms. Paper containing mechanical wood-cellulose is coloured orange with a brick-red shade. The coloration is easily recognised in the single fibres under the microscope, and the reagent gives no coloration with unbleached chemical pulp unless the boiling has been deficient. The solution will keep indefinitely.—J. F. B.

Thebaïne ; Reactions of ——. C. Reichard. Chem.-Zeit., 1906, **30**, Rep. 287 ; from Pharm. Zentral-H., 1906, **47**, 623.

ON rubbing together a few crystals of thebaïne and mercurous nitrate in a glazed porcelain mortar, and adding a few drops of water to the mixture, the latter assumes a blackish colour after half an hour or an hour. This reaction serves to distinguish thebaïne from narcotine, narceïne, and papaverine, or to detect thebaïne in a mixture of these bases.

Thebaïne may be distinguished from codeïne by means of its reaction with diphenylamine and sulphuric acid. On mixing a little diphenylamine with a few crystals of thebaïne on a porcelain tile, and adding a drop of cold concentrated sulphuric acid, the mixture immediately assumes a deep reddish-brown coloration, which slowly changes partly into green ; after the mixture has remained for 12 hours in the air, the colour changes to an intense violet-blue.—T. H. P.

ORGANIC—QUANTITATIVE.

Tannin analysis ; Use of chromed hide powder in ——. E. Nihoul. Bull. Soc. Chim. Belg., 1906, **20**, 236—240.

THE author has compared, using the I.A.L.T.C. method, samples of chromed hide powder with an old hide powder which had been kept for a year. He finds that from chromed powder containing 1 per cent. and 5 per cent. of chromic oxide respectively, distilled water only extracts about 2 mgrms. of soluble matter, as compared with 21 mgrms. from the old hide powder, in the 50 c.c. of the filtrate used for the determination of the non-tannins. Working with a standard solution of quebracho extract and 5·5 grms. of powder, almost exact results were obtained with the lightly chromed powder ; those from the hide powder as well as those from the heavily chromed preparation, were incorrect. With a larger weight (13 grms.) of the heavily chromed powder, good results were obtained ; but since good results are also obtained by the use of 5·5 grms. of lightly chromed powder, the author favours the adoption of the latter, providing it contain enough chromic oxide to keep well.—S. R. T.

Leather ; Determination of sulphuric acid in ——. L. Meunier. Collegium, 1906, 296—300.

THE following modification of the method of Nihoul and de Koninck (Monit. Scient., 1904, 504) gives good results. A hard glass tube about 50 cm. in length is bent, and drawn out at one end. A plug of glass wool is placed near the bend, next about 20 cm. of pure granulated calcium nitrate (prepared according to directions given by Nihoul and de Koninck), and then a mixture of small fragments of the leather and calcium nitrate. A current of oxygen is led through the open end of the tube, the bent delivery tube dipping beneath the surface of an alkaline solution. The portion of the tube containing calcium nitrate is now carefully heated, and subsequently the heating is extended to that portion containing the leather and nitrate. The leather burns easily in the presence of oxygen, and any volatile products escaping primary

combustion are burnt up by the calcium nitrate; the sulphuric acid formed is retained by the lime. When combustion is complete, the receiver containing the alkali is removed, and its contents evaporated to dryness in a platinum dish, incinerated over a spirit lamp, the residue dissolved in hydrochloric acid, and tested for sulphates. If the experiment has been properly carried out, these should be absent. When cool, the contents of the combustion tube are transferred to a beaker with water, and nitric acid neutralised if present. Hydrochloric acid is then added, and sulphuric acid is determined in the usual way. The process is accurate, but somewhat long and difficult on account of the large quantity of saline matter in the solution.

In the following method, these difficulties are obviated. The leather is burnt in oxygen in a Mahler's bomb calorimeter under a pressure of 30 atmospheres. Four pieces of about 20 mm. diameter and 2 grms. in weight, are punched out from different portions of the leather. A similar section is taken from each as an average sample for combustion, the remainder being used for the determination of moisture and normal sulphates, the latter by direct incineration without alkali. The sample for combustion is moistened with a 3 per cent. solution of potassium carbonate, and dried. Fifty c.c. of $N/10$ sodium carbonate solution are introduced into the bomb, and the sample is then placed in the platinum capsule and the bomb closed. The combustion is carried out in the usual way. After completion, the contents of the bomb and capsule are washed out and mixed, and, if necessary, filtered. When combustion has been complete, the filtrate will be colourless. It is acidified with hydrochloric acid, and evaporated to dryness in a porcelain dish. The residue is moistened with strong hydrochloric acid, and re-dried once or twice to expel nitric acid formed during the combustion. It is then dissolved in dilute acid, and the sulphuric acid precipitated as barium sulphate.

If A be the percentage of sulphuric anhydride calculated on the dry leather, B the percentage present in the ash as normal sulphate, and C the percentage corresponding to the average sulphuric acid content of the skin substance of leather, then $X = A - (B - C)$, where X is the percentage of sulphuric anhydride corresponding to the free acid of the leather. C must be experimentally determined once for all.—S. R. T.

Volatile fatty acids; Determination of soluble and insoluble —— [in butter]. J. Delaite and J. Legrand. Bull. Soc. Chim. Belg., 1906, **20**, 230—235.

To obtain concordant results in the determination of the Reichert-Meissl value, all the details of the process must be standardised; variations in any of the conditions lead to variations in the results. Especially the duration of saponification greatly influences the results; the longer the period the higher the Reichert-Meissl value obtained. The authors think this is due to de-polymerisation of the acids. Saponification by glycerol yields a lower value than saponification by alcohol, probably because at the higher temperature some of the acids are completely decomposed. The figure for insoluble acids, on the other hand, is always higher with glycerol than with alcohol; and the authors consider that in saponifying with glycerol, in using the Polenske process for cocoanut oil, there is always a liability to error.—J. T. D.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 871.)

Coagulation; Nature of ——. N. Pappadà. Gaz. Chim. Ital., 1906, **36** [2], 259—264.

The author's experiments on the coagulation, in dilute solution, of colloidal silicic acid, Prussian blue, copper ferrocyanide, and colloidal silver gave the following results: (1) Solutions of non-dissociated organic compounds have no coagulating action. (2) The coagulating action of electrolytes with monovalent cathions depends on the velocity of hydro-diffusion of the latter, and increases as this velocity increases. The following series gives the cathions arranged according to the decreasing magnitude of their coagulating actions: hydrogen, cæsium, rubidium, potassium, ammonium, sodium, lithium; the hydrogen ion is an exception as regards its action on silicic acid. (3) For electrolytes with bivalent cathions, the coagulating action varies in the same way in the same group of elements, but is greater than that of electrolytes with univalent cathions; and (4) the same holds for electrolytes with tervalent cathions.

The coagulating action of electrolytes depends also on the electric charge of the cathion, and, with solutions of chemically equivalent concentrations, increases with this charge.—T. H. P.

Desamido-casein. Z. H. Skraup and P. Hoernes. Monatsh. Chem., 1906, **27**, 631—652.

Nitrous acid reacts with albumins with evolution of nitrogen. According to Schiff, this nitrogen is derived from amido groups, $CONH_2$, whereas Paal has suggested that it is derived from the decomposition of free amino groups which are not coupled up in the form of peptide compounds. The authors have investigated the case of casein, and have obtained desamido-casein, a yellow body, as the product of the action of nitrous acid. In order to throw light on the above constitutional question they have made a complete study of the products of hydrolysis of desamido-casein. For instance, if any amino groups were present in casein in the free form, they should have been replaced by hydroxyl groups by the action of nitrous acid, and the residues containing them should appear amongst the products of hydrolysis in the form of hydroxy-acids. The authors, however, could detect no hydroxy-acids amongst these products. Desamidocasein on hydrolysis yields products very similar to those obtained from casein, with the exception that the tyrosine and the lysine which are obtained from casein are absent in the case of desamido-casein.—J. F. B.

Desamido-glutin. Z. H. Skraup. Monatsh. Chem., 1906, **27**, 653—662.

A study with gelatin on exactly similar lines to that on casein (see above), and leading to similar results, particularly as regards the absence of lysine from the products of hydrolysis.—J. F. B.

Casein; Some peptones obtained from ——. Z. H. Skraup and R. Witt. Monatsh. Chem., 1906, **27**, 663—684.—J. F. B.

Trade Report.

Italy; Tariff Modifications in ——.

Bd. of Trade J., Aug. 30 *and Sept.* 6, 1906.

The following are additions to the list of import duties given on page 871 of the Journal for Sept. 15:—

Tariff No.	Article.	Rate of duty. Per 100 kilos. Former.	Present.
		Lire cts.	Lire cts.
231	Arsenic, metallic	1 00	7 50
234	*Aluminium and its alloys with copper:—*		
	(a) Crude	5 00	80 00
	(b) Sheets, rods, and tubes	10 00	50 00
	(c) Wire	10 00	50—75 Lire
	(d) Manufactured	120 00	150 00
280	*Natural umber*	4 00	Free
307	Palm oil	4 00	Free
	Cocoanut oil	15 00	4 00 / 20 00
338 bis	*Paraffin candles**		
354 bis	*Celluloid:—*		
	(a) Rough, in lumps, or sheets or leaves not polished or otherwise worked	As fine cardboard	Free
	(b) Sheets, leaves, &c., polished, or subjected to other surface treatment		15 00

* Candles of stearine mixed with paraffin in a proportion exceeding 30 per cent are regarded as paraffin candles.

Additions to the tariff are printed in *italics*.

New Books.

THE CLAYWORKER'S HANDBOOK. A Manual for all engaged in the Manufacture of Articles from Clay. By the Author of "The Chemistry of Clayworking," &c. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1906. Price 6s. net.

8vo volume, containing 354 pages of subject matter with 33 illustrations, and including an Appendix with general information, tabular matter, and a bibliographic list of books on Clayworking, concluding with an alphabetical index.

The subject matter is classified under the following heads:—I. Materials used in Clayworking. II. Preparation of the Clay. III. Machinery. IV. Transport, Conveyors, &c. V. Drying and Driers. VI. Engobing and Glazing. VII. Setting and Charging. VIII. Kilns. IX. Firing. X. Discharging, Sorting, Packing, and Despatching. XI. Defects. XII. Waste. XIII. Tests, Analysis, and Control.

TECHNISCH-CHEMISCHES JAHRBUCH, 1904. Ein Bericht über die Fortschritte auf dem Gebiete der chemischen Technologie. Herausgegeben von Dr. Rudolf Biedermann. Druck und Verlag von Friedrich Viewèg und Sohn. 27'ster Jahrgang. 1906. Price M.12.

8vo volume, containing 642 pages of subject matter, with 50 illustrations, and an alphabetical index of names and subjects. The matters treated of in the text are as follows:—I. Iron. II. Aluminium and noble metals. III. Gold and Silver. IV. Copper. V. Zinc. VI. Lead. VII. Nickel, Manganese, and Chromium. VIII. Tin and other metals. IX. Sulphur and Sulphuric Acid. X. Alkali Industry. XI. Electro-chemistry. XII. Ammonia and Cyanogen Compounds. XIII. Alkaline Earths, &c. XIV. Gases. XV. Silicon, Carbon, Arsenic, and Antimony. XVI. Glass. XVII. Earthenware, &c. XVIII. Cement and Artificial Stone. XIX. Explosives and Matches. XX. Illuminants. XXI. Fuels, &c. XXII. Sugar. XXIII. Starch and Glucose. XXIV. Fermentation Industries. XXV. Fats, Soaps, and Resins. XXVI. Essential Oils and Scents. XXVII. Water. XXVIII. Foodstuffs. XXIX. Organic Products. XXX. Albuminoids, &c. XXXI. Dyestuffs. XXXII. Textile Industries. XXXIII. Paper. XXXIV. Photography. XXXV. Tanning and Glue, &c. XXXVI. Manures, &c., Disinfection. XXXVII. Apparatus. XXXVIII. New Books. XXXIX. Register of Patents, &c.

L'OZONE. Emile [illegible]. Professeur de Physique et de l'Electricité [illegible] Arts et Métiers de Lima (Pérou). H. Dunod et E. Pinat, 49, Quai des Grands-Augustins, Paris. 1906. Price 2 fr.

PAMPHLET, containing 24 pages of subject matter, and 9 illustrations.

The matters treated of are the following:—I. General Considerations and Discovery of Ozone. II. Nature and Production. III. Ozone in Nature, and Influence on Animal Life. IV. Ozone as Bactericide. V. Destruction of Miasma. VI. Ozone in Medicine. VII. Industrial Preparation by Electricity. VII. Sterilisation of Air and Water. IX. Industrial Applications of Water thus Sterilised. X. Ageing of Wine and Spirit. XI. Purification of Sugar Juice. XII. Bleaching of Starch, Textiles, &c.

I SOFFIONI BORACIFERI E LA INDUSTRIA DELL'ACIDO BORICO IN TOSCANA. Relazione del Prof. Raffaello Nasini. Pubblicata in Occasione del vi Congresso Internazionale di Chimica Applicata che si terrà in Roma nell'Aprile del 1906. Tipografia della R. Accademia dei Lincei. Roma. 1906.

4TO volume, containing 109 pages of subject matter, and an index. The latter part of the volume includes five pages devoted to a bibliographic index of works on the subject of Boric Acid. The text is illustrated with 55 engravings, and the subject matter is classified under the following heads:—I. Dedication to the Count Florestano de Larderel. II. General Description of the Boric Acid Regions. III. Description of the individual localities where Boric Acid is produced. IV. History of the Boric Acid Industry. V. Manufacture of Boric Acid and of other Products. VI. Statistical Notes on the Production of Crude and Refined Boric Acid, and on the Commercial Aspect of these Products. VII. Scientific Observations and Considerations. VIII. Appendix. IX. Bibliography.

ALKALI, &C., WORKS REGULATION ACTS, 1881 AND 1892. Forty-second Annual Report on Alkali, &c., Works, by the Chief Inspector. 289. Price 8d.

ACCORDING to this report the number of works now registered under the above-mentioned Acts in England, Ireland, and Wales is 1068; there are also 137 works registered in Scotland, bringing the total number of works registered in the United Kingdom to 1205. These numbers show an increase of 28 scheduled and registered works as compared with 1904.

JOURNAL OF THE

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

Official Notices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10*s.* (post free, 11*s.*). A second volume (1896—1905) is in preparation. The authors' name index is now in the press, and the subject matter index will follow in 1907. The whole will form a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10*s.* each copy, or 11*s.*, post free. A form of application for this purpose will shortly be issued.

CORRECTIONS FOR DECENNIAL INDEX.

Members are invited to call the attention of the Editor to any errors or omissions which they may have noticed in the Annual Indexes, 1896—1905, as soon as possible, in order that they may be put right in the Decennial Index.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

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Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 20,669. Price. Furnaces of tunnel dryers. Sept. 18.
,, 20,813. Baron, and Fuel Saving and Water Treating Co. Regulating the respective quantities of two liquids to be mixed as they flow. Sept. 19.
,, 20,894. Allison (Christ). Apparatus for separating substances of different specific gravities.* Sept. 20.
,, 20,918. Jury. Apparatus for producing extracts by diffusion and concentration. [Fr. Appl., Oct. 7, 1905.]* Sept. 20.
,, 21,337. Zeitlin. Mechanical production of high vacua. Sept. 26.
,, 21,424. Aktiebolaget Separator. Centrifugal separators. [Appl. in Sweden, Oct. 23, 1905.]* Sept. 27.
[C.S.] 18,877 (1905). Incandescent Heat Co., and Smallwood. *See under* X.
,, 21,116 (1905). Schmatolla. Vertical kilns. Sept. 26.
,, 10,187 (1906). Hemmerling. Filter presses. Oct. 3.
,, 10,852 (1906). Forsbach. Muffle furnaces. Sept. 26.
,, 11,877 (1906). Lanza. *See under* XII.

II.—FUEL, GAS, AND LIGHT.

[A.] 20,630. Reid. Apparatus for generating gas from liquid hydrocarbons. Sept. 17.
20,851. Ruane. Fuel for firing and heating furnaces. Sept. 20.
20,858. Pearson. Means for mixing combustible gases with steam, air, &c., and consuming them in furnaces.* Sept. 20.
20,953. Daudin. *See under* VIII.
21,284. Dowson. Manufacture of producer gas. Sept. 22.
[A.] 21,289. Koppers. *See under* III.
,, 21,493. Armstrong. Manufacture of coke and ovens therefor. Sept. 26.
,, 22,516. British Thomson-Houston Co. (Siemens Electrical Co.). Electrodes for electric arc lamps. Sept. 28.
,, 21,538. Wright. Coking ovens. Sept. 29.
,, 21,556. Hutchins. Gas-producer apparatus. Sept. 29.
,, 21,578. Jahoda, and Elektrische Glühlampfabrik. Manufacture of incandescing lamp filaments. Sept. 29.
[C.S.] 18,930 (1905). Boyd and McKay. Generation of power gas. Sept. 26.
,, 19,617 (1905). Bemelmans. Gas generator furnaces. Sept. 26.
,, 24,634 (1905). Still and Adamson. Incandescent gas mantles. Oct. 3.
,, 27,001 (1905). Hiby. Coke ovens. Oct. 3.
,, 3237 (1906). Miller. Burner for liquid combustibles. Sept. 26.
,, 8276 (1906). Bauke. Suction gas producers. Sept. 26.
,, 8778 (1906). Bauke. Suction gas generators. Sept. 26.
,, 10,945 (1906). Fitzpatrick (Weickart). Burner for liquid combustibles for producing a Bunsen flame. Sept. 26.
,, 12,076 (1906). Economic Safety Gas Co., and Fowler. Apparatus for producing carburetted air. Sept. 26.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 20,670. Wilson and Downing. Apparatus for vaporising petroleum and other fats and oils. Sept. 18.
,, 21,269. Koppers. Eliminating without danger the combustible but low grade gases of dry distillation or gasification. [Ger. Appl., Oct. 23, 1905.]* Sept. 25.
[C.S.] 19,502 (1905). Butterfield and Watson. *See under* XVIII*B*.
,, 3892 (1906). Thompson (Soc. d'Eclairage et de Chauffage proc. A. Guy). Vaporisation of petrol and other oils. Sept. 26.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 20,633. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series.* Sept. 17.
,, 20,802. Newton (Bayer und Co.). Manufacture of a new dyestuff of the oxazine series and its leuco-derivative. Sept. 19.
,, 20,837. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene compounds and colouring matters therefrom. Sept. 19.
,, 21,009. Lake (Farb. Mülheim vorm. Leonhardt und Co.). Manufacture of colouring matter. Sept. 21.
[C.S.] 22,513 (1905). Read Holliday and Sons, Turner and Dean. Manufacture of blue and black colouring matters. Oct. 3.
,, 23,740 (1905). Vidal. Production of colouring matters. Sept. 26.
,, 17,162 (1906). Kalle and Co. Manufacture of red colouring matters. Oct. 3.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 21,082. Evans. Process for dyeing cotton in union fabrics of cotton and wool. Sept. 22.
,, 21,444. Friedländer. Manufacture of artificial threads. [Ger. Appl., Sept. 23, 1905.]* Sept. 24.

[illegible] 21,363. [illegible] dyeing vegetable fibres.* Sept. 26.

" 21,374. Yates. Washing process and composition for dry cleaning fabrics.* Sept. 26.

" 21,502. Tyrone. Process in the finishing of linen, imitation silk, cotton, and like fabrics and materials. Sept. 29.

[C.S.] 25,893 (1905). Feilmann. Manufacture of products for use in dyeing and printing, and as pigments. Oct. 3.

" 8910 (1906). Lecœur.* *See under* VII.

" 12,938 (1906). Jahr. Drying loose wool yarn, &c., in the form of cops or strands. Oct. 3.

" 15,133 (1906). Thiele, and Soc. Gen. de la Soie Artificielle Linkmeyer. Method of producing cellulose threads. Sept. 26.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

[C.S.] 21,902 (1905). Pärr and Kopetz. *See under* IX.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 20,807. Humphrey. Separating and collecting the constituents of atmospheric air. Sept. 19.

" 21,182. Bambridge. Recovery of sulphur from the sulphur salts of the alkaline earths and metals. Sept. 25.

" 21,461. Garroway. Manufacture of acetate of alumina and by-products. Sept. 28.

[C.S.] 19,189 (1905). Stuart-Bailey. Manufacture of nitrate of soda and recovery of by-products. Sept. 26.

" 19,502 (1905). Butterfield and Watson. *See under* XVIIB.

" 27,009 (1905). Johnson (Badische Anilin und Soda Fabrik). *See under* XI.

" 8910 (1906). Lecœur. Purification of ammoniacal copper solutions. Sept. 26.

" 9971 (1906). Poulenc. Extraction of lithium as lithium carbonate from its ores. Oct. 3.

" 11,820 (1906). Berton. Kilns for burning lime. Oct. 3.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 20,955. Deselle. Regenerative gas furnaces for glass and other purposes.* Sept. 21.

[C.S.] 24,913 (1905). Gottlieb. Decoration of enamel, porcelain, glass, &c. Oct. 3.

" 25,639 (1905). Thornton, Sharp, Ingle and Stanley. Kilns for burning or fixing colours or glaze on glass, earthenware, &c. Sept. 26.

" 15,293 (1906). Chambers. Manufacture of glass. Sept. 26.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

[A.] 20,608. Ford. Manufacture of artificial stone. Sept. 17.

" 20,901. Hornell. Compositions for artificial marble, stone, and the like.* Sept. 20.

" 21,576. Hippa. Hardening and rendering durable coloured or uncoloured objects made of natural stone, plaster of Paris, magnesite, cement, and the like.* Sept. 29.

[C.S.] 19,471 (1906). Rowen. Manufacture of bricks. Sept. 26.

" 21,902 (1905). Pärr and Kopetz. Apparatus for impregnating or colouring wood. Sept. 26.

" [illegible] (1906). Smith, Tagye and Tagye. Cement. Oct. 3.

" [illegible] (1906). Hermann. Manufacture of a dust-[illegible] [illegible]

X.—METALLURGY.

[A.] 19,184 and 19,184A (1906). Tavernier. Manufacture of [illegible] Sept. 19.

" 20,520. Herdsman. Treating [illegible] powdered or small ore. Sept. 19.

" 21,110. Tucker. Recovery of zinc. Sept. 24.

" 21,423. Redruth Foundry Co., and Pryor. Apparatus for pulverising and amalgamating ore. Sept. 27.

" 21,440. McIvor and Fradd. Treatment of [illegible] residues. Sept. 27.

[C.S.] 18,877 (1905). Incandescent Heat Co., and Smal wood. Smelting, crucible, heating, annealing and like furnaces. Sept. 26.

" 19,198, 19,198A, and 19,198B (1905). Faschen Manufacture of metallic alloys. Oct. 3.

" 19,282 (1905). Claessen. Process for improvin aluminium alloys by heating and chilling. Oct.

" 19,781 (1905). Simpson. Method of refinin metals and apparatus therefor. Oct. 3.

" 19,781A (1905). Simpson. Crucibles for mixing an alloying metals. Oct. 3.

" 19,839 (1905). Worsey and Hoal. Treatment composite ores or zinc waste, and manufacture zinc white and other products. Oct. 3.

" 22,900 (1905). Enke. Sulphatisation of ores an their by-products. Oct. 3.

" 26,980 (1905). Heskett. Process for obtainin metals from their sulphides. Sept. 26.

" 3528 (1906). Day. Process for smelting ores an converting mattes. Sept. 26.

" 4199 (1906). Brunet. *See under* XXIIA.

" 9996 (1906). Defays. Manufacture of steel i Martin furnaces. Oct. 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 20,712. Roberts, Roberts and Jaffray. Electro deposition of metals and alloys.* Sept. 18.

" 20,716. Roberts, Roberts and Jaffray. Electro deposition of metals and their alloys.* Sept. 18.

" 21,081. Cowper-Coles. Manufacture of iron tube by electrodeposition. Sept. 22.

" 21,082. Cowper-Coles. Manufacture of iron cylinders, tubes, &c. Sept. 22.

" 21,100. Ashcroft. Electrolysis of haloid salts and compounds. Sept. 22.

" 21,336. Neville, Guye and Guye. Application of the electric arc for producing reactions in a gaseous mass. Sept. 26.

" 21,349. Cowper-Coles. Electrolytic production of copper wire, strip, or the like. Sept. 26.

" 21,416. Kjellin. Electrical furnaces. [Appl. in Sweden, March 5, 1906.]* Sept. 27.

" 21,583. Cowper-Coles. Electrolytic manufacture of metal wire, strip, or the like. Sept. 29.

[C.S.] 18,931 (1905). Ruzicka. Primary batteries. Sept. 26.

" 20,143 (1905). Whitehead and Marino. Treatment of wood to be used in electrochemical apparatus. Sept. 26.

" 20,500 (1905). Hatfield, and Reason Manufacturing Co. Mercury electrolytes for electrolytic cells. Oct. 3.

" 23,526 (1905). Platschick. Electrical furnaces. Sept. 26.

" 27,009 (1905). Johnson (Badische Anilin und Soda Fabrik). Electrolytic production of chromic acid. Sept. 26.

" 8452 (1906). Pauling. Electric furnaces for treating gases. Sept. 26.

" 10,219 (1906). Rink. Apparatus for the electrolytic decomposition of alkaline chloride solutions by means of mercury cathodes. Sept. 26.

" 10,316 (1906). Reilly. Submersible apparatus for electrically heating liquids. Sept. 26.

XII.—FATTY OILS, FATS, WAXES AND SOAP.

[A.] [illegible] Sept. 17.

[A.] 21,072. Pitchford and Knott. Liquid soap or detergent. Sept. 22.
„ 21,172. Boult (Van de Kerckhove). Treatment of vegetable oils.* Sept. 24.
[C.S.] 11,877 (1906). Lanza. Filtering apparatus, particularly adapted for the extraction of stearine from fatty acids in sulpho-oleic acid solution. Oct. 3.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

[A.] 20,702. Villard. Composition for paints. Sept. 18.
[C.S.] 19,190 (1905). Fireman. Manufacture of printing ink pigments. Oct. 3.
„ 19,839 (1905). Worsey and Hoal. *See under* X.
„ 25,693 (1905). Feilmann. *See under* V.
„ 4199 (1906). Brunet. Obtaining lithopone from complex ores and other substances. Sept. 20.

(C.)—INDIA-RUBBER.

[A.] 21,493. Claessen. Manufacture of masses of the nature of vulcanite or india-rubber.* Sept. 28.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 20,918. Jury. *See under* I.
[C.S.] 1850 (1906). Johnson (Badische Anilin und Soda Fabrik). Decolorisation of extracts containing tannin. Sept. 26.

XVI.—SUGAR, STARCH, GUM, &c.

[A.] 20,638. Cross and Briggs. Manufacture of xanthates of certain carbohydrates. Sept. 17.
„ 21,365. Calico Printers' Association, Browning and Barlow. Manufacture of soluble starch and dextrine. Sept. 27.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 20,936. West. Manufacture of alcohol from peat. Sept. 21.
„ 21,250. Sureties. Utilisation of spent hops. Sept. 25.
„ 21,326. Hellwig. Washing apparatus for spent malt or grain.* Sept. 26.
„ 21,567. Elektrochemische Werke. *See under* XX.
[C.S.] 18,636 (1905). House. Fermenting vats. Sept. 26.
„ 18,637 (1905). House. Mash tuns and infusion decoction and digester vessels. Sept. 26.
„ 26,041 (1905). Cowell. Treatment of malt. Oct. 3.
„ 5135 (1906). Vloeberghs. Process of fermentation. Sept. 26.
„ 9886 (1906). Pollak. Conversion of diastatic malt extracts into solid form for rendering same durable. Sept. 26.
„ 13,563 (1906). Nilsson and Jonson. Improving the quality of wine and the like. Sept. 26.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—FOODS.

[A.] 21,139. Michaëly. Manufacture of food for animals.* Sept. 24.

(B.)—SANITATION; WATER PURIFICATION.

[A.] 20,779. Guy. Manufacture of media for bacteria beds. Sept. 19.
„ 20,792. Hale. Treating, softening, and filtering water. Sept. 19.
„ 21,276. Taylor and Berry. Liquid sprinkler. Sept. 25.
[A.] 21,395. Carey and Lawrence. Method of treating softening, and purifying water. Sept. 27.
„ 21,444. Lyons. Apparatus for the bacteriologic treatment of fæcal matter, waste water, sewag and the like. Sept. 27.
[C.S.] 19,502 (1905). Butterfield and Watson. Destru tive distillation of sewage sludge and oth organic waste for the recovery of by-produc such as ammonia and oil, and utilisation of th residue. Oct. 3.
„ 26,527 (1905). Westfope and Cooper. Sterilisin softening, and heating water and other liquid and apparatus therefor. Sept. 26.

(C.)—DISINFECTANTS.

[A.] 20,680. Houghton. Antiseptic compounds. [U.S Appl., Sept. 25, 1905.]* Sept. 18.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 21,469. Jackson. Paper, and the manufactur thereof. Sept. 28.
[C.S.] 24,563 (1905). Pearson. Substance for renderin paper impervious to oil and grease. Oct. 3.
„ 10,228A (1906). Johnson (Badische Anilin un Soda Fabrik). Manufacture of substance resembling celluloid. Oct. 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 20,586. Daege, Knoll and Knoll. Manufacture o santalol carbonate.* Sept. 17.
„ 20,918. Jury. *See under* I.
„ 21,165. Johnson (Badische Anilin und Soda Fabrik) Manufacture of camphor. Sept. 24.
„ 21,171. Goldsmith, and British Xylonite Co Manufacture of camphor. Sept. 24.
„ 21,180. Goldsmith, and British Xylonite Co Manufacture of camphene. Sept. 24.
„ 21,567. Elektrochemische Werke. Process of de priving alcohols, and especially ethyl alcohol, o water. [Ger. Appl., Sept. 29, 1905.]* Sept. 29
[C.S.] 21,814 (1905). Spurge (Spurge). Manufacture o aldehydes. Oct. 3.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 21,189. Thornton. Photographic films. Sept. 25
„ 21,584. Neue Photographische Ges. Process fo converting silver pictures into pictures i higher oxides of manganese, and for toning silve pictures. [Ger. Appl., Oct. 12, 1905.]* Sept. 29
[C.S.] 13,032 (1905). Mallabar. Printing and developing photographs on silver chloride paper. Oct. 3.
„ 22,725 (1905). Zimmermann (Chem. Fabr. au Actien, vorm. E. Schering). Production o coloured photographs. Oct. 3.
„ 7935 (1906). Bloxam (Neue Photographische Ges.). Reproducing pictures by imprinting an original picture that has been treated with hydrogen peroxide. Sept. 26.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 20,889. Luis and Williamson. Explosives.* Sept. 20.
„ 21,240. Weyel. Explosive, and process of making same.* Sept. 25.
[C.S.] 437 (1906). Silbercad. Explosives for use in torpedoes and the like. Sept. 26.
„ 8304 (1906). Röhrecht. Manufacture of smokeless gunpowder. Oct. 3.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 21,342. Biddulph. Means of chemical analysis. Sept. 26.

Journal and Patent Literature.

I.—PLANT, APPARATUS, & MACHINERY.

(*Continued from page 875.*)

English Patents.

Atomising liquids; An improved machine for ——. P. Kestner, Lille, France. Eng. Pat. 20,697, Oct. 12, 1905.

A drum, formed of wire-gauze or parallel wires, is rotated at a high speed on an axis, and the liquid to be atomised is sprayed into the drum. The edges of the wires, on the outside of the drum, are sharpened, so that the liquid leaves the drum from the summits of very sharp angles or points. It is stated that with a drum 30 cm. diameter and 15 cm. deep, 20 tons of water have been atomised in an hour.—W. H. C.

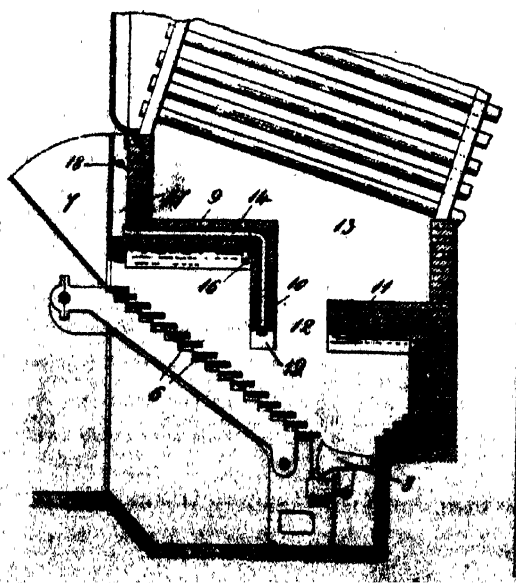
Boiler compositions [for preventing incrustation]. F. Smith and F. J. E. Smith, Grantham. Eng. Pat. 21,330, Oct. 20, 1905.

The claim is for a boiler composition composed of fluid extracts of bark, hemlock, and potatoes, mixed with sodium carbonate or a similar alkali. The extracts of bark and potatoes are made separately, by boiling with water, and the other ingredients are subsequently added. Twitch grass and grains may be added to the extract, if desired.—W. H. C.

Feed-water of steam boilers; Treatment of the ——. W. Clark, Hamilton, Lanarkshire. Eng. Pat. 22,148, Oct. 31, 1905.

The claim is for the process of treating the feed water with flue gases or with carbon dioxide, previous to its introduction into the boilers. This is effected either by spraying the feed water into the flue, and collecting the treated water in a reservoir, or by withdrawing the gases from the flue by a fan, and forcing them through the water in the feed tank.—W. H. C.

Smoke-consuming furnace. J. S. S. Fulton, New York. Eng. Pat. 24,620, Nov. 28, 1905. Under Int. Conv., April 10, 1905.



The fuel is fed from the hopper, 7, and passes down the inclined grate bars, 6, to the bottom, 5, whence the ashes are discharged. A primary supply of air reaches the fuel through the bars, 6, and the gases generated, along with the smoke, are deflected back upon the fuel by the walls, 9, 10, and 11. A secondary supply of air enters through the channel, 17, controlled by the damper, 18, and is heated by passing through a series of tubes, 14, set in the walls, 9 and 10. The tubes terminate alternately at the points indicated by the figures, 16 and 19, and the mixture of gases and air passes on through the opening, 12, into the combustion chamber, 13.—W. H. C.

Drying drums for drying sediments and other wet materials. E. Vial, Brussels. Eng. Pat. 5867, March 19, 1906.

See Fr. Pat. 364,291 of 1906; this J., 1906, 893.—T. F. B.

United States Patents.

Pyrometer. F. J. Albrecht, Pittsburg, Pa. U.S. Pat. 830,278, Sept. 4, 1906.

A composite tube, composed of an outer tube of brass and an inner tube of iron, which are rigidly fastened together at their outer ends by a nut, is attached to a casing containing a dial and pointer, and mechanism for operating the latter. The casing is formed of two sections provided with "lugs," by which they are held together, and has the inner end of the outer brass tube rigidly attached to it. The inner end of the iron tube projects beyond the end of the brass tube into the casing, and is attached by an arm and lever to the dial mechanism. The differential expansion of the two tubes of iron and brass under the influence of heat is indicated on the dial. —W. H. C.

Dryer; Revolving ——. R. C. Hills, Denver, Colo. U.S. Pat. 830,435, Sept. 4, 1906.

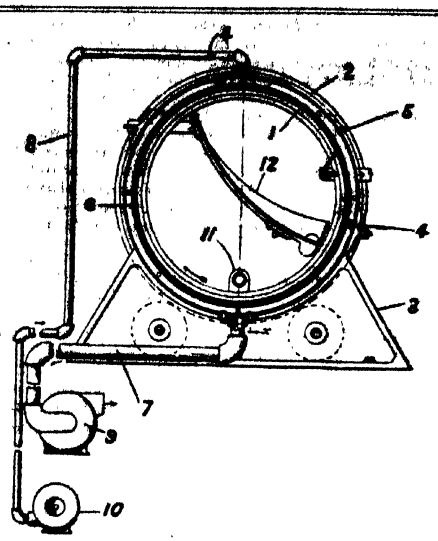
Two concentric cylinders, arranged so as to leave an annular space between them, are supported so that they can be rotated on rollers in a position slightly inclined to the horizontal. The materials to be dried are delivered on to a floor at the upper end of the cylinders, and are carried through the inner cylinder, and delivered at the lower end by ploughs or rabbles attached to an endless chain, which passes through the inner cylinder, and returns over the top of the outer cylinder on suitable rollers. The heating medium enters the annular space at the lower end, and leaves at the upper end.—W. H. C.

Dryer; Vacuum ——. E. Passburg, Berlin. U.S. Pat. 830,521, Sept. 11, 1906.

See Ger. Pat. 166,945 of 1903; this J., 1906, 933.—T. F. B.

Liquids from solids; Apparatus for separating ——. E. P. Starbird, Victorville, Cal. U.S. Pat. 830,624, Sept. 11, 1906.

The apparatus consists of an inner filter-cylinder, 1, which is rotated in the direction indicated by the arrow, and enclosed in an outer stationary cylindrical casing, 2, supported on the stand, 3. The annular space between the cylinders is divided by the partitions, 4, into an upper space, 5, and a lower space, 6. Suction is applied to the lower space, 6, through the pipe, 7, by the pump, 9, and air is forced by the pump, 10, through the pipe, 8, into the upper space, 5, producing a pressure. The liquid to be filtered is fed into the interior of the inner cylinder, which has open ends, by the pipe, 11, extending the whole length of the cylinder, and [illegible] of the filter. As the filter revolves the liquid is drawn through the filtering medium into the lower space, 6, and the solid portion remains behind, [illegible]



to the inner surface, from which it is loosened, as the cylinder continues to rotate, by the pressure in the space, 5, and is finally removed by the scraper, 12.—W. H. C.

FRENCH PATENTS.

Drying apparatus; Rotary ——. R. G. Poncet. Fr. Pat. 364,304, March 16, 1906.

A HORIZONTAL or inclined rotary cylinder is provided on its inner surface with a number of longitudinal shelves, which raise the material under treatment from the bottom of the cylinder, and allow it to descend on to a series of longitudinal tubes, mounted in the ends of the cylinder, and extending the whole length of same. These tubes, of any convenient section, have their walls extended tangentially to form longitudinal ledges, preferably helical in shape, by means of which the material is turned over, and discharged from one tube to the other, finally reaching the bottom of the cylinder, from which it is again raised by the aforesaid shelves. Means are provided for drawing a current of hot air through the cylinder.—C. S.

Drying pulverulent and other materials; Process and apparatus for ——. J. Savary. First Addition dated March 20, 1906, to Fr. Pat. 362,315, Jan. 10, 1906 (this J., 1906, 683).

THE addition consists in arranging the drying chambers in tiers, and in providing them with double-jacketed bottoms which are protected by an insulating covering. The materials to be dried are moved through the chambers by blades or stirrers, carried on hollow rotating shafts which pass through the chambers. The heating medium is caused to pass through the hollow shafts as well as through the jackets.—W. H. C.

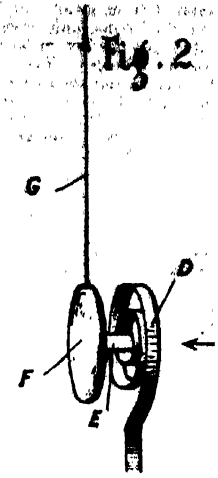
Clarifying liquids; Apparatus for mechanically ——. W. Rottmann, and J. A. Miller und Co. Fr. Pat. 365,265, March 29, 1906.

See Eng. Pat. 7878 of 1906; this J., 1906, 994.—T. F. B.

Radio-pyrometer; Expansion ——. C. Féry. Fr. Pat. 364,884, April 5, 1906.

TWO sliding tubes, A, B, are fitted at one end with a lens, C, and at the other with an eye-piece, J. At the focus of the lens, C, is placed a compound spiral, D (see Fig. 2), about 1 cm. long, 1 mm. wide, and 0·02 mm. thick, composed of strips of platinum and silver which expand unequally under the influence of heat. The spiral is supported on a light arm, H (Fig. 1), made of German silver or some other badly conducting metal, and has a disc, F, attached by a short bar, E, made of copper or some other good metallic conductor, to the other end. The face of the disc, F, which is turned towards the eye-piece, J, is polished to prevent radiation, and the other side, the spiral itself, and the connecting piece, E, are covered with lampblack to render them capable of easily absorbing heat rays. The apparatus is focussed by the rack and pinion, K, so that the heat rays from the object the temperature of which is to be determined, and toward which the lens, C, is directed, are concentrated upon th spiral, and a pointer, G, carried on the disc, F, indicates th temperature on the scale, I. The pyrometer is graduate by observing the point of fusion of bodies of know melting point, or by comparison with another therm meter.—W. H. C.

Fig. 2



GERMAN PATENT.

Evaporating apparatus; Vertical ——. A. Gude Ger. Pat. 169,243, May 20, 1905. Addition to Ge Pat. 160,670, Feb. 23, 1904.

IN the apparatus described in Ger. Pat. 160,670 (this J. 1905, 1162), the liquid to be evaporated was supplie to the heating tubes by means of a distributor, which fe it to pipes discharging vertically into a chamber belo the vertical heating tubes. It has been found that with thi arrangement the liquid rises more rapidly in the heatin tubes opposite the outlets of the supply pipes than in th others. To overcome this defect, it is proposed in th present patent to bend over horizontally the ends o the supply pipes leading from the distributor.—A. S.

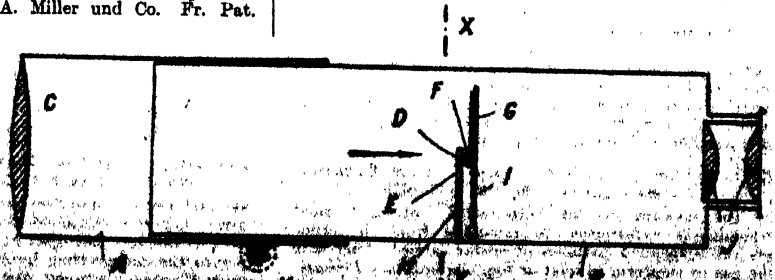
II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 878.)

Oils used for gas-making purposes; Composition an valuation of ——. R. Ross and J. P. Leather. Analyst 1906, 31, 284—298.

IN a former communication (this J. 1902, 676) the author showed the possibility of judging the value of an oil fo gas-making purposes by the results of certain chemica and physical tests. Since then they have made experi

Fig. 1



mental determinations of the value of different classes of hydrocarbons, and have examined a large number of typical gas-oils by methods substantially the same as those used before. Their results, given in detail, have led them to the following conclusions:—(1) Open chain compounds have the greatest value for gas-making purposes. (2) Double bonds in the chain reduce the value somewhat. (3) A considerable reduction in the value is caused by the presence of one or more rings. (4) Ring compounds are more valuable in proportion as they are more fully hydrogenised. (5) Benzene rings are practically valueless for "cracking" purposes.

As regards the relationship between specific gravity and refractive index, it was found that the specific refraction of open chain compounds, whether paraffin or olefine, was about 0·555 to 0·560. The specific refraction was reduced by the presence of a hexamethylene ring, and still more so by a saturated double ring, whilst, on the other hand, this value was increased to a considerable extent by the presence of an unsaturated ring, as in the case of tetrahydronaphthalene.

In illustrating the application of these conclusions, the authors here only compare the fractions boiling between 280° and 300° C., these being present in all the oils examined. In the case of Pennsylvanian oils the specific refraction of this fraction (0·556) was lower than in oils of other origin, and pointed to the presence of a large amount of paraffins and olefines. But the specific gravity of the oil (0·833) and that of the substance frozen out from ether-alcohol solution (0·849) indicated a mixture of paraffins, olefines, and "paraffinoid" bodies, *i.e.*, compounds with one or more long open chains, together with a hexamethylene ring, and this conclusion was confirmed by the high valuation figure of these oils (14,967 to 15,944). In like manner the same fraction from Russian oils was judged to consist, in the main, of paraffinoid compounds. Texas oil, in which the fraction had a sp. gr. of 0·895 and a specific refraction of 0·549, apparently contained a considerable amount of fully hydrogenised complex ring compounds not of a paraffinoid character—a conclusion confirmed by the valuation figure. In the case of Roumanian oils the average specific gravity (0·882) and specific refraction (0·557) of the fraction pointed to the presence of a considerable proportion of unsaturated ring compounds. Certain Roumanian oils, however, came between Russian and Pennsylvanian oils in their characteristics. Borneo oil was remarkable for containing a larger proportion of unsaturated and partially hydrogenised ring compounds than any of the other oils. This was shown by the high specific gravity (0·936) and low specific refraction (0·560) of the fraction, which were in accordance with the remarkably low valuation figure of the oil (7425 to 8067). Kansas oil, the fraction from which had a specific gravity of 0·850 and specific refraction of 0·555, was judged to be inferior to Pennsylvanian oil for gas-making purposes. Californian oil apparently contained a considerable amount of paraffins and paraffinoid compounds, together with some incompletely saturated compounds. The sample of Galician oil examined was concluded to contain a somewhat greater quantity of open chain compounds than the Russian oils did. Grosny oils resembled Russian oils, but were of less value for gas-making, probably owing to their containing less true paraffins and more paraffinoid substances. Scotch gas-oils yielded fractions of low specific gravity and high specific refraction (0·560), but the valuation figures were poorer than was anticipated from these constants. As these oils were the products of destructive distillation the authors inferred that they probably consisted of a considerable amount of olefines, together with substances containing benzene rings, the latter, judging by the low specific gravity, being probably of a paraffinoid character.—C. A. M.

Tar; Removal of —— from water gas. E. H. Earnshaw. J. Gas Lighting, 1906, 96, 637—639.

In the manufacture of carburetted water-gas, great difficulty is experienced in removing from the crude gas the suspended particles of oil or tar carried along with the gas in the form of mist or fog, the ordinary Pelouze-Audouin impingement extractor, used successfully with coal gas, being inefficient with the former gas. The author has made a series of experiments to ascertain how far it is possible by suitable modifications in the size of perforation and number of plates, to construct a modified Pelouze extractor which will also effectually remove the oil-tar fog, and as the outcome of these has ascertained that the most suitable size of perforation is ¼th in. diameter, and that with nine plates spaced ½ in. apart, a very effective separation of the oil-tar fog is obtained when the flow of gas is so regulated that a loss of pressure of about 1 in. per plate is experienced. The temperature of the gas for good working must not exceed about 100° F.—H. G. C.

Arseniuretted hydrogen; Removal of —— from crude hydrogen gas. O. Wentzki. Chem. Ind., 1906, 29, 405—406.

The hydrogen is passed upwards through a cylinder packed with a mixture of two parts of dry chloride of lime and one part of moist sand or other inert material. If the column of purification material be sufficiently high, the whole of the arsenic is retained. A small quantity of chlorine is set free, but can be easily removed by passing the hydrogen through a second cylinder packed with nearly dry slaked lime.—A. S.

Tantalum and the tantalum lamp. Werner von Bolton. XIB., page 937.

English Patents.

Briquettes from fuel, ores, and the like; Manufacture of ——. J. Noll, Frankfort-on-Maine, and E. Trainer, Wolfach, Germany. Eng. Pat. 12,516, June 16, 1905. Under Int. Conv., Sept. 14, 1904.

The refuse of lixiviated cellulose or wood-pulp is mixed with powdered coal, and the whole thoroughly dried; the powder is then subjected to a pressure equal to 500 kilos. per sq. c.m., the heat thereby produced rendering the mass plastic. Good results are obtained if one mixes with 100 parts of dry coal so much cellulose lixivium as will give 8—10 parts of dry residuum.—J. H. C.

Peat and similar fuel containing a large quantity of water; Method of and apparatus for partly coking —— in conjunction with coke ovens. Oberbayerische Kokswerke und Fabrik Chemischer Produkte A.-G., Benesberg, Bavaria. Eng. Pat. 5503, March 7, 1906. Under Int. Conv., May 20, 1905.

See Fr. Pat. 357,174 of 1905; this J., 1906, 19.—T. F. B.

Fire damp (methane) or other light gas or gases in mines or other places; Apparatus for detecting the presence and volume of ——. J. McCutcheon. Eng. Pat. 24,990, Dec. 1, 1905. XXIII., page 954.

Gas manufacture [Coal gas mixed with producer gas]. R. G. Shadbolt, Grantham, Lincs. Eng. Pat. 15,955, Aug. 22, 1905.

Coal gas is made by the usual method of carbonisation, and a portion of the gas from the producer is mixed simultaneously, whilst at a high temperature, with the gas passing from the retorts. To effect this, a pipe, coated with non-conducting material, is provided between the generator and the pipe which connects the hydraulic main and the foul gas main; the two gases mingle in the connecting pipe. The quantity of producer gas introduced is determined by the suction of the exhauster commonly employed, and in order that this quantity may vary with the quantity of retort gas passing, a water loading device is attached to the steam or compensating governor of the exhauster, and so arranged as to increase the speed of the exhauster as the make of coal gas increases, and *vice versâ*.—E. B.

Carburetting apparatus. E. Grunewald, Schoneberg, Germany. Eng. Pat. 12,129, May 24, 1906.

The carburetter comprises an outer vessel containing a series of narrow concentric tubes, one end of which is closed, the other end open at the bottom. The tubes dip into the evaporating liquid, and the gas to be carburetted passes between the outer [illegible]

arranged alternately at the top and at the bottom, ledges of porous material being placed between the tubes to force the gas to follow a helical or winding path.—R. L.

Carbon dioxide; Process for the elimination of —— from the gaseous combustion products of combustion engines. P. Wimand, Cologne. Eng. Pat. 3570, Feb. 13, 1906. Under Int. Conv., Feb. 18, 1905.

For condensing the gaseous combustion products of combustion engines, especially for use in submarines, the carbon dioxide contained in the gases is fixed by adding a base, either before or after the gases have performed their work. If a volatile base, as ammonia, be used, it may be evaporated under pressure, and thus made to perform work by expansion, either separately or in combination with the combustion gases. Sodium nitrate may be heated, yielding the oxygen required for combustion, together with sodium hydroxide, which can be dissolved and used to absorb the carbon dioxide. Or, alkali peroxide may be employed to supply oxygen, or to oxidise directly carbonaceous material, in both cases producing a base suitable for absorbing the carbon dioxide.—R. L.

Gas calorimeter. J. W. B. Stokes and D. Stewart & Co. (1902), Ltd. Eng. Pat. 21,872, Oct. 27, 1905. XXIII., page 953.

Gas analysis; Apparatus for ——. W. H. Sodeau and Brady and Martin, Ltd. Eng. Pat. 12,225, May 25, 1906. XXIII., page 954.

Temperature of materials; Compositions for use in raising and maintaining the —— in the manufacture of calcium carbide and other processes. H. L. Hartenstein, Constantine, Mich., U.S.A. Eng. Pat. 10,157, May 1, 1906.

See U.S. Pat. 819,218 of 1906; this J., 1906, 544.—T. F. B.

Carbide; Manufacture of ——. H. L. Hartenstein, Constantine, Mich., U.S.A. Eng. Pats. 10,158 and 10,160, May 1, 1906.

See U.S. Pats. 819,219 and 819,221 of 1906; this J., 1906, 544.—T. F. B.

Filaments for incandescing electric lamps; Manufacture of ——. J. R. Crawford, London. Eng. Pat. 14,898, July 19, 1905.

A filament composed of a conductor of the first class, e.g., a carbon filament, is immersed in a bath composed of a pure hydrocarbon, such as benzene, in which silicon tetraphenyl or boron or silicon triethylphenyl, or other "organic compound of a metal" has been dissolved. A current is then passed through the filament to raise it to incandescence, whereby graphitic carbon and the "metal" are deposited upon it as a dense coating.—H. B.

Filaments for electric incandescent lamps; Manufacture of ——. H. Zerning, Halensee, Germany. Eng. Pat. 2554, Feb. 1, 1906.

The filaments are formed of hydrogen or nitrogen compounds of chromium, molybdenum, or tungsten, used either separately or in admixture. These compounds are obtained by reduction of the corresponding oxides by zinc powder or by some other metal which has less affinity for oxygen than magnesium, aluminium, potassium, or sodium. The product obtained is purified by treatment with acid, and after mixing with an agglomerant is formed into filaments, which are heated in an inert atmosphere by an electric current. The current strength used is about double that which the filaments will subsequently be expected to carry when in use, and the heating may be continued in an atmosphere of nitrogen until nitrogen compounds of the metals are formed.—W. H. C.

Incandescent bodies for electric lighting; Manufacture of ——. J. Imray, London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 9548, April 19, 1905.

See Fr. Pat. 361,324 of 1906, following this.—T. F. B.

UNITED STATES PATENTS.

Fuel; Artificial ——. J. W. Leadbeater, Leeds. U.S. Pat. 830,086, Sept. 4, 1906.

See Fr. Pat. 364,305 of 1906, following these.—T. F. B.

Peat or turf; Apparatus for treating wet —— [for fuel making]. M. Ekenberg, Stockholm. U.S. Pat. 830,311, Sept. 4, 1906.

See Fr. Pat. 332,600 of 1903; this J., 1903, 1238.—T. F. B.

Fuel; Artificial —— and process of making same. V. J. Kuess, Tunis. U.S. Pat. 830,333, Sept. 4, 1906.

See Eng. Pat. 7481 of 1904; this J., 1904, 817.—T. F. B.

Gas; Apparatus for producing ——. W. A. Fourness, New York. U.S. Pat. 829,518, Aug. 28, 1906.

A gas generator, for making water-gas and producer gas, has a fuel-charging hole provided with a lid in its upper wall, and has a single outlet which communicates with two gas mains. The connection between the outlet and the mains is controlled by a valve in such a manner that on opening one passage, the other is closed. The generator is connected with a casing containing a heating chamber and a retort within this chamber. The heating chamber receives producer gas from the generator by a separate conduit, whilst the water-gas and producer gas issuing by the common outlet can be directed either to the retort or to the heating chamber by means of the controlling valve.—R. L.

Gas producer. W. B. Hughes, Philadelphia, Pa. U.S. Pat. 829,651, Aug. 28, 1906.

In a gas producer, a revolving body is combined with a revolving base, independent of the body, and a stationary ash receiver, into which the base extends, leaving an annular space between the latter and the receiver for the discharge of the ashes. Adjustable scrapers are arranged in the annular space for regulating the discharge.—R. L.

Gas; Apparatus for generating ——. M. D. Shaw and W. P. Rhody, Wapakoneta, Ohio. U.S. Pat. 830,015, Sept. 14, 1906.

"Crude oil" is forced from a store tank into a reservoir by a pump operated by compressed air. It is then forced by compressed air from the reservoir into flues set in a furnace, and a regulated proportion of compressed air is mixed with the oil as it enters the flues. Compressed air from an external source of supply is stored in a reservoir, from which it is distributed by a pipe having branches, controlled by valves, and leading to the oil pump, the oil reservoir, and the oil pipe to the flues. The gas generated in the flues is passed through a cooler, a scrubber, and a purifier on its way to the holder or main.—W. H. C.

Gas generator. W. H. Cone, Berlin, Ontario. Assignor to the Cone Gas Machine Co., Detroit, Mich. U.S. Pat. 830,883, Sept. 11, 1906.

The claim is for a gas generator, having a conical bottom to the "fire-pot" and a conical shaking grate superimposed on the bottom, and provided with a shaking handle. At the apex of the conical bottom there is a projecting cylindrical air-passage, or pipe, which is prolonged downwards, and communicates with an annular chamber into which air and steam can be introduced. The air-passage has a valve at the top, which is attached to a rod passing down the pipe, and which is raised or lowered by another rod, extending horizontally beyond the casing of the generator. At about the level of the top of the "fire-pot" is another annular air or steam chamber, having several lateral openings into the generator. A ring, with a series of holes corresponding to the above-mentioned openings, and which is situated in the annular chamber, can be adjusted by a handle from outside, so as to entirely or partially close the openings into the generator.—W. H. C.

Gas producer. W. E. Cook, Berlin, Canada, Assignor to the Cook Gas Machine Co., Detroit, Mich. U.S. Pat. 830,694, Sept. 11, 1906.

A "WATER-SECTION," with a central opening, and which is pierced by several gas-flues, is superimposed on the generator described in the preceding abstract. The "water-section" is covered by a dome, with a corresponding central opening, and is provided with water- and air-supply pipes and a valve-controlled vapour pipe, which passes down through the brickwork of the wall of the generator to the annular chamber surrounding the "fire-pot."—W. H. C.

Gas producer. G. Campion and M. Wyant, Anderson, Ind. U.S. Pat. 830,968, Sept. 11, 1906.

THE producer has a cylindrical upper portion, a conical intermediate portion, and a cylindrical lower portion, and is supported on "arc-form" piers over a central "water-bosh." It is provided with four ribbed, angular, inclined grates supported on pillars projecting upwards from the "water-bosh" and on ledges formed on the interior of the lower cylindrical wall of the producer. Four charging hoppers are arranged on the top of the producer, each one being placed immediately over one of the four grates.—W. H. C.

Coal gas; Process of treating —— for extracting tar, water, and ammonia. W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 830,983, Sept. 11, 1906.

SEE Fr. Pat. 360,528 of 1905; this J., 1906, 529.—T. F. B.

Storage vessels for liquid gases; Appliance for —— [to prevent freezing on discharge]. L. von Orth, Berlin, Assignor to Deutsche Schiffs Feuerlöschges., m.b.H., Bremen, Germany. U.S. Pat. 830,248, Sept. 4, 1906.

SEE Eng. Pat. 4694 of 1904; this J., 1904, 483.—T. F. B.

Filament; [Electric] Incandescent lamp ——, and method of making the same. J. M. Canello, Paris. U.S. Pat. 829,568, Aug. 28, 1906.

A FILAMENT for incandescence lamps having a core composed of the oxide of a rare earth, a continuous conducting coating of metal, and an outer coating of oxide, is made by incinerating a combustible thread impregnated with a rare earth compound, rendering it conducting by the application of a metallic deposit, heating it by passing an electric current through, and exposing the heated thread to reducing gases and to vapours of compounds of the ruthenium group. The filament is then subjected to the action of a thorium compound of acetylacetone, to form an outer coating of thorium oxide.—R. L.

FRENCH PATENTS.

Fuel; Artificial ——, and method of making the same. J. W. Leadbeater. Fr. Pat. 364,305, March 16, 1906.

THE briquettes are prepared with the aid of an enriching material composed of petroleum (approximately 56 per cent.), sawdust, peat, or other granular absorbent (26 per cent.), tar, pitch, resin, or wood tar (8 per cent.), and dry slaked lime (10 per cent.). The bulk of the sawdust is intimately mixed with the petroleum, the pitch, lime, and remainder of the sawdust being gradually added in succession, and incorporated in the mixer. The product is mixed with the substance forming the basis of the fuel; and when the whole is to be made into briquettes, a further proportion of the enriching material is incorporated after the fuel has passed through the heating apparatus, and before it reaches the moulds.—C. S.

Briquettes; Binding agent for ——. G. A. Besnard. Fr. Pat. 364,341, March 17, 1906.

[illegible] petroleum, vegetable gum, [illegible] are dissolved in [illegible] water, and [illegible] dust, lime, [illegible] the mixture [illegible] of [illegible] gas.

"Bûches de Noël" (Christmas logs); Manufacture of combustible bodies, known as ——. Bataille & Co. Fr. Pat. 365,393, April 11, 1906.

IN order to make the combustible bodies, known as "Bûches de Noël" (Christmas logs), sufficiently porous to avoid the production of carbon monoxide during the process of combustion, sodium bicarbonate or other body susceptible of partial or complete transformation into gas at the moment of carbonizing the combustible in a closed vessel, is added to the other ingredients in the course of the manufacture.—W. C. H.

Glue or size, and process of making the same. M. Bamiat. Fr. Pat. 365,285, April 14, 1906. XIV., page 962.

Gas retorts of refractory clay. T. Jerratsch. Fr. Pat. 365,162, April 11, 1906. Under Int. Conv., July 20, 1905.

A RETORT for the manufacture of illuminating gas has its extreme ends made as separate pieces. Thus the central part of the retort which is most exposed to the heat can be replaced separately, without replacing the end parts. These ends, which carry the mouthpieces, may have a rectangular or polygonal section where they are fixed in the masonry of the furnace, whilst at the other ends they have openings of the same shape as the cross-section of the central part of the retort. The body of the retort is thus relieved of the weight of the casings at the ends.—R. L.

Gas from rocks and other carbonated minerals; Process for the extraction of lighting and heating ——. S. and A. Seigle. Fr. Pat. 361,546, June 9, 1906.

POWDERED carbonates of lime or magnesia are mixed with powdered coal, or these ingredients may be compressed into balls with the addition of an agglomerant, and maintained at a suitable temperature in distillation retorts, or in producers constructed for the purpose, in such a way that in proportion as the carbon dioxide is liberated, it can take up a fresh equivalent of carbon, or in certain cases that arise, a fresh equivalent of hydrogen, under the action of hydrocarbon vapours or of hydrocarbons or powder of incandescent carbon, with or without the intervention of steam, in order to yield a combustible gas.—W. C. H.

Water-gas; Manufacture of ——. L. J. Terneden and J. M. Muller. Fr. Pat. 364,661, March 19, 1906.

THE improvements in the manufacture of water-gas, claimed are: The "blowing up" in parallel is so effected that the current or blast traverses a number of producers, at least equal to two, and the gasification in two or more producers arranged in series; the producers are worked in such a way that the gasification goes on only up to a certain height above the bottom of the products to be gasified, a height at which the gas is also drawn off; the producer is supplied with a circular gas collector, mounted either in the masonry of the producer, or outside it, in which case the gas collector can be advantageously cooled by water. The objects of these arrangements are to give uniformity to the production of gas, to diminish the amount of carbon dioxide in the gas, and to prevent the formation of clinker on the bars.—W. C. H.

Air and gas; Production of a mixture of —— for lighting purposes. Soc. par Actions pour l'éclairage [illegible]. Fr. Pat. 364,840, April 2, 1906. Under Int. Conv., April 4, 1905.

IN an apparatus for the production of mixtures of gas and air for lighting purposes, the orifices admitting gas and air into the aspiration chamber are provided with shutters, whereby their size can be varied, this regulation being controlled by a governor which is in direct communication with the aspiration chamber, and [illegible] regulated by the pressure prevailing in it. [illegible]

Gas; Combination of a generator for poor —— with a steam-generator. A. Guiot. Fr. Pat. 364,841, April 2, 1906.

The fire-box of a steam generator or boiler is transformed into a gas producer by closing it in, and burning the fuel with artificial draught. The poor gases produced serve at the same time for heating the boiler, and supplying motive power to a gas motor.—R. L.

Combustibles; Gasifying and superheating liquid ——. C. Heinrichsdorff. Fr. Pat. 364,891, April 4, 1906.

Liquid combustibles are gasified and superheated in an apparatus consisting of two concentric tubes, the space between them being divided into an upper and a lower chamber. The liquid enters the lower annular chamber, and passes through orifices into the inner tube, which, in its lower part, is filled with a granular filtering material such as sand, to retain residues of carbonisation. The liquid is then gasified, and passed through perforations in the upper half of the inner tube into the upper annular space, which is open at the end. The jacket spaces being filled with liquid and gas respectively, the heating of the bulk of liquid and the superheating of the vapours takes place more uniformly than by applying the heat direct to a single tube.—R. L.

Gas producer. E. Lorin. Fr. Pat. 364,893, April 4, 1906.

In a generator for the production of heating or illuminating gas, the blast-pipes supplying the necessary air are movable, so that they may penetrate the incandescent mass to varying depths, according to the quality of fuel burned. They are surrounded by water pipes, which cool and protect the air blowers from the fire. The steam generated can be blown into the generator together with the air. A movable dust chamber is provided in the exit opening of the generator, and the gases produced are conveyed through a tar separator, washer, and purifier. —R. L.

Gas producers for poor gases. J. L. M. Fornas. Fr. Pat. 364,970, April 5, 1906.

The poor gas formed is collected in an annular chamber round the base of the producer. This chamber is provided with a water-jacket, in which the steam required for the gas producer is generated, and which incidentally cools the lower part of the producer. The grate is protected by a layer of ashes.—R. L.

Gas; Process for the production of ——. Deutsche Bauke-Gas. Ges. m.b.H. Fr. Pat. 365,334, April 17, 1906.

According to this process for the production of power gas, the producer is worked at a comparatively low temperature, and the fire zone is maintained too shallow to yield a good water- or producer-gas, or mixture of the two, but the quality of the gas is raised to a suitable value by blowing into the reducing zone carburetted bodies, either as powder, or as vapour or gas, suitably mixed with air or steam. In cases where bituminous coals are used, the products of distillation, tar, &c., drawn from the upper part of the producer, are re-introduced into the fire zone, which is kept shallow to ensure regular working of the gas-producing process, after previous admixture with air or steam.—W. C. H.

Suction Gas Producer. Deutsche Bauke-Gas. Ges. m.b.H. Fr. Pat. 365,364, April 18, 1906.

The producer consists of an outer casing from near the top of which the gas is drawn off to the engine. Within this casing is another which extends downwards nearly as far as the grate bars; fuel is fed into the top of this inner casing, and there undergoes a process of distillation, the products of which are drawn off near the top and carried down by a pipe, provided with an injector, capable also of introducing steam or a mixture of steam and air, and forced into the bed of incandescent fuel on the grate bars. Near the lower end, and nearly filling the inner casing, is a hollow inverted cone, which can be raised, lowered, or screwed by suitable mechanism from without. The object of this cone is to increase by its movement the regular distribution of the air-supply, and thereby distillation, and as the cone is hollow and open at the bottom, the distillation is favoured by the heat radiated from the reducing zone of the producer, which reaches the combustible through the wall of the cone. (See also Fr. Pat. 363,348, Feb. 16, 1906; this J., 1906, 342.)—W. C. H.

Gases or vapours; Apparatus for the elimination of impurities from ——. R. Scheibe. Fr. Pat. 365,065, April 7, 1906.

The invention consists essentially in the introduction of a rotary fan or blower into the main or flue through which the gases or vapours pass from the generators to the place of use. The rotation is effected either by the passage of the gas itself, or by external mechanism, and the centrifugal force throws the impurities either through a perforated casing, or directly on to the walls of the chamber in which the fan works, and from which they are removed. —W. H. C.

Gas calorimeter. H. L. Doherty. Fr. Pat. 365,214, April 13, 1906.

See Eng. Pat. 8866 of 1906; this J., 1906, 633.—T. F. B.

Incandescence mantles; Manufacture of ——. H. L. Cossard. Fr. Pat. 364,754, March 30, 1906.

A mixture of thorium nitrate, 1000 grms.; cerium nitrate, 10 grms.; and beryllium nitrate, 2·5 grms., is placed in a flask and treated with ammonia gas obtained from "the aqueous solution of ammonia liquefying at −40° under atmospheric pressure." The product is then "hydrated," and, after washing, the "solution" of oxide is used for impregnating a fabric woven from cotton and natural silk. This is dried rapidly at 50°—60° C., and then burned off.—H. B.

Incandescence mantle for automatic ignition. Fischel und Pick, and G. Imiela. Fr. Pat. 364,839, April 2, 1906. Under Int. Conv., Aug. 2, 1905.

An igniting body, consisting of alumina and platinum black, is applied to the interior of the mantle at not more than 3 cm. above the mouth of the burner, and is connected to several igniting strips or lines formed from ammonium chloroplatinate or the like.—H. B.

Incandescence mantles for gas burners. J. E. T. Woods and M. von Schmidt. Fr. Pat. 365,341, April 17, 1906. Under Int. Conv., April 17, 1905.

See Eng. Pat. 8162 of 1905; this J., 1906, 213.—T. F. B.

Incandescence lamps; Process of increasing the electric resistance of certain metals, especially those used for glow-bodies of ——. H. Kuzel. Fr. Pat. 364,613, March 27, 1906. Under Int. Conv., July 26, 1905.

The metallic glow-body, consisting of chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, platinum, osmium, or iridium, whether in the colloidal or crystalline (wire-drawn) state, is heated to whiteness in an indifferent atmosphere whilst in contact with small quantities of boron, silicon, or carbon, or compounds capable of liberating these elements. The metal absorbs a certain amount of the boron, silicon, or carbon, whereby its resistance is increased. The boron, &c., may be applied in the gaseous form (as boron hydride, &c.), mixed with an inert gas, or as a liquid, in which the incandescent metal is immersed.—H. B.

Glow-bodies for electric lighting; Manufacture of ——. Siemens und Halske A.-G. Fr. Pat. 364,925, April 5, 1906. Under Int. Conv., April 8, 1905.

A wire, of rolled or wire-drawn metal, is transformed from the surface inwards into a chemical compound of increased electrical resistance, by causing the wire to absorb substances capable of forming chemical compounds with it. For example, a wire of tantalum is stretched, upon a support, such as is used in a tantalum lamp, and is immersed in a liquid capable of being carbonised, such as petroleum or benzol, whilst heated to incandescence by means of an electric current. Carbide of tantalum is

formed progressively from the surface towards the centre of the wire, and the treatment is stopped when the desired resistance is reached.—H. B.

Incandescence electric lamps with metallic filaments; Manufacture of ——. Deutsche Gasglühlicht. A.-G. (Auergesellsch.). Fr. Pat. 365,185, April 12, 1906.

The breaking of the filament in a metallic-filament lamp seems to be due to the fritting of the filament on to its supports, owing to the deposition at such points of the metallic particles liberated by the disintegrating action of the current. To obviate this defect, the patentees provide the lamp internally beforehand with surfaces carrying a slight metallic deposit, which offers numerous points on which the pulverised metal may collect, instead of upon the filament. To provide such surfaces, for example, the bulb, before it is sealed, is filled with hydrogen at a pressure of a few millimetres, and the electric current is passed through the filament. In a few minutes, disintegration of the filament substance occurs, and a deposit is formed on the various surfaces inside the lamp. If the supports for the filament are white, the formation of the deposit is indicated by the appearance of a greyish colour. The hydrogen is then removed from the bulb.
—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 879.)

Benzene; Determination of carbon bisulphide and total sulphur in ——. E. S. Johnson. XXIII., page 955.

Oils used for gas-making purposes; Composition and valuation of ——. R. Ross and J. P. Leather. II., page 916.

United States Patent.

Wood, peat and the like; Process for charring —— C. J. R. Müller, Sundyberg, Sweden. U.S. Pat. 830,352, Sept. 4, 1906.

See Fr. Pat. 351,209 of 1905; this J., 1905, 839.—T. F. B.

French Patents.

Ammonium nitrate; Manufacture of —— [*from distillation gases*]. W. Feld. Fr. Pat. 365,409, April 19, 1906. VII., page 928.

Ferrocyanides; Process for obtaining —— *from gases of distillation.* W. Feld. Fr. Pat. 365,410, April 19, 1906. VII., page 928.

Mineral oils; Process and apparatus for refining ——. The Alcohol Syndicate, Ltd. First Addition, dated Nov. 30, 1905, to Fr. Pat. 325,636, Oct. 27, 1902.

See Eng. Pat. 28,243 of 1904; this J., 1905, 1294.—T. F. B.

Distilling apparatus [*for petroleum, &c.*]. Dampfkessel- und Gasometerfabr. vorm. A. Wilcke and Co. Fr. Pat. 363,993, March 9, 1906. Under Int. Conv., July 29, 1905.

A still is connected with a column and a condenser by two pipes, each of which is fitted with a tap, to enable the vapours liberated in the still to be diverted at will into the column or the condenser, according as the vapours are furnished by substances of low or high boiling point.
—C. S.

Petroleum; Process for extracting —— *from outcrops of bituminous rock.* K. Rudeloff. Fr. Pat. 364,431, March 30, 1906. Under Int. Conv., March 31, 1905.

Compressed [air] into the outcrop is mixed with fuel, which is also introduced into the [bituminous] rock. The outcrop being covered up, the impervious material is pierced [to prevent loss by evaporation], the fuel is ignited, and the petroleum which distils out is collected in pipes or gutters (previously arranged within and upon the surface of the rock). Means are provided for admitting air to the burning fuel, and also for pumping or conveying the oil to the surface.—C. S.

Distilling hydrocarbonaceous substances; Process and apparatus for ——. American Eduction Co. Fr. Pat. 365,168, April 12, 1906.

See U.S. Pat. 821,323 of 1906; this J., 1906, 584.—T. F. B.

Lubricating oil which emits no odour or even has an agreeable odour on burning. A. Haenflein and L. Kornfeld. Fr. Pat. 365,335, April 17, 1906. XII., page 933.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 880.)

Nitrophenolsulphonic acids; Contribution to the knowledge of ——. R. Gnehm and O. Knecht. J. prakt. Chem., 1906, **74**, 92—111.

o-Nitroanisol-p-sulphonic acid is obtained quantitatively by mixing molecular proportions of *o*-nitroanisol and chlorosulphonic acid at the ordinary temperature. The new acid dissolves in anhydrous ethyl acetate, and very readily in water, crystallising from the latter in lustrous transparent plates. By treatment with phosphorus pentachloride, *o*-nitroanisolsulphonchloride, m. pt. 66° C., is prepared, and this substance yields a sulphonamide m. pt. 146·3° C., which is identical with the product obtained by Franklin (see Amer. Chem. J., 1896, **19**, 463) by the nitration of anisol-*p*-sulphonic acid. The sulphonic group in the above acid must, therefore, be in the *p*-position. By reduction of the nitrosulphonic acid with tin and hydrochloric acid, *o*-anisidine-*p*-sulphonic acid is obtained. This easily soluble substance when diazotised and combined with β-naphthol in alkaline solution produces a bluish-red dyestuff. By complete reduction with tin and hydrochloric acid the sulphonchloride is converted into *p*-methoxy-*m*-aminothiophenolhydrochloride ($ClNH_3$)(OCH_3).C_6H_3.SH[OCH_3:NH_3Cl:SH = 1:2:4], which crystallises in odourless white needles, m.pt. 230°—235° C. This hydrochloride is an unstable substance which has a great tendency to go over by oxidation into the hydrochloride of the corresponding disulphide. The latter substance, however, is readily diazotised, and forms a yellow diazonium solution, which combines with β-naphthol in alkaline solution to form a crimson azo dyestuff.

The authors attempted to prepare sulphurised thiazines by condensing *p*-methoxy-*m*-aminothiophenolhydrochloride with dimethyl-*p*-phenylenediaminethiosulphonic acid. A very impure reaction product was obtained, from which a homogeneous substance could not be isolated. The blue coppery powder finally prepared by partial purification of the crude mass appeared to be intermediate between a thiazine and a sulphide dyestuff. It possesses a great affinity for tannin-mordanted cotton, on which it is stated to produce bright sky-blue shades of great fastness to washing. On the other hand, it does not form a hydrochloride, and if dyed on untreated cotton with the addition of sodium sulphide, fairly deep but not very fast blue shades are obtained after oxidation in the air.
—F. L.

Brazilin and Haematoxylin. J. Herzig and J. Pollack. Monatsh. Chem., 1906, **27**, 763—771.

In referring to the different formulæ which have been proposed for brazilin, the authors mention, that in view of their observations on the behaviour of tetraethyl-brazilone and tetramethylhæmatoxylin with hydroxylamine and phenylhydrazine, they prefer to adopt a formula of structure [illegible]

with acetic anhydride, sodium acetate, and zinc dust, a reduced acetyl compound, $C_{23}H_{19}N_3O_3(OCH_3)_4$, is obtained, analogous with the substance prepared in a similar manner from trimethylbrasilone. It crystallises from alcohol in white needles melting at 188°—192° C. The transformation product obtained by treating tetramethylhæmatoxylone with cold sulphuric acid is described. It contains a highly acid hydroxyl group, does not react with hydroxylamine and phenylhydrazine, and yields a methyl ether melting at 99°—101° C. which can be readily hydrolysed with alkali. The compounds obtained by nitrating the transformation products of trimethylbrasilone and tetramethylhæmatoxylone are described.—D. B.

Saponarin, a new glucoside, coloured blue with iodine. G. Barger. XX., page 951

English Patents.

Indigo; Manufacture of —— from phenylglycine or its derivatives. A. G. Bloxam, London. From F. Becker, Friedenau, Germany. Eng. Pat. 19,353, Sept. 25, 1905.

It is found that the formation of products, easily converted into indigo, by the action of sodium amide and sodium cyanide on phenylglycine or its derivatives, is primarily due to the presence of disodium cyanamide. The present process consists, therefore, in introducing equal weights of disodium cyanamide and phenylglycine into a crucible heated to 300°—400° C., treating the mass, when cool, with water, and blowing air through the solution. The yield of indigo is stated to be nearly quantitative.—T.F.B.

Indophenol [for sulphide dyestuffs]; Manufacture of an ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,000, Dec. 27, 1905.

In the preparation of the indophenol, $NH_2.C_6H_4.N:C_6H_4:O$, by the joint oxidation of paraphenylenediamine and phenol, it is claimed that good yields are obtained by using certain insoluble metal peroxides, *e.g.*, lead peroxide or manganese dioxide, as oxidising agents, especially in presence of a substance, such as disodium hydrogen phosphate, which facilitates the oxidising action of the peroxide. For example, 11 parts of paraphenylenediamine and 10 parts of phenol are dissolved in 1500—2000 parts of water, and the solution is treated, with agitation, with a paste containing 48 parts of lead peroxide, 50 parts of disodium hydrogen phosphate, and 35 parts of sodium bicarbonate; the last-named substance is for the purpose of rendering the mixture faintly alkaline. The precipitate is filtered off, and the indophenol extracted from it by alcohol or hot water; the resulting solution may be used directly in the manufacture of sulphide dyestuffs.—A. S.

Colour lakes [from azo dyestuffs]; Manufacture of ——. O. Imray. From Meister, Lucius, und Brüning. Eng. Pat. 27,252, Dec. 30, 1905. XIII*A*., page 939.

Azo dyestuffs; Manufacture of yellow ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 2622, Feb. 2, 1906.

Yellow dyestuffs, stated to be very fast to light, are produced by combining diazotised *m*-xylidine-*o*-sulphonic acid $[(CH_3)_2:NH_2:SO_3H = 1:3:4:5]$ with 1-sulphoaryl-3-methyl-5-pyrazolones or with 1-sulphoaryl-5-pyrazolone-3-carboxylic acids. The same compounds are obtained by sulphonating the reaction products of diazotised *m*-xylidine-*o*-sulphonic acid with 1-aryl-3-methyl-5-pyrazolones or 1-aryl-5-pyrazolone-3-carboxylic acids.—H. L.

Dyestuff; Manufacture of an [azo] ——, and colour lakes made therefrom. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/ Main, Germany. Eng. Pat. 9989, April 28, 1906. Under Int. Conv., May 18, 1905.

Diaminoxylylmethanes, obtained by condensing xylidine with formaldehyde, are diazotised with 2 mols. of nitrous acid and combined with 2 mols. of "2.3 acid" (naphthol-sulphonic acid $OH:SO_3H = 1:2:4$-naphthol-3-sulphonic acid). The resulting dyestuff is stated to be particularly adapted, on the preparation of lakes in the usual manner, these are said to be absolutely fast to water, and to possess very pure, brilliant blue-red shades. (See Eng. Pat. 15,386 of 1892; this J., 1893, 754.)—T. F. B.

Naphthalene derivatives; Manufacture of new colouring matters [Azo dyestuffs] from ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7287, March 26, 1906.

Azo dyestuffs giving red to violet shades, fast to light, are obtained by combining monoalkyl-ethers of 1.4-dihydroxynaphthalene with sulphonated diazo- and tetrazo-compounds of the benzene and naphthalene series. For instance, the diazo solution from 17·3 parts of metanilic acid is run into a solution containing 17·4 parts of the sodium salt of the monomethyl-ether of 1.4-dihydroxynaphthalene, together with sufficient sodium carbonate to render the solution alkaline, the mixture being stirred, and cooled to 0° C. The dyestuff is recovered by salting out. It dyes wool very level bluish-red shades.—A. S.

Naphthalene derivatives; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 7287*A*, March 26, 1906.

Monoalkylethers of 1.4-dihydroxynaphthalene are prepared by heating 1.4-dihydroxynaphthalene with alcohol and a mineral acid.—H. L.

Thioindoxylcarboxylic acid; Manufacture of a sulphur-containing red colouring matter from ——, and from Thioindoxyl. Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 14,057, June 19, 1906. Under Int. Conv., Dec. 22, 1905.

Thioindoxylcarboxylic acid or thioindoxyl are converted into the corresponding red dyestuff, which contains sulphur, by heating with sulphur, sulphuretted hydrogen being evolved.—H. L.

United States Patent.

Ortho-oxymonoazo dye [Azo dyestuff], and process of making same ——. K. Schirmacher, F. Schmidt, C. Pretzell, and W. Schumacher, Assignors to Farbw. vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. U.S. Pat. 827,468, July 31, 1906.

The process is claimed for preparing *o*-oxymonoazo dyestuffs from chromotropic acid and diazotised *o*-amino-oxybenzene derivatives containing no sulpho-group, which consists in causing these bodies to act upon each other in presence of hydroxides of elements forming "the five middle members of the second group of the periodic system." The bluish-red dyestuff formed by the combination above referred to is claimed as a new product (see this J., 1906, 471).—H. L.

French Patents.

Phenylnaphthimidazole; Process of making aminohydroxylated derivatives of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,543, June 8, 1905.

See Eng. Pat. 11,759 of 1905; this J., 1906, 215.—T. F. B.

Dyestuffs; Process for making new monoazo ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 365,040, April 9, 1906.

Aminosulphonic acids of the benzene or naphthalene series are diazotised, and combined with 1.4-dihydro-2.6-phenylenediamine; the resulting dyestuffs dye wool from acid baths in yellow to orange shades, of satisfactory fastness to light and acids.—T. F. B.

Dyestuffs; Production of azo —— susceptible to shrinking on the fibre. Soc. pour l'Industrie Chimique à Bâle. Second Addition, dated June 19, 1905, to Fr. Pat. 355,188, Jan. 4, 1905.

The presence of certain organic compounds, such as glycerol, glycerol, invidine, and sorbine, has been found to

increases greatly the power of combination of *o*-diazonaphthylamine-sulphonic acids with other components. When alcohol is employed, diazotisation may also take place in alcoholic suspension. 24 kilos. of 1.2.4-aminonaphtholsulphonic acid, previously acetylated in the hydroxyl group, as described in the principal patent (this J., 1905, 849), are dissolved by means of 7 kilos. of sodium nitrite, the acetyl group is eliminated (either by long standing, or by neutralising with sodium hydroxide), and the solution is added to a solution of 16 kilos. of 1.5-dihydroxynaphthalene, 25 kilos. of caustic soda solution, 30° B., and 100 kilos. of pyridine; the formation of the dyestuff commences immediately; after two hours the product is diluted, and the dyestuff precipitated by acetic acid or a mineral acid. It dyes wool in violet shades, transformed on after-chroming into very fast greenish-black shades. The combination of similar diazonium compounds with α-naphthol, β-naphthol, 1.8-dihydroxynaphthalene, 1.5-naphtholsulphonic acid, and 1.6-aminonaphthol is also described. (See also this J., 1905, 1168.)—T. F. B.

Indigo; Process for making ——. A. Rahtjen. Fr. Pat. 365,109, Feb. 17, 1906. Under Int. Conv., March 6, 1905.

INDIGO can be formed quantitatively from α-isatinanilide by treatment with hydrogen sulphide, in neutral or alkaline suspension, at temperatures between 25° and 70° C. At lower temperatures indigo is not formed directly, but the product (probably α-thioisatin) can be readily converted into indigo. Hydrogen sulphide may, for example, be passed into a solution of 10 parts of α-isatinanilide in 30—40 parts of alcohol, at the ordinary temperature, until the solution is decolorised; after dilution, the indigo is precipitated by means of air or other oxidising agent, alone or in presence of alkali, or by addition of alkalis or acids. Indigo may be produced directly by passing hydrogen sulphide into an aqueous suspension of α-isatinanilide at a temperature of 50° C. The sulphur can be removed from the indigo by any suitable method. —T. F. B.

1.8-Arylaminonaphtholsulphonic acids; Production of ——, *and of azo dyestuffs derived therefrom.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 364,004, March 9, 1906. Under Int. Conv., April 26, 1905.

THE preparation is claimed of 1.8-arylaminonaphtholsulphonic acids by heating 1.8-aminonaphtholsulphonic acids or their salts with an aromatic base in the presence of water, and of azo dyestuffs by combining these substances with diazo compounds. Arylation may be carried out with or without the addition of a condensing agent or of a salt of the aromatic amine. Example: 341 parts of 1.8-aminonaphthol-3.6-disulphonic acid, 200 parts of aniline, and 1000 parts of water are heated to 140° C. for 48 hours. The mass is then made alkaline, and the excess of aniline driven off with steam. After neutralising, 1.8-phenylaminonaphthol-3.6-disulphonic acid is precipitated with salt in the form of white needles. The shades of a number of the combinations made with the above and other 1.8-arylaminonaphtholsulphonic acids by the process claimed are shown in the following table:—

Dyestuff.		Shade produced on wool.
p-nitraniline α-naphthylamine β-naphthylamine diphenylaniline *o*-anisidine aminoazobenzene	+ 1.8-phenylaminonaphthol-3.6-disulphonic acid	Black Blue black Violet black Violet black. Violet Black
p-nitraniline α-naphthylamine aniline	+ 1.8-*p*-tolylaminonaphthol-3.6-disulphonic acid	Black Blue black Violet black
α-naphthylamine 1.4-nitronaphthylamine-8-sulphonic acid [illegible]	+ 1.8-phenylaminonaphthol-4.6-disulphonic acid	Violet Blue black Violet-black
[illegible]	[illegible]	Blue black
[illegible]	[illegible]	Black Violet
[illegible]	[illegible]	Black Violet

Anthracene series; Production of dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 364,219, March 13, 1906. Under Int. Conv., June 13, 1905.

DYESTUFFS of the anthracene series which dye cotton from an alkaline hydrosulphite vat, are produced by heating α-aminoanthraquinones with alkali phenolates or with mixtures of caustic alkalis and phenols, with or without the addition of oxidising agents. The product thus obtained from α-aminoanthraquinone yields, it is stated, blue shades; that from 1.4-diaminoanthraquinone, green shades; and those obtained from 1.5- and 1.8-diaminoanthraquinone respectively, yield bluish-green shades. —H. L.

Azo dyestuffs; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 364,406, March 19, 1906. Under Int. Conv., Oct. 23, 1905.

NEW azo dyestuffs are prepared by combining the tetrazo-compound of the di-*p*-aminophenyl ether of glycol, $NH_2.C_6H_4.O.CH_2.CH_2.O.C_6H_4.NH_2$, with two molecules of either 2.5-aminonaphthol-7-mono- or 1.7-disulphonic acid, or substitution products thereof, or with one molecule of these substances and another molecule of some other suitable compound. The products obtained are stated to possess excellent affinity for unmordanted cotton, producing bright red shades fast to acids. A table is given in which twenty-one such combinations are described.—H. L.

Anthracene series; Production of derivatives of the —— [*Anthracene dyestuffs.*] Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 365,305, April 14, 1906. Under Int. Conv., Oct. 23, 1905.

BY condensing alizarin or its derivatives with *o*-diamino anthraquinones, hydro-azines are obtained, which form "vats" when treated with alkaline reducing agents, dyeing cotton blue, green, and brown shades. Twenty kilos. of alizarin, 20 kilos. of 1.2-diaminoanthraquinone, 20 kilos. of boric acid, and 200 kilos. of phenol are heated to boiling for 16 to 20 hours, and the product is poured into water, and purified by washing with hot water and hot pyridine; a blue "vat" is obtained from this product, as also from those from 1.2- or 2.3-diamino anthraquinone and purpurin. The products from 1.2- or 2.3-diaminoanthraquinone and purpurin-α-sulphonic acid give bluish-green vats, those from 2.3-diaminoanthraquinone and Alizarin Blue or Alizarin Bordeaux, green vats, whilst those from 2.3-diaminoanthraquinone and alizarin or β-nitroalizarin form brown vats. (See also this J., 1902, 42; 1903, 1192; 1904, 1626, 1209, 1210; 1906, 1167.)—T. F. B.

Dyestuffs; Production of new mordant-dyeing azo ——. Farbenfabr. vorm. F. Bayer und Co., Fr. Pat. 365,415, April 19, 1906. Under Int. Conv., Dec. 20, 1905.

5-NITRO-4-CHLORO-2-AMINOPHENOL, obtained together with 6-nitro-4-chloro-2-aminophenol, by nitrating 4-chloro-2-aminophenol, or its ethenyl derivative, is diazotised and combined with the sulphonic acids of the naphthol-aminonaphthols, dihydroxynaphthalenes, or their derivatives. The dyeings on wool from acid baths are reddish shades of red, converted, by subsequent treatment with bichromate, into blue, green, and black shades.—T. F. B.

Indigo; Preparation of an [illegible] —— [illegible]. Fr. Ext. 364,681, March 19, 1906.

[illegible]

of caustic soda of 38° B. for 30—45 minutes at 80° C., and claims that after precipitation with dilute sulphuric acid he obtains a "new variety" of indigo. This substance is said to be practically soluble in water made slightly alkaline with sodium carbonate or ammonia, and to produce shades 50 per cent. deeper than ordinary indigo of the same strength under equal conditions of dyeing.—H. L.

Dyestuff suitable for the preparation of lakes; Process for making an [azo] ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 364,807, March 31, 1906. Under Int. Conv., May 18, 1905.

See Eng. Pat. 9989 of 1906; preceding these.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 881.)

Sodium sulphide-formaldehyde; Reserves under Aniline Black by means of ——. E. Trepka. Rev. Gen. Mat.-Col., 1906, **10**, 257—258.

The author proposes to produce coloured reserves under Aniline Black by means of basic dyestuffs fixed with zinc sulphide. (See H. Schmidt, Bull. Rouen, 1883, 291.) The dyestuff is printed together with a soluble zinc salt and sodium sulphide-formaldehyde. On steaming, zinc sulphide is formed, and is precipitated on the fibre, together with the dyestuff. The sodium sulphide-formaldehyde is prepared as a thin paste by adding 2000 grms. of 40 per cent. formaldehyde to a solution of 1000 grms. of sodium sulphide in 4 litres of water at 40° C. After 24 hours this mixture is strained through a cloth, and is then ready for use. The following are the recipes for the reserves which are printed on cloth prepared with aniline salt, sodium chlorate, and potassium ferrocyanide in the usual way for Aniline Black.

	Red.	Pink.	Yellow.	Olive.	Dark blue.	Sky blue.
Thickening S.	400	400	400	400	400	400
Zinc sulphate cryst.	100	100	100	100	100	100
Rhodamine 6G. ...	12	10	—	—	—	—
Thioflavine	12	—	—	—	—	—
Safranine	12	—	—	—	—	—
Auramine	—	—	30	35	—	—
Methylene Blue....	—	—	—	5	30	10
Water	104	240	100	100	220	240
Methyl alcohol	100	—	70	80	—	—
Sod. sulphide-form.	200	200	200	200	200	200
Sod. acetate	—	—	50	30	—	—
Magnesium acetate, 24° B.	60	50	50	50	50	50
	1000	1000	1000	1000	1000	1000

Thickening S is made up of 320 parts of dextrin, 500 parts of starch, 100 parts of water, 480 parts of potassium sulphite 40° B, 100 parts of glycerol, and 100 parts of olive oil. After printing, the goods are steamed for four to five minutes, chromed, rinsed, and soaped. The colours are stated to be as fast to washing, but scarcely so bright as those obtained with zinc-white and albumin preparations; but the mixtures can be much better printed as they are free from insoluble substances.—H. L.

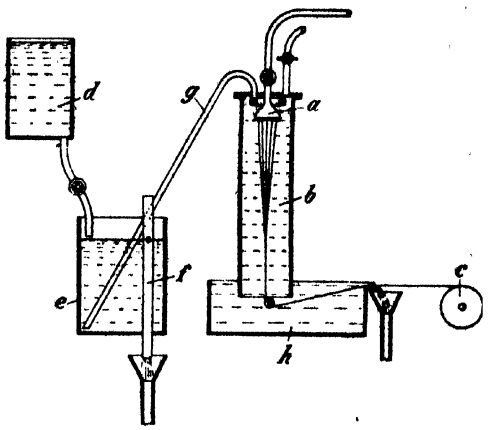
English Patents.

Silk, artificial; Process for the manufacture of ——. G. Gerrard, Saint-Etienne, France. Eng. Pat. 6160, March 14, 1906.

See Fr. Pat. 364,494 of 1906; this J., 1906, 1196.—T. F. B.

Artificial silk; Improved apparatus for the manufacture of ——. E. Thiele, Brussels. Eng. Pat. 16,078, July 16, 1906. Under Int. Conv., Oct. 23, 1905.

A new apparatus for spinning artificial silk is described (see figure). The spinning solution enters in thread form into the spinning vessel, *b*, through a rose or nozzle, *a*, and after passing through is wound upon a drum, *c*. The precipitation liquor is allowed to flow from the main reservoir, *d*, into the open auxiliary tank, *e*, in which the level of liquid is kept constant by means of an adjustable overflow pipe, *f*. It is conveyed by a pipe, *g*, into the spinning vessel, *b*, from which it flows away into the trough, *h*. The spinning vessel is closed at the top and



open at the bottom, so that the whole apparatus actually represents an upright siphon filled with precipitation liquor, of which one leg is formed by the spinning vessel, and the other by the tube, *g*. By this arrangement the auxiliary tank, *e*, is at a lower level than the spinning vessel, so that the fluid column in *b* is freed from the pressure it receives in the apparatus where the tank is above the spinning vessel. In the figure the level of liquid in *e* is higher than in the trough, *h*, so that the precipitation liquor flows in the direction mentioned. On the other hand, by lowering the overflow pipe, *f*, sufficiently, the direction of the flow of liquid may be reversed. By these means, it is claimed, a steadily uniform "vacuum," adjustable without interruption of the continuity of spinning, may be obtained.—H. L.

Silk; Process for simultaneously ungumming and dyeing raw natural ——. J. G. Lorrain, London. From Gebrueder Schmid, Basle, Switzerland. Eng. Pat. 2350, Jan. 30, 1906.

One hundred kilos. of raw silk hanks are suspended within a vessel containing a solution of 33 kilos. of soap and 5 kilos. of a rhodamine dyestuff in 580 kilos of water, the silk not being in contact with either the solution or the walls of the vessel. The solution is then heated to the boiling point, the lather produced rising and enveloping the hanks. After from 20 to 50 minutes, the dyed hanks are removed, and washed in water, whereby the softened sericin (silk-gum) is completely or partly removed from the fibroin. The formation of lather may be accelerated by injecting air under pressure into the soap solution at or near the bottom of the vessel, and weighting substances may be added to the bath.—A. S.

Warps or hanks of yarn or other woven or felted fabrics or fibrous materials; Machinery for drying ——. A. N. Marr, Leeds. Eng. Pat. 19,296, Sept. 27, 1906.

This machine consists preferably of three chambers placed parallel to the movement of the material, the middle compartment being the drying chamber and the lateral

ches the fan chambers, through one of the latter may be dispensed with if desired. The fans, working in the fan chambers, draw the moist air from the drying chamber, and also circulate the air over a heating apparatus before it enters the drying chamber. "Races," or angle iron paths, are mounted at the top and bottom of the drying chamber, and rods or poles intermittently traverse the races; the material is passed alternately around the upper and lower series of rods, thus forming folds or festoons, in which the material passes over the upper rod and under the lower. A pair of horizontal endless chains in the upper portion of the drying chamber, and a pair in the lower portion, work intermittently over sprocket wheels mounted on shafts carried by fixed bearings at the ends of each of the races, and each chain is provided with projections for carrying along through the drying chamber the series of rods inserted in the loops of the material. Two pairs of vertical endless chains are placed at the feed end of the machine, and one pair at the delivery end, each chain being provided with projections, and arranged to intermittently reciprocate in pairs over sprocket wheels. These chains convey the rods, when free from the material, from the lower to the upper races, and *vice versâ*. The cycle of intermittent movements of the whole of the endless chains is controlled by suitable gearing. The rods are thus automatically arranged and inserted on the under and upper surfaces of the material for forming it into loops, the material is made to traverse the drying chamber, and the rods afterwards disengaged from the festoons, and returned into position for re-insertion at the feed end of the machine. —B. N.

Seaweeds; Treatment of certain —— for the production of a thickening suitable for calico printing and various other purposes. The Calico Printers' Association, Ltd., Manchester, and W. Warr, Stalybridge. Eng. Pat. 22,301, Nov. 1, 1905.

Irish moss or other seaweed (70 lb.) is treated with dilute hydrochloric acid (1 lb. of 30 per cent. acid) to remove the lime, washed, and boiled with water containing sodium carbonate (30 ozs.) or ammonia; the mucilage is freed from the fibrous residue, and bleached, 6 lb. of bleaching powder being sufficient; when sufficiently bleached, 10 lb. of sodium bisulphite, 70° Tw., are added, and 2 lb. of 22 per cent. ammonia solution. When cool, the mucilage forms a thick transparent jelly, which may be employed in calico printing and finishing, especially with basic dyestuffs dissolved in phenol or aniline.—T. F. B.

Formaldehyde-sulphoxylic acid; Manufacture of alkali salts of ——. [Discharges.] J. Rohner, Basle, Switzerland. Eng. Pat. 14,343, June 22, 1906.

See Fr. Pat. 362,405 of 1906; this J., 1906, 692.—T. F. B.

United States Patent.

Cotton; [Electrolytic] Method of treating ——. G. D. Burton, Boston, Mass. U.S. Pat. 827,293, July 31, 1906.

Cotton is immersed in a bath in which wool has been degreased, and sodium carbonate or a mixture of one part of sodium chloride with two parts of sodium carbonate is added. An electric current is then passed through the whole. It is claimed that the wool grease is thus absorbed by the fibre, which becomes softened, and at the same time gains in tensile strength. Several methods for carrying out the process are described.—H. L.

French Patents.

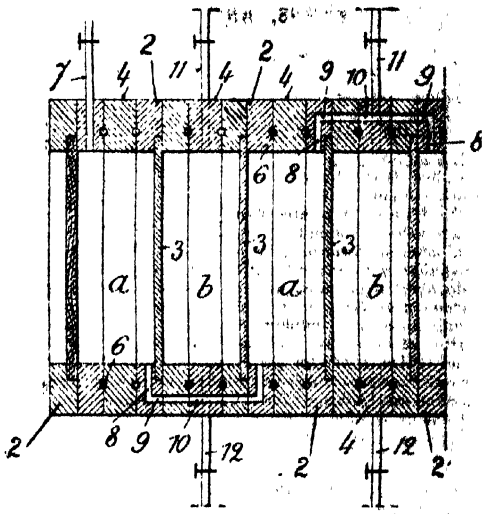
Artificial silk works, &c.; Process for the recovery of the alcohol and ether contained in the air of ——. J. M. E. Dervin. First Addition, dated May 4, 1905, to Fr. Pat. 350,296, Nov. 8, 1904.

In the process described in the main patent (this J., 1906, 71) the air is passed through absorption towers containing sulphuric acid, and the acid is then distilled *in vacuo* in order to recover the ether. In the present addition, the process is modified: (1) by mixing the saturated sulphuric acid with one to two molecular proportions of water before distilling off the dissolved ether, to prevent loss of ether by conversion into ethylsulphuric acid; (2) the spinning operation is conducted in a closed chamber, with the primary object of limiting the volume of air which it is necessary to heat, and thus diminishing the amount of sulphuric acid necessary for absorption; (3) the dried air issuing from the towers is led back to the spinning chamber, and is thus forced to circulate continuously. In order to counteract the excessive dryness of the air with which it is brought into contact, hygroscopic substances, such as glycerol, or calcium or magnesium chloride, are added to the collodion, either before or after it has been drawn out into threads.—H. L.

Artificial silk; Tubular apparatus for forming gaseous coverings round the filaments formed in the manufacture of ——. H. E. A. Vittenet. Fr. Pat. 361,568, June 19, 1905.

See U.S. Pat. 828,155 of 1906; this J., 1906, 845.—T. F. B.

Dialyser [Purification of cuprammonium solutions in manufacture of artificial silk]. A. Lecœur. Fr. Pat. 365,099, April 11, 1906.



The apparatus, which is especially applicable to the process of purifying colloidal ammoniacal copper hydroxide, described in Fr. Pat. 362,986, of 1906 (this J., 1906, 903), has the form of an ordinary filter-press, as shown in the figure. The dialysing plates, 3, are formed of "asbestos-porcelain," and are carried in wooden frames, 2, between which are placed the distance frames, 4, the joints being made with rubber cord, as shown at 6. The liquid to be treated enters through the pipe, 7, into the first chamber, *a*, and circulates through the other chambers, *a*, *a*, by the channels, 8, 9, 10. The water enters through the pipes, 11, into each of the chambers, *b*, *b*, and leaves by the pipes, 12, carrying off the crystalloids in solution.—W. H. C.

Rabbit fur; Manufacture of an antiseptic product from —— to replace wool or down. J. Serre. Fr. Pat. 363,722, Feb. 22, 1906.

Rabbit fur is first beaten into a woolly or downy material, then treated with an "acid antiseptic" solution, consisting of 10 parts of ether and 90 parts of carbon bisulphide, and afterwards dried. It is claimed that treatment with this "acid antiseptic" solution renders the material stronger and more coherent, enables it to be spun, completely protects it against microbes and all kinds of insects, renders it a suitable substitute for antiseptic wadding, and makes it well adapted for the manufacture of all kinds of hygienic fabrics.—H. L.

Bleaching; Process of ——. E. Bingemann. First Addition, dated Feb. 10, 1906, to Fr. Pat. 362,513, April 7, 1906.

The process of bleaching described in the principal patent

(see this J., 1905, 1011) is modified by the introduction of a tier, in which a continuous boil can be given, so that the whole process of bleaching, from singeing to drying, can, it is claimed, be carried out in one operation.—H. T.

Bleaching and scouring of textile fabrics and vegetable and animal fibres; Electrolytic apparatus applicable to the ——. A. Dossonville. Fr. Pat. 363,866, March 3, 1906.

THE material receives a preliminary washing for the removal of impurities during its passage over a washing roller, and is then passed into the electrolytic bath between vertical plates of carbon insulated from each other, and supported on an insulated perforated plate. Two or more small windlasses, provided with blades, convey the material through the bath, the blades being cleaned by scrapers actuated by cams, in order to prevent the material from being entangled. The material, after leaving the electrolytic bath, is conveyed by travelling aprons between squeezing rollers, on to which streams of water are falling, in order to thoroughly wash it.—B. N.

Bleaching textile fibres, threads, and fabrics; Process for ——. H. Zeitschner. Fr. Pat. 364,797, March 31, 1906.

SEE Eng. Pat. 5296 of 1905; this J., 1906, 372.—T. F. B.

Shaded effects [on fabrics]; Process for obtaining ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,582, June 24, 1905.

SEE Eng. Pat. 10,195 of 1905; this J., 1906, 262.—T. F. B.

Drying installation [for textile materials]. E. Mertz. Fr. Pat. 364,914, April 4, 1906.

A DRYING-CHAMBER is placed over a heating-chamber, being separated from it by a floor formed of gratings. An air-flue, with a damper at each end, passes along each side of the floor of the drying chamber. By suitably arranging the dampers, a current of fresh air is forced by a fan into the heating chamber, rises through the floor into the drying chamber, and is exhausted from the side flues by a second fan, placed at the other end. Also, by altering the arrangement of the dampers, the same air can be made to circulate from the heating to the drying chamber, and thence by the side flues back to the heating chamber.—W. H. C.

Glue or size, and process of making the same. M. Bonnet. Fr. Pat. 365,285, April 14, 1906. XIV., page 942.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 885.)

Lime, gypsum, water, at 25° C.; The system ——. F. K. Cameron and J. M. Bell. J. Amer. Chem. Soc., 1906, 28, 1220—1222.

Two series of solutions were prepared; in one case solid gypsum was added to solutions containing varying quantities of calcium hydroxide, and in the other lime was added to solutions of gypsum. After two weeks, at 25° C., the solutions were analysed. The results are shown in the following table:—

Calcium sulphate. grms. per litre.	Calcium hydroxide. grms. per litre.	Solid phase.
0·0	1·166	$Ca(OH)_2$
0·991	1·141	"
0·466	1·160	"
0·955	1·215	"
1·214	1·248	"
1·368	1·223	$Ca(OH)_2$; $CaSO_4$, $2H_2O$
1·434	0·939	$CaSO_4$, $2H_2O$
1·442	0·611	"
1·508	0·342	"
1·525	0·175	"
2·003	0·269	"
2·134	0·0	"

It thus appears that the solubility of lime in gypsum solutions is hardly affected by the concentration of the gypsum, but slightly increases with it; whilst the solubility of gypsum in lime solutions decreases regularly as the concentration of the lime increases.—J. T. D.

Gelatinous inorganic salts of the alkaline-earths. C. Neuberg and E. Neimann. Biochem. Zeits., 1906, 1, 166—17 Chem. Centr., 1906, 2, 590—591.

IF dilute sulphuric acid be added to a solution of bariu oxide in methyl alcohol, a coagulum of barium sulpha separates, which retains its gelatinous character aft filtering with the aid of the pump. On drying *in vacu* and even after gentle heating, the product retains th character, forming a very hard, porcelain-like, translucen substance. By boiling the product for a long time with large quantity of water, or more rapidly by addition hydrochloric acid, the ordinary form of barium sulpha is obtained. Colloidal barium phosphate, $BaHPO_4$, ca be obtained in a similar manner On leading carbo dioxide into a saturated solution of barium oxide in meth alcohol, the liquid suddenly sets to a jelly, with evolutio of heat. On draining the jelly with the aid of the pum gelatinous barium carbonate in a pure condition is o tained. If the current of carbon dioxide be kept passi in after the liquid sets, the jelly is converted into a whi powder of the composition, $BaCO_3 + H_2O$, which is solub in a much smaller quantity of water than ordinary bariu bicarbonate is. If the gelatinous barium carbonate or t white powder, $BaCO_3 + H_2O$, be kept under meth alcohol, they gradually dissolve, whereas ordinary bariu carbonate is quite insoluble in methyl alcohol. The sol tions have the appearance of colloidal liquids, conta barium and carbonic acid in the colloidal condition, gi a thick jelly of gelatinous barium sulphate on addition sulphuric acid, and have a high viscosity. The meth alcohol may be partly distilled off from the solutio without injuring the colloidal character of the compoun on evaporating to dryness *in vacuo*, the carbonate remai behind in the form of transparent plates resembling cell loid. The atomic ratio of barium to carbon dioxide the solution is about 1:4. On adding a large quantity water to the solution, a gelatinous precipitate separate Other gelatinous salts of barium and of calcium, strontiu and magnesium were prepared.—A. S.

Sulphur; Action of —— on solutions of metal sal A. Manuelli. Atti R. Accad. dei Lincei Roma, 1906, [1], 703. Chem. Centr., 1906 2, 667—668.

SOLUTIONS of metal salts were mixed in a tube with sulphu the air expelled by carbon dioxide, and the mixture heat to 150°—180° C. In this way a solution of cupric chlori acidified with hydrochloric acid yielded a cuprous sa and potassium bichromate in solution was reduced chromic oxide, a considerable amount of sulphuric ac being formed in both cases. (See also Brückner, this 1906, 476.)—A. S.

Sulphur production in U.S.A. Oil, Paint, and Drug Re Sept. 11, 1906. [T. R.]

THE following abstract is taken from the annual repo of the United States Geological Survey prepared by Edw C. Eckel:—

The sulphur and sulphuric acid supply of the Unit States is at present derived from three sources: (1) nati sulphur, (2) iron pyrites, and (3) a by-product fro sulphides carrying workable percentages of copper, le &c. In 1905 the production of sulphur in the United Sta amounted to 181,677 long tons, valued at $3,706,5 The bulk of this output was from Louisiana.

The following table shows the combined output sulphur and pyrites during the past five years:—

Year.	Quantity. Long tons.	Valu
1901	241,491	$
1902	207,674	
1903	253,187	
1904	334,[illegible]	
1905	454,[illegible]	

Imports.—The following figures show the quantity and value of various grades of sulphur imported into the United States in 1905:—Crude, 83,901 long tons, valued at $1,523,136; flowers of sulphur, 572 tons, valued at $16,037; refined, 779 tons, valued at $19 960; all other (including sulphur lac and other grades not otherwise specified, but not pyrites), 27 tons, valued at $3,353; total value, $1,567,485. During the past three years there has been a steady decline in the imports of sulphur of all grades except refined. The total value of the imports of all grades in 1903 was $3,709,690, or nearly two and one-half times the value of the imports of 1905.

The following table shows the origin of the sulphur imported into the United States in 1905:—

Country.	Quantity. Long tons.	Value. $
England	2,322	51,342
Italy	69,196	1,305,605
Japan	19,887	327,662
Other countries	59	1,588
Totals	91,464	$1,686,197

It will be noted that there is a discrepancy in the total amount of sulphur imported in 1905, as shown in the above table and as previously summarised, which is due to the fact that the summarised figures represent imports entered for consumption.

Pyrites.—In 1905 the production of pyrites amounted to 253,000 long tons, valued at $938,492 as compared with 207,081 long tons, valued at $814,808 in 1904.

The quantity and value of pyrites containing less than 3·5 per cent. of copper imported into the United States during the past five years is as follows:—

Year.	Quantity. Long tons.	Value. $
1901	403,706	1,415,149
1902	440,363	1,650,852
1903	420,410	1,636,450
1904	422,720	1,533,997
1905	511,946	1,774,379

World's production.—The following table shows the pyrites production in the principal producing countries of the world, and also shows to what extent pyrites has supplanted sulphur for acid making:—

Country.	1903. Long tons.	1904. Long tons.
Spain	153,543	159,292
France	324,212	267,268
Portugal	370,253	377,540
United States	233,137	253,000
Germany	168,307	172,030
Norway	127,887	131,499
Hungary	95,560	95,618
Italy	99,857	110,240
Canada	33,039	12,010
Newfoundland	42,000	60,200
United Kingdom	9,639	10,287
Bosnia and Herzegovina	6,484	10,257
Belgium	709	1,058
Sweden	7,670	15,705
Total	1,672,297	1,676,004
Sulphur displaced	752,534	754,202

Consumption in the United States.—The sulphur content of domestic and imported pyrites, which taken together constitute the total domestic consumption, is given in the following table:—

Source.	1904. Long tons.	1905. Long tons.
Domestic sulphur and sulphur content of pyrites	220,478	274,863
Imported sulphur	129,532	84,339
Sulphur content of imported pyrites	190,224	230,376
Total domestic consumption	540,234	589,578

"The sulphur content of imported pyrites in the above table is based on an average of 45 per cent."

Deacon chlorine process. Formation of the catalyser in the ——. J. M. C. Lant and M. Vogtlen. Eng. Chem. Ind., 1906, 29 [A], 513—524.

The authors have made further experiments as to the action of the catalyser in the Deacon chlorine process, more especially to ascertain whether the view that the essential factor is the capacity of the catalyser of absorbing moisture holds good with other substances than cupric chloride (see this J., 1905, 890). Cupric oxide, when heated at 400° C. in a dry mixture of hydrochloric acid and air, yields chlorine and cupric chloride. In 27 hours, 21 per cent. of the cupric chloride produced had decomposed into oxychloride and chlorine; at 400° C. the same amount of chlorine was produced in eight hours. By converting the cupric chloride superficially into oxychloride by too rapid drying, the production of chlorine at 250° C. was prevented, whilst the yield at 400° C. was diminished. The yield of chlorine increases if the proportion of hydrochloric acid in the gaseous mixture be diminished. With copper sulphate at 400° C., and a gaseous mixture containing six parts of air to one of hydrochloric acid, a yield of chlorine amounting to 55 per cent. was obtained in two hours; the copper sulphate remained almost unaltered, only a very small quantity of chloride being formed. The yield was smaller than when cupric chloride was used as catalyser. By the action of dry hydrochloric acid gas, copper sulphate is partially converted into cupric chloride at 400° C. When copper sulphate is used as catalyser, its activity diminishes considerably after some time. Calcium chloride is not very effective as a catalyser. The yield of chlorine (3—8 per cent.) increases slightly with rise of temperature. Barium chloride is inactive even at 526° C. Magnesium chloride, on the other hand, is a good catalyser; it loses a considerable proportion of its chlorine during the reaction. Nickel chloride does not give good results. It is pointed out that the results of these experiments can be explained either by the old hypothesis of Deacon (formation of oxychlorides), or by the authors' theory of the temporary formation of hydrates. The unfavourable results obtained with calcium chloride are probably due to hydrolysis. With magnesium chloride, also, hydrolysis would come into play, but the magnesium hydroxide formed decomposes much more readily than calcium hydroxide. The results of the experiments with copper sulphate are in favour of the hydrate theory, whilst the results previously obtained (*loc. cit.*) as to the stability and activity of oxychlorides at different temperatures are opposed to Deacon's theory. The authors conclude that the Deacon chlorine process is probably a case of double catalysis.—A. S.

Nitric acid; Two new colour reactions of ——. C. Reichard. XXIII., page 954.

Seaweed industry of Japan. C. J. Davidson. XVIII A., page 948.

English Patents.

Acid; Tubes for concentrating ——. G. Krell, Braubhausen, Germany. Eng. Pat. 4063, Feb. 19, 1906.

See Fr. Pat. 363,604 of 1906; this J., 1906, 847.—T. F. B.

Crystallisation process for crystal soda, Glauber's salt, and other solutions. G. Schicht, Vienna. Eng. Pat. 10,917, May 25, 1905.

See Fr. Pat. 354,522 of 1905; this J., 1905, 1161.—T. F. B.

Copper sulphate contaminated with salts of iron; Separation of ——, and the consequent direct extraction of the sulphate of copper from ores. B. Conaders, Massa Marittima, Tuscany. Eng. Pat. 1299, Jan. 17, 1906. Under Int. Conv., Feb. 19, 1905.

See Fr. Pat. 362,442 of 1906; this J., 1906, 697.—T. F. B.

Nitrites; Production of ——. J. T. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen am Rhine, Germany. Eng. Pat. 4210, Feb. 22, 1906.

See Fr. Pat. 363,643 of 1906; this J., 1906, 847.—T. F. B.

United States Patents.

"Sulphurous oxide" [Sulphur dioxide]; Process of recovering —— [from furnace gases]. F. R. Carpenter. U.S. Pat. 829,765, Aug. 28, 1906. X., page 934.

Bisulphite liquor; Process of making ——. N. Heath, Antioch, Cal., Assignor to W. S. Wright and J. W. Stewart, Chicago, Ill., and to J. H. Winslow, Glencoe, Ill. U.S. Pat. 830,996. Sept. 11, 1906.

Continuously generated sulphurous "fumes" are directed into the upper portion of a column of a solution of lime, which continuously descends within a pipe of such height that, in falling, it causes an induced flow of the sulphurous "fumes," with which it intermingles in an attenuated and divided state.—E. S.

Liquefying air and other gases; Apparatus for ——. R. P. Pictet, New York, N.Y., U.S. Pat. 830,613, Sept. 11, 1906.

The apparatus consists of primary and secondary cooling chambers in which liquids of progressively lower boiling points are used; the former surrounds the latter, which, in its turn, surrounds a heat-interchanger having an expansion valve for the gas to be liquefied, which actuates a turbine-motor as it escapes from the valve. The gas or air passes successively through the coils in the series of cooling chambers, and then through the heat-interchanger coil, and the portion which is not liquefied returns over the coils of the interchanger, and assists in cooling the incoming gas. The primary cooling chamber is provided with a second coil, through which the liquid evaporated in the secondary cooling chamber is forced by a pump, in order to be cooled and returned. The liquid evaporated in the primary cooling chamber is compressed by another pump, cooled, and returned for use over again.—W. H. C.

French Patents.

Nitric acid or anhydride; Process for producing —— from atmospheric air. Salpetersäure Ind.-Ges., m.b.H. Fr. Pat. 365,070, April 10, 1906.

This invention relates to processes in which nitric acid or anhydride is produced from atmospheric air, or air mixed with oxygen, at a temperature exceeding 1200° C., and in which sudden cooling is effected by causing the gases of reaction to traverse cooled surfaces, or by injecting into them inert cold liquids or gases. The present process consists essentially in employing, as cooling agent, the cooled reacting mixture which results from the process itself. The rapidity of the cooling may be regulated by increasing or reducing the quantity of the reacting gases, already cooled, added to the gases to be cooled.—E. S.

Liquid sulphur dioxide; Tube for measuring ——. P. V. Pacottet. Fr. Pat. 365,224, April 13, 1906.

This arrangement for measuring definite volumes of liquid sulphur dioxide consists of a graduated glass tube connected to the reservoir of the liquid by a three-way cock. The top of the glass tube ends in a small hole, which can be closed or slightly opened by a pointed screw. This screw is so regulated that on opening the cock, the liquid fills the tube to any requisite volume without boiling or evaporating. On again turning the cock, the measured volume of liquid escapes into the vessel to be charged.—F. Sheen.

Salt; Manufacture of white —— from rock salt. H. Tee, Fr. Pat. 364,731, March 29, 1906. Under Int. Conv., March 29, 1905.

See Eng. Pat. 6611 of 1905; this J., 1906, 697.—T. F. B.

Magnesium and zinc peroxides; Manufacture of rich ——. F. Hinz. Fr. Pat. 364,825, April 2, 1906.

A soluble magnesium salt, such as the chloride, is dissolved in a concentrated neutral or slightly acid solution of hydrogen peroxide, and sodium peroxide is added to precipitate magnesium peroxide, which is separated from the solution, and, without being washed, is dried at about 70° C. The dried mass is powdered, washed, and again dried. Zinc peroxide is similarly formed.—E. S.

Ammoniacal cupric hydroxide (Schweitzer's reagent); Recipient for the preparation of ——. E. Mertz. Fr. Pat. 364,911, April 4, 1906.

The recipient is conical in form, narrowing towards the top, so that the copper scraps subjected within to the action of ammonia may descend as the lower portions dissolve. The recipient is jacketed for circulation of a cooling agent. The narrow cover of the recipient is closed by a screwed-down cap. Means for discharging and for cleaning the vessel are shown.—E. S.

Alkali bicarbonates; Manufacture of —— [for production of carbon dioxide]. J. G. Behrens. Fr. Pat. 365,059, April 10, 1906.

Iron pipes, charged to about half their capacity with anhydrous sodium carbonate, are heated to the temperature at which, under atmospheric pressure, sodium bicarbonate evolves carbon dioxide. At this temperature, generator gas, containing carbon dioxide with water vapour in molecular proportions, together with nitrogen, is admitted under pressure. The following reaction is stated to occur: $Na_2CO_3 + H_2O + CO_2 = 2NaHCO_3$. The residual nitrogen is discharged and the pressure released, the temperature remaining unaltered, when the bicarbonate formed decomposes, and the pure carbon dioxide evolved is withdrawn for liquefaction. The sodium carbonate remaining is then ready for exposure under pressure to the renewed action of the generator gas.—E. S.

Ammonium nitrate; Manufacture of —— [from distillation gases]. W. Feld. Fr. Pat. 365,409, April 19, 1906.

A solution of a nitrate of an alkaline-earth is brought into contact with distillation gases from coal or the like (freed from hydrogen sulphide) containing ammonia and more or less carbon dioxide. The alkaline-earth is thus precipitated as a carbonate, and ammonium nitrate remains in solution. In case a concentrated solution of an alkali nitrate, such as sodium nitrate, is used as described, and should the carbon dioxide present in the gases passed through be insufficient, when sufficient ammonia has been absorbed, to form sodium bicarbonate, the solution is submitted to the further action of carbon dioxide from any other convenient source, to complete the formation of the bicarbonate, the bulk of which separates, leaving ammonium nitrate in solution, as in the former case. The solution may be evaporated to obtain the solid salt.—E. S.

Ferrocyanides; Process for obtaining —— from gases of distillation. W. Feld. Fr. Pat. 365,410, April 19, 1906.

To abstract cyanogen from coal gas and other gases containing it, a washing solution is used to which, for example, a mixture is added containing two molecules of ferrous chloride to one molecule of calcium ferrocyanide, which latter may be in some excess of this proportion. A precipitate is thus produced, and slaked lime is added. As the cyanogen-carrying gases pass through the suspended mixture, calcium ferrocyanide is formed. Various modifications of the process are given. The mud remaining from the reaction, after separation of excess of liquid, may be again used similarly, with addition of milk of lime.—E. S.

Oxygen generator. G. F. Jaubert. Fr. Pat. 361,537, June 5, 1905.

The generator consists of a closed vessel formed of drawn steel, and charged nearly to its full capacity with briquettes, containing as a base such oxygenated salts as chlorates, perchlorates, or nitrates. (See Fr. Pat. 350,377 of 1904 and Addition thereto; this J., 1906, 160 and 835.) It is nearly immersed in a vessel through which a current of cold water flows. Two such generators are shown, immersed in a common vessel, each communicating by a valved tube with a pipe leading to a column charged with caustic soda or the like, to absorb acid fumes or carbon dioxide, whence the oxygen liberated by firing the briquettes in the generators passes into an iron receiver.

When a pair of generators is used, they may be worked in rotation, being discharged alternately, so that there may be no interruption in the production of the oxygen. —E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 885.)

Chert mining in England and Wales. H. L. Terry. IX., next column.

Glass industry of the United States. *U.S. Geol. Survey,* Oil, Paint, and Drug Rep., Sept. 17, 1906. [T.R.]

THE value of glass products manufactured in the United States in 1905 is in round numbers $65,000,000. The cost of material used approximates $18,000,000, and in this the cost of glass sand was somewhat more than $1,000,000, exclusive of freight charges. Within the half-century preceding 1900 the value of glass products showed an average increase of 70 per cent. for each decade, and the growth is still vigorous. Glass of four general classes—plate, window, green bottle, and flint—is made in the middle Mississippi basin from materials obtained, for the most part, in the region. The majority of the glass factories are grouped into two districts—the St. Louis district and the South-Eastern Kansas district. Where coal is the basis of the fuel, if it requires 1 ton of coal to 1 ton of glass, nearly as much coal by weight as raw material has to be transported, but the freight rates on sand, lime, and salt cake are decidedly higher than on coal for a given distance. Therefore, it is important that plants using coal should also be relatively near a supply of sand. When natural gas in a fresh field is the fuel, it is so much cheaper than producer gas made from coal near the mines that the glass can stand the cost of a long haul for sand and other materials if necessary. Eight factories are situated in the St. Louis district—two at St. Louis and one at Valley Park, one at Crystal City, Mo., and one each at East St. Louis, Belleville, Alton, and Litchfield, Ill. Producer gas from southern Illinois coal is commonly employed as fuel, although the furnace at Alton is fired direct with coal. Plate glass is made at Crystal City and at Valley Park. The factory at Crystal City has been established about 30 years. Its present capacity is two furnaces of 20 pots each. The factory at Valley Park, erected within the last few years, contains four furnaces of 20 pots each.

The manufacture of glass in the Kansas gas belt was begun less than three years ago. There are now 21 plants all using natural gas for fuel. Many of them have been moved from the waning gas fields of Indiana, attracted by the cheapness and abundance of gas in the new field. Sand is supplied mostly from the belt west of St. Louis. A little sand has been imported from the Ottawa, Ill., district. In regard to limestone supplies, the Kansas factories are situated more advantageously. Some crushed limestone has been obtained from neighbouring cement mills, and a portion is shipped from Sedan. Still it seems to be necessary to import the greater portion of it from Missouri points. Salt cake is brought from Argentine, Kan. Illinois and Missouri together furnish at present about 350,000 short tons annually, nearly 40 per cent. of the total supply of glass sand in the United States. Pennsylvania produces about 33 per cent., and therefore ranks first in quantity of this product, with Illinois second, and Missouri third. According to the latest complete statistics (or 1905) the average value of glass sand per ton in Pennsylvania was $1.31; in Illinois, 63 cents; and in Missouri, 60 cents. This difference in price is accounted for in part by the fact that Pennsylvania sand is somewhat more expensive to produce, being made from harder rock.

ENGLISH PATENT.

Glass-melting furnaces. W. P. Gibbons, Lower Gornal, Staffs., and R. Masters, Dudley, Worcester. Eng. Pat. 15,560, July 29, 1905.

IN the glass-melting furnace described, each pot is heated independently of the others, producer gas being used as fuel. The invention is described both as applied to an old furnace burning solid fuel in a central fireplace, which is suitably altered, and also as to an entirely new furnace. Essentially, each pot is placed in one of a series of small glass-melting furnaces, arranged in one or more rows. An arched gas producer or main gas flue extends underneath these small furnaces, the arches of the gas flues having secondary air passages receiving secondary air from passages underneath the gas flues. Communicating with these gas flues and with the furnaces, are placed combustion chambers, the arches of which are supplied with another set of air passages. Uptakes provided with dampers lead from the furnaces to the outlet flues, by means of which the heat of each furnace can be regulated independently of the others.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 886.)

Chert mining in England and Wales. H. L. Terry. Paper read before the Institution of Mining and Metallurgy, May 17, 1906.

CHERT, an impure form of flint, is a silicious rock containing calcium carbonate as a normal constituent. It differs from chert in physical properties; for instance, a sharp blow will break a flint into two pieces, but will splinter a piece of chert into numerous fragments. Chert beds occur at many geological horizons, but those of the carboniferous formation are the most important economically, and are mined in the millstone grit of North Wales, in the carboniferous limestone and in part of the Yoredale shale of Derbyshire, and in the Upper Yoredales from the underset limestone to near the base of the millstone grit in Yorkshire, the districts being Halkyn Mountain and Gronant, Bakewell, and Swaledale respectively. The chief use of chert is for the pavers, and runners of wet grinding mills for grinding calcined flints, china-stone, and bones in the manufacture of pottery. The pavers form the bed of the pan, and are usually from 10 to 18 in. thick, and otherwise of variable dimensions; they are chiefly supplied from Flintshire, as the beds there are of about the required thickness, and consequently less dressing of the blocks is required. The large blocks, or runners, travel over the pavers at a rate of about 15 revolutions per minute, and vary very much in size and weight, 16 cwt. being a common weight. The annual consumption of chert may be taken roughly at 8,000 tons, the price varying from 25s. to 42s. per ton delivered, according to quality.

The chert from Swaledale has a flinty appearance, is semi-transparent, of a bluish tinge, and has a characteristic uniform fracture. It is about 7 in the scale of hardness, and has a sp. gr. of 2·59. It exhibits no regular cleavage planes, but tends to split along irregular pressure planes. It consists of nearly pure silica, with a small amount of ferrous silicate and carbonate of lime. The latter is evidently due to infiltration, and great care is necessary in selecting an average sample for analysis. The following analyses, made by the author, may be taken as representative:—

Analyses of chert sold to the Potteries.

	Derbyshire.		Swaledale.	Flintshire.
	(1.)	(2.)		
Water	0·54	0·60	1·61	1·62
Silica	82·53	63·40	95·60	93·56
Ferrous oxide	—	—	1·02	4·52
Ferric oxide	1·05	2·34	—	—
Carbonate of lime	15·88	33·66	1·80	0·43
	100·00	100·00	100·13	99·83

IN Derbyshire the percentage of limestone is the most important factor in determining the value of chert property,

and in the carboniferous limestone areas of the North of England, though there is a large amount of good chert, yet the bulk of it is valueless, owing to the tendency to split up into fragments during the dressing operation. It may be mentioned that a 2-ton Swaledale chert runner working on flint alone lasted 10 months, by which time it was reduced to 7 cwt. The paper also contains a full description of the mining details involved.—W. C. H.

Cement; Influence of the sulphur dioxide contained in illuminating gas on the determination of the loss on ignition of ——. L. von Szathmáry. XXIII., page 954.

Cement production in U.S.A. in 1905. Bd. of Trade J., Sept. 13, 1906. [T.R.]

A RECENTLY published bulletin of the United States Geological Survey gives the following particulars of the production of cement in the United States in 1905:—

	Quantity.	Value.
	Barrels.	Dols.
Portland cement	35,246,812	33,245,867
Natural ,, ...	4,473,049	2,413,052
Puzzuolana ,, ...	382,447	272,614
Total production in 1905	40,102,308	35,931,533
Corresponding total for 1904	31,675,257	26,031,920

The total capacity of United States cement plants for 1905 is estimated at 129,000 barrels per day; it is expected that before the close of 1906 the total possible production will exceed 140,000 barrels per day. Some concentration of interests in the cement industry is noted, but the possibility of a trust or combination to bring about unduly high prices is dismissed by the bulletin as out of the question.

Magnesium carbonate manufactures. Italian Customs decision. Bd. of Trade J., Sept. 13, 1906. [T.R.]

MANUFACTURES of carbonate of magnesia mixed with asbestos are assimilated to manufactures of magnesia cement, which, in accordance with the official index to the Tariff, are dutiable as "earthenware" under No. 267 of the Tariff.

ENGLISH PATENTS.

Artificial stone; Manufacture of ——. B. Alexander-Katz, Görlitz, Germany. Eng. Pat. 3182, Feb. 9, 1906. Under Int. Conv., Sept. 22, 1905.

SEE Fr. Pat. 362,418 of 1906; this J., 1906, 698.—T. F. B.

Kilns; Brick and like ——. J. T. Price, Brierley Hill, Staffs. Eng. Pat. 7464, March 28, 1906.

THE object of the invention is to economise heat by causing the burnt gases from the burning chamber to effect the drying of green goods in another chamber. For this purpose, the kiln is provided with two or more separate interchangeable burning and drying chambers, and with one central or side stack. Flues are so arranged in the walls of each chamber that the hot gases from one chamber, on their way to the chimney, have to pass around and then through the second chamber.—A. G. L.

Cement; Manufacture of ——. W. Jeroch, and Deutsche Ferrit-Cement Ges. m. b. H., Berlin. Eng. Pat. 3655, Feb. 14, 1906. Under Int. Conv., Sept. 28, 1905.

SEE Fr. Pat. 363,103 of 1906; this J., 1906, 848.—T. F. B.

Fireproof or heat-resisting surfacing composition or cement. R. J. Crowley and F. F. Payne, London. Eng. Pat. 8627, April 10, 1906.

FOUR parts of granular corundum are finely ground, mixed with one part of powdered graphite, and made into a paste with a 10 per cent. solution of sodium silicate. The composition is intended for use both as a heat-insulating and fireproof material in building construction, &c., and also as a non-absorbent lining for furnaces and crucibles.—A. G. L.

UNITED STATES PATENTS.

Brick; Method of making refractory [magnesia] ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 829,427, Aug. 28, 1906.

REFRACTORY magnesia brick is prepared by heating magnesia to a temperature sufficient to vitrify it, cooling, grinding the vitrified material to powder, pressing it into shape, and subjecting it to a temperature high enough to cause some of the magnesia to sublime without fusing. —A. S.

Cement; Process of burning ——. B. E. Eldred, New York. U.S. Pat. 829,956, Sept. 4, 1906.

THE powdered material is continuously burnt by passing it through two independent reverberatory furnaces, in the first of which it is calcined, the operation being carried to incipient fusion so as to reduce the quantity of dust produced on entering the second furnace, in which the material is clinkered in a flame "regenerated by products of combustion" abstracted from this furnace.—A. G. L.

Cement clinker; Apparatus for making ——. B. E. Eldred, Bronxville, N.Y. U.S. Pat. 829,957, Sept. 4, 1906. (See preceding abstract.)

AN inclined horizontal kiln is provided with a number (generally two) of successive rotating chambers, forming sections having stationary partition walls between adjacent sections. These walls allow of the transit of solid material from one chamber to the other, but form thermal insulators between the chambers. The chambers are fed with gas from a producer, and are supplied with separate means of firing. The calcining of the materials takes place in one chamber, and the clinkering in another.—A. G. L.

Cement blocks; Process of rendering —— waterproof. J. M. Rauhoff, Tinley Park, Ill. U.S. Pat. 830,003, Sept. 4, 1906.

METALLIC iron in the form of fine dust held in suspension in water or other liquid is supplied to the surface of the cement blocks or other substance. The iron is then allowed to oxidise and expand, and thus fill the pores in the surface of the block.—A. G. L.

FRENCH PATENT.

Agglomerations of sawdust and magnesia; Addition of extra hard materials to ——. H. Coppin. Fr. Pat. 364,890, April 4, 1906.

THIS patent covers the addition of very hard materials, such as silica, porphyry, emery, carborundum, corundum, &c., to agglomerated products of sawdust and magnesia, and of chlorides, such as prismalith, stucolyth, xylolith, &c., for the purpose of increasing the resistance of these products to wear and tear in their various applications. —W. C. H.

X.—METALLURGY.

(*Continued from page* 899)

Sulphur in iron. R. Baumann. Metallurgie, 1906, 3, 416—417; Science Abstracts, 1906, 9A, 441.

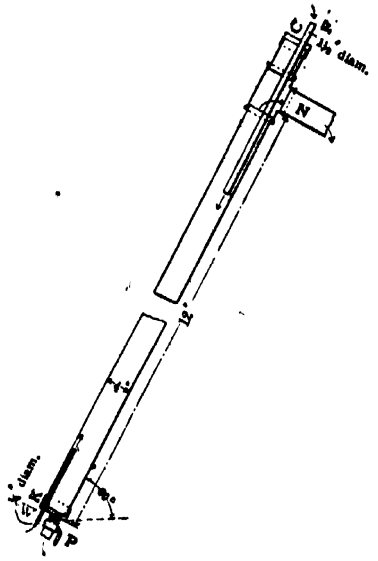
THE author describes a simple method for detecting the distribution of sulphide particles in sections of iron or steel. A piece of photographic silver bromide paper is soaked in dilute sulphuric acid, allowed to drain, and then pressed against the surface of the section of iron, which has previously been ground flat, and cleaned from grease. At parts where sulphide particles are present, sulphuretted hydrogen is evolved, and produces a blackening of the paper, which can afterwards be fixed and washed in the usual manner.—A. S.

Sodium cyanide; A negative experience with —— [*in gold extraction*]. W. Magenau. Eng. and Mining J., 1906, 82, 363.

ON using sodium cyanide in place of potassium cyanide

for the extraction of gold from a complex ore containing sulphides of copper, iron, and arsenic, poor yields were invariably obtained, in some cases as low as 20 per cent., as compared with 75 per cent. when potassium cyanide was used. The sodium cyanide used was almost pure; it contained a small quantity of sulphide, but not nearly so much as the potassium cyanide with which good results were obtained.—A. S.

Sands; Simple device for separating —— from slimes. [*Ore treatment*]. C. De Kalb. Eng. and Mining J., 1906, **82**, 206.



The simple device shown in the accompanying figure has proved very efficient as a separator for removing fine sand from slime. It consists of a 4-in. pipe, 12 ft. long, set at an angle of 60°. At the upper end the pipe is provided with a 4-in. T and nipple, N, above which is a short length of 4-in. pipe fitted with a cap, C, through which passes a 1¼-in. pipe, F, extending 2 ft. below the nipple. The lower end of the pipe is also fitted with a cap, K, through which pass a 2-in. discharge pipe, P, and a 1¼-in. pipe, W, which extends 2 ft. above the cap. The ore-pulp is introduced through the pipe, F, and water is delivered through W. The slime is carried upwards by the ascending current of water, and overflows through the nipple, N, whilst the washed sand is drawn off through P.—A. S.

Copper matte (coarse metal); Loss of silver and copper in refining —— to highly concentrated matte and to black copper respectively. E. Günther. Z. angew. Chemie, 1906, **36**, 1558—1559.

According to Ger. Pat. 160,046 (this J., 1905, 897), coarse metal is refined by the converter process so as to yield a highly concentrated matte containing 72—80 per cent. of copper, and this product is used directly as anode material for the production of pure electrolytic copper, with simultaneous recovery of the gold and silver. In this manner the various steps involved in the usual process of first refining the coarse metal to black (crude) copper are avoided. The author has made comparative experiments to determine the losses of silver and copper in the two processes. The results show that on Bessemerising the coarse metal to highly concentrated matte, no appreciable volatilisation of metals occurs, whereas on refining up to black copper the loss may be very considerable.—H. B.

Copper residues. Italian Customs decision. Bd. of Trade J., Sept. 13, 1906. [T.R.] [illegible]

Residues of copper salts, insoluble, not utilisable directly, but fit only to be treated in order to extract the copper therefrom, are to be free of duty as copper ores under No. 208 (c) of the Tariff.

Brass; Effect of arsenic on——. E. S. Sperry. Mech. Eng., 1906, **17**, 763—764. Science Abstracts, 1906, **9A**, 437.

The effect of arsenic up to 0·5 per cent. on the properties of Muntz metal (copper, 60; zinc, 40 per cent.) was examined. Sharper and cleaner castings were obtained from the alloys containing arsenic than from those free from that substance. The ductility of the alloys was improved by addition of arsenic up to 0·02 per cent., probably owing to the reducing action of the latter on cuprous oxide. With higher percentages of arsenic the alloys became brittle, and cracked in the rolls.—A. S.

Vanadium; New occurrence of —— in Peru. Foster Hewett. Eng. and Mining J., 1906, **82**, 385.

A rich vanadiferous mineral, for which the name *patronite* is proposed, has been discovered by A. R. Patron in the neighbourhood of Cerro de Pasco, Peru. It has a dark green colour similar to that of olivenite, and shows a conchoidal to uneven cleavage, and a greenish-black streak; its sp. gr. is 2·65, and hardness, 3·5. An analysis by J. O. Handy gave the following results:—Moisture, trace; silica, 10·88; alumina, 3·85; iron, 2·45; vanadium, 18·08; sulphur, 54·06; molybdic oxide, 0·50; sulphur soluble in carbon bisulphide, 6·55 per cent. W. F. Hillebrand, of the U.S. Geological Survey, reports that the vanadium can be completely extracted by caustic alkali; the iron in the residue is probably in the form of pyrites. After dissolving the pyrites, a black residue containing carbonaceous matter is left. The vanadium appears to be present as a sulphide. The mineral occurs as a vein about 8 ft. thick, in which the vanadium content varies from 9·5 to 15·7 per cent. Associated with the vein is a vein of asphaltite. The latter yields 3·31 per cent. of ash, of which 0·533 per cent. is vanadic oxide. A material apparently intermediate in composition and nature between the vanadiferous mineral and the asphaltite occurs between them. It is black, has a conchoidal fracture, and contains 2 per cent. of ash, which is highly vanadiferous. This material has a vesicular structure, some of the cavities being filled with coked asphaltite. Along a portion of the outcrop the vanadiferous mineral has been oxidised to a brownish substance, resembling limonite, containing as much as 45 per cent. of vanadium oxide. W. F. Hillebrand reports that this oxidation product contains about 45 per cent. of vanadium in the quinquevalent state, about 15 per cent. of water, a small proportion of sulphuric acid, 14—15 per cent. of iron oxide, 20 per cent. or more of silicious gangue, and 0·9 per cent. of molybdic oxide.—A. S.

Aluminium-lead and aluminium-bismuth alloys; Determination of melting-points of —— by thermoelectric pyrometers. H. Pécheux. Compt. rend., 1906, **142**, 397—398.

The author has determined the melting points of these alloys by means of two couples, one platinum-iridio-platinum, the other nickel-copper. The temperatures determined were:—

Per cent. of aluminium.	Platinum-iridioplatinum.	Nickel-copper.
	°C.	°C
Lead alloys—		
92	643	645
94	648	652
96	637	635
Bismuth alloys—		
75	720	719
85	650	674
88	663	664
94	655	650
Aluminium, pure—	635	630

Up to 720° C., then, a nickel-copper junction, well protected from oxidation, can be used instead of the much more expensive platinum combination for the measurement of temperatures.—J. T. D.

"*Silicones.*" O. Boudouard. Bull. Soc. Chim., 1906, 35, 710—715.

Silicones may be prepared from steels rich in silicon by heating with hydrochloric acid until all the iron is dissolved, washing the residue thoroughly and rapidly with cold water, and drying for some days *in vacuo* over sulphuric acid. Amorphous powders varying in colour from white to a deep grey are thus obtained. These contain small quantities of carbon and moisture, but exhibit the general properties of silicones, being insoluble in acids, excepting hydrofluoric acid, liberating hydrogen with alkalis, and reducing metallic salts in the presence of alkalis. They are apparently decomposed by prolonged heating with hydrochloric acid. The author regards them as mixtures of silicoformic anhydride, $Si_2H_2O_3$, and silico-oxalic acid, $Si_2H_2O_4$.—F. Sodn.

Foam-structure of matter; Transition from the liquid to the solid state, and the ——. G. Quincke. Roy. Soc. Proc., 1906, 78A, 60—67.

The author has previously (this J., 1905, 1259) described the foam-structure of ice, and he now states that phenomena similar to those observed in the freezing of water occur in all bodies in nature. The present communication deals mainly with the foam-structure of solid bodies, especially of metals. Molten metals on cooling form first a liquid jelly, and later a solid jelly. The walls and contents of the foam-cells of such a jelly still consist of viscous liquid, *i.e.*, the jelly itself is still liquid—like ice—at temperatures lower than the melting points of the respective metals. The welding of two pieces of metal corresponds to the running together of the cell walls and cell contents of two lumps of jelly, or the regelation of ice. The surfaces of solidified drops of pure molten metals (gold, silver, platinum, palladium, iridium, indium, copper, zinc, iron, nickel, cobalt, bismuth, sodium, potassium, mercury) show a network of straight lines or arcs of circles (usually inclined to one another at 120° or 90°), or foam-walls with embedded lens-shaped masses (compare Ewing and Rosenhain, this J., 1901, 1115; Holborn and Henning, this J., 1902, 1332). Similar phenomena are to be observed on the surface of solidified drops of sulphur and selenium, and on the surface of carbon which has been distilled by means of the electric arc in a magnetic field, and deposited on the cathode. The shapes of the bounding surfaces of the metallic grains formed on cooling molten metals, and the arcs of circles in the network of lines on the surface of metals raised to red or white heat, indicate that these bounding surfaces are not crystalline faces, as has hitherto been believed, but solidified oily foam-walls, which, as in the glacier-grains of ice, enclose foam-cells with contents differing from the walls. On heating the metals nearly to their melting points, larger foam-cells with fewer foam-walls are formed, just as the glacier-grains of ice run together and become larger, owing to the bursting of the foam-walls. A network of lines or foam-walls similar to that on the natural surface of solidified metals becomes visible also on artificial surfaces of metal castings when these are polished, or suitably etched by acids or other liquids (see Beilby, this J., 1901, 992; 1903, 1107, 1108, 1166), the foam-walls being attacked or dissolved either more easily or less easily than the contents of the foam-cells. From a study of Heyn's photographs of etched surfaces of slowly cooled iron containing varying amounts of carbon, it is concluded that iron with 0·05 per cent. of carbon shows fine circular foam-walls of cementite enclosing foam-cells, 0·04—0·1 mm. in diameter, filled with ferrite, the foam-walls meeting at angles of 120°, 90°, &c. Islets of perlite are suspended in the partly invisible foam-walls. When the iron contains more carbon, the cementite separates periodically in parallel layers, or as parallel cylindrical tubes with bulgings and rounded heads, or as spherical foam-walls enclosing "foam-lenses" and foam-cells, 0·001—0·003 mm. in diameter. The tubes, lenses, and foam-cells are filled with ferrite, and also surrounded by ferrite. The greater the percentage of carbon, and the more quickly the molten iron is cooled, the less is the distance of the layers from one another, and the smaller are the foam-cells, just as in the case of ice containing a dissolved salt. The shapes of the microscopic structures in solidified iron containing carbon are the same as in ice containing a salt. The cementite corresponds to the "oily" salt solution in freezing water. Other foreign substances in iron—carbon in the form of graphite and temper carbon, silicon, phosphorus, sulphur, air or other gases, and other metals such as manganese and nickel—even if present only in small quantities, are able to considerably modify the surface tension, melting point, and viscosity of the foam-walls and of the contents of the foam-cells and the size and shape of the foam-cells or glacier-grains of the iron.—A. S.

Carbon dioxide and carbon [in steel]; Determination of ——. J. Macfarlane and A. W. Gregory. XXIII. page 954.

Arseniuretted hydrogen; Removal of —— from crude hydrogen gas. O. Wentzki. II., page 917.

Bismuth production in U.S.A. Oil, Paint, and Dru Rep., Sept. 13, 1906. [T.R.]

The following is taken from the Annual Report of th U.S. Geological Survey, prepared by C. C. Schnatterbeck:—

During 1905 the marketed production of bismuth or in the United States amounted to 24,405 lb., containin approximately 2288 lb. of metal, valued at $4187. Th sales in 1904 were 5184 lb. of ore, valued at $314. In 190 and 1903 there were no transactions.

Metallic bismuth to the amount of 148,589 lb., valued a $318,007, was imported into the United States in 190 as against 185,905 lb., valued at $339,058 in 1904 147,295 lb., valued at $235,199 in 1903; and 190,837 lb valued at $213,704 in 1902. Comparatively little bis muth salt is imported, suggesting expansion in the domesti manufacturing industry.

Features in the bismuth industry in 1905 have been th shipment of ore from a new deposit in California, th resumption of mining on the Ballard property in Colorad and the reduction in the combination's price of the meta in London from 10s. ($2.43) to 5s. ($1.22) per lb. Mor attention has also been given to the development of th deposits in Saxony, the most important in the world as well as to those in Austria, Bolivia, and Australia In the United States the consumption of metallic bismut in 1905 was between 175,000 and 200,000 lb. Most o this was imported free of duty. Small quantities o bismuth salts for chemical and pharmaceutical purpose have also been imported. It is a fact worthy of note tha the import trade has grown over 50 per cent. in the las 10 years, while the bismuth-mining industry in the U.S.A has shown comparatively little progress. This is no because there is a scarcity of bismuth-bearing deposits i the United States, as they have been found in Colorad California, Nevada, Arizona, and Utah, but it is rather th result of inadequate methods of smelting the metal her The refined bismuth imported from Great Britain an Germany frequently contains over 96 per cent. of pur metal, whilst crude metal will contain 93 to 96 per cent. having as impurities antimony and arsenic, or othe metals.

Mining for bismuth in the United States is at presen centred at Leadville, Colo., where the newly incorporate Ballard Consolidated Mining and Milling Compan resumed shipments on June 1, 1905, from properties tha have heretofore been owned and leased by individuals The new deposit in California, from which early in th year were shipped 20 or 30 tons of ore, is situated 55 mile east of Banning. Of late there has been a good enquir in the market for bismuth sulphide ore, and it would no be surprising if in the near future the metal were recovere from the immense placer dumps of schirmerite (containin sulphides of bismuth, silver, and lead) in Montana an other Western States.

Manganese and manganiferous ores; Production of —— in U.S.A., in 1905. Bd. of Trade J., Sept. 13, 1906. [T.R.

The production of manganese ore in the United State in 1905 amounted to 4,118 tons, valued at $36,214, a compared with 3,146 tons, valued at $29,466, in 1904 The production of manganiferous iron ore amounted t 769,256 tons, valued at $1,554,969; that of argentiferou

manganiferous iron ores amounted to 61,736 tons, valued at $276,299; and that of manganiferous zinc ores to 90,289 tons, valued at $90,289. This makes a total production of manganese and manganiferous ores in the United States in 1905 of 945,401 tons, valued at $1,951,771.

Tantalum minerals in U.S.A. Mineral Resources of U.S.A. for 1905. [T.R.]

A TANTALUM mineral has recently been discovered at a felspar quarry at Henryton, Carroll county, Md., about 28 miles from Baltimore. It occurs in irregular masses and rough crystals. A specimen sent to the Westinghouse Electric Company at Pittsburg on analysis gave the following result:—Tantalic oxide, 38·19; niobic oxide, 13·21; manganese oxide, 10·48; ferric oxide, 21·42; and silica, 12·98 per cent.

Some material obtained from Tinton, S.D., was concentrated at Portland, Oregon, and a heavy black mineral was obtained with *cassiterite* and *scheelite* as concentrates from the Wifley table, which, upon analysis, gave 44 per cent. of tantalic oxide and 30·5 per cent. of niobic oxide, these determinations having been made by W. F. Hillebrand, of the United States Geological Survey. The specific gravity of the mineral was determined to be 6·8.

Mineral production of Spain. Eng. and Mining J., Sept. 8, 1906. [T.R.]

THE output of mineral and metal products in Spain for the past two years is officially reported, in metric tons, as in the subjoined tables. The production of fuels was as follows:—

	1904.	1905.
Anthracite	119,096	135,099
Bituminous	2,903,671	3,067,826
Lignite	100,773	168,994
Total	3,123,540	3,371,919

Of the more important metallic ores, the output was:—

	1904.	1905.
Copper ore	2,646,126	2,621,054
Iron ore	7,964,748	9,077,245
Manganese ore	18,732	26,020
Lead ore	93,230	105,113
Mercury ore	27,185	26,485
Silver-lead ore	177,104	160,381
Silver hematite ore	122,109	152,027
Zinc ore	156,329	160,567

Other less important metallic ores were produced in the following quantities:—

	1904.	1905.
Antimony ore	245	77
Arsenic ore	3,510	4,790
Bismuth ore	5	14
Cobalt ore	25	25
Pyrites	161,841	179,079
Silver ore	303	540
Tin ore	299	209
Tungsten ore	60	375

A large part of the pyrites mined in Spain—most of it exported—is included in copper ore, as it carries some copper. The pyrites in the table above is only that which carries no copper.

In the final table are given the output of the lesser non-metallic minerals:—

	1904.	1905.
Amblygonite	90	120
Asphaltum	3,761	5,725
Bituminous rock	100	750
Barytes	453	290
Graphite	20	15
Kaolin	1,700	720
Magnesite	1,129	1,446
Phosphate rock	3,595	1,370
Salt	542,088	493,451
Sulphur	40,230	36,153

The total value of this production in 1905 was estimated at $37,320,435. Statistics of metallurgical production in 1905 are not yet available. The principal metals smelted in Spain are zinc, copper, iron, lead, and mercury. The total metallurgical output in 1904 was valued at $44,166,631, which was probably largely exceeded by that of last year.

Mineral resources of Ceylon. Bd. of Trade J., Sept. 13, 1906. [T.R.]

THE Report for 1905 on the trade of Ceylon, just issued by the Colonial Office, after referring to the discovery of thorianite, states that monazite has also been discovered, and has proved to be of widespread occurrence in Ceylon river sands. Small deposits of cassiterite and galena have been found, as well as molybdenite. The output of plumbago, in spite of the falling of value from Rs. 20·88 per cwt. in 1902 and Rs. 12·50 in 1903 and 1904 to Rs. 11·70, which in some cases leaves barely sufficient margin to cover expenses, shows an increase over previous years, and 612,848 cwt. were exported.

Mineral resources of Algeria. For. Off. Ann. Series, No. 3712. [T.R.]

THE report of the British Vice-Consul at Bône contains an account of the mineral resources of that locality. The districts of Souk-Ahras and Tébessa, he says, abound in zinciferous deposits still unworked. Discoveries of carbonate of lead at Batna and of cinnabar near Jemmapes are not being worked owing to lack of capital. Peroxide of manganese, said to contain 65 per cent. of metal, is found one mile from Ain-Yagout. Antimony mines near Guelma are for sale. The province of Constantine, says the Vice-Consul, contains more ferruginous beds than the provinces of Algiers and Oran put together

ENGLISH PATENTS.

Briquettes from fuel, ores, and the like; Manufacture of ——. J. Noll and E. Trainer. Eng. Pat. 12,516, June 16, 1905. II., page 917.

Metals; Processes for purifying ——. H. M. Chance, Philadelphia. Eng. Pat. 17,449, Aug. 29, 1905.

SEE U.S. Pat. 800,984 of 1905; this J., 1905, 1116.—T. F. B.

Cast-iron. E. and S. Wallis, Derby. Eng. Pat. 9453, April 23, 1906.

THE improved cast-iron is made by melting in a cupola furnace, in the order given, and mixed with a suitable quantity of fuel: 3 cwt. of Warner pig-iron No. 4, 2 cwt. of Warner pig-iron No 3, 1 cwt. of Stanton pig-iron No. 3, 4 cwt. of good scrap iron, consisting preferably of old machine castings, and 5 lb. of mild steel in small pieces. The mixture of pig-irons used contains approximately: Carbon, 3·33; silicon, 1·65; sulphur, 0·04; phosphorus, 0·30; and manganese, 0·47 per cent. Other irons of similar composition may be used instead of those given above, and the steel may be melted separately, and then intimately mixed with the molten iron if desired.—A. G. L.

Zinc and lead-sulphide ores; Treatment of ——. A. H. Imbert, Grand Montrouge, France. Eng. Pat. 10,303, May 2, 1906.

THE ore is mixed with lime and ferric oxide or other suitable substances, and heated in a retort connected with a suitable condenser to about 1100° C., whereby, it is stated, a perfectly fluid homogeneous bath is produced. If new metallic iron or other metal in a solid or liquid state be introduced, it is found that the zinc is almost completely volatilised in about a quarter of an hour, leaving a perfectly liquid mass, which on being run out and cooled, consists of an upper layer of slag and a lower stratum of sulphide containing scarcely any zinc. When lead is present in the ore, most of it is found in a metallic state beneath the sulphide, but a small proportion passes over with the zinc fumes.—J. H. C.

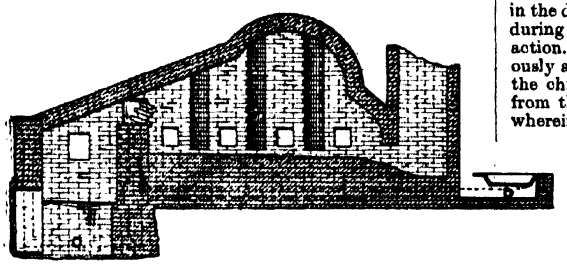
United States Patents.

Furnace for the immediate production of metal from ores; and metallurgical process. O. B. Dawson, Caldwell, N.J. U.S. Pats. 829,574 and 829,575, Aug. 28, 1906.

The invention relates to a process of producing directly from ores, metals which do not form carbides at the temperature of a gas-fired furnace. The ground ore is subjected, in the absence of air and without any flux, at a temperature below the melting or volatilising point of the metal, to the action of finely-divided carbon and of the carbon monoxide which is instantaneously produced therefrom. The process is carried out in a rotating reducing furnace, heated internally by a flame, which is introduced at one end, in such a manner that it can be directed to any part of the charge or hearth. Means are provided for regulating the character of the flame. The ends of the furnace are covered with caps lined with fire-proof material, and an inspection tube is provided passing through the stack and the cap at the flue end of the furnace.—A. S.

Furnace; Metallurgical ——. G. W. Shear, Joliet, Ill. U.S. Pat. 829,676, Aug. 28, 1906.

The furnace (see figure) has its roof formed with straight portions inclined in opposite directions, and united by a



"rampant" arch, the inclination of one of the straight portions being greater than that of the other. The lines of the arch merge into the lines of the straight portions, and the inclination of the arch is towards the front of the furnace.—A. S.

Furnace; Roasting and volatilising ——. S. I. Clawson, Salt Lake City, Utah. U.S. Pat. 829,843, Aug. 28, 1906.

The furnace comprises a muffle fixed in and extending through a revolving cylinder mounted in an inclined position. Between the muffle and the cylinder are "fire chambers" (heating chambers) communicating with a fire-box at the lower end of the cylinder. The upper end of the muffle communicates with a vertical "fume-pipe," and there is also a stationary chimney or smoke-stack, from which a longitudinal branch extends above the cylinder for its entire length. The ore is fed into and conveyed through this branch of the stack, and then falls down a shoot into a conveyor, which passes transversely through the fume-pipe, and extends into the muffle. The branch of the stack also contains a nest of air-superheating pipes, the air from which is forced by a fan into the fuel-feeding device, which delivers powdered coal to the fire-box. There are also longitudinal air-superheating pipes disposed in the wall of the cylinder, communicating with a coiled pipe surrounding the fire-box, the coil being connected to a blast-pipe which delivers the hot air into the lower end of the muffle.—A. S.

Furnace; Matte-producing ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 830,039, Sept. 4, 1906.

The invention relates to a furnace for producing copper matte or copper, and consists in constructing the wall of the furnace in adjustable water-cooled sections, one of which carries a slag-spout.—A. S.

Blast furnace. M. Mannaberg, Assignor to Frodingham Iron and Steel Co., Frodingham. U.S. Pat. 830,513, Sept. 11, 1906.

See Eng. Pat. 26,263 of 1905; this J., 1906, 319.—T.F.B.

Furnace for roasting, chloridising [chlorinating], or drying ores. A. V. Leggo, Pendeen, Victoria. U.S. Pat. 830,904, Sept. 11, 1906.

See Eng. Pat. 21,160 of 1905; this J., 1906, 591.—T.F.B.

Sulphurous oxide [Sulphur dioxide]; Process of recovering——[from furnace gases]. F. R. Carpenter, Denver, Colo. U.S. Pat. 829,765, Aug. 28, 1906.

The gases from furnaces burning sulphide ores are moistened with cold water, and caused to deposit suspended particles of solid matter, and the sulphurous oxide (sulphur dioxide) in the gases is recovered by absorption in water cooled to about 0° C.—A. S.

Ores; Method of smelting ——, and separating mattes. R. Baggaley, Pittsburg, Pa., C. M. Allen, Lo Lo, Mont., and E. W. Lindquist, Chicago, Ill. U.S. Pat. 830,040, Sept. 4, 1906.

A body of molten matte is formed in a converter, and air is blown through. Sulphide ore is then fed in at one end of the converter, and allowed to float on the molten matte in the direction of the other end, being oxidised and melted during its travel, by the heat produced by the converting action. The resulting slag and matte overflow continuously at the axis of the converter, and are protected from the chilling effect of the atmosphere during their travel from the converter to a fore-hearth or settling chamber, wherein they are separated by gravity.—A. S.

Crucible. E. A. Colby, Newark, N.J. U.S. Pat. 830,208, Sept. 4, 1906.

The claim is for a lining of friable material which is applied in sections or otherwise to the inner face of the inner side of an annular crucible. It is formed so as to be less resistant to internal pressure than the material of the crucible, in order that the latter may not be fractured by the expansive force of the solidifying metal.—W. H. C.

Zinc; Apparatus for obtaining ——. J. Armstrong, London. U.S. Pat. 830,283, Sept. 4, 1906.

See Eng. Pat. 20,543 of 1905; this J., 1905, 1113.—T.F.B.

Silicon; Method of melting and casting ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 830,738, Sept. 11, 1906.

The silicon is fused in a vessel of carbon, the temperature being kept too low to form silicon carbide. The molten silicon is cooled in a suitable mould.—E. S.

French Patents.

Volatile minerals; Recovery and utilisation of heat lost in the condensation of metallic dust from roasting ——. See Anon. des Mines et Usines d'Antimoine de Brioude-Auvergne. Fr. Pat. 361,530, Dec. 21, 1905.

By means of an arrangement of cooling tubes, each open at one end to the air, whilst the other end opens into a common channel, through which air is supplied to the furnace, the heat abstracted from the volatilised substances is utilised in the roasting furnace.—J. H. C.

Metals and alloys; Production of fused —— by means of their oxides and other compounds. Weldite, Ltd. Fr. Pat. 364,949, Feb. 24, 1906.

See Eng. Pat. 10,881 of 1905; this J., 1906, 763.—T.F.B.

Furnaces; Regenerative ——, with arrangement for regulating the firing. Bethlehem Steel Co. Fr. Pat. 364,240, March 14, 1906.

The furnace proper is built over regenerative chambers which are supplied with air and gas; these having become heated in their passage through the chambers are allowed

to mix in a conduit whence they pass into the furnace-chamber through a series of orifices—the spent gases being finally allowed to escape to the chimney through a similar series of orifices, the whole circulation being controlled by valves so arranged as to reverse the currents when desired.—J. H. C.

Thermic process, based on the action of silicon combined with magnesium or its compounds. T. Goldschmidt. Fr. Pat. 364,313, March 16, 1906.

This process is based on the mutual reaction of oxides or sulphides of metals, or of metallic compounds and halogen substances, or of combinations of such bodies with each other when mixed with a reducing agent consisting of a mixture, or alloy, of magnesium and silicon, all the substances being employed in a finely divided or granulated condition. Such mixture is analogous to "aluminothermite," which forms the basis of the "Goldschmidt's process," wherein aluminium acts as the reducing agent.
—J. H. C.

Copper and other metals; Extraction of —— from burnt pyrites residues. A. Tixier. Fr. Pat. 364,512, March 23, 1906.

The residues are treated with nascent chlorine in an acid solution at a temperature of from 70° to 80° C., whereby the copper and other metals are brought into solution for subsequent treatment by known methods.

The nascent chlorine is obtained from chloride of lime, or alkali or alkaline-earth hypochlorites. The dry burnt pyrites residues may, for example, be treated with from 2 to 5 per cent. of chloride of lime, and then, in the vats, the mixture is treated with dilute hydrochloric acid.
—J. H. C.

Minerals; Process and apparatus for the reduction or fusion of —— by means of carbon monoxide. E. A. A. Grönwall. Fr. Pat. 365,412, April 19, 1906. Under Int. Conv., May 8, 1905.

See Eng. Pat. 9799 of 1906; this J., 1906, 850.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 892.)

(*A.*)—ELECTRO-CHEMISTRY.

Paper and solid cellulose [and acetylcellulose]; Electrical insulating properties of dry ——. A. Campbell. Proc. Roy. Soc., 1906, 78A, 196—211.

The results of experiments on a number of papers used for insulating telephone wires are given. All the papers were of "chemical wood fibre," this kind being considered the most durable. For telephonic purposes a minimum of specific inductive capacity is desirable; this constant ranged from 1·8 to 2·5 (air = 1) in the papers examined, after thorough drying, and was found to be approximately proportional to the density. The best material is that which contains the greatest proportion of air spaces, and in which the fibres lie as much as possible parallel to the surface.

For transparent films of pure cellulose the specific inductive capacity was found to be about 7, for normal cellulose triacetate about 3·9. The latter material is far less susceptible to temperature changes, as regards electrical properties, than cellulose. Cellulose as an insulator is very greatly affected by minute amounts of moisture, and the author's experiments on this point lead to the inference that in air-dried material a part of the moisture is chemically combined with cellulose to form an electrolytic solution, possibly of water in cellulose hydrate. When the temperature is raised, dissociation takes place, and an altered equilibrium between cellulose and water is eventually attained.—W. A. C.

Reduction processes; Rôle of metal hydrides in ——, and new data as to the composition of certain fats and fish oils. S. Fokin. J. russ. phys.-chem. Ges., 1906, 38, 419—446. Chem. Centr., 1906, 2, 758—759.

It has been stated by Marie (Compt. rend., 136, 1331; also this J., 1903, 1003) and Petersen (Z. Elektrochem., 11, 549; also this J., 1905, 895) that, in the electrolytic reduction of unsaturated acids, the nature of the cathode used has no appreciable influence upon the course and velocity of the reaction. The author finds, however, that reduction can only be effected with cathodes of palladium, platinum, rhodium, ruthenium, iridium, osmium, nickel, cobalt, and copper, and that the quantity and the physical condition of the metal has a considerable influence on the course of the reduction. It is known that the metals named have the capacity of occluding hydrogen, with the formation of unstable hydrides. It is these metals, also, which have been found to act as hydrogen-carriers in the reduction processes studied by Sabatier and Senderens (this J., 1901, 978; 1902, 504, 566, 1070, 1157; 1903, 1012; 1904, 341, 654). The author is of the opinion that all reduction processes taking place in presence of the metals mentioned, *viz.*, electrolytic reduction, reduction of gaseous substances by reduced metals by the process of Sabatier and Senderens, reduction by galvanic couples, and reductions by metal hydrides in solutions, are due to a special activity of the occluded hydrogen, probably owing to such hydrogen being in the monatomic condition. The activity of the metals varies directly with their capacity of occluding hydrogen; palladium is the most efficient, and then follow, in the order given, platinum, nickel, cobalt, and copper. The best results are obtained by the electrolytic process, and the author has studied in this way the reduction of the fatty acids from linseed oil, Japanese wood oil, castor oil, and cod-liver oil, other unsaturated acids, allyl alcohol, nitrobenzene, and carbon tetrachloride. He finds that linseed oil contains besides linolenic acid, an isomeride of linolic acid, which does not form a crystalline tetra-bromo-derivative. The elæomargaric acid from Japanese wood oil contains 18, not 17, carbon atoms, and appears to be an isomeride of linolic acid. The hydroxystearic acid from castor oil is identical with the acid described by Kojanski (J. russ. phys.-chem. Ges., 32, 149). Cod-liver oil contains fatty acids with from 18 to 21 carbon atoms. Carbon tetrachloride is reduced to chloroform, and also, in part, to methylene dichloride and methyl chloride.—A. S.

English Patents.

Filaments for incandescing electric lamps; Manufacture of ——. J. R. Crawford. Eng. Pat. 14,898, July 19, 1905. II., page 918.

Filaments for electric incandescent lamps; Manufacture of ——. H. Zerning. Eng. Pat. 2554, Feb. 1, 1906. II., page 918.

Voltaic strong-current arcs; Production of ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 7869, April 2, 1906.

In order to produce voltaic strong-current arcs between electrodes comparatively distant from each other, the discharges of an auxiliary spark-gap are blown into the space between the electrodes. The horn-shaped electrodes between which the arc is to be struck are connected by wires to a source of electrical energy. In parallel with this main spark-gap is arranged the primary coil of a transformer, the secondary coil of which is connected to an auxiliary pair of electrodes disposed below and in the same plane as the main electrodes. The two pairs of electrodes are contained in a pipe of oval cross-section, through which a current of gas is blown at a velocity of at least 50 metres per second. The discharge between the auxiliary electrodes is blown by the current of gas between the main electrodes, and allows the electrical energy supplied to the latter to jump across the spark-gap.—A. S.

United States Patents.

Furnace; Electric ——. B. Platschick, Paris. U.S. Pat. 826,962, July 24, 1906.

This invention relates to an electric muffle, consisting of a receptacle of fire-proof material and a casing into which the receptacle fits. The casing is provided with a bottom and fixed vertical walls, together with a movable vertical side wall which is pivoted at its lower edge to the bottom, and a top or lid pivoted to the upper edge of the movable wall. In the wall of the receptacle is secured a heating conductor, the latter being connected to two contact pieces projecting from the lateral wall of the receptacle, and passing through apertures in the casing. When the receptacle is placed in position in the casing, the contact pieces engage with spring contacts fixed to a bed-plate which carries the casing. In the back of the receptacle, is an opening, through which is placed a thermo-electric couple, one end of the latter projecting into the heated portion of the furnace. Resistance wires, housed in the wall of the receptacle, are attached to the rear end of the couple, the couple and resistance wires being protected against the influence of the temperature at the outside of the apparatus by a "heat-repelling pad." Rods are connected to the resistance wires, and project outside the receptacle, so that connection may be made with a suitable galvanometer.—B. N.

Filament; [Electric] Incandescent lamp ——, *and method of making the same.* J. M. Canello. U.S. Pat. 829,568, Aug 28, 1906. II., page 919.

Cotton; [Electrolytic] Method of treating ——. G. D. Burton. U.S. Pat. 827,293, July 31, 1906. V., page 925.

Gases; [Electrical] Method of effecting chemical action in ——. D. R. Lovejoy, Assignor to Atmospheric Products Co., Niagara Falls, N.Y. U.S. Pat. 829,872, Aug. 28, 1906.

This invention relates to a method of causing gases to unite chemically, and consists in charging the gases separately with electrostatic charges of different polarity, and of a potential sufficient to effect chemical combination. When the gases are mixed, the electrostatic attraction of the molecules of one gas for the molecules of the other gas will cause combination of the gases.—B. N.

Gases; Apparatus for subjecting —— *to high-tension [electrical] discharges.* D. R. Lovejoy, Assignor to Atmospheric Products Co., Niagara Falls, N.Y. U.S. Pat. 829,873, Aug. 28, 1906.

The apparatus comprises a chamber for receiving the gases, a series of fixed electrodes mounted adjustably in the walls of the chamber, and a series of movable electrodes, both sets being connected in parallel with a high-tension alternating current. In order to ensure a minimum volume and minimum current for each of the arcs, each of the parallel electrode circuits is provided with an inductance, and the electrodes are constructed of fine wire. The movable electrodes are fixed to the ends of supports carried by a shaft capable of rotation, the shaft being provided with insulated bearings. As the shaft turns, the movable electrodes come within arcing distance of the fixed electrodes, and the arcs are successively formed, elongated, and extinguished. The arc formed between any pair of electrodes is isolated by suitable means from the arcs formed between adjacent pairs of electrodes. A synchronous motor, mounted on, but insulated from, the chamber, is connected to the generator, and drives the movable electrodes, means being provided for adjusting the making and extinction of the arcs relatively to the alternation and phase of the alternating current. A rectifier, in the alternating current circuit, with its commutator moving with the movable electrodes, is arranged so as to cause reversals of current during extinction of the arcs, whereby the same potential relation between the electrodes is maintained. The gases are supplied to the central portion of the chamber at a pressure higher than that of the atmosphere, and the gases receive an outward spiral motion. Outlets for the products are arranged in close proximity to the arcing points, and each outlet is provided with a deflector, directed contrary to the direction of rotation of the shaft, so as to deflect the products formed by the arcs into the outlets. Gas-ducts, leading from the outlets, are provided with valves, which are intermittently opened and closed by suitable means, thus giving an intermittent flow of gases into the chamber, the impulses of flow being timed to commence just after the arcs are struck, and to cease just after the arcs are extinguished. The gases may be separately charged electrostatically before being led into the chamber, and allowed to mix in the presence of the arcs, or immediately before coming into contact with the arcs.—B. N.

Gases; [Electrical] Method of effecting the combination of ——. D. R. Lovejoy, Assignor to Atmospheric Products Co., Niagara Falls, N.Y. U.S. Pat. 829,874, Aug. 28, 1906.

This invention relates to a process of forming nitrogen compounds, an electric arc or arcs being formed, elongated, and interrupted, and a mixture of air and oxygen, containing about equal volumes of nitrogen and oxygen, being introduced into the presence of the arc. The residual gas may be again treated after enriching with oxygen. Hydrogen may also be added, so as to form a mixture containing less than 10 per cent. of hydrogen.—B. N.

Gases; [Electrical] Apparatus for effecting chemical action in ——. D. R. Lovejoy, Assignor to Atmospheric Products Co., Niagara Falls, N.Y. U.S. Pat. 829,875, Aug. 28, 1906.

A suitable reaction chamber is provided with one outlet and two inlet-passages for supplying gases, the latter passages being provided with electrodes. Electrostatic charges of opposite potential are given to the electrodes, which thus impart similar charges to the gases. Means are provided for heating the electrodes, and for subjecting the gases to the influence of a source of radiant energy.
—B. N.

Gases; [Electrical] Process and apparatus for effecting chemical action in ——. D. R. Lovejoy, Assignor to Atmospheric Products Co., Niagara Falls, N.Y. U.S. Pats. 829,876 and 829,877, Aug. 28, 1906.

The molecules of the gases, such as nitrogen and oxygen, are separately charged electrostatically to opposite potentials, and the gases mixed, and subjected to the action of an electric current in the form of an arc of minimum volume. The arc is maintained at a minimum volume, sufficient to prevent the breaking of the arc, or the latter may be repeatedly formed, elongated, and interrupted.—B. N.

Ozonised air or oxygen; Apparatus for producing highly ——. A. Déchaux, Paris, Assignor to W. Mallmann, Ruremonde, Holland. U.S. Pat. 830,975, Sept. 11, 1906.

See Fr. Pat. 335,092 of 1903; this J., 1904, 193.—T. F. B.

French Patents.

Incandescence lamps; Process of increasing the electric resistance of certain metals, especially those used for glow-bodies of ——. H. Kuzel. Fr. Pat. 364,613, March 27, 1906. II., page 920.

Glow-bodies for electric lighting; Manufacture of ——. Siemens and Halske, A.-G. Fr. Pat. 364,925, April 5, 1906. II., page 920.

Incandescence electric lamps with metallic filaments; Manufacture of ——. Deutsche Gasglüh. A.-G. (Auergas). Fr. Pat. 365,168, April 12, 1906. II., page 921.

Sugar from molasses; Process of extracting —— *by the aid of a new compound.* R. Battistoni and R. Rotelli. Fr. Pat. 364,689, Jan. 6, 1906. XVI., page 944.

to mix in a conduit whence they pass into the furnace-chamber through a series of orifices—the spent gases being finally allowed to escape to the chimney through a similar series of orifices, the whole circulation being controlled by valves so arranged as to reverse the currents when desired.—J. H. C.

Thermic process, based on the action of silicon combined with magnesium or its compounds. T. Goldschmidt. Fr. Pat. 364,313, March 16, 1906.

This process is based on the mutual reaction of oxides or sulphides of metals, or of metallic compounds and halogen substances, or of combinations of such bodies with each other when mixed with a reducing agent consisting of a mixture, or alloy, of magnesium and silicon, all the substances being employed in a finely divided or granulated condition. Such mixture is analogous to "aluminothermite," which forms the basis of the "Goldschmidt's process," wherein aluminium acts as the reducing agent.
—J. H. C.

Copper and other metals; Extraction of —— from burnt pyrites residues. A. Tixier. Fr. Pat. 364,512, March 23, 1906.

The residues are treated with nascent chlorine in an acid solution at a temperature of from 70° to 80° C., whereby the copper and other metals are brought into solution for subsequent treatment by known methods.

The nascent chlorine is obtained from chloride of lime, or alkali or alkaline-earth hypochlorites. The dry burnt pyrites residues may, for example, be treated with from 2 to 5 per cent. of chloride of lime, and then, in the vats, the mixture is treated with dilute hydrochloric acid.
—J. H. C.

Minerals; Process and apparatus for the reduction or fusion of —— by means of carbon monoxide. E. A. A. Grönwall. Fr. Pat. 365,412, April 19, 1906. Under Int. Conv., May 8, 1905.

See Eng. Pat. 9799 of 1906; this J., 1906, 850.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 892.)

(*A.*)—ELECTRO-CHEMISTRY.

Paper and solid cellulose [and acetylcellulose]; Electrical insulating properties of dry ——. A. Campbell. Proc. Roy. Soc., 1906, 78A, 196—211.

The results of experiments on a number of papers used for insulating telephone wires are given. All the papers were of "chemical wood fibre," this kind being considered the most durable. For telephonic purposes a minimum of specific inductive capacity is desirable; this constant ranged from 1·8 to 2·5 (air = 1) in the papers examined, after thorough drying, and was found to be approximately proportional to the density. The best material is that which contains the greatest proportion of air spaces, and in which the fibres lie as much as possible parallel to the surface.

For transparent films of pure cellulose the specific inductive capacity was found to be about 7, for normal cellulose triacetate about 3·9. The latter material is far less susceptible to temperature changes, as regards electrical properties, than cellulose. Cellulose as an insulator is very greatly affected by minute amounts of moisture, and the author's experiments on this point lead to the inference that in air-dried material a part of the moisture is chemically combined with cellulose to form an electrolytic solution, possibly of water in cellulose hydrate. When the temperature is raised, dissociation takes place, and an altered equilibrium between cellulose and water is eventually attained.—W. A. C.

Reduction processes; Rôle of metal hydrides in ——, and new data as to the composition of certain fats and fish oils. S. Fokin. J. russ. phys.-chem. Ges., 1906, 38, 419—446. Chem. Centr., 1906, 2, 758—759.

It has been stated by Marie (Compt. rend., 136, 1331; also this J., 1903, 1003) and Petersen (Z. Elektrochem., 11, 549; also this J., 1905, 895) that, in the electrolytic reduction of unsaturated acids, the nature of the cathode used has no appreciable influence upon the course and velocity of the reaction. The author finds, however, that reduction can only be effected with cathodes of palladium, platinum, rhodium, ruthenium, iridium, osmium, nickel, cobalt, and copper, and that the quantity and the physical condition of the metal has a considerable influence on the course of the reduction. It is known that the metals named have the capacity of occluding hydrogen, with the formation of unstable hydrides. It is these metals, also, which have been found to act as hydrogen-carriers in the reduction processes studied by Sabatier and Senderens (this J., 1901, 978; 1902, 504, 566, 1070, 1157; 1903, 1012; 1904, 341, 654). The author is of the opinion that all reduction processes taking place in presence of the metals mentioned, *viz.*, electrolytic reduction, reduction of gaseous substances by reduced metals by the process of Sabatier and Senderens, reduction by galvanic couples, and reductions by metal hydrides in solutions, are due to a special activity of the occluded hydrogen, probably owing to such hydrogen being in the monatomic condition. The activity of the metals varies directly with their capacity of occluding hydrogen; palladium is the most efficient, and then follow, in the order given, platinum, nickel, cobalt, and copper. The best results are obtained by the electrolytic process, and the author has studied in this way the reduction of the fatty acids from linseed oil, Japanese wood oil, castor oil, and cod-liver oil, other unsaturated acids, allyl alcohol, nitrobenzene, and carbon tetrachloride. He finds that linseed oil contains besides linolenic acid, an isomeride of linolic acid, which does not form a crystalline tetra-bromo-derivative. The elæomargaric acid from Japanese wood oil contains 18, not 17, carbon atoms, and appears to be an isomeride of linolic acid. The hydroxystearic acid from castor oil is identical with the acid described by Kojanski (J. russ. phys.-chem. Ges., 32, 149). Cod-liver oil contains fatty acids with from 18 to 21 carbon atoms. Carbon tetrachloride is reduced to chloroform, and also, in part, to methylene dichloride and methyl chloride.—A. S.

English Patents.

Filaments for incandescing electric lamps; Manufacture of ——. J. R. Crawford. Eng. Pat. 14,898, July 19, 1905. II., page 918.

Filaments for electric incandescent lamps; Manufacture of ——. H. Zerning. Eng. Pat. 2554, Feb. 1, 1906. II., page 918.

Voltaic strong-current arcs; Production of ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 7869, April 2, 1906.

In order to produce voltaic strong-current arcs between electrodes comparatively distant from each other, the discharges of an auxiliary spark-gap are blown into the space between the electrodes. The horn-shaped electrodes between which the arc is to be struck are connected by wires to a source of electrical energy. In parallel with this main spark-gap is arranged the primary coil of a transformer, the secondary coil of which is connected to an auxiliary pair of electrodes disposed below and in the same plane as the main electrodes. The two pairs of electrodes are contained in a pipe of oval cross-section, through which a current of gas is blown at a velocity of at least 50 metres per second. The discharge between the auxiliary electrodes is blown by the current of gas between the main electrodes, and allows the electrical energy supplied to the latter to jump across the spark-gap.—A. S.

Olive marc; Extraction of —— with carbon bisulphide or carbon tetrachloride. R. Jürgensen. Z. angew. Chem., 1906, 36, 1546—1547.

THE residues left after the extraction of oil from olives by pressure contain from 10 to 16 per cent. of oil, which is usually recovered by means of volatile organic solvents, such as ether, benzine, and especially carbon bisulphide. Carbon tetrachloride may be used advantageously in place of carbon bisulphide, as it is now obtainable at a moderate price. It is non-inflammable and leaves no odour in the oil.—H. B.

Herring oil; Japanese ——. C. E. Sage. Chem. and Drug., 1906, 69, 398.

A SAMPLE of Japanese herring oil examined by the author gave the following results:—Colour, pale brown; sp. gr. at 20° C., 0·9116; acid value, 16·8; saponification value, 193·7; iodine value, 137·0. (See also this J., 1906, 819.) —A. S.

Reduction processes; Role of metal hydrides in ——, and new data as to the composition of certain fats and fish oils. S. Fokin. XIA., page 935.

ENGLISH PATENTS.

Fatty acids; Manufacture of —— from fatty acid esters. Verein. Chemische Werke A.-G., Charlottenburg, Germany. Eng. Pat. 25,080, Dec. 9, 1905. Under Int. Conv., Jan. 25, 1905.

SEE Addition of Dec. 11, 1905, to Fr. Pat. 328,101 of 1902; this J., 1906, 654.—T. F. B.

Tallows; Process for purifying ——. J. Harris, London. Eng. Pat. 4290, Feb. 21, 1906.

OZONE is blown through the melted fat, which is then treated with an alkaline solution to precipitate impurities and colouring matters. The supernatant fat is next treated with air or, if necessary, with ozone again, and is finally mixed with, say, 5 per cent. of an alkaline aluminous earth, and filtered. In the case of abnormal rancidity or odour, low-pressure steam may be blown through the fat after the separation of the precipitated impurities, and before the final treatment with air.—C. A. M.

Soap powders or detergents having both cleansing and polishing properties. W. Pochin and J. H. Richardson, Manchester. Eng. Pat. 26,119, Dec. 15, 1905.

THE powder consists of a mixture of soapstone (say 100 parts), a sodium compound such as anhydrous sodium carbonate (say 20 parts), with or without a little caustic soda, and soap (say 7 parts). Special claim is also made for the method of mixing these ingredients, the soap and sodium carbonate being first ground together, the soapstone, preferably in powder, then added, and the whole ground until thoroughly mixed.—C. A. M.

UNITED STATES PATENTS.

Lubricant. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 830,739, Sept. 11, 1906.

A GREASE or an oil is thickened by the mere addition of, and mixing with, powdered silicon monoxide.—E. S.

Soap, and process of making the same. M. Kuess, Tunis. U.S. Pat. 830,332, Sept. 4, 1906.

SEE Fr. Pat. 337,714 of 1903; this J., 1904, 488.—T.F.B.

FRENCH PATENTS.

Fatty substances; Saponification of ——. A. Haller. Fr. Pat. 361,552, June 13, 1905.

THE process claimed is for the simultaneous saponification of oils or fats and esterification of the fatty acids, by treating the fats, &c., with pure or concentrated alcohols and a small quantity of an acid such as hydrochloric acid, preferably on a hot water bath, under a reflux condenser. The resulting esters are separated from the glycerol and excess of the alcohol by treatment with cold water or salt water, and then isolated from one another by rectification, filtration, &c.—C. A. M.

Olive and other vegetable oils; Process of extracting ——. Don Miguel del Prado y Lisboa. Fr. Pat. 365,187, April 12, 1906.

THE entire olives or other fruit are introduced into a closed vessel surrounded by a hot water chamber, and provided with a mechanical agitator, and the oil liberated at a low temperature (20° C. at most) is drawn off below through filtering material by means of a vacuum pump. The temperature of the pulp is then raised to, say, about 50° C., and a second quality of oil drawn off through a filter into a second receptacle. Finally steam is blown into the vessel, and the supernatant oil drawn off through a pipe at the top, yielding oil of the third class. The olive stones separated from the residual pulp can be utilised in the manufacture of alcohol, acetic acid, &c., by destructive distillation, whilst the fruit pulp itself can be used as food for cattle. Special claim is made for a form of apparatus in which the above-described method of separating the oil can be carried out.—C. A. M.

Lubricating oil which emits no odour, or even has an agreeable odour on burning. A. Haenflein and L. Kornfeld. Fr. Pat. 365,335, April 17, 1906.

CLAIM is made for an addition to ordinary lubricating oil of substances which give off a pleasant odour on burning, and have a boiling point lower than that of the oil itself. Suitable substances mentioned are oil of mirbane, "*huile de terpine* ($C_{10}H_{18}O$)," and salicylic aldehyde.—C. A. M.

Wax; Method of bleaching ——. E. Weingärtner. Fr. Pat. 365,355, April 17, 1906.

THE crude substance (beeswax, carnäuba wax, &c.) is heated above its melting point, and treated with about 10 per cent. of fullers' earth, which is added little by little. The temperature is then gradually raised and maintained at, say, 150°—170° C., until the wax is bleached, after which the fullers' earth and impurities are separated by filtration, and the wax left in the residue subsequently extracted by means of a solvent.—C. A. M.

Detergent for use with hard or saline waters. R. Macpherson and W. E. Heys. Fr. Pat. 364,975, April 6, 1906. Under Int. Conv., Nov. 16, 1905.

A SOAP is prepared by treating cocoanut olein and a suitable albuminoid substance, preferably finely powdered cocoanut pulp, at a high temperature with a sufficient quantity of caustic alkali to effect saponification. Flour or other filling material can be added to the ingredients before saponification. It is claimed that the product is cheap, that it is easily soluble in hard and sea water, that it does not leave any odour, and that the small quantity of insoluble soap which it leaves on clothes, &c., is easily removed by rinsing.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page 895.*)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Paints or compounds; Anti-corrosive ——. A. Milburn, trading as the Firsoline Manufacturing Co., East Sunderland, Durham. Eng. Pat. 18,683, Sept. 15, 1905.

A PREPARATION specially intended for metallic surfaces is made by incorporating oils, tallow, rosin, or the like with a mineral colour, such as zinc white, and an inert substance such as plaster of Paris. The ingredients and proportions specially claimed are as follows:—Fir or pine oil, 25; zinc white, &c., 15; plaster of Paris, 10; Archangel or Stockholm tar, 5; a resin, preferably Kauri, 10; and tallow, 35 per cent.—C. A. M.

Colour lakes [from azo dyestuffs]; Manufacture of ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 27,252, Dec. 30, 1905.

THE patent relates to the preparation of colour lakes from the azo dyestuffs obtained by combining diazo compounds with the β-hydroxynaphthoic acid melting at 216° C. The free azo-carboxylic acids are treated at a high temperature with one or more alkaline-earth salts of a feeble acid (fatty or resin acids), or the sodium salt of the azo-carboxylic acid is treated with a soluble alkaline-earth salt in presence of one or more alkaline-earth salts of a weak acid. For example, 100 parts of white, finely ground heavy-spar are well stirred with 250 parts of water, and 23·47 parts of a paste containing 20 per cent. of *p*-nitrobenzene-azo-β-hydroxynaphthoic acid, diluted with 250 parts of water, are stirred in. Then, whilst stirring is continued, 3·2 parts of calcium chloride dissolved in 64 parts of water, 2·4 parts of sodium carbonate dissolved in 48 parts of water, and 2·5 parts of Turkey red oil (50 per cent.) in 25 parts of water, are added, and the whole is boiled until the shade no longer changes.—A. S.

Dyestuff; Manufacture of an [azo] ——, *and colour lakes made therefrom.* Farbw. vorm. Meister, Lucius, und Brüning. Eng. Pat. 9989, April 28, 1906. IV., page 922.

UNITED STATES PATENTS.

White lead; Apparatus for producing ——. J. W. Bailey, Jersey City, N.J., Assignor to United Lead Co., New Jersey. U.S. Pat. 830,196, Sept. 4, 1906.

THE apparatus comprises a corroding chamber fitted with overlapping shelves disposed one above the other. An endless chain moves over the shelves in succession, and is provided with cross-bars to which are pivoted rows of ploughs, "placed alternately in reversed positions." The movement of the chain operates mechanism for feeding comminuted lead to the top shelf, and for supplying a limited amount of moisture to the lead. By means of the ploughs the lead on the shelves is continually turned over, and moved along the shelves and from one shelf to the next lower one, at a rate slower than the movement of the chain. Means are provided for supplying a corroding gas to the chamber.—A. S.

Paint. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg. U.S. Pat. 830,737, Sept. 11, 1906.

SEE Eng. Pat. 1279 of 1906; this J., 1906, 434.—T. F. B.

Paint; Method of making ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 830,740, Sept. 11, 1906.

A SILICON monoxide paint is made, which is used in combination with other paints or pigments. (See Eng. Pat. 1279 of 1906; this J., 1906, 434.)—E. S.

FRENCH PATENTS.

Lithopone; Manufacture of —— stable to light. W. Ostwald. Fr. Pat. 364,713, March 29, 1906. Under Int. Conv., April 1, 1905.

SEE Eng. Pat. 7819 of 1906; this J., 1906, 768.—T. F. B.

Paint; Liquid cementing ——. The Standard Paint Co. Fr. Pat. 364,752, March 30, 1906.

THIS paint is intended specially for filling interstices in roofing, and for flexible coverings, and is stated not to crack with changes of temperature or when the material, which may contain bitumen or pitch, is rolled or unrolled. It consists of suitable proportions of an agglutinating substance (e.g., 30 parts of sterin pitch), of a colouring matter, preferably a metallic oxide (e.g., 20 parts of red oxide of iron), and of a volatile solvent (e.g., 46 parts of turpentine oil).—C. A. M.

Colour bases; Process for preparing salts, soluble in water, fats, and oils, from organic ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 365,025, April 7, 1906. Under Int. Conv., May 19, 1905.

SEE Eng. Pat. 10,079 of 1906; this J., 1906, 768.—T. F. B.

(B.)—RESINS, VARNISHES.

Copals; Action of naphthalene upon ——. C. Coffignier. Bull. Soc. Chim., 1906, 35, 762—767.

THE author has compared the properties of a copal from Madagascar with those of the same rendered soluble by fusion and by heating with naphthalene under pressure (Terrisse, this J., 1904, 552). The advantages of this latter method of treatment are: (1) There is no loss of weight; (2) the resulting product is pale in colour; (3) its hardness is almost unimpaired. The effects of each process on the properties of the copal are shown in the following table:—

	Original copal.	Fusion process.	Naphthalene process.
Specific gravity at 16° C.	1·058	1·062	1·061
Melting point	above 300° C.	205° C.	165° C.
Acid value	93·0	68·2	68·0
Saponification value ..	70·1	44·9	65·9
Percentage insoluble in—			
Ethyl alcohol	73·8	91·8	74·4
Methyl alcohol	79·6	93·3	86·8
Amyl alcohol	22·4	66·7	13·8
Ether	65·0	51·8	19·7
Chloroform	69·0	1·7	soluble
Carbon tetrachloride..	85·0	4·0	25·8
Spirit of turpentine..	60·3	3·6	52·1
Acetone	64·3	84·8	65·0
Benzene	78·4	1·5	40·0
Aniline	17·8	gelatinous	soluble
Benzaldehyde	21·8	2·0	soluble
Amyl acetate	24·6	51·2	soluble

—F. SODN.

UNITED STATES PATENTS.

Wood distilling and preserving apparatus [for extraction of turpentine, &c.]. F. S. Davis, Mulligan, S.C. Assignor to J. C. Richardson, Robertsville, S.C. U.S. Pat. 826,407, July 17, 1906.

THIS invention relates to an apparatus for treating wood with a heated fluid, such as melted rosin, the latter extracting turpentine and other light volatile oils without injuring the texture of the wood. The material to be treated is placed in a retort, or battery of retorts, a valved branched supply pipe connecting each of the retorts with a centrifugal pump located at or near the bottom of a tank. The latter is heated by a suitable furnace for melting down the material used as a distilling fluid, and the fluid is thoroughly agitated, and discharged from the tank to the retorts by the pump. A valved gravity discharge pipe connects each retort with the tank. The distilling fluid is maintained at an even temperature after being charged into a retort, by circulating it through a reheater and back to the retort by means of a second pump.—B. N.

Turpentine; Process for clarifying and deodorising oil of wood ——. E. Heber, New York. U.S. Pat. 830,069, Sept. 4, 1906.

TARRY matters are removed from oil of wood turpentine by distillation over lime, and the purified oil is emulsified with soap solution; the emulsion is treated with oxidising agents to oxidise the colouring matters and odoriferous substances, the soap is precipitated, and the product distilled with steam, the purified turpentine oil being subsequently separated from the water.—T. F. B.

FRENCH PATENT.

Resins; Process for obtaining transparent synthetic —— to be used as substitutes for natural resins. Fabr. de Prod. de Chim. Organ. de Laire. Fr. Pat. 361,839, June 8, 1905.

TRANSPARENT synthetic resins, which can be used in place

of copal, amber, shellac, &c., are prepared by condensing commercial phenol or its homologues with formaldehyde or its homologues, and heating the condensation product in the air, under pressure, or *in vacuo*. For example, 10 parts of phenol are treated with 5—10 parts of a 40 per cent. solution of formaldehyde and about 10 parts of 15 per cent. hydrochloric acid. The product is washed free from acid and excess of phenol, and the resulting plastic mass is heated for about half an hour at 140° C., either in the air or in presence of an inert gas under pressure, when a hard, transparent, yellow resin, resembling amber, is obtained.—A. S.

(*C.*)—INDIA-RUBBER, &c.

India-rubber latex; Physical chemistry of ——. V. Henri. Gummi-Zeit., 1906, **20**, 1227—1229.

The latex of *Hevea brasiliensis* is faintly alkaline, and contains 8·7 per cent. of total solids. In one cubic millimetre there are 50 millions of microscopically visible globules, which show well-marked Brownian movement, but can be brought to rest by dilution with at least 500 volumes of 20 per cent. brine. Latex which has been freed from salts, &c. by dialysis, may by suitable reagents be either precipitated in flocculent particles or coagulated to a clot, the latter phenomenon being experimentally proved to be merely an advanced stage of the former. Alcohols have no effect on dialysed latex; neither have alkalis and salts of univalent metals. Salts of the alkaline earths, in at least N/1 concentration, and salts of the heavy metals as dilute as N/20, precipitate but do not coagulate. Acids are precipitants, sulphuric acid being especially active and causing coagulation in moderate dilution. Trichloracetic acid, even dilute, and acetone, are coagulants. Coagulation is readily brought about by mixtures of alcohol with very small proportions of bivalent salts or of acids, whilst alkalis have an inhibitory influence.—W. A. C.

Latex of Kickxia (Funtumia) elastica. H. Strunk. Ber. Dtsch. pharm. Ges., 1906, **16**, 214—226. Chem. Centr., 1906, **2**, 689.

Specimens of the latex of *Kickxia elastica* were obtained from cuts in the barks (1) 20 cm. and (2) 2½ m. above the ground, (3) from cuts in thin branches 4 m. above the ground, and (4) from leaf-stalks. These contained respectively: (1), 49·09; (2), 44·17; (3), 35·38; and (4) 52·02 per cent. of dry substance; and (1), 44·84; (2), 35·94; (3), 22·84; and (4), 44·94 per cent. of pure caoutchouc. The percentage of caoutchouc in the latex thus appears to decrease as the distance of the cut above the ground increases. In Kamerun, the natives coagulate the latex by mixing it with one-half or one-third of its volume of water, and boiling in an earthenware vessel. Coagulation can, however, be effected without boiling by pouring the latex into five times its volume of water, and vigorously agitating the mixture. An addition of 1 c.c. of 25 per cent. hydrochloric acid retards the coagulation of the caoutchouc by boiling; an addition of 3 c.c. of 32 per cent. hydrochloric acid, on the other hand, so accelerates the process that coagulation takes place at 45°—50° C.; the caoutchouc obtained in this manner shows less tendency to decompose than that obtained in other ways. The average specific gravity of the latex was 0·9961 at 28° C., and the average content of dry substance, 46·88 per cent., with 0·806 per cent. of ash. The freshly coagulated rubber contains 5·31—7·41 per cent. of resin. On keeping, the rubber softens somewhat owing to oxidation, the proportion of caoutchouc decreasing and that of resin increasing. The author recommends collecting the latex from long, vertical incisions in the tree.—A. S.

Latex of Dyera costulata. W. A. Tilden. Brit. Assoc., Section B, York, 1906. Chem. News, 1906, **94**, 102.

The sample of the latex of *Dyera costulata* examined by the author contained a small quantity of ammonia, which had been added to prevent coagulation. It was a white creamy liquid of sp. gr. 1·11, miscible with water. It is coagulated, sooner or later, by all acids, and on vigorous agitation the suspended particles unite to form lumps. It is also coagulated by strong brine, and by warming with an equal volume of a 20 per cent. solution of sodium carbonate. When heated to 70°—80° C., a skin forms on the surface. The latex yielded about 44 per cent. of solid matter when coagulated by hydrochloric acid; the coagulum was tough, but contained very little rubber substance, being almost completely soluble in alcohol and in acetone.

Pontianak, which is stated to be obtained from *Dyera costulata*, contains a small quantity of caoutchouc mixed with two or more other substances, of which one, melting at 173° C., can be crystallised from alcohol. The crystals contain 81·2 per cent. of carbon and 11·0 per cent. of hydrogen, corresponding approximately to the formula, $C_{14}H_{22}O$. The molecular weight, as determined by the freezing-point method, was, however, about 322, as compared with 206 required by the formula given.—A. S.

Rubber; Sicilian ——. E. Marckwald and F. Frank. Gummi-Zeit., 1906, **20**, 1254—1255.

A sample of crude rubber prepared from the latex of *Ficus elastica* plants, grown in the Botanical Gardens, Palermo, was found to have the following composition:—

Moisture (loss at 100° C.), 1·51; mechanical organic impurities, 2·30; inorganic impurities, 1·75; resins, 22·19; and rubber substance, 72·29 per cent.

Although the change of habitat of the plant appears to have influenced the product detrimentally in the sense of increasing its resin-content, the crude rubber was yet of apparently good quality.

From a sample of the latex the authors obtained 38 per cent. of dry substance by coagulation.

A sample of a rubber-containing resinous product, obtained from *Abractylis gummifera L.*, indigenous to Sicily (*cf.* Landerer, Ueber den Akanthomastix des Orients. Buchners Repertorium, 1874, p. 437; Lefranc, Med. pharm. Botanik, 1883, p. 1105; Wiesner, Rohstoffe, 2nd Edition, Vol. I. p. 81, Vol. II. p. 495), was also examined and found to have the following composition:—

Moisture (loss at 100° C.), 4·24; mechanical organic impurities, 1·40; albuminoids, 4·07; inorganic impurities, 2·31; resins, 51·52; and rubber substance, 36·46 per cent.

The product has been stated to be used to adulterate mastic (Landerer, *loc. cit.*).—E. W. L.

Rubber industry of Brazil. For. Off. Ann. Series, No. 3713. [T.R.]

The development of the trade in seringa rubber is evident from the following figures, showing the exports from Brazil for the past five years:—

Year.	Quantity. Tons.	Value. £
1901	29,161	8,454,179
1902	27,177	7,052,586
1903	29,068	9,293,839
1904	28,505	10,515,877
1905	31,474	13,795,372

English Patents.

Caoutchouc and the like; Processes for obtaining ——. B. Grätz, Berlin. Eng. Pat. 4692, Feb. 26, 1906. Under Int. Conv., Feb. 1, 1906.

See Fr. Pat. 363,339 of 1906; this J., 1906, 895.—T.F.B.

India-rubber, artificial; Process of manufacturing ——. P. Beresin, St. Petersburg. Eng. Pat. 8953, April 14, 1906.

See Fr. Pat. 365,047 of 1906, following these.—T.F.B.

United States Patent.

India-rubber; Process for devulcanising ——. C. A. R. Steenstrup, Assignor to Aktieselskabet Gummi-Regenerations-Societet (System Rosen-Steenstrup), Copenhagen. U.S. Pat. 830,260, Sept. 4, 1906.

See Fr. Pat. 351,816 of 1905; this J., 1905, 935.—T.F.B.

FRENCH PATENT.

Caoutchouc; Process for the manufacture of artificial ——. P. Beresfne. Fr. Pat. 365,047, April 9, 1906.

COD-LIVER oil or a vegetable oil, preferably that extracted from the flowers of the sunflower (*Helianthus annuus*), is treated with sulphur chloride (25 parts to 100 parts of oil). The mixture becomes hot, and when the temperature rises to 115° C. the action is stopped by cooling. The mass is then exposed to the air for at least 10 days, when an elastic, yellow substance, called "caoutchène," is obtained. This is cut into small pieces, dissolved in benzene, mixed with a solution of "matésite" in benzene, and isoprene added to the mixture. The product is freed from benzene by heating *in vacuo*. The "matésite" is obtained from the sticky juice of a plant of the *Apocyneæ* species, which grows in Madagascar. The juice is added to a 2 per cent. solution of sodium chloride, heated to 30° C. with agitation, for half an hour, the salt solution decanted off, the residue washed with cold water, and dried. The isoprene is prepared by treating fusel oil with fuming sulphuric acid whilst blowing a current of air through the liquid, filtering the resulting black mass, treating the filtrate with quicklime, and subjecting it to destructive distillation; isoprene begins to distil over at 117° C.

—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 897.)

Tannin; Determination of —— in tanning materials. Boudet. XXIII., page 956.

Seaweed industry of Japan. C. J. Davidson. XVIII*A*., page 948.

Chrome tanning industry of Madras. Bd. of Trade J., Sept. 13, 1906. [T.R.]

MR. A. CHATTERTON, Superintendent of Industrial Development, Chrome Tanning Department, Madras, reports on the results of the chrome tanning operations undertaken under his superintendence during the year ended 31st March. The following is extracted from Mr. Chatterton's report:—

"The output of chrome leather from the Chrome Tanning Department, Madras, has risen in value from Rs. 400 a month in 1904–05 to Rs. 2500 a month in 1905–06. . . . . Experience extending now to more than two years shows that the leather is well adapted to kavalais (for well irrigation), but that the price at which they can be manufactured in Madras is more than the ordinary ryot will pay. . . .

"The natural colour of the leather is a pale green or light lavender blue, and for boots, shoes, and harness it has to be dyed.

"The cost of manufacture of chrome leather is little greater than that of bark-tanned leather, but in order to turn out presentable chrome tanned leather, a superior class of hide or skin is required. In Madras only 'seconds' are suitable for this trade, and for these enhanced prices are asked, as the demand for them is considerable. . . .

"The goods certainly do not possess the finish of imported material, but they lack nothing in respect to strength and durability. . . . ."

Mr. Chatterton ascribes the failure of chrome leather to be adopted for the manufacture of kavalais for well irrigation to three causes, *viz.*:—

1. The fact that the purchase of raw skins from the market is itself a highly difficult art, in the technique of which his subordinates are just beginning to acquire experience;

2. The cost of the chrome-tanning process, which cannot be reduced unless operations are carried on on a much more extensive scale than is possible with the present limited demand for chrome-tanned leather and chrome leather articles; and

3. The fact that the price of chrome leather articles is prohibitive to the ordinary Indian purchaser, accustomed to cheap kavalais and to shoes and sandals made of country leather.

ENGLISH PATENTS.

Leather; Manufacture of ——. F. Kohl, Stuttgart, Germany. Eng. Pat. 14,602, June 26, 1906.

THE patent relates to an improved method of tanning hides. Two vats are used: after being treated in one vat, the hides are passed between pressure rollers, and then transferred to the other vat, these operations being repeated until the desired effect is produced. It is claimed that in this way the preliminary soaking of the hides is finished in one to two hours, the swelling and loosening of the hair in about two hours, and the actual tanning in about half an hour.—A. S.

Glutinous substance in a dry and neutral state; Method of obtaining a soluble —— from tang-acid. Soc. Franç. La Norgine, Paris. Eng. Pat. 9622, April 24, 1906. Under Int. Conv., May 23, 1905.

SEE Fr. Pat. 361,498 of 1905; this J., 1906, 897.—T. F. B.

UNITED STATES PATENT.

Plastic masses from casein, &c.; Manufacture of ——. L. Collardon, Leipsic, Germany. U.S. Pat. 830,493. Sept. 11, 1906.

SEE Fr. Pat. 359,073 of 1905; this J., 1906, 327.—T. F. B.

FRENCH PATENTS.

Tanning; Process of ——. M. Guigneux. Fr. Pat. 364,954, March 17, 1906.

THE skins are soaked in soft water for about 24 hours, scraped on the flesh side to remove fatty and other matters, and then soaked in soft water for from four to eight days, the water being renewed at least every 48 hours. They are next treated in succession in four baths of the following composition:—

Temperature.	Water.	Alum.	Sea salt.
	litres.	kilos.	kilos.
(1) 30° C.	100	50	37·5
(2) At 35° C., (3) at 40° C., and (4) at 45° C.	100	50	18·75

Whilst in these baths the skins are worked with the hands, turned over, and rubbed, to accelerate the penetration of the dissolved salts into the skin. The skins are afterwards treated again in baths of the same composition as those described, but with an interval of 7—8 days between each treatment, until they are sufficiently tanned. The tanned skins are finished by oiling on the flesh side with dégras. The process is stated to be very economical, and to leave unaltered the natural colour of the fur.—A. S.

Gelatin; Process for rendering —— iridescent. A. Lecocq née C. Mouton. Fr. Pat. 361,562, June 17, 1905.

THE gelatin is dissolved in water containing some ammonium bromide in solution (3—5 per cent. of the weight of the gelatin), and if the finished product is to be more or less opaque, zinc white or the like is added. The solution is poured on to glass plates in the usual manner to obtain sheets or films of gelatin, which after being dried, are soaked in a bath of alcohol or ether, or a mixture of the two, or in alcohol or ether to which has been added a small quantity of acetic acid or ammonia. The gelatin is then dried, and afterwards soaked in a solution of silver nitrate in 80 per cent. alcohol (2 grms. of silver nitrate per litre), with or without the addition of ether, and again dried. Instead of soaking the gelatin in the first bath of alcohol or ether, it may be moistened with water.—A. S.

Gelatin with a dull surface; Process for the manufacture of ——. A. Lecocq née C. Mouton. Fr. Pat. 361,563, June 17, 1905.

THE process consists in incorporating with the gelatin,

before forming it into sheets, a suitable proportion of starch (from 5 to 20 per cent. of the weight of dry gelatin). If the gelatin be then allowed to set on a surface of ground glass, both sides of the sheet are dull; if the mould be of smooth glass, the gelatin will have a bright surface on the side which has been in contact with the glass, but this can be made dull by moistening or soaking in water.—A. S.

Casein; Process for rapidly drying precipitated hydrated ——. J. Ricard and C. E. Riche. Fr. Pat. 364,635, March 27, 1906.

The process is based on the fact that at about 100° C. the hydrated casein is converted into a pasty mass. The moist casein is fed from a hopper between two drying cylinders rotating in opposite directions, and heated to 100°—110° C.; it forms a film on the surface of the cylinders, and is quickly dried; the dry casein is removed by scrapers. A modification is also claimed in which only one drying cylinder is used.—A. S.

Glue or size, and process of making the same. M. Bonnet. Fr. Pat. 365,285, April 14, 1906.

The size is prepared with suitable proportions of rosin, carbon bisulphide, cellulose, caustic soda, and water. For example, 2 parts of rosin, 5 parts of carbon bisulphide, 8 parts of cellulose, 30 parts of caustic soda solution at 20° B., and 55 parts of water yield an agglutinant suitable for the manufacture of briquettes, &c. If 115 parts of water be used, a product suitable as a distemper is obtained; with 227 parts of water, a size applicable in the manufacture of paper is obtained; whilst with 400 parts of water the resulting product is suitable as a finish for textiles.—A. S.

German Patents.

Plastic mass; Process for the preparation of a ——. A. Allers. Ger. Pat. 168,358, Feb. 23, 1904.

One hundred and thirty grms. of aniline hydrochloride are dissolved in 130 grms. of water, and 90 grms. of formalin (40 per cent. solution of formaldehyde) are added. The mixture becomes hot. It is well stirred, cooled to 40°—50° C., and a further 90 grms. of formalin added. After stirring, the mixture is allowed to cool, when it sets to a plastic mass.—A. S.

Plastic mass from ivory- or horn-cuttings; Process for the preparation of a ——. H. Foerster. Ger. Pat. 168,360, April 14, 1904.

Ivory- or horn-cuttings are softened by heating, mixed with a binding agent such as albumin, and with fibres of "wood wool," or crude vegetable fibres, and pressed. The fibrous material increases the strength of the mass, and imparts a marbled appearance to the finished product. —A. S.

XV.—MANURES, &c.

(*Continued from page* 898.)

Beetroot vinasse; Concentration of —— with regard to the production of manure. P. Kestner. XVII., page 946.

Artificial manures in Japan. For. Off. Ann. Series, No. 3700. [T.R.]

The demand for fertilisers in Japan is very active; the import still grows, while the home production increases, and yet prices continue to rise. The import is composed mainly of ammonium sulphate, oil-cake, and phosphates. The greater part of the sardines caught in Japanese waters, in value about £750,000 a year, are ultimately used as manure.

Guano, &c.; Licence to remove —— from Ashmore Islands. Bd. of Trade J., Oct. 4, 1906. [T.R.]

Tenders are invited for an exclusive licence from the Secretary of State for the Colonies to occupy the Ashmore Islands (lying off the coast of Western Australia, in Latitude 12 deg. 14 min. S., Longitude 123 deg. 6 min. E.) and to remove guano and other fertilising substances therefrom. Tenders should be on the basis of a fixed royalty per ton of guano removed, the sum payable in any one year not to be less than a fixed amount, whatever the quantity of guano removed during that year. The term of years for which a licence is desired should also be stated. Further information may be obtained at the Colonial Office, Downing Street, S.W.

Phosphate of lime in Algeria. For. Off. Ann. Series, No. 3712. [T.R.]

Phosphate of lime is found in such a great number of places in the province of Constantine, and is so easily worked, that it can be considered one of the first mineral resources of Algeria.

The principal beds in the province may be divided into four groups: (1) District of Tébessa; (2) district of Sétif; (3) district of Guelma; (4) district of Aïn-Beïda.

The rock phosphate extracted is of two qualities: No. 1 containing 63 to 70 per cent. of phosphate of lime; No. 2, 58 to 63 per cent.

The cost price of the phosphate on trucks at Tébessa station is about 4s. per ton. This includes extraction, drying, and transport from the mines to Tébessa. The cost of carriage from Tébessa to Bône, which is already very high according to the railway tariff—6s. 2d. per ton—is further increased by the necessity of transhipping the phosphate at Souk-Ahras from the narrow-gauge line of Tébessa into the trucks of the broad-gauge line between Souk-Ahras and Bône.

Altogether the cost of a ton of phosphate on quay at Bône is from 11s. to 12s.

French Patent.

Distillation residues of starchy matters [Vinasse]; Process for recovering ——. F. and E. D. Verbiese. Fr. Pat. 361,534, June 2, 1905. XVII., page 947.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 899.)

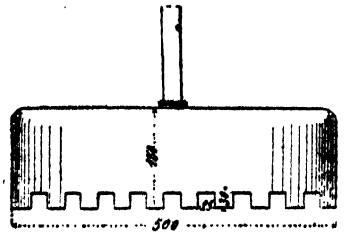
Sugar content of the beetroot and purity of diffusion juice as well as that of the massecuite obtained therefrom; Relation between ——. F. Sachs. Sixth Internat. Congr. Appl. Chem., Rome, 1906; Z. Ver. deut. Zuckerind., 1906. 827—838.

The author considers that too much importance is attached to the "coefficient of purity" of sugar juice, and prefers to value the latter by the estimation of the "coefficient of impurity," *i.e.*, the amount of foreign matter (non-sugar) per 100 parts of sugar in manufacturing products. Similarly, the "coefficient of salts" should be replaced by the "coefficient of ash," *i.e.*, the amount of inorganic matter per 100 parts of sugar. The difference between the coefficient of impurity and that of ash represents the amount of foreign organic matter per 100 parts of sugar. To find approximately the "true" coefficient of impurity, the author recommends the estimation of the apparent coefficient (deduced from the polarisation and the degrees Balling), the ratio between the apparent and the true coefficients of impurity being taken as 10:9.

Analytical results from a number of Belgian and Dutch sugar factories, obtained during 1892—1905, are tabulated and compared. In one series of tables the author has classified the results in three periods, 1892—1895, 1895—1901, 1901—1905, for the Belgian analyses, and 1892—1894, 1894—1900, 1900—1905, for the Dutch analyses. In both cases the percentage of sugar in the beetroot shows a progressive increase, and the impurity coefficient of the diffusion juice and also of the first product massecuite shows a progressive decrease. In both cases, also, the results show an improvement in the factory work; in the first period (1892—1895) 33 and 36 per cent. respectively of the foreign matter in the diffusion juice were removed during the preparation of the first product massecuite, in the second period the amounts removed were 32 and

38 per cent., and in the third period 40 and 41 per cent. The results also show that the work in the Dutch factories is, on the average, better conducted than that in the Belgian factories.—L. E.

Carbonation [Sugar manufacture]; Latest improvements in ——. Dutilloy. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 111—114.



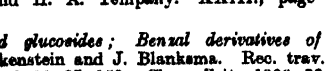
The continuous carbonation process when properly conducted gives excellent results. The supply of juice and gas is regulated by frequent testing of samples taken from the carbonating apparatus. In practice the process is controlled by the adjustment of the rate of supply of juice, that of gas being seldom altered. The supply of juice must be regular, and the proportion of lime in the juice must be nearly constant. A proper degree of alkalinity of the carbonated juice is not a sufficient guarantee of satisfactory working, since this may be the result of a mixture of over-carbonated juice with juice containing too much alkali. The working of the process is simpler than that of the older methods, but it requires constant attention.

In factories where continuous control cannot be ensured, the author recommends the use of the ordinary cylindrical apparatus with a new form of gas distributor. This consists of a bell-shaped apparatus (see figure), the notched edge of which causes a more thorough agitation of the juice and perfect utilisation of the gas. Three of these distributors are employed in each carbonating vat. Two vats of 60 hectols. working capacity are sufficient to deal with the juice from 500 tons of beetroot.—L. E.

Sucrose; Polarimetric determination of —— II. F. Watts and H. A. Tempany. XXIII., page 957.

Sugars and glucosides; Benzal derivatives of ——. A. v. Eckenstein and J. Blanksma. Rec. trav. chim. Pays-Bas, 1906, **25**, 153; Chem.-Zeit., 1906, **30**, Rep., 301—302.

In the presence of phosphorus pentoxide, arabinose combines with benzaldehyde to form dibenzal-arabinose



a well crystallised substance (m.pt. 154° C.), which contains no hydroxyl groups. Xylose and rhamnose form similar compounds. Dilute sulphuric acid decomposes these benzal derivatives into the sugar and benzaldehyde. The hexoses also react with benzaldehyde in the presence of phosphorus pentoxide; the condensation products, however, could only be obtained in the form of syrups, and, unlike the benzal pentoses, they are capable of taking up an acetyl group. The glucosides combine with benzaldehyde much more readily than the sugars. By heating a glucoside with benzaldehyde and anhydrous sodium sulphate, a well crystallised body is obtained which does not reduce Fehling's solution, and which is decomposed by dilute sulphuric acid. From *α*- and *β*-methylglucoside monobenzal derivatives were obtained; *α*-methylmannoside yielded a mono- and a dibenzal-methylmannoside. Salicin and arbutin furnish monobenzal compounds. The aldehydes of tolulo and cuminic acids also give condensation products with pentoses and glucosides; salicylic aldehyde on the contrary does not react with the sugars.—L. E.

Vinasse; Influence of sulphur compounds on the refining of ——. Lecombe. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 46—51.

Owing to the employment of sulphites as clarifying agents for sugar juice, the vinasse obtained from juice so treated contains a considerable quantity of sulphides, sulphites, hyposulphites, and thiocyanates. The presence of these substances interferes with the accuracy of the titration of the potassium carbonate in the vinasse; the hyposulphites, in oxidising to sulphates on calcination, decompose some of the potassium carbonate. Moreover, to obtain a calcined product containing 75—80 per cent. of carbonate, the lye must be evaporated to a greater concentration when these substances are present, the consumption of fuel being thereby increased. The author considers that care should be taken that the secondary combustion which occurs through contact with the air, when the calcined vinasse leaves the furnace, is as complete as possible, so that the sulphur compounds are converted into sulphates. He also considers that in the analysis of the calcined vinasse the lower compounds of sulphur should be oxidised to a degree corresponding to the oxidation which occurs in the subsequent refining of the calcined vinasse, so that the value of the sample may be accurately judged.

In the discussion which followed, H. Pellet recommended the abandonment of sodium bisulphite as a clarifying agent.—L. E.

Waste waters [from manufacture of beet sugar]; Re-employment and purification of ——. *Application of carbonation.* H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 58—67.

The author recommends carbonation as a means of purifying the waste water from the beetroot presses and from the diffusion process. This method presents the following advantages: 1. Reliable purification and production of a clear water free from all noxious organisms. 2. Recovery of all the sugar present in the waste waters. 3. Recovery of a considerable proportion of water ready for direct use in diffusion. 4. Reduction of the number of vats required for decanting and purifying the waste waters. 5. Elimination of all the trouble caused by running the waste waters of the refinery into rivers. 6. Small initial expense of installation, which takes up less space and is always ready for use; the cost of working is covered by the value of the sugar obtained.

The author cites the results of a bacteriological analysis of the water before and after treatment by the carbonation process, which show that the process is very efficient, the purified water being comparable from a bacteriological standpoint to many potable waters. The purified water may readily be preserved without alteration, and as it would be used at once after purification in the diffusion battery, it should be preferable to ordinary water for this purpose, since the latter is sometimes contaminated with dissolved or suspended matters which are injurious to the regular working of the battery.

A sample of purified waste water from the press, after concentration, yielded a syrup having an apparent purity of 74·5. A blank experiment showed that 12·2 per cent. of impurity was due to mineral and organic matter present in the fresh diffusion water. Hence organic and mineral impurities from the beetroot are contained in the purified waste water in comparatively small quantity.—L. E.

Sugar cane and bagasse; Direct determination of sugar in ——. H. Pellet. XXIII., page 956.

Polarimetric sugar analysis; Clarification with dry basic lead acetate in ——. W. Horne. XXIII., page 956.

Maple syrup and maple sugar; Determination of "lead number" in ——. A. L. Winton and J. L. Kreider. XXIII., page 957.

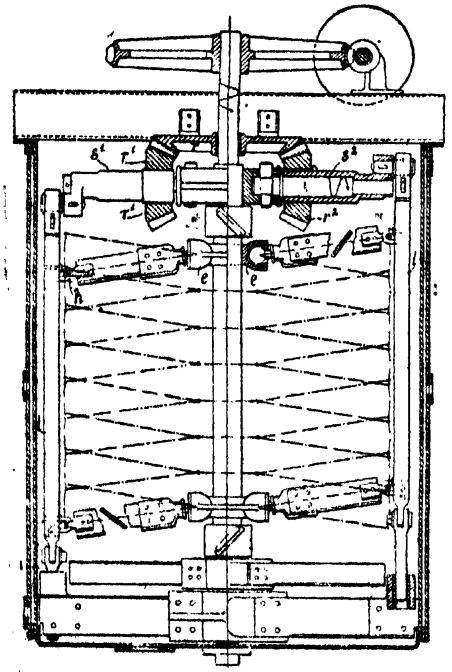
Musts and wines; Speed of inversion of sucrose in ——. L. Mathieu. XVII., page 945.

Sugar production of Germany. Bd. of Trade J., Sept. 20, 1906. [T.R.]

THE "Reichsanzeiger" of September 14th publishes statistics of the production of sugar in Germany during the campaign 1905–06 (from September 1st, 1905 to August 31st, 1906). In 1905–06 the quantity of raw beet used in sugar manufacture was 15,728,425 metric tons as compared with 10,071,211 metric tons during the 1904–05 campaign; the amount of raw sugar produced in 1905–06 was 2,125,344 metric tons against 1,367,566 metric tons in 1904–05, whilst the production of refined sugar amounted to 1,709,099 metric tons in 1905–06, as compared with 1,286,328 metric tons in 1904–05. The total output of sugar (raw and refined) during the period of September, 1905 to August, 1906, expressed in terms of raw sugar, was 2,394,445 metric tons as compared with 1,605,438 metric tons in the corresponding months of 1904–5.

ENGLISH PATENTS.

Sugar masses; Apparatus for promoting the crystallisation of ——, and for intimately mixing other pulpy masses with diluting agents. T. Drost, Charlottenburg, Germany. Eng. Pat. 6009, March 12, 1906.



FOR promoting the crystallisation of sugar-masses by stirring, a special form of agitator is claimed, which is characterised by horizontal stirring arms to which a rocking motion is imparted in addition to the rotary motion of the stirring shaft. The rocking motion is obtained by means of spur wheels, r, r^1, r^2 (see figure), which cause the rotation of the crank shafts, s^1, s^2, constituting the top arms of the stirrer. These rotary crank shafts actuate the connecting rods, l, to which the other arms of the stirrer are linked, these other arms being connected to the central shaft by swivel joints, e. In this manner, all parts of the fluid are maintained in constant motion.—J. F. B.

Gum tragacol from locust-bean kernels; Manufacture of ——. P. C. D. Castle, Bebington, Cheshire. Eng. Pat. 10,822, May 24, 1905.

AN improved method of extracting gum tragacol from the locust bean (see Eng. Pats. 24,677 of 1894 and 6151 of 1899; this J., 1896, 112) consists in steeping 3 parts of prepared kernels in 10 parts of cold water containing about 1 per cent. of formalin for about one hour. The excess of water may then be drained off, and a further quantity of 10 parts of water with 1 per cent. of formalin added. After a short time, hot water is added at intervals of half an hour, until there are about 65—90 parts of water for every 3 parts of kernels, and the mash is maintained at a temperature of about 185° F. Finally, the solution of gum is strained through cloth. The formalin prevents the extraction of any of the colouring matter from the husks, which need not therefore be removed before treatment.—J. F. B.

UNITED STATES PATENT.

Saccharine liquids; Defecating ——. F. L. Stewart, Murrysville, Pa., Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 829,678, Aug. 28, 1906.

THE hot juice is neutralised, treated with a mixture of stearic acid and the sulphite of a light metal or of an alkaline-earth, *e.g.*, magnesium sulphite, the whole heated to boiling, and the clear juice separated from the precipitated impurities.—A. S.

FRENCH PATENTS.

Sugar from molasses; Process of extracting —— by the aid of a new compound. R. Battistoni and R. Rotelli. Fr. Pat. 364,639, Jan. 6, 1906. Under Int. Conv., Jan. 14, 1905.

THE molasses is diluted with water, and treated with a quantity of alkali carbonate solution in order to precipitate the calcium salts present. After filtration, the liquid is mixed with another liquid containing carbon and barium hydroxide, obtained by carbonising barium sucrate. The barium sucrate may be washed with a saturated barium hydroxide solution, or it may be decomposed by treatment with carbon dioxide, and then mixed with powdered charcoal before filtration. The mother-liquor from the barium sucrate precipitate can be treated with carbon dioxide, filtered, and the filtrate concentrated to form a manure after being mixed with calcium sulphate or peat. The mixture containing carbon and barium oxide used for precipitating the sugar is called "baryundum," and is prepared by heating the cakes of barium carbonate, obtained from the sugar solutions, in an electric furnace; native barium carbonate mixed with charcoal, sugar, and sodium and potassium salts may also be employed for preparing the compound. Whilst in the furnace, the charge is subjected to heating and electrolytic actions, and the process may be applied to the preparation of pure barium oxide or a mixture of the oxide and sulphide from barium sulphite or sulphate. Strontium oxide can be obtained in a similar manner. The carbon dioxide liberated from the barium carbonate in the furnace is collected and utilised for the carbonation of the sugar solutions.—W. P. S.

Starch; Process of preparing —— to render it capable of swelling in cold water. The Arabol Manufacturing Co Fr. Pat. 365,161, April 10, 1906.

SEE Eng. Pat. 7705 of 1905; this J., 1906, 601.—T. F. B.

Gum solutions; Preparation of aseptic ——. Zieger und Wiegand. Fr. Pat. 365,193, April 13, 1906.

SOLUTIONS of gum may be rendered aseptic, for surgical use, by treating them with formaldehyde. The latter is added in the form of an ethereal solution, the ether serving as a carrier for the formaldehyde, and preventing the precipitation of the gum by the latter.—W. P. S.

GERMAN PATENT.

Animal or bone charcoal; Process for the preparation of purified ——, by means of an acid. G. Banfi. Ger. Pat. 168,034, Dec. 1, 1904.

ANIMAL charcoal is treated, in presence of water, with

sulphur dioxide gas under slight pressure, in order to convert the calcium carbonate and calcium phosphate contained in it into soluble calcium salts, which can be removed by washing first with dilute sulphurous acid solution, and afterwards with water.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 903.)

Diastase; Preparation of pure ——, and its properties. S. Fränkel and M. Hamburg. Woch. f. Brau., 1906, 23, 473—475.

Five kilos. of malt grist, prepared from highly diastatic malt, are mashed with 15 litres of water at 25° C. After stirring for one hour, the mash is allowed to stand for half an hour. The diastatic power (liquefying and saccharifying power) of a measured quantity of the aqueous extract is then determined To an equal quantity of the extract, measured amounts of basic lead acetate solution are added so long as the diastatic power shows no sensible change. The bulk of the extract is now treated with the calculated amount of the lead solution, the avoidance of excess of the latter being assured by testing a small portion of the filtrate with ammonium sulphide. The lead precipitate is allowed to settle, the solution filtered through paper, and then rapidly through a sterilised Pukal filter into a sterile flask. After seeding with a small quantity of a pure culture of Frohberg yeast (previously cultivated in a nutrient medium poor in sugar and rich in diastase), the solution is fermented in a thermostat at 28° C. When fermentation is finished, the solution is again passed through a Pukal filter, into a previously sterilised vacuum apparatus, and evaporated at 10 mm. pressure to a volume of about 500 c.c. If the solution has become acid it must be neutralised with sterilised calcium carbonate. The solution is now sown with a very small quantity of a mixed culture of Frohberg and Logos yeasts (previously cultivated as above). In this second fermentation, which should be carried as far as possible, the yeast employed should be cultivated so as to be capable of assimilating nitrogen very readily. After filtration through a Pukal filter again, the solution is concentrated *in vacuo*, and, under favourable conditions, a syrupy liquid is obtained, which by further concentration in an absolute vacuum, over sulphuric acid, can be converted into a powder. A substance is thus obtained which is free from fermentable and reducing carbohydrates, and which gives no reaction for albumin. The diastase prepared by the authors is much more sensitive to the action of chemicals (alcohol, ether, acetone) than ordinary impure diastase. It is a light yellow powder, easily soluble in water, insoluble in alcohol; it does not give the biuret reaction, nor does it reduce Fehling's solution. It reacts with Millon's reagent slightly. The aqueous solution may be partially salted out with sodium chloride, ammonium sulphate, or magnesium sulphate.

The authors have investigated the problem of precipitating diastase from pure aqueous solutions. Colloidal ferric hydroxide appears to be the only substance of those investigated capable of effecting this practically completely, but by this process it is quite possible that the diastase is destroyed, as the precipitate has practically no diastatic power. The incapacity of colloids and of electrically charged colloids to precipitate diastase from its solution argues against the colloidal nature of the latter. An electric current passed through a diastase solution does not cause the diastase to travel towards either anode or cathode. When the diastase solution is examined with an ultramicroscope, bi-concave pencils of light are observable, indicating the presence of very minute particles, whence it would seem that diastase is of a colloidal nature. By dialysing diastase solution against boiled spring water the authors have succeeded in separating to a certain extent the two chief groups of diastases (saccharifying and liquefying diastases) which constitute ordinary diastase.—L. E.

Ferments and life of micro-organisms; Action of compressed gases on ——. C. Fok. Atti R. Accad. dei Lincei Roma, 1906, 15 [II.], 53—58; Woch. f. Brau., 1906, 23, 476.

The author has studied the action of oxygen, hydrogen, and carbon dioxide at pressures of two, three, four, and five atmospheres on *Bacillus subtilis*, *Sacch. inversus*, *Sarcina aurantiaca*, *Bacillus typhi*, and *Sacch. cerevisiæ*. Hydrogen, at four atmospheres, in the presence of oxygen at normal partial pressure showed no injurious action on the micro-organisms, nor on the activity of ferments; oxygen and carbon dioxide, on the contrary, showed an inhibiting effect on the development of the organisms, but did not affect enzymes injuriously. Unlike oxygen, carbon dioxide at four atmospheres retarded alcoholic fermentation.—L. E.

Enzymes (Invertase); Action of light on —— in absence of oxygen. A. Jodlbauer and H v. Tappeiner. Münchener Med. Woch., 1906, 653; Woch. f. Brau., 1906, 23, 476.

The authors have previously shown that light free from ultra-violet rays exerts an injurious action on enzymes. They have now extended their investigations to the action of light as a whole. The enzyme, placed in an illuminated flask, was affected injuriously even when the flask was filled with hydrogen, nitrogen, or carbon dioxide, *i.e.*, in the absence of oxygen.—L. E.

Wort cooling; Inexpensive ——. T. Pongratz. Woch. f. Brau., 1906, 23, 468—470.

The author recommends the employment of a cooling vat placed between the cold water cistern and the liquor back as a substitute for the ordinary wort cooler. The wort from the hop filter is sprayed into the cooling vat, coming in contact at the same time with a current of cold air. The cooling vat contains a system of tubes through which passes a stream of cold water from the cold water cistern to the liquor back. A continuous stream of cold sterile air is passed over the surface of the wort when all the latter has been pumped into the vat, in order to produce further evaporation and absorption of oxygen; at the same time albuminoid matter settles to the bottom of the vat. According to results of experiments, temperatures below 50° C. have no influence on the colour or degree of attenuation of the wort, and this temperature is attained as quickly by the above method as by the ordinary cooling process. In breweries where an abundant supply of water is not available, a portion of the water which has circulated through the cooling vat may be passed into a special cistern, whence it may be pumped back into the cold water cistern on the following day to be used again for cooling purposes.—L. E.

Musts and wines; Speed of inversion of sucrose in ——. L. Mathieu. Bull. Assoc. Chim. Sucr. et Dist., 1906, 24, 79—82.

The author has investigated the speed of inversion of sugar added to actively fermenting wine or must, to wine undergoing secondary fermentation, and to completely fermented wine. With wine undergoing active fermentation, the sucrose had disappeared in all cases within 24 hours. Hence if sucrose be added at the beginning of fermentation or during active fermentation, it is quite unnecessary to invert it beforehand, since the acidity of the wine and the invertase secreted by the yeast effect inversion rapidly. In the case of wine undergoing secondary fermentation, the inversion is slower but complete; hence the utility of preliminary inversion of the sucrose added is doubtful. In the case of completely fermented wines, inversion proceeds still more slowly the rate of inversion decreasing as the percentage of alcohol increases; in a sample of red wine containing 16·4 per cent. of alcohol, all the added sucrose was inverted after three months. To retard or arrest the hydrolysing action of must or wine, it is sufficient to add an excess of at least 4 grms. per litre of crystallised sodium carbonate. —L. E.

Wine; Ageing of ——. M. Schtscherbakow. Winogradstwo i Winodjelie, July 22, 1906. Chem. Centr., 1906, 2, 623—625.

The author has studied the formation and decomposition of volatile and non-volatile esters and volatile acids, and the alteration of the amount of total acid during fermentation. If the quantities of alcohol formed during the fermentation of wine-must be plotted as ordinates, and the time as abscissæ, the curve rises at first (20 days), and after attaining a maximum becomes, roughly, a horizontal line; there are, however, irregularities in the curve, indicating periods in which a diminution of the amount of alcohol produced occurs. The curve representing the amount of volatile acids is similar, in its first portion, to the alcohol curve, but after attaining a maximum it descends, the amount of acids formed showing a decrease. There are many more irregularities in the curve corresponding to the volatile acids than in the alcohol curve. After fermentation is complete, the amount of volatile acids becomes less, probably owing to decomposition by certain enzymes, and also to the acids being utilised as food by the yeast. The quantity of volatile acids formed by the auto-fermentation of yeast is extremely small under ordinary conditions. The volatile acids are exposed to continual processes of formation and of decomposition. After fermentation is complete, the quantity falls gradually to a minimum, and then in the course of two to three years again increases to twice or three times the minimum quantity, owing to the action of atmospheric oxygen. Esters are formed chiefly during the period of energetic fermentation, and only in smaller quantities afterwards. The curves representing the formation of volatile and non-volatile esters respectively, show great similarity, but the volatile esters are produced in smaller quantities than the non-volatile. In both cases, after the maximum is passed, the curves show breaks and irregularities, indicating continual formation and decomposition of the compounds, these changes being probably caused by enzymes secreted by the yeast. The formation of esters during the fermentation period is not to be attributed to the interaction of alcohol and acids, but is a result of the vital activity of the yeast organisms. Moreover, the esters are only intermediate products in the formation of other compounds, the nature of which has not yet been determined. When wine is kept under ordinary conditions, the quantity of non-volatile esters gradually diminishes, and the development of bouquet must therefore be due to other factors. The quantity of volatile esters increases with the age of the wine. The total esters decrease in quantity as the age of the wine increases, the diminution being greater the more the bouquet and flavour of the wine are developed. The acidity of wine varies to a considerable extent during the fermentation period; the largest amount of acid is formed concurrently with the production of the largest quantity of alcohol. This relation between the formation of acids and of alcohol can be easily explained in the light of the results obtained by Buchner and Meisenheimer (this J., 1905, 246). On keeping wines under normal conditions, the quantity of free acid first shows a distinct diminution, then increases, and subsequently remains fairly constant. The flavour of the wine, however, becomes more pleasant and less sour, probably owing to a change in the nature of the acids. The quantity of lactic acid varies considerably, according to the kind of yeast used; in general it increases with the age of the wine.—A. S.

Wines; Persian ——. O. Lecomte. J. Pharm. Chim., 1906, 24, 246—247.

In the following table the results of the analysis of seven wines from the districts of Cazevine and Schariare, Persia, are given:—

Geographical source of wine.	Red wines.					White wines.	
	Schahaghni.	Cazevine.	Chouchebouland.	Schahaghni.	Schariare.	Azandéi.	Askari.
Sp. gr. at 15°	0·9921	0·991	0·9926	0·9916	0·9919	0·994	0·991
Alcohol	14·5°	15·0°	14·0°	14·4°	14·5°	16·0°	15·0°
Extract (at 100° C.) grms.	22·30	20·20	24·6	21·68	23·40	30·80	22·06
Polarisation	0°	0°	−0° 8′	0°	0° 6′	−0° 10′	−0° 6′
Reducing sugars (as dextrose) grms.	2·50	1·92	3·57	2·18	2·20	4·76	3·66
Sulphates (as potassium sulphate)	0·22	0·18	0·28	0·24	0·25	0·46	0·34
Chlorides (as sodium chloride)	0·09	0·06	0·08	0·07	0·11	0·09	0·09
Cream of tartar	1·70	1·60	2·44	2·38	1·43	2·82	1·80
Tartaric acid	0	0	0	0	0	—	—
Phosphates (as phosphoric anhydride)	0·17	0·44	—	—	—	—	—
As sulphuric acid—							
Non-volatile acids	2·87	4·22	3·27	2·38	2·89	2·89	2·48
Volatile acids	0·95	1·17	0·26	0·56	0·32	0·44	0·32
Glycerol	6·61	6·79	6·22	6·52	6·65	8·87	6·42
Tannin	2·64	2·40	2·14	2·30	3·69	1·60	1·75
Ash	3·25	4·20	3·24	3·04	3·60	4·24	3·75

—A.S.

Rum; Manufacture of Jamaica ——. C. Allan. West Ind. Bull., 1906, 7, 141—145.

Two types of rum are produced in Jamaica, known respectively by the names of "common clean" and "flavoured" or "German" rum. The flavoured rum is only manufactured on certain estates and in certain districts, and somewhat complicated processes are adopted. The enhanced value of the highly flavoured rums is directly attributable to their high contents in compound ethers. From a large number of analytical results, the author concludes that whenever a rum contains over 1,000 parts of esters per 100,000 of alcohol, that rum invariably commands a high price. In the manufacture of flavoured rum the wash is set up with "skimmings," "dunder" (vinasse), molasses, "acid," and "flavour."

"Acid" is made by fermenting "rum cane juice" which has been warmed in the coppers. To this juice "dunder" is added, and sometimes a little "skimmings." When fermentation is nearly over, the fermented liquor is pumped on to "cane trash," and allowed to get sour; the ripe "acid" has an odour like sour beer. Sludge settled out from fermented wash is added from time to time. "Flavour" is prepared by running fermented cane juice into cisterns outside the fermentation house along with cane trash and "dunder" which has been stored from the previous crop. The fermentation of the "flavour" in presence of cane trash with the addition of "dunder" is effected three times before the "flavour" is ready. "Skimmings" are run from the boiling house into cisterns half-full of cane trash, and are allowed to ripen for four to six days before they are used for setting up the wash. Fermentation lasts for seven to eight days, but a period of 13 to 14 days elapses between the setting up of the wash and the distillation.—J. F. B.

Beetroot vinasse; Concentration of ——, *with regard to the production of manure.* P. Kestner. Bull. Assoc. Chim. Sucr. et Dist., 1906, 24, 86—90.

For the recovery of saline matter from vinasse it is sufficient to concentrate the latter to about 40° B. before

incineration. In order to recover the nitrogenous matter as well, the concentration of the vinasse must be carried to 40° B., the resulting syrup being mixed with peat, and used as a manure. The author has made an estimate of the cost of the latter process in the case of a sample of diffusion vinasse. He considers that the margin of profit is sufficient to justify experiments on a commercial scale. —L. E.

Mineral acids in presence of organic acids [*in wine and vinegar*]; *New method for the detection of free* ——. O. Carletti. XXIII., page 955.

Vinasse; Influence of sulphur compounds on the refining of ——. Lacombe. XVI., page 943.

Alcohol used under the Act of 1902. Pharm. J., Sept. 22, 1906. [T.R.]

THE report of the Commissioners of Inland Revenue, just issued, states that during the year ended March 31, 1906, 354,516 proof gallons of spirit were used in connection with arts and manufactures under the Finance Act, 1902. The following table shows the quantities used under the 1902 Act since its provisions came into force:—

Year ended March 31.	Use.	Total.
		Proof galls.
1902–03	Arts and manufactures ..	341
	Scientific (universities, hospitals, &c.)	358
		699
1903–04	Arts and manufactures ..	206,452
	Scientific (universities, hospitals, &c.)	2,272
		208,724
1904–05	Arts and manufactures ..	267,706
	Scientific (universities, hospitals, &c.)	2,680
		270,386
1905–06	Arts and manufactures ..	354,516
	Scientific (universities, hospitals, &c.)	3,314
		357,830

ENGLISH PATENTS.

Grain; Preparation of —— for brewing and the like. K. J. Somló, Temesvár, Hungary. Eng. Pat. 367, Jan. 5, 1906.

SEE Addition of Jan. 12, 1906, to Fr. Pat. 331,578 of 1903; this J., 1906, 773.—T. F. B.

Beer; Improving the flavour and aroma of carbonic acid gas used for carbonating ——. A. Hartley, Emsworth, Hants. Eng. Pat. 2559, Feb. 2, 1906.

THE carbon dioxide gas intended for carbonating beer is passed through a cushion or mass of hops at a temperature between 60° and 120° F. The hops are placed in a vertically disposed vessel consisting of a tube or cylinder, surrounded by a heating jacket, the arrangement being carried by a suitable frame-work. Caps are fitted to the ends of the containing tube or cylinder, one cap being connected with an inlet nozzle and the other with an outlet nozzle for the gas.—J. F. B.

UNITED STATES PATENTS.

Ferment and process of producing the same. G. Johnson and P. R. Hare, Bromley. U.S. Pat. 830,506, Sept. 11, 1906.

SEE Eng. Pat. 10,093 of 1903; this J., 1904, 499.—T. F. B.

Wort; Process of treating and ageing ——. H. E. Deckebach, Cincinnati, Ohio. U.S. Pat. 803,576, Sept. 11, 1906.

WORT is fermented in two stages in the following manner: The wort is placed in contact with the yeast, and fermentation is allowed to proceed for only a short time; it is then checked by chilling the partially fermented wort, and the main portion of the yeast is separated at a low temperature. The wort still containing yeast in a finely divided and suspended condition is then placed in a closed vessel at a higher temperature, and fermentation is allowed to complete itself under pressure so as to develop the necessary quantity of gas.—J. F. B.

FRENCH PATENTS.

Wines; Process for improving —— before fermentation. E. A. Barbet. Fr. Pat. 361,483, May 18, 1905.

THE grape juice issuing from the press is subjected to (preferably continuous) distillation in a column still, under reduced pressure and with partial aëration, by means of low-pressure steam circulating through tubes, a coil, or a steam jacket. This treatment removes any unpleasant odours, and concentrates the juice so that it will furnish wines containing "11°—12°" of alcohol without fortifying. —C. S.

Liquids such as fruit juices, fermented liquors, &c.; Process and apparatus for sterilising ——. P. M. C. Mauvernay. Fr. Pat. 365,425, April 19, 1906. XVIII*A*., page 949.

Worts, juices, and syrups; Process for preparing concentrated —— [*retaining their natural aroma*]. E. Monti. Fr. Pat. 365,338, April 17, 1906.

THE fruit, such as grapes, lemons, &c., is cooled to a temperature of 0° C., as soon as possible after being gathered. The juice is then expressed at the same temperature, and concentrated by freezing, the ice being removed. After filtration, the concentrated juice may be pasteurised under pressure in an atmosphere of carbon dioxide. Cream of tartar may be separated from the residue obtained on the filter.—W. P. S.

Alcohol and the like; Rectification of ——. E. Guillaume. Fr. Pat. 365,417, April 19, 1906.

A SPECIAL column is placed between the rectifying column and the final purifying column in order to combine the process of "final purification" with that of "pasteurisation." A device for regulating the discharge of the vapours from the head of the rectifying column is also employed. This device consists of a side tube fitted on the tube leading to the cooling chamber and outlet, and serves the purpose of supplying the outlet with spirit from a separate condenser, or of taking up any surplus of condensed liquid.—W. P. S.

Distillation residues of starchy matters [*Vinasse*]; *Process for recovering* ——. F. and E. D. Verbiese. Fr. Pat. 361,534, June 2, 1905.

THE vinasse is treated with quicklime, slaked lime, milk of lime, or lime water, the resulting precipitate being recovered in a filter-press, and utilised as a manure, since it contains part of the nitrogenous matter and nearly all of the phosphoric acid of the vinasse. The filtrate, which now has a constant alkaline reaction, is passed through a multiple evaporator of any suitable type, and the resulting syrup, after being concentrated if necessary, is mixed with oil cake, chaff, or other solid matters for use as fodder.—C. S.

Amylaceous matters; Recovery of the residues from the distillation of ——. F. Verbiese and E. D. Verbiese. First Addition, dated June 5, 1905, to Fr. Pat. 361,534, June 2, 1905 (see preceding abstract).

ANY of the alkalis or alkali carbonates may be used in place of calcium carbonate to neutralise the acidity of the vinasse before evaporation.—W. P. S.

Tartaric acid and tartrates from grape residues and the like; Extraction of ——. P. P. Carles. Fr. Pat. 365,084, April 9, 1906. XX., page 952.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 905.)

(*A.*)—FOODS.

Seaweed industry of Japan. C. J. Davidson. Bull. Imp. Inst., 1906, **4**, 125—149.

In Japan, seaweeds are utilised as foodstuffs, in the preparation of plaster, glue, and isinglass, as manure for rice fields, and for the extraction of iodine. The present article deals with the preparation of *kanten* (isinglass), *kombu* (kelp), *amanori* (laver), and *funori* (seaweed glue), and the extraction of iodine. It should be noted that in Japan the word "nori" is frequently used to designate useful seaweeds generally, but properly speaking it should only be applied to laver. There is another word "nori," meaning paste or mucilage, which is used in the names of those species of "*funori*" (*Gloiopeltis sp.*) from which paste or mucilage is prepared, and care must be taken to distinguish between the two.

Kanten, or seaweed isinglass, is prepared chiefly from seaweeds of the species *Gelidium*, especially *G. sawanii* Japanese: *tengusa*), but such seaweeds as *ego* (*Campylaephora hypneoides*), *tori-ashi* (*Acanthopeltis japonica*), and *ogo* (*Gracilaria confervoides*) are also frequently employed as substitutes, or are added to the *tengusa* in larger or smaller quantities according to the quality of *kanten* to be made; the best quality of *kanten* is, however, made from *tengusa* alone. The seaweed, dried and partially bleached by exposure on the sea-shore, is freed from mechanical impurities by pounding in a mortar, and washing with water, and is then completely bleached by exposure. It is next boiled with water (about 950—1000 galls. per 165 lb. of seaweed) for 5—6 hours, with occasional agitation, 1½ galls. of vinegar or 2 oz. of sulphuric acid added, and then 30 galls. of water, and the whole boiled for a further 30 minutes. The resulting gelatinous solution is strained twice through coarse cloths, and then allowed to set, the jelly being called "*tokoro-ten.*" The jelly is congealed by exposing it at night during very cold weather, and is finally dried by exposure to the rays of the sun. Ordinary *kanten* or "*kaku-kanten*" is made in the shape of bars, 17 in. by 1·4 in. by 1·6 in.; "*hoso-kanten*" is made in the form of slender sticks, 10—14 ins. long and ½ in. thick. The preparation of *kanten* of good quality by the process described is stated to depend almost entirely upon the atmospheric conditions, especially during the bleaching and congealing operations. *Kanten* is used for the preparation of edible jellies, for clarifying wines and *saké*, as a sizing material for textiles and paper, and as a cultivating medium for bacteria. A specimen gave the following results on analysis:—Water, 21·79; nitrogenous organic matter, 5·95; carbohydrates, 64·59; cellulose, 3·54; and ash, 4·13 per cent. In the following table, the amount and value of the *kanten* produced in and exported from Japan during recent years is given:—

Year.	Production.		Exports.	
	Amount in kwan.	Value. £	Amount in kin.	Value. £
1900....	284,462	115,300	1,444,499	96,432
1901....	261,344	106,846	1,584,748	121,719
1902....	271,436	95,027	1,665,501	110,854
1903....	266,914	90,997	1,391,268	81,817
1904....	—	—	1,776,098	101,359

1 kwan = 8·2673 lb. 1 kin = 1·32277 lb.

The greater bulk of the *kanten* exported goes to China and Hong Kong. *Kombu* or *kobu* belongs to the family of "kelps" (*Laminariacæ*), and is the most prolific seaweed found on the coast of Japan. *Kizami-* (sliced) *kombu* is prepared by boiling the kelp with water, drying, and shredding the dry material. Preparations are also made from *oni-kombu* (*Laminaria diabolica*) by soaking in vinegar, drying, and scraping the dry substance, and from other kinds of kelp. Kombu is used in a variety of ways for culinary purposes. An analysis of *Laminaria longissima* by K. Oshima gave the following results:—Water, 25·944; proteids, 6·724; fat, 1·730; soluble non-nitrogenous matter, 31·896; fibre, 6·415; and ash, 27·290 per cent. The production and exports of *kombu* during the five years ending 1904 were as follows:—

Year.	Production of Kombu.		Exports.			
			Kombu.		Kizami-kombu.	
	Amount in kwan.	Value. £	Amount in kin.	Value. £	Amount in kin.	Value. £
1900	6,454 078	60,277	30,988,010	73,084	5,053,001	15,288
1901	9,216,765	92,816	51,526,468	109,292	9,383,262	32,540
1902	5,073,689	36,904	33,021,851	60,914	6,346,523	20 034
1903	7,099,598	60,698	43,699,026	83,929	6,808,784	20,430
1904	5,043,200	49,691	45,158,836	105,415	5,847,738	19,235

Asakusa-nori, or laver, is the only seaweed which is regularly cultivated in Japan. The method of cultivation of laver (*Porphyra tenella*; Japanese: *Asakusa-nori*, *nori*, or *amanori*) consists in planting, at about the middle of September, branches of trees in rows from 30—70 yards long, and about 8 ft. apart, the branches being inclined at an angle of about 45° towards the flowing tide, and rising 6—9 ft. above the mud. The floating spores of the *Porphyra* attach themselves to the branches. The laver is gathered from January to near the end of March. It is freed from mechanical impurities, washed in salt water, chopped up finely, and thrown into fresh water (12 galls. to 8 bushels of laver). A small quantity of rape oil is added to destroy the froth which rises to the surface of the water, the laver is removed, drained on mats, and dried in sunlight. A specimen gave the following results on analysis:—Water, 15·475; proteids, 34·350; fat, 0·650; and ash, 10·685 per cent. The production of *nori* during the four years ending 1903 was as follows:—

Year.	Amount in kwan.	Value.
1900.....	154,853 ..	£51,394
1901.....	433,501 ..	77,420
1902.....	249,525 ..	71,158
1903.....	335,940 ..	89,526

The exports of *nori* are increasing yearly, and exceed 10,000 yen in value.

Funori, or seaweed glue.—The name, *funori*, is applied to seaweeds from which mucilage can be made, and also to the mucilage itself, but the word is written with different Chinese characters in the two cases. The

seaweeds chiefly used in Japan for the preparation of mucilage are the various kinds of *funori* (*Gloiopeltis coliformis* and other species) and *tsunomata* (*Chondrus sp.*). If the seaweed be of a tough character, it is subjected to a preliminary treatment consisting of soaking in water, steaming, cutting into small pieces and drying, but slender and soft seaweeds are used as collected. The material is spread on the ground, sprinkled with water, kneaded with the hands and feet, washed with water, and dried and bleached by exposure, with occasional sprinkling with water. When a sticky juice is observed to exude from the material, no more water is used, but the seaweed is left for one night, after which it is ready for sale. It is made into glue or paste by dissolving in boiling water, and is used as a finish for textiles, for plastering walls, and for decorating chinaware. Other kinds of seaweed used for making mucilage, besides those already mentioned, are:—*Ginnanso* (*Iridæa sp.*), *mukade-nori* (*Grateloupia ficilinus*), *kotoji-tsunomata* (*Chondrus etatus*), *tamba-nori* (*Grateloupia sp.*), *tobera* (*Chondrus sp.*), *saimi* (*Gymnogongrus sp.*), and *yanagi-funori* (*Gloiopeltis tenax*). The production of *funori* during the four years ending 1903 was as follows:—

Year.	Amount in kwan.	Value.
1900.....	257,932 ..	£15,406
1901.....	355,481 ..	26,161
1902.....	284,083 ..	26,794
1903.....	181,513 ..	16,660

Extraction of iodine.—The seaweeds chiefly used in Japan for the extraction of iodine are:—*Kombu* (*Laminaria sp.*), *kajime* (*Ecklonia cava*), *arame* (*Ecklonia bicyclis*), *hondawara* (*Sargassum horneri*), and *yatsumata-moku* (*Sargassum patens*). Analyses of specimens of different kinds of seaweed gave the following results:—Waste *kombu*, 0·144; *kajime* stems, 0·148; *kajime* fronds, 0·002; *arama*, 0·0003; and *nagahijiki* (*Cystophyllum*), 0·005 per cent. of iodine. The iodine content varies, however, with the age of the algæ, and also with the time of year, being greatest during June to September. The iodine is extracted by charring or burning the seaweeds, leaching the ash with water, evaporating the solution, and heating the residue with sulphuric acid and manganese dioxide. The amount of potassium iodide exported during the three years ending 1904 was as follows:—

Year.	Amount in kin.	Value.
1902.....	3,051 ..	£1,482
1903.....	22,371 ..	10,117
1904.....	52,012 ..	26,680

It is stated that investigations are being carried out under Government supervision as to the cultivation and collection of useful kinds of algæ, and the most economical and productive method for the extraction of iodine.

The total value of the seaweeds prepared in Japan in 1904 exceeded £400,000, and the total value of the exports was £124,651. The value of the exports of seaweeds from Japan to various countries during the five years ending 1904 was as follows:—

	1900.	1901.	1902.	1903.	1904.
	£	£	£	£	£
Seaweeds—					
China	68,611	105,239	57,592	80,361	100,467
Corea	1,154	1,048	1,288	1,075	2,015
Hong Kong ...	2,734	2,577	1,779	2,002	2,435
Other countries	583	426	315	489	498
	73,082	109,290	60,914	83,927	105,415
Seaweeds cut—					
China	14,458	31,684	18,809	19,419	17,067
Other countries	830	856	1,224	1,011	2,168
	15,286	32,540	20,033	20,430	19,234

English Patents.

Chocolate; Process for the manufacture of malt-containing ——. J. Meinl, Vienna. Eng. Pat. 24,414, Nov. 25, 1905.

See Addition of Dec. 9, 1905, to Fr. Pat. 316,861 of 1901; this J., 1906, 651.—T. F. B.

Homogenising breaker to emulsionise, pulverise, and homogenise liquid and semi-liquid matters [*milk*], *and break fatty or albuminous cellules and nuclei.* C. Petitpierre, Paris. Eng. Pat. 10,162, May 1, 1906.

See Fr. Pat. 353,753 of 1905; this J., 1905, 1055.—T. F. B.

French Patents.

Distillation residues of starchy matters [*Vinasse*]; *Process for recovering* ——. F. and E. D. Verbièse. Fr. Pat. 361,534, June 2, 1905. XVII., page 947.

Desiccation; Process of ——, *applicable especially to vegetable substances.* P. Rasmus. Fr. Pat. 365,051, April 10, 1906. Under Int. Conv., March 17, 1906.

The process claimed consists in exposing the materials to be dried alternately to heat alone and to heat while a current of air is passed over them.—W. H. C.

Alimentary materials; Process for treating [*rendering more digestible*] ——. E. Maris. Fr. Pat. 365,069, April 10, 1906.

The process consists in treating all kinds of food materials and fodders with specific ferments and yeasts, the operations being carried out in closed vessels at various temperatures and for different periods of time. The treatment increases the digestibility of the foods.—W. P. S.

Liquids such as fruit juices, fermented liquors, &c.; Process and apparatus for sterilising ——. P. M. C. Mauvernay. Fr. Pat. 365,425, April 19, 1906.

The liquid to be sterilised is heated in a serpentine tube surrounded by a steam-jacket. During the heating process the liquid is subjected to a pressure equal to at least three times the vapour pressure of the volatile constituents present in the liquid. To aid in the thorough heating of every part of the liquid during its passage through the steriliser, boxes or enlargements are placed on the serpentine tube at regular intervals. The pressure is kept constant automatically, and the sterilised liquid is cooled by passing it through a coil surrounded by liquid on its way to the steriliser, the pressure being maintained during the cooling operation.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

United States Patents.

Garbage and sewage; Process of reducing ——. E. R. Edson, Cleveland, Ohio. U.S. Pat. 829,954, Sept. 4, 1906.

The garbage or sewage is digested in a closed chamber at a temperature above 285° F., and under a pressure of from 75 to 80 lb. per sq. in., for a period long enough to thoroughly disintegrate the mass, and to render the grease easily separable by percolation. The liberation of ammonia and the volatilisation of glycerol during this digestion are prevented by the high pressure used. The digested material is then dried so as to remove substantially the whole of the water, and the dried mass is extracted with a solvent.—A. G. L.

Garbage and sewage; Apparatus for reducing ——. E. R. Edson, Cleveland, Ohio. U.S. Pat. [illegible] Sept. 4, 1906.

The apparatus claimed is used in carrying out the process described in the preceding abstract. It comprises [illegible] upright shell forming a jacket and provided with a [illegible] for this shell. A receptacle for receiving the [illegible] to be treated is suspended from the upper end of the [illegible]

receptacle, and is provided at its upper end and externally with a flange resting upon and removably secured to the shell. The head forming the top wall of the chamber of the receptacle is provided with a charging aperture, and rests upon, and is removably secured to, the cast-iron section of the receptacle.—A. G. L.

[*Water*] *Distilling apparatus.* W. H. Bartholomew, East Orange, N.J., Assignor to C. B. Hill, Montgomery, N.Y. U.S. Pat. 829,756, Aug. 28, 1906.

A WATER distilling apparatus is claimed, comprising a still which is connected with a condenser, surrounded by a jacket, and with a receptacle consisting of a pair of telescopic members. A feed-pipe connects the still with the lower of these members, terminating some distance above the bottom of the receptacle, the space below forming a chamber for the accumulation of sediments which may be removed by a discharge pipe. The upper member is adjustably supported by the lower one. The condenser jacket is provided with an inlet for the water supply, and an overflow at its upper end leading to a point within the receptacle. An overflow at the upper part of the receptacle allows impurities to run off. The still communicates with the condenser through a coil in the receptacle, and the condenser is provided with an outlet near its bottom.—R. L.

Water; Apparatus for distilling ——. C. Parker, Dubuque, Iowa. U.S. Pat. 829,999, Sept. 4, 1906.

THE still comprises a boiler, a diaphragm arranged in the path of the steam-current and constructed with openings so as to direct the steam at right angles to its normal path, a condensing chamber, a reservoir placed between the condensing chamber and diaphragm, and means of communication between the spaces above the diaphragm and the condensing chamber. The reservoir is provided with a normally sealed inlet tube, and a separating-chamber is arranged between the diaphragm and reservoir. —A. G. L.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 906.)

Paper and solid cellulose [*and acetylcellulose*]; *Electrical insulating properties of dry* ——. A. Campbell. XI*A*., page 935.

Cellulose industry of Norway. Bd. of Trade J., Sept. 20, 1906. [T.R.]

THE Canadian Commercial Agent at Christiania reports that the cellulose mills now building in Norway and the enlargement of existing mills will cause an increase in the Norwegian output of cellulose of about 50,000 tons per year. The manufacturers reckon on a total increase of production in Norway and Sweden of about 130,000 tons in the two years 1907 and 1908.

The Norwegian and Swedish cellulose production has grown in the last seven years (including 1905) by some 240,000 tons, *i.e.*, from about 150,000 tons in 1898 to 394,000 tons in 1905.

ENGLISH PATENTS.

Paper pulp [*Draining*]; *Treatment of* ——. L. Evans, Watford. Eng. Pat. 19,808, Sept. 30, 1905.

IN the use of the "tower" system of treating and bleaching paper pulp, an improved form of drainer is claimed for the purpose of washing or draining the pulp in the tower. This drainer consists of one or more vertical frames or boxes rising from the base of the tower, and covered with wire gauze. In this arrangement, both sides of the drainer box are available for use, so that a maximum draining surface is obtained as compared with the displacement caused by the drainer.—J. F. B.

Cellulose; Manufacture of non-inflammable material containing non-nitrated ——. C. Trocquenet, Colombes, France. Eng. Pat. 8167, April 4, 1906.

SEE Fr. Pat. 362,989 of 1906; this J., 1906, 825.—T. F. B.

Cellulose; Manufacture of solutions of ——. E. W. Friedrich, Blaton, Belgium. Eng. Pat. 17,164, Aug. 24, 1905. Under Int. Conv., Aug. 25, 1904.

SEE Fr. Pat. 357,171 of 1905; this J., 1906, 88.—T. F. B.

UNITED STATES PATENT.

Paper pulp; Process of making —— [*from the Southern Pine*]. J. L. Coker, jun., Hartsville, S.C. U.S. Pat. 830,570, Sept. 11, 1906.

PAPER pulp is made from the wood of the Southern Pine by subjecting it, with its bark still on, to the action of "natural agencies," until tests show that the resinous constituents have become so modified that they no longer produce any injurious influence in the process of pulp-making. The bark is then removed, the trunk is split up into suitable lengths, the core or heart-wood is separated from the sap-wood, and the latter is converted into pulp by any suitable process.—J. F. B.

FRENCH PATENTS.

Paper-making; Utilisation of machine "back-waters" in ——. C. Gérard. Fr. Pat. 364,720, March 29, 1906.

ALL the "back-waters" from the paper-machine, together with the fibrous waste scraped off the top press-roll, are collected in a pit below the machine, and are pumped into a special reservoir at the top of the mill. This reservoir consists of two deep conical tanks, one relatively small, into which the pump discharges directly, and the other very large, which is fed by an overflow from the small one. The two conical tanks and the pump catch-pit can all be discharged into a "save-all" if necessary. In normal working, however, the "back-waters" are continuously re-utilised in the beating engines and stuff-chests. The discharge pipes from the large tank are situated at the apex of the cone, and are covered by a conical hood, which diverts the discharge stream in such a manner that any deposits of solid matters are washed through.—J. F. B.

Paper pulp from flax, hemp, ramie, &c.; Preparation of ——. Soc. anon. pour la Fab. des Pâtes à Papier de lin et succédanés. Fr. Pat. 365,046, April 9, 1906. Under Int. Conv., Oct. 6, 1905.

FLAX-STRAW, and similar materials consisting of bast (pectocellulose) and wood (lignocellulose) are treated in such a manner that the two components are separated, the bast fibres being purified, and the wood being obtained in the state of short fibres suitable for making millboards or paper. The stems are first passed through a breaker, then moistened, and subjected to a retting treatment, or else they are steamed in presence of air, caustic soda, &c. The mixture of fibres and wood so obtained is then exposed to the action of an oxidising agent such as chlorine gas or calcium hypochlorite in presence of steam, so as to disintegrate the wood without attacking the bast fibres. Finally, the material is boiled at a temperature of 150° C. in an alkaline liquid containing caustic soda and sodium carbonate, sulphate, and sulphite. The short wood fibres are then separated from the long bast fibres by washing on suitable sieves.—J. F. B.

Glue or size, and process of making the same. M. Bonnet. Fr. Pat. 365,285, April 14, 1906. XIV., page 942.

Cork; Artificial —— [*from cellulose*]. G. C. de Briailles. Fr. Pat. 364,641, Jan. 25, 1906.

ARTIFICIAL cork is made of a mixture of amorphous cellulose (pith of rushes, powdered cocoanut shells, bark, or paper pulp), fibrous cellulose (thistle-down, cotton, textiles, esparto, wood pulp), and agglutinating cellulose (solution of nitrocellulose). The pasty composition is pressed into glass-lined moulds provided with very small perforations for the escape of the vapours. The volatile solvents of the nitrocellulose are then distilled off under vacuum at the ordinary temperature, the corks are removed from the moulds, and the nitrocellulose is denitrated by a suitable reducing agent. Finally the corks

are dipped in an alkaline solution of tungstic acid, which imparts "water-resisting" qualities to the product. —J. F. B.

Celluloid; Plastic, non-inflammable composition resembling ——. A. Blanchin. Fr. Pat. 364,690, March 28, 1906.

Ten kilos. of nitrocellulose are dissolved in ether-alcohol, wood spirit, or acetone, and to the solution are added 0·5—1·2 kilos. of castor oil, glycerol, or camphor, 0·3—1·0 kilo. of sulphuric acid at 66° B., 1·0—2·5 kilos. of calcium chloride, and 0·5—1·5 kilos. of manganese chloride. In order to impart a certain amount of brilliancy to the product, 10—500 grms. of a chloride of carbon may be added. The mixture is thoroughly incorporated, and the volatile solvents are distilled off under vacuum until the product has a thick pasty consistence. The mass is then treated on the rolling machine, and formed into blocks by hydraulic pressure. The denitration of the nitrocellulose brought about by the action of the sulphuric acid on the calcium and manganese chlorides causes the finished product to be non-inflammable.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 910.)

Quinine; Influence of halogen salts on the fluorescence of ——. G. Denigès. Bull Soc. Pharm., Bordeaux; through Pharm. J., 1906, **77**, 283.

The fluorescence of a 1 per cent. solution of quinine sulphate containing 5 c.c. of pure sulphuric acid is destroyed by the addition of 3·2 c.c. of *N*/1 potassium chloride solution, 1·4 c.c. of *N*/1 potassium bromide solution, 0·9 c.c. of *N*/1 potassium iodide solution, or 95 c.c. of potassium fluoride solution. It is apparent from these numbers that equal quantities of the different halogens are required to discharge the fluorescence. If the acidity of the quinine solution be diminished, a smaller quantity of halogen salt will discharge the fluorescence, but the amount required is not proportional to the quantity of quinine present.—A. S.

Alkaloids in Strychnos leaves. Lotsy. Apoth.-Zeit., 1906, 475. Chem. and Drugg., 1906, **69**, 332.

Brucine and strychnine are present in the young leaves, but not always in the old leaves of *Strychnos nux-vomica*. On cutting the leaves the amount of strychnine appears to increase, and that of brucine to diminish. Frequently no strychnine was present in the leaves in the early morning, whereas in the afternoon it was present. The leaves of *Strychnos laurina* are free from both of these alkaloids. Strychnine is present in both the young and old leaves of *Strychnos tieuté*. The leaves of most of the species examined also contained the alkaloid, strychnicine. —A. S.

Saponarin, a new glucoside, coloured blue with iodine. G. Barger. Chem. Soc. Trans., 1906, **89**, 1210—1224.

The author gives the results of his further investigation of saponarin (this J., 1904, 1004). The air-dried glucoside has the composition, $C_{21}H_{24}O_{12}$; it is lævo-rotatory, $[\alpha]_D = -7{\cdot}90°$. When boiled for a few seconds with a large excess of acetic anhydride and a few drops of concentrated sulphuric acid, it yields an ennea-acetyl derivative, $C_{21}H_{15}O_{12}(C_2H_3O)_9$, m.pt. 183°—185° C. On hydrolysis with dilute mineral acids, saponarin yields dextrose and two apparently isomeric compounds of the formula, $C_{15}H_{14}O_7$. One of these compounds proved to be identical with the vitexin obtained by A. G. Perkin from the dye-wood of the New Zealand tree, *Vitex littoralis* (this J., 1898, 1138). The other compound, to which the name saponaretin is assigned, differs from vitexin in being readily soluble in boiling alcohol. Both substances yield phloroglucinol and *p*-hydroxybenzoic acid when fused with caustic alkali. Vitexin differs from apigenin by 2 mols. of water; it is probably a flavanone derivative containing either a reduced pyrone ring or a reduced phloroglucinol nucleus. It would thus belong to a new class of colouring matters, of which scoparin (this J., 1899, 576), considered by Perkin to be methoxyvitexin, would also be a member. Saponaretin is possibly a chalkone derivative corresponding to vitexin, or it may be identical with Perkin's homovitexin.—A. S.

Poison ivy plant [Rhus toxicodendron]; Some constituents of ——. S. F. Acree and W. A. Syme. Amer. Chem. J., 1906, **36**, 301—321.

The leaves and flowers of the poison ivy plant (*Rhus toxicodendron*) were extracted with ether. In the ethereal residue the following substances were found: Gallic acid, fisetin, rhamnose, and a poisonous tar, gum, or wax. The poison was not volatile with the vapour of alcohol or acetic acid. The poisonous tar or wax is probably of a glucoside character; it is decomposed by acids yielding gallic acid, fisetin, and rhamnose. It can be partially precipitated by lead acetate from a solution of the tar in 50 per cent. alcohol. All cases of poisoning can be easily cured with potassium permanganate. The poisonous substance can be isolated as follows: The alcoholic extract is precipitated with lead acetate. The precipitate is washed, dried, and extracted with ether. The ethereal solution is mixed with water, and hydrogen sulphide passed through. The ethereal portion is washed, and evaporated at a low temperature.—F. Shdn.

Conifer oils; Notes on some ——. R. E. Hanson and E. N. Babcock. J Amer. Chem. Soc., 1906, **28**, 1198—1201.

The authors have investigated the following oils; they are all obtained from leaves and twigs save where otherwise marked, and the chief results obtained are tabulated:—

	Yield per cent.	Sp. gr. at 15° C.	Change in sp. gr. for 1° C.
Black spruce (*Picea Mariana*)	0·57	0·9274*	0·0010
Hemlock (*Tsuga Canadensis*)	0·43	0·9255	0·0010
American larch (*Larix Americana*)	0·149	0·8816	
White spruce (*Picea Canadensis*)	0·103	0·9216	0·0013
Ditto (cones)	0·25	0·899	—
Red spruce (*Picea rubens*)	0·204	0·9289	0·0014
Ditto (cones)	0·38	0·8600	—
Pitch pine (*Pinus rigida*)	0·002	—	—
Red pine (*Pinus resinosa*)	0·001	—	—
Juniper (*Juniperus communis*)	0·18	0·8531†	—

* 19° † 20°

White spruce oil contains 25·7 per cent. of esters calculated as bornyl acetate. It differs in smell from black spruce or hemlock oil.

Red spruce oil contains 66·2 per cent. of bornyl acetate and 7·76 per cent. of free borneol. It has a very agreeable odour, suggesting bornyl acetate.

American larch oil contains 15·1 per cent. of esters calculated as bornyl acetate, and the remainder is largely pinene.—J. T. D.

Cade oil [Empyreumatic oil of juniper wood]; Characters and tests for genuine ——. C. Pépin. J. Pharm. Chim., 1906, **24**, 248—259.

Genuine cade oil should be fluid, slightly lighter than water, and have a characteristic smoky odour. The acidity, in terms of acetic acid, should not exceed 1·5 per 100 c.c. The reaction with light petroleum spirit and copper acetate (this J., 1906, 776) should give a brown colour, not green. When distilled under ordinary atmospheric pressure, at least 65 per cent. should pass over between 150° and 300° C.; under reduced pressure (65 mm.) from 70 to 75 per cent. should distil between 10° and 215° C.

Other published tests have been examined, and are found to be useless to differentiate between genuine and sophisticated oils. The oils employed by the author were authentic, having been produced under his supervision from the wood of *Juniperus oxycedrus alpha*. —J. C. B.

Colchicine; Determination of ——. A. Panchaud. XXIII., page 957.

Methyl alcohol; Detection of ——. H. Scudder and R. B. Riggs. XXIII., page 955.

Methyl alcohol; Detection and determination of —— [*in presence of ethyl alcohol*]. E. Voisenet. XXIII., page 957.

Citronella and lemongrass oils in Ceylon. Col. Off. Ann. Series, No. 494. [T.R.]

THE output of citronella oil in Ceylon (1,242,800 lb.) has increased by 80,000 lb. over that of the preceding year, the price having risen from 75 cents to 84 cents per lb. Consignments of a really pure oil, grown at the Peradeniya Experiment Station, have been sent home, and have aroused considerable interest among manufacturers.

The cultivation of lemon grass for oil has been proceeded with at the Peradeniya Experiment Station with fairly favourable results, and as the price of this oil is rising, its cultivation may prove profitable.

Attar of roses; Export of —— from Bulgaria. Bd. of Trade J., Sept. 20, 1906. [T.R.]

ACCORDING to the "Revue Commerciale du Levant" the export of attar of roses from Bulgaria in 1905 amounted to 5316 kilos., valued at 3,712,000 frs., as compared with an average of 4150 kilos., valued at 2,750,000 frs., during the preceding seven years. The principal purchasers of attar of roses in 1905 were: United States, 30·8 per cent.; France, 28·8 per cent.; United Kingdom, 16·8 per cent.; Germany, 13·4 per cent.; Russia, 4·5 per cent.; and Turkey, 4·3 per cent. The United States bought only 12 kilos. in 1897.

ENGLISH PATENT.

Carbamic acid esters of the pyrogallol-1.3-dialkyl ethers. O. Imray, London. From the Basle Chemical Works, Switzerland. Eng. Pat. 17,167, July 30, 1906.

THE carbamic acid esters of the pyrogallol-1-3-dialkyl ethers are prepared either (1) by treating the ethers with carbamic chloride, $ClCONH_2$, in ethereal solution, or (2) by causing phosgene to react with a salt of a pyrogallol-dialkyl ether, and subsequently converting the chloroformic acid ester of the pyrogallol ether into the carbamic acid ester by the action of ammonia.—J. F. B.

UNITED STATES PATENTS.

Salicylic acid menthol ether; Process for producing —— B. Bibus and R. Scheuble, Vienna. U.S. Pat. 830,043, Sept. 4, 1906.

SEE Eng. Pat. 8544 of 1905; this J., 1906, 233.—T. F. B.

Ketone; Aromatic ——, and process of making same. H. S. Blackmore, Mount Vernon. U.S. Pat. 830,044, Sept. 4, 1906.

AROMATIC ketones are obtained by oxidising aromatic hydrocarbons by means of anhydrides of "carbon oxy-acids." A keto derivative of tetrahydromethylpropyl-benzene is produced by heating a mixture of dipentene and carbon dioxide to a temperature below the decomposition point of the product; the resulting ketone is a colourless, semi-transparent substance, readily soluble in alcohol, and having a melting point of 210° C.; in its molten state it readily dissolves pyroxylin.—T. F. B.

Aldehydes; Manufacture of certain ——. G. Darzens, Paris. U.S. Pat. 830,213, Sept. 4, 1906.

SEE Fr. Pat. 360,513 of 1905; this J., 1906, 496.—T. F. B.

FRENCH PATENTS.

Camphor; Synthetic process for preparing —— from terpenes. O. L. A. Dubosc. Fr. Pat. 361,332, April 6, 1905.

OIL of turpentine or other source of terpene is dehydrated by treatment with calcium carbide, and the crude terpene saturated with hydrochloric acid gas at a temperature of 30° C. The hydrochloride is then heated with a metal and an oxidising agent to 180° C., when it is stated that camphene is formed quantitatively; suitable mixtures are molecular proportions of zinc and barium peroxide, or sodium metal and barium peroxide; it is also stated that, if manganese peroxide is used, no metal is required. The camphene thus produced is treated with an oxidising agent (chromic acid, &c.), at 180° C., when it is said to be converted into an ozonide, $C_{10}H_{16}O_3$, which loses oxygen on treatment with water, and is converted into a lactone, camphenolide; this is transformed into camphor by heating in presence of water.—T. F. B.

Lecithin; Process for the manufacture of a product containing lecithin and suitable for the extraction of free ——. E. Ziegler. Fr. Pat. 364,896, April 4, 1906.

THE germs of wheat are dried, and extracted with a suitable solvent to remove oil. They are then extracted with alcohol. The alcohol on evaporation leaves behind a residue composed chiefly of lecithin, albumin, and sugar. If this residue be taken up with 60—80 per cent. alcohol, the lecithin can be precipitated by the addition of mineral salts, and purified by known methods.—F. SHDN.

Tartaric acid and tartrates from grape residues and the like; Extraction of ——. P. P. Carles. Fr. Pat. 365,034, April 9, 1906.

PRODUCTS such as marcs, tartars, vinasses, &c., are treated with dilute sulphuric acid, so as to obtain a solution of tartaric acid. If this solution be saturated with potassium carbonate, potassium bitartrate is precipitated in a crystalline form.—F. SHDN.

Monoalkylanilines; Production of acidyl derivatives of tri- and polyhalogenated —— [for use in making celluloid]. Badische Anilin und Soda Fabrik. Fr. Pat. 365,297, April 14, 1906. Under Int. Conv., July 22, 1905.

SEE Eng. Pat. 8077 of 1906; this J., 1906, 608.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 910.)

ENGLISH PATENT.

Printing from a surface in relief; Method of ——. A. G. Bloxam, London. From Neue Photographische Ges., A.-G., Steglitz, Germany. Eng. Pat. 996, Jan. 13, 1906.

THE process consists, in general, in applying a suitable printing medium to a surface in relief, of which the parts in relief and those not in relief have a different effect on the medium, and then imprinting the medium on a suitable surface. The relief surface may, for instance, be composed of gelatin on a glass support; if this is flooded with an ethereal solution of hydrogen peroxide, the gelatin will absorb the peroxide in proportion to its mass, so that, when the peroxide has evaporated from the glass, the picture can be printed on a surface of gelatin paper or a similar surface, and developed in the known manner. Or again, the support may be prepared by treating gelatin-coated paper with potassium permanganate solution (manganese dioxide being thus formed), and the relief may consist of bichromated gelatin, in which case the hydrogen peroxide would be unaffected by the portions of the picture in relief, but would be decomposed by the catalytic action of the support.—T. F. B.

UNITED STATES PATENT.

Colour photography. W. C. South, Berwyn, Pa. U.S. Pat. 827,188, July 31, 1906.

A SUITABLE paper is coated with an emulsion of an animal glue (*e.g.*, fish glue) containing a red dyestuff, for which alizarin is recommended. It is slightly hardened by means of alum solution, and sensitised by treatment.

with an alkali bichromate solution. An image is printed on this paper from a negative taken through a suitable screen, and this image is coated with a transparent sensitive coating, which receives a blue image of the same object.—T. F. B.

FRENCH PATENTS.

Catatype pictures; Process of producing ——, *on prepared surfaces, and stable positive papers, plates, and films therefor.* Neue Photographische Ges., A.-G. Fr. Pat. 364,621, March 27, 1906. Under Int. Conv., March 31, 1905.

PAPERS or films for receiving impressions from negatives which have been treated with hydrogen peroxide, are prepared by means of substances which react with hydrogen peroxide, forming coloured products, either alone, or by the aid of some simple solution (*e.g.*, ammonia). For example, papers developed merely by treatment with a dilute solution of ammonia may be prepared by impregnating paper coated with gelatin, with a 5 per cent. solution of a manganous salt. Papers which require no subsequent development may be produced by impregnating gelatin-coated paper with cobalt salts, *e.g.*, with a 10 per cent. solution of the acetate. This process can also be applied to the catalytic preparation of prints similar to "carbon" prints, by incorporating a suitable pigment with the gelatin coating of the paper.—T. F. B.

Photographs in colour; Process for preparing ——, *by superimposing the various coloured monochrome images, produced on detachable layers of silver emulsion.* Chem. Fabr. auf actien, vorm. E. Schering. Fr. Pat. 365,314, April 14, 1906.

EACH of the monochrome positives, except that which is first applied to the permanent support, is printed on a layer of silver emulsion, detachably mounted on a thin sheet of mica, celluloid, &c., which renders superposition in register easy, owing to the transparency of the temporary support.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 911.)

Phosphorus in presence of large quantities of phosphorus sesquisulphide; Detection of small quantities of white ——. L. Aronstein. XXIII., page 955.

ENGLISH PATENTS.

Powders; Smokeless ——. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 21,779, Oct 26, 1905.

THE invention consists in the production of a "bulk" powder by forming the nitrocellulose into grains, and causing the grains to revolve over each other, at the same time thoroughly wetting them with a liquid which will act as a solvent for a portion only of the nitrocellulose. About 120 lb. of a mixture of benzene and alcohol are added to 100 lb. of dry nitrocellulose grains, and the digesting of the revolving grains is continued for a length of time depending on the degree of density required. The grains are then poured into 250 lb. of water at a temperature of about 85° C., and the mass quickly agitated to replace the solvent and stop gelatinisation. An increase in the temperature of the water produces a decrease in the density of the grain.—G. W. McD.

Explosives. G. Reschke, Hamburg, Germany. Eng. Pat. 25,781, Dec. 11, 1905.

SEE Fr. Pat. 360,349 of 1905; this J., 1906, 498.—T. F. B.

Explosives; Manufacture of safety ——. B. G. Reschke, Hamburg. Eng. Pat. 12,716, May 31, 1906.

THE invention consists in the addition of fennel, with or without wood pulp, to explosives of the ammonium nitrate class. The following are examples:—(*a*), Ammonium nitrate (69·6 per cent.), potassium nitrate (10), fennel (14·4), dinitrobenzene (1), and copper oxalate (5 per cent.). (*b*), Ammonium nitrate (94·3 per cent.), fennel (3), and wood pulp (2·7 per cent.).—G. W. McD.

UNITED STATES PATENT.

Glycerin nitrates; Manufacture of ——. A. Mikolajczak, Kastrop, Germany. U.S. Pat. 830,909, Sept. 11, 1906.

SEE Fr. Pat. 349,078 of 1904; this J., 1905, 636.—T.F.B.

FRENCH PATENTS.

Explosive. R. Imperiali. Fr. Pat. 364,948, Feb. 22, 1906.

SEE Eng. Pat. 14,545 of 1905; this J., 1905, 1084.—T.F.B.

Nitroglycerin explosives of low freezing point; Method of manufacture of ——. C. Classen. Fr. Pat. 364,803, March 31, 1906.

GLYCEROL is converted by heating at ordinary pressure into diglycerol. This body is then nitrated and used as an explosive either alone or admixed with trinitroglycerol. It is said that the presence of 25 per cent. of this body reduces the freezing point of nitroglycerin explosives to – 18° C.—G. W. McD.

Powder; Manufacture of a smokeless cannon ——. G. Robrecht. Fr. Pat. 364,973, April 6, 1906.

VEGETABLE fibre is immersed for a period of twelve hours in a mixture of three volumes of sulphuric acid and one volume of nitric acid, at a temperature of 25° C. It is then removed, and allowed to stand for a further period of two hours. The nitrocellulose is then, after washing in water, dissolved in acetone or sulphuric acid, re-precipitated by the addition of water, and formed into powder in the ordinary manner.—G. W. McD.

Nitrocellulose; Apparatus and method for the manufacture of ——. J. M. and W. T. Thomson, England. Fr. Pat. 364,981, April 6, 1906.

THE apparatus consists of two vessels placed side by side, furnished with false bottoms, and joined together at their lowest points by a pipe provided with a stop-cock. Each vessel has also a tap for the purpose of emptying. They are used alternately for the nitrating process as follows: One of the vessels is partly filled with nitrating acid, and the cellulose immersed in the usual manner. A thin layer of dilute sulphuric acid is run over the surface of the nitrating acid to prevent fuming. When nitration is complete, water is slowly and carefully run into the nitrating vessel, so as to flow over the surface without mixing. The stop-cock between the two vessels is then opened sufficiently to allow the nitrating acid to pass into the empty vessel at the same rate as the water flows into the other. The whole of the acid contained in the vessel first used is thus displaced by water into the adjoining one, where it is revivified and used for a further process of nitration, after which it is returned by water displacement to the vessel first used, which has then been emptied of its charge of nitrocellulose. (See also Eng. Pat. 8278 of 1903; this J., 1904, 560.)—G. W. McD.

Explosives in mines; Process for destroying the noxious gases resulting from the use of ——. H. Walker. Fr. Pat. 364,999, April 6, 1906. Under Int. Conv., Nov. 21, 1905.

SEE Eng. Pat. 24,002 of 1905; this J., 1906, 609.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 913.)

APPARATUS, &c.

ENGLISH PATENTS.

Gas calorimeter. J. W. B. Stokes, Shettleton, Lanark., N.B., and D. Stewart and Co. (1902), Ltd., Glasgow. Eng. Pat. 21,872, Oct. 27, 1905.

THE instrument consists of a cylindrical cast-iron vessel, which may be filled to any desired depth with mercury by raising or lowering a mercury reservoir communicating with the vessel by means of flexible tubing, the level being

shown on a gauge glass which may be closed by cocks. Two stop-cocks at the top of the vessel serve for supplying gas and air respectively, and a third one communicates with a pressure gauge. At the upper end of the vessel there is provided a device for electrically igniting the charges, which may consist of a sparking plug of the kind usually fitted to small internal combustion motors, and may be operated by a high tension coil. A water jacket may be provided in order to maintain the vessel at a given temperature. In operation, the vessel is filled with mercury, the gas cock which is connected with the source of gas is opened, and a certain volume of gas drawn in by lowering the mercury reservoir; the gas cock is then closed, the air cock opened, and the requisite quantity of air drawn in. The air cock is then closed, the stop-cock controlling ingress to the pressure gauge is opened, and if any initial pressure of the explosive mixture be desired, the mercury reservoir is raised to a corresponding height. Subsequently the cocks on pressure gauge and level gauge are closed, and the charge is electrically fired. From the pressure then recorded with the proportions, volume, temperature, and initial pressure as factors (which may be made constants), the calorific value of the gas can be easily calculated.—R. L.

Fire damp (methane) or other light gas or gases in mines or other places; Apparatus for detecting the presence and volume of ——. J. McCutcheon, Edinburgh. Eng. Pat. 24,900, Dec. 1, 1905.

The apparatus comprises a U-shaped tube, the right limb of which is connected at the bottom with a third vertical tube, the connecting tube being provided with a stop-cock. The latter tube has an enlargement above the level of the U-tube, and, above this, is connected to an india-rubber ball provided with a tap or valve. In the left limb of the U-tube is a float connected above with a rod of aluminium, the rod terminating in a metal disc coated with platinum foil. This disc is directly opposite the spring terminal of a wire which is connected to one pole of an electric battery, and also to a scale on which the percentage of fire damp is indicated; the rod of the float carries a small platinum wire dipping into a cup of mercury connected with the other pole of the battery. An electric bell or other alarm signal is included in the electric circuit. A mobile liquid, preferably "azine" (paraffin or other mineral oil treated with a vegetable colouring matter), is introduced into the U-tube and the other vertical tube, then the stop-cock between the latter and the U-tube is closed, and the india-rubber ball is compressed to expel air through the valve provided, which valve is then closed. On now opening the tap between the U-tube and the other tube, the liquid in the U-tube is drawn partly into the latter by the vacuum in the india-rubber ball, the float in the U-tube descends, and the electric circuit is broken. The right limb of the U-tube carries at the top a vessel of unglazed earthenware, provided with a tap. If fire damp or other light gas be present, then, owing to endosmose action, the liquid in the U-tube is forced down in the right limb, and up in the left limb, the float rises, the electrical circuit is closed, and the bell rings.—A. S.

Gas analysis; Apparatus for ——. W. H. Sodeau, and Brady and Martin, Ltd., Newcastle-on-Tyne. Eng. Pat. 12,225, May 25, 1906.

The apparatus comprises a water-jacketed measuring vessel, an absorption-pipette, a combustion-pipette, and an aspirator, with the requisite connections. A three-way cock with the handle distinctly marked at one end so as to indicate which way communication has been made is specially claimed. The gas to be examined is measured, the carbon dioxide absorbed in the absorption-pipette, the residue measured, then transferred to the combustion-pipette, wherein any carbon monoxide and hydrogen present are burnt by means of an electric current passed through a platinum spiral. The residue is again measured in order to ascertain the contraction due to combustion, and the carbon dioxide formed is estimated by absorption. Claim is also made for the application of the apparatus, in conjunction with suitable pyrometric or thermometric appliances, for the purpose of determining the efficiency of a boiler or furnace.—A. S.

United States Patent.

Gaseous mixtures; Testing ——. F. Haber, Karlsruhe, Assignor to Carl Zeiss, Jena, Germany. U.S. Pat. 830,225, Sept. 4, 1906.

See Fr. Pat. 356,388 of 1905; this J., 1905, 326.—T. F. B.

INORGANIC—QUALITATIVE.

Nitric acid; Two new colour reactions of ——. C. Reichard. Chem.-Zeit., 1906, **30**, 790—791.

A small volume of the solution containing a nitrate is evaporated to dryness, and a small quantity of arbutin and a drop of concentrated sulphuric acid added, when an intense yellow coloration is produced.

A more delicate reaction consists in moistening a small quantity of berberine hydrochloride with the solution containing nitrate, and adding one drop of concentrated sulphuric acid; a deep reddish-brown coloration is produced. If hydrochloric acid be used in place of sulphuric acid, the coloration appears only on warming. —A. S.

INORGANIC—QUANTITATIVE.

Iron and manganese; Separation of —— from nickel and cobalt by treatment of their sulphides with dilute acids. W. Funk. Z. anal. Chem., 1906, **45**, 562—570.

The author finds that treatment of their sulphides with dilute acids does not afford a quantitative method for the separation of iron from nickel and cobalt, even when formic acid is used instead of hydrochloric acid. It may be used, however, to separate manganese from nickel and cobalt. For this purpose the sulphides of the three metals are treated in the cold with $N/1$ formic acid in such excess that the solution finally contains from 0·5 to 1·5 per cent. of free formic acid. After saturating the liquid with hydrogen sulphide, the manganese solution is filtered from the insoluble sulphides of cobalt and nickel, which are washed with a solution of hydrogen sulphide. In the filtrate all the sulphides are again precipitated and treated as above in order to recover the small quantity of nickel and cobalt dissolved by the formic acid.—A. G. L.

Cement; Influence of the sulphur dioxide contained in illuminating gas on the determination of the loss on ignition of ——. L. von Szathmáry. Z. anal. Chem., 1906, **45**, 600—604.

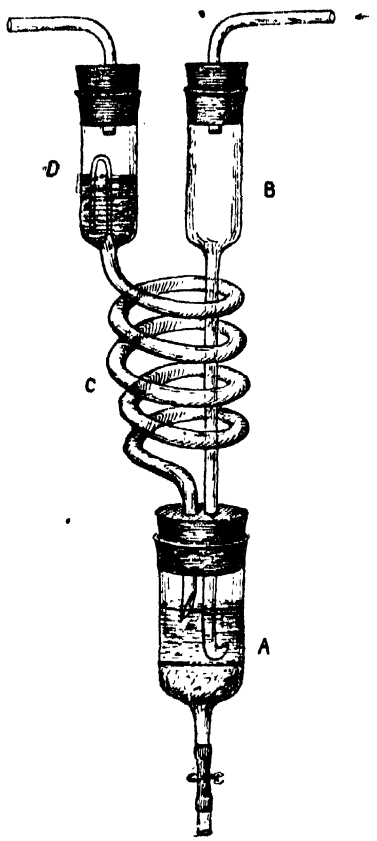
The author determines the loss on ignition of cement by heating in a platinum crucible over the blow-pipe, and finds it impossible to obtain constant results in this way unless the products of combustion of the gas are prevented from entering the crucible (by means of an asbestos shield), as the cement takes up sulphuric anhydride from the gases. Direct experiments have shown that it is really sulphuric anhydride, and not carbon dioxide, which is absorbed, and also that, of the constituents of the cement, neither alumina nor magnesia, but only lime, takes any part in the reaction.—A. G. L.

Carbon dioxide and carbon [in steel]; Determination of ——. J. Macfarlane and A. W. Gregory. Chem. News, 1906, **94**, 133—134.

For the determination of small quantities of carbon dioxide evolved by the combustion of steel, &c., the authors have devised the combined absorption and filtering apparatus shown (see figure). The base of the funnel, A, is plugged with a filtering layer of glass-wool covered with asbestos or paper pulp. When the apparatus has been freed from carbon dioxide, a measured volume of standard baryta solution is introduced at B, and is caused to rise into the spiral, C, and cup, D, by the passage of a current of air. The gases of combustion, entering at B, are then passed through, and the carbon dioxide is absorbed in the vessel, A, and in the spiral, C; the liquid in the cup, D, should

remain clear. Lastly, the stem of the funnel, A, is opened and the apparatus is washed with boiling water until free from barium hydroxide. The carbon dioxide can be determined either directly by titration of the barium carbonate, or indirectly by precipitating the barium as sulphate.

Larger quantities of carbon dioxide can be absorbed by an ammoniacal solution of barium chloride contained in ordinary flasks. The barium carbonate is precipitated only on boiling. When cold, the precipitate can be



filtered and washed in the open air, without fear of further precipitation of barium carbonate by the carbon dioxide of the air.—J. F. B.

Phosphorus in presence of large quantities of phosphorus sesquisulphide; Detection of small quantities of white ——. L. Aronstein. Chem. Weekblad, 1906, 3, 283—287. Chem. Centr., 1906, 1, 1906.

By means of a T-tube dry hydrogen which has been previously washed with potassium permanganate solution and sulphuric acid, or dry carbon dioxide washed with water and sulphuric acid, is mixed with a small proportion of air, and led over the phosphorus sesquisulphide. If white phosphorus be present, phosphorescence is produced. The phosphorescence disappears if the proportion of air be increased, and reappears if the supply of air be again diminished. Pure phosphorus sesquisulphide, under these conditions, produces phosphorescence only at temperatures above 80° C. It is stated that 0·2 per cent. of white phosphorus can be detected in this manner, provided the absolute weight is not less than 0·04 mgrm. If the material under examination contain oil of turpentine, alcohol, or other volatile substance, phosphorescence appears only after the current of gas has been passing for several minutes.—A. S.

Phosphorus in presence of large quantities of phosphorus sesquisulphide; Detection of small quantities of white ——. L. Aronstein. Chem. Weekblad, 1906, 3, 493—499.

The author states that the lead acetate method recommended by Van Eijk (this J., 1906, 869) is not suitable for the detection of white phosphorus in presence of phosphorus sesquisulphide. Phosphorus is attacked by boiling lead acetate solution, a black precipitate being produced even if air be carefully excluded. Moreover, when phosphorus sesquisulphide is boiled with excess of lead acetate solution, phosphorescence is produced if air be allowed to enter the condenser. The method, also recommended by Van Eijk, in which the residue left after extracting with carbon bisulphide is rubbed in the dark, was only capable of detecting the presence of 1·4 per cent. of phosphorus in phosphorus sesquisulphide in the author's hands. Reference is made to the method previously described by the author (see preceding abstract). —A. S.

ORGANIC—QUALITATIVE.

Mineral acids in presence of organic acids [in wine and vinegar]; New method for the detection of free ——. O. Carletti. Boll. Chim. Farm., 1906, 45, 449—451. Chem. Centr., 1906, 2, 825.

The Jorissen-Lindet reaction for the detection of furfura in alcohol is based on the formation of basic colouring matters from furfural and aromatic amines. The author finds that if aniline be used as the amine, the reaction takes place only in presence of organic acids, but not with aniline salts of mineral acids, or after addition of mineral acid to aniline salts of organic acids. This fact may be utilised for the detection of small quantities of free mineral acids in wine and vinegar. Two solutions are employed: (*a*) 5 grms. of pure aniline and 20 grms. of concentrated acetic acid diluted to 100 c.c. with water; (*b*) 1 grm. of freshly-prepared furfural diluted to 100 c.c. with 95 per cent. alcohol. Fifty c.c. of the wine (or vinegar), previously decolorised by means of animal charcoal, are treated with 25 c.c. of 95 per cent. alcohol, and 10 c.c. of the mixture are treated with five drops of solution, (*a*), shaken, and mixed with five drops of the furfural solution. If free mineral acid be present (even to the extent of 1 per 1000) in the wine, the liquid retains unaltered its faint greenish tint, but if mineral acids be absent, there is produced almost immediately a distinct pink coloration, which attains its greatest intensity in half an hour.—A. S.

Methyl alcohol; Detection of ——. H. Scudder and R. B. Riggs. J. Amer. Chem. Soc., 1906, 28, 1202—1204.

Leach and Lythgoe (this J., 1905, 943) recommend, as a confirmatory test for methyl alcohol, oxidation through the medium of a hot copper spiral, and testing for formaldehyde by means of milk and hydrochloric acid containing ferric chloride. The authors show that a great number of organic compounds yield, by this treatment, sufficient formaldehyde to give the reaction, and that therefore the test cannot be depended upon to detect methyl alcohol. —J. T. D.

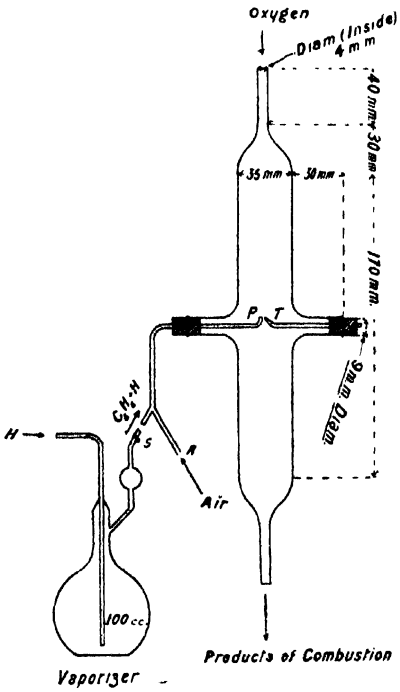
ORGANIC—QUANTITATIVE.

Benzene; Determination of carbon bisulphide and total sulphur in commercial ——. E. S. Johnson. J. Amer. Chem. Soc., 1906, 28, 1209—1220.

Carbon bisulphide.—To 75 c.c. of the benzene contained in a 250 c.c. stoppered flask, alcoholic solution of potassium hydroxide is added (about 1 c.c. of the saturated solution for each 0·1 grm. of bisulphide expected) and agitated for 15—20 minutes. Water is added to dissolve the xanthate formed, and after shaking, the mixture is transferred to a separating funnel, and the xanthate drawn off. The extraction with potassium hydroxide is repeated, using about three-quarters of the original amount, and, if necessary, gone through a third time. The extracts and washings are made up to 500 c.c. An aliquot portion of the solution is acidified with "wall-diluted" acetic acid in not too great excess, and precipitated cold with 20 per

cent. copper sulphate solution, adding the solution in slight excess, and stirring frequently during 1½ hours. The precipitate is filtered off, washed, dried, and ignited in a porcelain crucible. Numerous experiments with varying amounts of carbon bisulphide, varying excess of copper sulphate, and varying intervals of time between filtration and precipitation, showed that the ratio of cupric oxide obtained, to carbon bisulphide present, varied from 1·593 to 1·825; for general practice the working factor of 1·75 is adopted by the author.

Total sulphur.—The principle of the method is the combustion of the benzene (5 grms.) in a stream of oxygen. The apparatus used is shown in the figure.



The sample is contained in the flask. Pure dry oxygen is passed through the combustion chamber from top to bottom, and passes out through two wash-bottles containing jointly 25 grms. of crystallised sodium carbonate dissolved in 110 c.c. of water, to which has been added more than enough bromine water (say 10 c.c.) to oxidise any possible amount of sulphurous acid. The little pilot flame, T, of pure hydrogen is lighted and adjusted in position; the flask is filled with pure hydrogen from another supply, then connected to the A-tube, and the stream of hydrogen continued. The benzene vapour and hydrogen ignite at P, and pure dry air is then sent by A through the A-tube till the flame is but slightly luminous. The flame is kept about an inch in length, and the flask warmed, if necessary, till the whole of the benzene is burnt. This should take about three hours, and the end of the operation is readily seen by the vanishing of the luminosity of the flame. The stop-cock, S, is then closed, the pilot-flame extinguished, the oxygen shut off, and air sent through, first by A, and then from the top, till all traces of the products of combustion have been washed through the absorbing liquid. The sulphur in this liquid is then determined gravimetrically.—J. T. D.

Tannin; Determination of —— in tanning materials Boudet. Bull. Soc. Chim., 1906, **35**, 760—762.

In the estimation of tannin by means of standard iodine and thiosulphate (Jean's method) it is necessary to allow two hours for the reaction between the iodine and tannin before titrating the excess of iodine. One grm. of iodine has been found to react with 1·137 grms. of pure dry tannic acid. Gallic acid behaves similarly, 1 grm. of iodine reacting with 0·467 grm. of this substance. Both tannin and gallic acid may be determined in the same material by treating the extract with standard iodine solution before and after getting rid of the tannin with hide-powder, the difference between the two titration results being calculated as tannin and the second as gallic acid. The end of the titration, using starch indicator, may be seen quite easily even with the highly coloured tanning liquor obtained from cutch.—F. Sodn.

Sugar cane and bagasse; Direct determination of sugar in ——. H. Pellet. Sixth Int. Congr. Appl. Chem., Rome, 1906; Z. Ver. deut. Zuckerind., 1906, 838—840.

The author considers that the method of alcoholic digestion for the estimation of sugar in sugar cane and bagasse should be abandoned, and that the aqueous digestion method should be used instead. He also considers that the single digestion of 20—30 grms. of the ground material with 300—500 c.c. of water does not give a trustworthy result. Owing to the non-homogeneity of the material, 50 grms. should always be taken for analysis, and the sample should be subjected to several successive extractions with boiling water, since one extraction does not suffice to remove all the sugar from the material. The author recommends Zamaron's apparatus for extraction. For practical purposes a modification of the single extraction process may suffice: 50 grms. of the material are extracted with boiling water, the solution is decanted off, and the residual bagasse expressed in an ordinary screw-press, the expressed juice being added to the decanted solution. The author also recommends the estimation of the sugar in the expressed juice alone for the purpose of getting an idea of the amount of sugar lost in the working operations.—L. E.

Polarimetric sugar analysis; Clarification with dry basic lead acetate in ——. W. Horne. Sixth Int. Congr. Appl. Chem., Rome, 1906; Z. Ver. deut. Zuckerind., 1906, 825—827.

According to results published by Watts and Tempany, the ordinary polarisation method in the case of Muscovado and partly refined products gave results which on the average were 0·3 per cent. too high, the error being due to the volume occupied by the lead precipitate. On the contrary, by the use of dry basic lead acetate (according to Horne's clarification method), the results obtained were only 0·04 per cent. too high. H. and L. Pellet have objected to the latter method on the ground that the lead precipitate absorbs sugar, and thereby compensates the error introduced in the ordinary clarification method. (See this J., 1906, 823.) The author has examined this statement, and concludes that the lead precipitate does not absorb sugar. 52·096 grms. of dry granulated sugar were dissolved, and the solution made up to 200 c.c. Of this solution 50 c.c. were made up to 100 c.c., and polarised, the reading being 49·725. Another 50 c.c. of the solution were placed in a 100 c.c. flask, treated with 10 c.c. of an optically inactive organic solution of an earlier lead precipitate, and then with 2 c.c. of basic lead acetate solution, and finally made up to volume with water. The filtrate polarised 49·80. The calculated value (allowing for the volume of the lead precipitate) was 49·755. Hence the value obtained was higher than the calculated one, instead of lower as it should have been if the precipitate had absorbed sugar. In a second experiment four times the amount of organic solution, *i.e.*, 40 c.c., was used, together with 8 c.c. of lead solution. The original solution polarised 49·783, whilst after treatment it polarised 49·916, the calculated value being 49·903, thus showing that no sugar had been absorbed by the precipitate. In another experiment 1 grm. of dry powdered lead precipitate was shaken for 15 minutes with 50 c.c. of a normal pure sugar solution; the polarisation reading was practically unaltered by this treatment. In conclusion the author shows that the very slightly high results obtained by his

method of clarification with dry basic lead acetate are due in part to the presence of insoluble matter in the raw sugar.—L. E.

Sucrose; Polarimetric determination of —— II. F. Watts and H. A. Tempany. West. Ind. Bull., 1906, 7, 132—140.

In continuation of previous work (see this J., 1905, 817) on the changes of the specific rotatory power of cane sugar solutions with changes of temperature, the authors have made further determinations in the following manner: A standard solution of pure cane sugar was made, and its rotation was observed at two extreme temperatures (about 16° and 33° C.), care being taken that the temperature of the instrument and of the whole room in which the observations were made should follow closely the same variations as the temperature of the sugar solution. Having thus determined the total difference of rotation of the same sugar solution at two different temperatures, the following corrections were subtracted from it: (*a*) the expansion of the sugar solution; (*b*) the variation due to the change of the specific rotation of the quartz wedge of the instrument between the same limits of temperature; (*c*) the expansion of the polarimeter tube. The residual difference between the sum of these corrections and the total variation in the rotation of the sugar solution is expressed as the influence of the change of temperature on the specific rotatory power of the sugar. In this manner of working, any errors due to the making up of the solution and to the presence of impurities are eliminated. From their results, which agree well with observations made by Wiley and by Schonrock, the authors deduce the following rule:—"Polarise at the temperature at which the solution is prepared, and correct for temperature by the formula: polarisation + (0·00031 *t*) N, where *t* is the difference between the temperature of observation and that at which the instrument was standardised, and N is the Ventzke scale reading."—J. F. B.

Maple syrup and maple sugar; Determination of "lead number" in ——. A. L. Winton and J. L. Kreider. J. Amer. Chem. Soc., 1906, 28, 1204—1209.

Instead of measuring the volume of the precipitate produced by adding basic lead acetate to maple products (see Hortvet, this J., 1904, 1241), the authors determine the amount of lead in the precipitate. Twenty-five grms. of the material (26·048 grms. if sugars are to be determined polariscopically in the same portion) are weighed into a 100 c.c. flask, 25 c.c. of standard solution of basic lead acetate added, the liquid made up to the mark, shaken, allowed to stand for an hour, and filtered through a dry filter. Ten c c. of the filtrate are taken, diluted to 50 c.c., and precipitated with sulphuric acid and 100 c.c. of 95 per cent. alcohol. The precipitate is allowed to stand over night, filtered in a Gooch crucible, washed with 95 per cent. alcohol, dried, ignited at a low red heat for three minutes, and weighed. The lead in this precipitate, subtracted from the amount in 2·5 c.c. of the standard solution and divided by 2·5, gives the "lead number." The standard lead solution is made by boiling for half an hour 430 grms. of lead acetate and 130 grms. of litharge with a litre of water, allowing to cool and settle, decanting the clear liquid, and diluting to sp. gr. 1·25.

The method gave, on 15 samples of authentic maple syrup (total solids 64 to 68·5 per cent.) and maple sugar (94·6 to 99·2 per cent.) of various qualities, lead numbers of 1·19 to 1·77 for the syrups, and 1·83 to 2·48 for the sugars, whilst 12 adulterated syrups on the market gave lead numbers of 0·02 to 0·92.—J. T. D.

Colchicine; Determination of ——. A. Panchaud. Schweiz. Woch. Chem. Pharm., 1906, 44, 563—564.

1·5 grms. of coarsely powdered seeds are macerated for 30 minutes with 150 grms. of chloroform, with agitation. Six c.c. of a 10 per cent. solution of ammonia are then added, with further thorough agitation for another 30 minutes. 100 grms. of the chloroform extract are then filtered into a tared Erlenmeyer flask, and distilled to perfect dryness. The residue is taken up in 1 grm. of dry chloroform, to which 2 grms. of dry ether are added, followed by 30 grms. of dry light petroleum spirit. The precipitate is collected on a small filter, washed with light petroleum spirit, well drained, and dissolved, and washed back into the empty flask by means of warm chloroform, the filter being thoroughly extracted with the same solvent. The chloroform is again distilled off, and the dry residue, dissolved in 15 drops of chloroform, is again precipitated, as before, with the same quantity of absolute ether and dry light petroleum spirit. The precipitated colchicine is collected on a small tared filter. Any alkaloid adhering to the flask is dissolved in five drops of chloroform, and precipitated with 1 grm. of absolute ether and 10 grms. of dry light petroleum spirit, and transferred to the rest on the filter. The flask and filter contents are then washed with a little petroleum spirit, the filter is drained, dried until constant in weight, and weighed. The weight obtained + 0·0022 grm. × 10 gives the percentage of colchicine in the seeds.—J. O. B.

Methyl alcohol; Detection and determination of —— [in presence of ethyl alcohol]. E. Voisenet. Bull. Soc. Chim., 1906, 35, 748—760.

This is an application of a colour reaction of formaldehyde already described (this J., 1905, 1326) to the detection and estimation of small quantities of methyl alcohol, more particularly in samples of ethyl alcohol. Such a volume of the alcohol is taken as corresponds to 10 c.c. of absolute alcohol. It is diluted to 50 c.c., and 5 grms. of powdered potassium bichromate and 30 c.c. of sulphuric acid (one to five by weight) are added. The mixture is shaken until the bichromate is dissolved, and left for one hour at the ordinary temperature. In this process methylal is produced which readily decomposes to give formaldehyde. The mixture is then distilled very slowly so as to obtain about 30 c.c. of distillate in the first hour. This contains the whole of the acetaldehyde produced, and is rejected. The next 20 c.c. contains all the methylal, and is used for the colour test. To 4 c.c. of this distillate are added 1 c.c. of a solution of albumin and 15 c.c. of hydrochloric acid containing nitrous acid. The albumin solution is prepared by vigorously beating the white of an egg with one-fifth of its volume of distilled water, and straining, the clear liquid thus obtained containing about 10 per cent. of albumin. The nitrous acid solution is made by adding 0·1 c.c. of a 3·6 per cent. solution of potassium nitrite to 200 c.c. of pure concentrated hydrochloric acid. After shaking to dissolve the coagulated albumin, the tube is placed in a water-bath at 50° C. If methylal is present, *i.e.*, if the alcohol contained wood spirit, a violet coloration results immediately or in a few minutes, the maximum colour being developed in 15 minutes. A blank experiment should be carried out under precisely similar conditions, using pure alcohol, and if standard tints are prepared by adding known quantities of methyl alcohol, the reaction may be made quantitative. The standards remain unaltered for some weeks. One part of methyl alcohol in 20,000 parts of ethyl alcohol may be detected, the above directions being most suitable where the proportions lie between one in 10 and one in 1000. If the proportion is found to be greater than one in 50, it is advisable to dilute the distillate for quantitative purposes.

As before described (*loc. cit.*), some other aldehydes and aldehydic phenols give a similar colour by the above treatment, but whereas that with formaldehyde is at once discharged by such reducing agents as sulphuretted hydrogen or sulphur dioxide, a large excess of these reagents and heating is required to destroy the colour produced by other aldehydes. The reaction is therefore characteristic of methyl alcohol and formaldehyde.

—F. Sodn.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Presentations to Sir W. Perkin in America. *Times Oct.* 8, 1906.

Sir William Perkin was the guest of honour at Delmonico's on October 6, at a dinner given by 400 American

iemists and manufacturers of chemical products. Prof. handler presided, and many well-known Americans ere among the guests. Dr. Nichols presented to Sir 'illiam Perkin the first cast of a gold medal to be known i the Perkin medal and to be awarded each year to some merican chemist who has distinguished himself in the eld of research. Another gift to Sir W. Perkin was a lver service as a personal tribute from the chemists and anufacturers who were present.

New Books.

EPORT OF THE INTERNATIONAL COMMITTEE ON ANALYSES TO THE 6TH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY AT ROME, 1906. By Prof. Dr. G. LUNGE. Verlag von Zürcher und Furrer. Zürich. 1906. Price M. 10 or 12.50 frcs.

vo volume, containing 421 pages of subject matter, evoted to the following subjects:—I. By-Laws of the nternational Sub-Committee on Analyses. II. Introuction and Report by the President (G. Lunge). Reports f the 11 Sub-Committees upon the various questions resented.

'OXINES AND ANTITOXINES. By CARL OPPENHEIMER, M.D., Ph.D. Translated from the German by C. A. Mitchell, B.A. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1906. Price 7s. 6d. net.

vo volume, containing 245 pages of subject matter, ollowed by alphabetical indexes of authors and subjects. The text is subdivided as follows:—GENERAL PART.—. Introduction, with definition of a "Toxine," &c. II. Behaviour of Toxines towards Antitoxines. III. Endoxines and Bacterial Proteins. SPECIAL PART.—I. The rue Toxines. II. Endotoxines and other Bacterial Poisons. III. The Vegetable Toxines (*Phytotoxines.*) IV. The Animal Toxines. (*Zootoxines.*)

THE LABORATORY BOOK OF MINERAL OIL TESTING. By JAS. A. HICKS. With introduction by Sir Boverton Redwood. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1906. Price 2s. 6d. net.

SMALL 8vo volume, containing frontispiece (Abel Petroleum Testing Apparatus), preface, 68 pages of subject matter, with 31 illustrations. Appendix, with thermometric tables, and the alphabetical index. The text is classified as follows: I. Specific Gravity. II. Flashing Point. III. Viscosity. IV. Colour. V. Sundry Apparatus.

PRACTICAL METHODS OF INORGANIC CHEMISTRY. By F. MOLLWO PERKIN, Ph.D., head of the Chemistry Department, Borough Polytechnic Institute, London. Archibald Constable and Co., Ltd., London. 1906. Price 2s. 6d. net.

SMALL 8vo volume, containing 152 pages of subject matter, with 27 illustrations, and the alphabetical index. This is essentially a treatise on "Inorganic Methods of Preparation for Students," as defined by the author himself. The text is subdivided and classified as follows:—I. General Methods and Preparations. II. Salts. III. Halogens and Halogen Compounds. IV. Metallic Oxides. V. Acids. VI. Preparations of Metals and Metalloids. VII. Special Preparations. VIII. Tables, Melting Points, and Specific Gravities, Approximate Temperatures, &c. IX. Preparation of some Reagents.

THE EXTRA PHARMACOPŒIA OF MARTINDALE AND WESTCOTT. Revised by W. HARRISON MARTINDALE, Ph.D., and W. WYNN WESTCOTT, M.B.Lond., D.Ph. Twelfth Edition. H. K. Lewis, 136, Gower Street, London, W.C. 1906. Price 10s.

MED. 24mo volume, containing 1075 pages of subject matter, and including an alphabetical index and posological table. The text is classified as follows:—I. New Chemicals, Drugs, and Modes of Treatment. II. Abbreviations, Weights, and Measures, &c. III. Materia Medica, Official and Non-official, alphabetically arranged, also Secondary List of Drugs. IV. Physiological Standardisation, Note. V. Antitoxins, Vaccines, Antitoxic Serums. VI. Animal Organotherapy. VII. Mineral Waters: Nature, Chemical Constituents, Medicinal Uses, and Season VIII. British Health Resorts. IX. Analytical Memoranda. X. Neutralisation Table. XI. B.P. and International (1906) Atomic Weights. XII. Freezing Mixtures. XIII. Percentage and Grains per ounce Equivalents. XIV. Approximate Melting Points of some Fats and Waxes, and Mixtures. XV. Thermometric Equivalents. XVI. Poisons Schedule. XVII. Drop Measure based on the Table in Farmacopea Española. XVIII. General Index and Posological Table. XIX. Therapeutic Index of Diseases and Symptoms.

A HISTORY OF CHEMISTRY. By F. P. ARMITAGE, M.A. Longmans, Green and Co., 39, Paternoster Row, London. Also New York and Bombay. 1906. Price 6s.

8vo volume, containing 254 pages of subject matter, and indexes of names. The text is classified into the following sections:—I. From Earliest Times to the Downfall of "Iatro-Chemistry." II. From Boyle to Lavoisier, and the Establishment of the Quantitative Method. III. From Lavoisier to the Enunciation of the Atomic Theory by Dalton. IV. Dalton's Atomic Theory, and the Work of Davy. V. Berzelius, and the Development of the Atomic System. VI. The Fortunes of the Atomic Theory between the Years 1819 and 1844. VII. Development of Organic Chemistry. VIII. The Radical Theory and Discovery of Substitution. IX. Constitution of Acids and the Differentiation of the Terms Atom, Molecule, and Equivalent. X. Gerhardt's Unitary System. XI. Valency, Chemical Nature of Carbon, and the Constitution of Organic Compounds. XII. Development of Stereo-Chemistry. XIII. Inter-Relationship of Atomic Weights, Cannizzaro's Reform, and the Periodic Law.

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[C.S.] 5890 (1906). Newton (Bayer und Co.). Manufacture of a new dyestuff of the anthracene series. Oct. 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 21,769. Schoop. *See under* XI.
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" 22,955. City of Bradford, Wyld, and Shepherd. Apparatus for the manufacture of sulphuric and other acids. Oct. 13.
[C.S.] 5437 (1906). Hay. Manufacture of common salt by evaporating brine. Oct. 10.
" 12,208 (1906). Joubert. Manufacture of oxygen [illegible]. Oct. 17.
" 12,807 (1906). Rossler. Production of oxide of [illegible] by means of magnesia. Oct. 17.
" 13,035 (1906). [illegible] Oxygen generators. Oct. 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 21,721. Gyperyuk. Manufacture of [illegible] glass. Oct. 2.
[C.S.] 26,595 (1905). Thompson. Utilisation of [illegible] sand or "burgy" from glass works. Oct. 17.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 21,667. British Thomson-Houston Co. (General Electric Co.). Treatment of refractory materials and apparatus therefor. Oct. 1.
" 22,390. Gramiccia. Artificial conglomerates for building purposes.* Oct. 10.
" 22,425. Cowper-Coles. Manufacture of cement. Oct. 10.
" 22,426. Cowper-Coles. Manufacture of cement. Oct. 10.
" 22,487. Watson. Insulating material [illegible] resistance of damp. Oct. 11.
[C.S.] 20,070 (1905). Thom. Artificial stone [illegible]
" 20,153 (1905). Parkes. Burning bricks [illegible] therefor. Oct. 10.
" 20,646 (1905). Sutcliffe and Speakman. *See under* I.
" 6681 (1906). McWhirter. Apparatus for heating, steaming, and chemically treating wood, &c., and for drying such goods. Oct. 10.

X.—METALLURGY.

[A.] 7277A. Betts. Making aluminium. [U.S. Appl., April 1, 1906.]* Oct. 3.
" 21,672. Sulman. Separation of zinc from ores or compounds. Oct. 1.
" 21,770. Simpson and Bourcoud. Production of iron. Oct. 2.
" 21,811. Bradley. Depositing metals or alloys on other metal alloys or fabrics without the aid of a bath. Oct. 3.
" 21,864. Carson. *See under* XIIIA.
" 21,876. Ruthenburg. Methods and apparatus for reducing ores. Oct. 3.
" 21,947. Elmore. *See under* I.
" 22,065. Crowe. Open-hearth steel plant. Oct. 5.
" 22,032. Brandenburg. Extraction of tin from tin ores, ashes, waste, residues, &c.* Oct. 5.
" 22,033. Brandenburg. Extraction of iron from iron-containing tin products such as residues, slags, ashes, scrap, &c.* Oct. 5.
" 22,162. McIvor and Fradd. Extraction of tin from ore or oxide. Oct. 8.
" 22,166. Carrick and Pattinson. Smelting sulphide ores.* Oct. 8.
" 22,174. Hyatt and Bamber. Manufacture of iron and steel. Oct. 8.
" 22,264. James (Hobson). Gold alloy.* Oct. 9.
" 22,491. Bloxam (Siemens und Halske A.-G.). Production of homogeneous masses of tantalum or other difficultly fusible metal.* Oct. 11.
" 22,534. Sulman. Separation of zinc from its ores or compounds. Oct. 11.
" 22,663. Nicklin. Process for recovering iron from the slag of puddling furnaces. Oct. 13.
[C.S.] 17,561 (1905). Boult (Sutton and Steele). Dry concentration of ores. Oct. 10.
" 17,653 (1905). Boult (Sutton and Steele). Dry electric separators. Oct. 10.
" 20,004 (1905). Goldschmidt and Weil. Manufacture of metals according to the aluminio-thermic process. Oct. 10.
" 20,390 (1905). Bousfield (Mackay and Bousfield). Treatment of sulphide ores. Oct. 17.
" 24,672 (1905). Tucker. Extraction of metals from their ores. Oct. 17.
" 24,714 (1905). Sulman, Picard, and Ballot. Ore concentration. Oct. 10.
" 6666 (1906). Goldschmidt. Aluminium process. Oct. 10.

[C.S.] 3089 (1906). Jensen (Maemeche). Mixtures for heating by reduction of metallic compounds. Oct. 17.
„ 6569 (1906). Townsend. Reduction of sulphide ores or compounds. Oct. 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 21,769. Schoop. Graphite carbon electrodes for electrical bleaching apparatus. Oct. 2.
„ 22,000. Sokal, Bloomfield, Wolf and Wolff. Storage batteries.* Oct. 5.
„ 22,002. Wheatley and Lark. Deposition of metallic alloys by electrolysis. Oct. 5.
„ 22,031. Boult (Urbasch). Electrolytic manufacture of peroxide of hydrogen. Oct. 5.
„ 22,100. Gauntlett. Deposition of metals or metallic compounds upon metals and metallic articles. Oct. 6.
„ 22,212. Kjellin. Electric furnaces.* Oct. 9.
„ 22,219. Diamant. Increasing the electrical capacity of spongy lead plates for storage batteries.* Oct. 9.
„ 22,510. Frick. Electric transformer furnaces.* [Appl. in Sweden, Dec. 18, 1905.]* Oct. 11.
„ 22,658. Weichert. Apparatus for the electrolysis of fluids.* Oct. 13.
„ 22,692. Heymann. Electrode for secondary batteries. Oct. 13.
[C.S.] 19,616 (1905). Schauli. Electric batteries. Oct. 10.
„ 9293 (1906). L'Hommedieu. Electroplating apparatus. Oct. 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 22,301. Spaull and Spaull. Manufacture of a material for refining oils, fats, waxes, &c. Oct. 9.
„ 22,420. Harris. Treating vegetable or mineral oils.* Oct. 10.
[C.S.] 19,958 (1905). Dreymann. *See under* XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

[A.] 21,954. Carson. Production of zinc white and reduction of metals from their compounds. Oct. 3.
„ 22,023. Cowper-Coles. Manufacture of white lead. Oct. 5.

(*B.*)—Resins; Varnishes.

[A.] 22,411. Lastookhine. Oil varnish. Oct. 10.

(*C.*)—India-Rubber.

[A.] 22,106. Ormandy, and Harvey, Frost, & Co. Vulcanising. Oct. 6.
„ 22,182. Wheatley. Manufacture of india-rubber substitutes. Oct. 8.
[C.S.] 20,606 (1905). Wilderman. Manufacture of rubber. Oct. 17.
„ 2869 (1906). Gratz. Preparation of rubber for vulcanisation. Oct. 17.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 21,973. Thomson and Morrice. Manufacture of modified or soluble starch, dextrine, and sugars. Oct. 5.
„ [illegible]. Manufacture of a homogeneous horn substance. Oct. [illegible].
„ [illegible]. Manufacture of [illegible] and albuminous leather. Oct. [illegible].

XV.—MANURES, &c.

[C.S.] 26,780 (1905). Crosse, Taylor, and Williams. Manufacture of fertilisers and apparatus therefor. Oct. 17.

XVI.—SUGAR, STARCH, GUM, &c.

[A.] 22,387. Mirrlees Watson Co. (Knight). Removal of impurities from cane juice and apparatus therefor. Oct. 10.
[C.S.] 9205 (1906). Monti. *See under* XVII.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 21,916. Linzel. Apparatus for de-alcoholising liquids. [Ger. Appl., May 23, 1906.]* Oct. 4.
[C.S.] 26,730 (1905). Ellermann. Drying apparatus for malt and the like. Oct. 17.
„ 9205 (1906). Monti. Preparation of concentrated worts, juices, syrups, and scented extracts. Oct. 10.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 21,746. Héritte. Alimentary extracts of blood Oct. 2.
„ 22,309. Schmolle. Manufacture of aërated liquids. Oct. 9.
„ 22,340. Pabst. *See under* XIV.
[C.S.] 17,320 (1905). Paudler. Manufacture of a substitute for coffee from maize. Oct. 10.
„ 6756 (1906). Finan. Composition for preventing deterioration of foodstuffs. Oct. 10.

(*B.*)—Sanitation; Water Purification.

[A.] 21,782. Thwaite. Destruction of bacteria in blood and tissues. Oct. 3.
„ 21,944. Ryder and Wilson. Materials for purifying air. Oct. 4.
[C.S.] 20,750 (1905). Kestner. Purification of water, sewage, effluent, and the like. Oct. 17.

XIX.—PAPER, PASTEBOARD, &c.

[C.S.] 15,001 (1906). Schmidt. Manufacture of partly transparent papers. Oct. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 22,499. Goldsmith, and British Xylenine Co. Obtaining valuable products from camphene. Oct. 11.
[C.S.] 19,958 (1905). Dreymann. Conversion of unsaturated compounds into saturated compounds. Oct. 10.
„ 2682 (1906). Rosenberg. Therapeutic preparations containing formaldehyde. Oct. 10.
„ 9205 (1906). Monti. *See under* XVII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 10,651 (1906). Stendel. Self-toning silver chloride printing papers. Oct. 17.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 21,966. Wheelwright. Igniting compositions for the manufacture of matches. Oct. 4.
[C.S.] 22,589 (1905). Abell. Manufacture of explosives Oct. 10.
„ [illegible] (1906). [illegible] Explosive [illegible] Oct. [illegible].

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Meeting held at University on Wednesday, October 10, 1906.

DR. JAMES T. CONROY IN THE CHAIR.

THE GRADUAL DETERIORATION OF NITRO-CELLULOSE ON STORAGE.

BY OSWALD SILBERRAD, PH.D., AND ROBERT CROSBIE FARMER, D.SC., PH.D.

Among the characteristics which distinguish the nitric ester explosives from the true nitro-compounds, one of the most important, from a practical point of view, is the tendency to decompose gradually but continuously, even at ordinary temperatures. Although numerous qualitative observations have been made as to the characteristics which accompany the deterioration of nitrocellulose, very few quantitative data have hitherto been published. Indications of the gradual deterioration are given by Abel (Phil. Trans., 1867, 157, 181); Thomas (Zeits. angew. Chem., 1898, 1027); Spica (Atti. del Reale 1st Veneto, 1899, 58, 289), and others; but no systematic examination of the progress of the decomposition has hitherto been published. In the present work, the explosives have been systematically examined and analysed at intervals during storage. The influence of temperature has been examined by a series of trials in which the powders were stored at different temperatures in large thermostats; the effect of moisture has also received full consideration. In order to approximate as closely as possible to the conditions of storage in powder magazines, large quantities of the explosives have been taken (in many instances several hundred kilogrammes). From the results of the trials, the following conclusions have been drawn:—

(1) *Physical alterations on storage.*—In general, an external examination of the powder gives very little information as to the degree of deterioration which it has undergone; it is only when the decomposition has proceeded to an extreme pitch, that any marked alterations in the physical properties are observable, although, in Russia, the usual stability tests are supplemented by an external examination of the powders (course of Naval Artillery, 1901–02).

The most marked characteristics of deterioration in nitrocellulose powders are the following:—

(a) *Odour.*—Nitric peroxide is liberated during the decomposition, and permeates the nitrocellulose; thus highly deteriorated powders smell strongly of this product. In cases where ether-alcohol has been used as the gelatinising solvent, an odour of ethyl nitrite is frequently also noticeable.

(b) *Action on packing materials.*—The nitric peroxide and free acids formed on storage also attack the silk cloth wrappers of the cartridges very considerably, weakening the fibres of the cloth and bleaching any colouring matter. Similarly, oiled paper is considerably attacked, whilst if india-rubber sheeting be used as a packing material, the sulphur present becomes oxidised to sulphuric acid, and thus accelerates the decomposition.

For this reason, the use of rubber sheeting should be avoided. The shellac of the primers attached to the cartridges was gradually bleached and ultimately disintegrated.

(c) *Appearance.*—When stored, according as the powder has been heated to a more or less considerable degree, the only alterations that appear are a slight change in colour, usually towards brown, and the powder loses its comparatively glossy and pitted, and shows a striated appearance. In cases of extreme deterioration, the colour darkens greatly, and sometimes becomes almost black. Where the decomposition takes place in a moist atmosphere, the hygroscopic gives rise to deliquescent acid products. Hence, the surface tends to become sticky, and water is taken up with considerable avidity. If the decomposition proceeds far enough, the interior of the sticks becomes filled with a soft, semi-crystalline core, consisting chiefly of oxalic acid. The surface of the nitrocellulose loses its explosive properties to some extent, and in extreme cases the sticks burn with great difficulty, and leave an inner and outer annulus of unburnt substance. This occurs also, to some extent, in a dry atmosphere, but is chiefly noticeable in the presence of moisture. The black powder in the primers of the cartridges gradually disintegrates with production of a fine brown powder, which partially cakes together.

2. *Effect of storage upon chemical analysis.*—A review of the analytical data shows that the deterioration is accompanied by the following alterations:—

(a) *Loss of weight.*—A gradual but continuous loss of weight occurs on storage; this has generally been assumed to be mainly due to the gradual volatilisation of the gelatinising solvents. The results show, however, that the percentage of volatile matter does not in any case decrease materially, and thus the loss of weight must be due to the decomposition of the nitric esters. This is fully confirmed by measurements of the velocity of gas evolution, to be published shortly by the authors.

(b) *Loss of nitrogen.*—A decrease in the percentage of nitrogen always occurs on long storage. This indicates the breaking down of the nitric groups, with formation of oxides of nitrogen, which partially escape, and partially act catalytically upon the remaining nitrocellulose.

(c) "*Soluble*" *and* "*insoluble*" *nitrocelluloses.*—The percentage of matter soluble in ether-alcohol tends to increase, and the insoluble nitrocellulose to decrease. This has erroneously been taken as implying that the insoluble cellulose nitrates break down first, leaving the soluble cellulose nitrates intact. In reality, the two decompose simultaneously, but the tendency is to form compounds which are soluble in ether-alcohol, possibly nitric esters of polyhydroxy acids. These will appear in the analytical results as "soluble in ether-alcohol." The increase in the percentage of soluble nitrocellulose on heating has been confirmed by Bergmann and Junk (Zeits. angew. Chem., 1904, 1075).

(d) *Substances insoluble in acetone.*—The acetone residue shows a slight tendency to increase. This does not indicate a reconversion of nitrocellulose to cellulose, but is to be traced to the formation of insoluble decomposition products. The increase in the acetone residue when nitrocellulose is heated, has been shown by Sy (J. Amer. Chem. Soc., 1903, 25, 568).

(e) *Aqueous extract.*—This forms a valuable guide to the degree of deterioration of nitrocelluloses. The majority of the decomposition products are readily soluble in water (Silberrad and Farmer, Chem. Soc. Trans., 1906, 89, 1168), and thus the water-soluble matter increases on storage. Attempts to estimate the extracted products volumetrically proved unsatisfactory. Potassium permanganate, chromic acid, cuprammonium tartrate, and iodine were reduced by the solution, but gave no satisfactory end points. Titrations with baryta water, using phenolphthalein as indicator, were somewhat more satisfactory.

The residues obtained on evaporating the aqueous extract were, for the most part, insoluble in acetone and in ether.

(f) *Heat test.*—As is well known, the heat test falls as the decomposition proceeds, and in extreme cases the colouration of the test paper appears almost on mixing even in the cold. This is the earliest to appear of all the products than to any decomposition which [illegible]

3. *Examination of the decomposition products.*—Since the oxides and [illegible]

react detrimentally upon the remaining nitrocellulose, the deterioration is auto-catalytically accelerated. This is best illustrated by a comparison of the percentages of nitrogen found at intervals during storage. The following table is extracted from the large scale trials recorded in Table I.

Decrease in percentage of nitrogen in nitrocellulose on storage.

Nitrocellulose powder, diam. 8·75 mm., stored in a dry atmosphere.

Temp. of magazine.	Percentage of nitrogen (calculated on dried substance).				
	unheated.	4½ mths.	9 mths.	10½ mths.	18 mths.
35° C.	13·22	12·88	12·18	12·10	11·77
54·4° C.	13·32	12·17	—	11·78	10·66
60° C.	13·32	12·24	11·81	10·32	—

The oven trials (Tables VIII. to XXV.) show a similar acceleration, though in a number of instances the total decomposition is too slight to give any distinct indication of this. The following list shows the loss of nitrogen during the first and second periods of three months respectively for the powders which underwent sufficient deterioration to affect the analytical results to a marked extent.

Decrease in percentage of nitrogen in nitrocellulose.

Propellant.	Alteration in percentage of nitrogen.			
	Trial at 60° C. in a dry atmosphere.		Trial at 49° C. in a wet atmosphere.	
	First 3 mths.	Second 3 mths.	First 3 mths.	Second 3 mths.
Nitrocellulose powder				
No. 58	— 0·1	— 0·5	—	—
„ 62	—	—	+ 0·2	— 3·9
„ 63	0·0	— 0·5	0·0	— 0·1
Flamdess powder—				
No. 73	— 0·1	— 2·0	— 0·4	— 4·7
„ 78	— 0·2	— 3·0	— 1·9	—
Pyrocollodion—				
For 11-pdr.	— 0·2	— 0·9	— 2·2	— 3·9
„ 6-in. Q.F.	— 0·1	— 0·5	— 2·9	— 4·9
„ 4-in. Q.F.	— 0·2	— 0·6	— 1·2	— 3·9
„ 6-in. gun ..	0·0	— 0·2	— 0·1	— 1·7

4. *Influence of moisture.*—The trials have shown very conclusively that the humidity of the atmosphere largely determines both the velocity and the nature of the decomposition. At any given temperature, the velocity of deterioration is much greater in a moist atmosphere than in absence of water, the reason being, obviously, that the hydrolytic decomposition of the nitric esters requires the presence of water.

As mentioned above, the physical characteristics of the powder differ very strongly, according as the deterioration has taken place in a wet or a dry atmosphere. The hydrolytic form of decomposition is characterised by the formation of deliquescent hydroxy acids, which render the nitrocellulose more difficult to ignite, and, for this reason, hydrolysis does not readily lead to spontaneous ignition. The nitrous acid formed causes the heat test to fall considerably when a slight hydrolysis occurs, and in such cases the heat test may cause a powder to be condemned, whilst it is still in a perfectly stable condition. Results of firing trials are given in the practical part, to show that the heat test may fall to a very low point, whilst the ballistics are still unaffected. Even when the ballistics commence to suffer, there is little or no liability to spontaneous ignition, and it is thought that in a saturated atmosphere a powder would ultimately lose its explosive properties, without ever having passed through a dangerously unstable condition. Nevertheless, all possible steps should be taken to minimise the amount of hydrolysis which occurs, for this form of decomposition is so rapid that it tends greatly to reduce the serviceable life of the powder.

5. *Influence of temperature.*—The climatic trials at different temperatures show that the decomposition takes place very much more rapidly when the temperature is raised, even by a few degrees. Experiments at higher temperatures indicate that the velocity is approximately doubled by a rise of temperature of 5° C. This points to the necessity of carrying out stability tests very much more frequently in a hot than in a temperate climate. Thus, a powder stored at 40° C. (104° F.) should be tested 16 times as frequently as one stored at 20° C. (68° F.), to ensure an equal degree of safety. Powders manufactured with modern precautions may be regarded as almost indefinitely stable at temperatures below 15° C.

Experimental.

Method of storage.—In order to store such quantities of nitrocellulose powder as would adequately represent the conditions which occur in a magazine, it was necessary to provide chambers of considerable size, whose temperature could be maintained for long periods at a given point. The magazines were situated in an isolated position, and were surrounded by earth mounds, which screened them from each other and from the steam-generating station. Each magazine consisted of a zinc-lined inner chamber, surrounded with a suitable thickness of non-conducting material. This chamber was enclosed in a corrugated iron building, large enough to allow of a passage round the inner chamber. The inside clear dimensions of the inner chamber were as follows: Length, 2·4 m.; breadth, 1·4 m.; height, 1·8 m. One of these magazines, which was required to hold exceptionally large quantities of powder, was 2 m. instead of 1·4 m. in breadth. The chambers had small double plate-glass windows in line with the windows through the outer building, for the purpose of making thermometric observations with the help of a telescope. The refrigerating chamber (temperature, —18° C.) was of the same internal dimensions as the heating chambers, but had thicker non-conducting walls (12 in. thick of flake charcoal). The heating was carried out by means of steam, circulating through coils of pipe. In most cases, the trials were carried out in a dry atmosphere, but in some of the trials, the atmosphere was kept saturated with moisture, by placing the heating coils in a tank of water, and also by blowing part of the steam direct into the magazine.

Regulation of temperature.—The accurate regulation of the temperature in chambers of such a size as the above presented considerable difficulties. After a number of modifications, the method eventually adopted was to control the flow of steam by means of a valve and electro-magnet. The valve, which was placed on a by-pass, was normally open to such an extent as to admit rather more steam than was necessary to retain the temperature at the required point. When the current was allowed to pass through the electro-magnet, the lever which actuated the valve was raised, and the flow of steam was interrupted in the by-pass, and only that passing through the main pipe admitted; this was adjusted so that it was not quite sufficient to maintain the desired temperature alone. The current was regulated by means of a contact thermometer with a spiral built placed inside the climatic magazine. The mercury thread of the thermometer did not, however, form a part of the main circuit which controlled the electro-magnet, as it was considered undesirable to allow a current of such strength to flow through a fine column of mercury. For this reason, a current of [illegible] was passed through the thermometer and [illegible] which, in its turn, controlled the circuit of the [illegible]

In this way the passage of the steam was at once interrupted when the temperature rose above the desired limit. By means of the two clamping screws at the ends of the boiler, the valve could be regulated, so that, when open, the amount of steam allowed to pass was just greatly in excess of the required quantity, and, when closed, the apparatus did not come in absolute contact with the electric magnet.

The temperatures were recorded at intervals of half an hour throughout the trials, and varied only about ±1° C. from the mean temperature.

Fluctuations in composition of nitrocellulose.—Nitrocellulose, being a colloidal mixture of various nitric esters of cellulose, is liable to fluctuations of composition, and these are not wholly removed by the prolonged incorporation of the gelatinised mass. Since this has an important bearing upon the analytical results of climatic trials, experiments were first carried out to ascertain to what extent the different sticks varied in composition, and whether differences could be detected in different parts of the same stick.

A tubular nitrocellulose of diameter 8·75 mm. was chosen for these experiments. Sticks differing as widely as possible in appearance were chosen for analysis, and duplicate analyses were carried out with samples taken from different ends of the same stick (under the headings (1) and (2) in the following table).

Method of sampling.—A bundle of the powder sticks, as taken from the store of the consignment, [illegible] the latter was made by tying together a number of sticks. For the analysis of the collected powder, the bundle was sawn across, near the end, so as to give enough powder for the complete analysis, and the remainder was returned in the magazine, together with the bulk of the powder. At the expiration of stated periods, the bundle was removed and sawn across as before, so that the samples taken before and after storage were made up of discs of equal lengths of a considerable number of different sticks, and were strictly comparable with one another.

Analytical Results.

(*A*) *Large scale experiments.*—The analytical data given in Tables I. to VII. were obtained by stoving large quantities of nitrocellulose powders in climatic magazines as described above. The results have all been calculated to show the composition of the ashless powder, since, as is well known, traces of metal are unavoidably introduced into the powder during grinding.

The volatile matter was estimated after grinding and allowing the sample to reach an approximately constant weight under atmospheric conditions, and is used to correct the analytical results. The nitrogen determinations were carried out as usual by Lunge's method. The volatile matter was estimated by heating to 99° C. for 24 hours. The aqueous extract was determined by treating the ground powder with boiling water, in a Soxhlet extractor, for 1 hour, evaporating the aqueous solution, and drying the residue to constant weight at 80° C. Each figure given is the mean of two closely agreeing results.

Variability in composition of gelatinised nitrocellulose.

——	Per cent. in sample.						Calculated on dried substance.					
	Light stick.		Medium stick.		Dark stick.		Light stick.		Medium stick.		Dark stick.	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Insoluble in ether-alcohol	7·82	7·72	8·64	8·30	12·80	13·10	8·05	7·93	8·91	8·44	12·89	13·21
Soluble in ether-alcohol	89·00	89·25	89·29	89·71	83·89	83·86	91·58	91·68	92·09	91·25	86·13	86·32
Insoluble in acetone	0·36	0·38	0·22	0·29	0·56	0·52	0·37	0·39	0·23	0·31	0·58	0·54
Volatile matter	2·82	2·65	2·85	2·80	2·75	2·70	—	—	—	—	—	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen	11·98	12·05	11·92	11·86	11·79	11·80	12·34	12·33	12·40	12·46	12·23	12·28
Ash	1·02	0·87	0·60	0·72	0·78	0·78	1·05	0·89	0·62	0·75	0·79	0·81

From these analytical data it is seen that although the opposite ends of each stick are almost identical in composition, the different sticks show considerable variations. This will give rise to fluctuations in the analytical results, unless the sampling of the powder is systematically carried out. The following procedure was eventually found to be the most satisfactory, and appears to exclude practically all possibility of error.

Table I.—*Nitrocellulose, gelatinised with ether-alcohol.*

Tubular sticks of length, 77 cm.; external diameter, 8·75 mm.; internal diameter, 3·55 mm.

Time of storage.	Loss of weight on storage, per cent.	——	Analytical results.							Physical properties.
			Soluble in ether-alcohol.	Insoluble in ether-alcohol.	Insoluble in acetone.	Volatile.	Nitrogen.	Aqueous extract.	Heat test (mins.) at 106° F.	
(*a*) Storage at —18° C. (0° F.). *Quantity stored: 313 kilos. Mode of storage: 6-in. cartridges wrapped in silk cloth and packed in wooden cases.*										
Unstored	—	Raw cotton	—	—	0·42	3·82	11·83	0·80	22	Not determined.
Six months	—	Gelatinised	—	—	0·44	2·82	12·03	0·81	—	
Six months	—	Raw cotton	—	—	—	2·68	11·89	—	24	
Six months	—	Gelatinised	—	—	—	2·70	12·03	—	—	

TABLE I.—(*continued*).

Time of storage.	Loss of weight on storage, per cent.	——	Analytical results. Soluble in ether-alcohol	Insoluble in ether-alcohol.	Insoluble in acetone.	Volatile.	Nitrogen	Aqueous extract.	Heat test (mins.) at 180° F.	Physical properties.
(ii.) *Storage at 38° C. (100° F.) in a dry atmosphere. Quantity stored:* 720 *kilos. Mode of storage:* 6-*in. cartridges wrapped in silk cloth and packed in wooden cases.*										
Unheated	—	Per cent.								
		On sample	85·58	10·18	0·42	3·82	11·85	0·20	26	Alteration in physical properties very slight. Packing material not attacked. Slight odour of ethyl nitrite.
		Dried substance	88·07	10·59	0·44	—	12·32	0·21	—	
4½ mths.	—	On sample	—	—	—	2·99	11·91	—	13	
		Dried substance	—	—	—	—	12·28	—	—	
9 „	—	On sample	—	—	—	3·31	11·73	—	5	
		Dried substance	—	—	—	—	12·13	—	—	
10½ „	—	On sample	—	—	—	3·29	11·71	—	2	
		Dried substance	—	—	—	—	12·10	—	—	
12 „	6·75	On sample	86·91	9·33	0·63	3·13	11·41	0·55	3	
		Dried substance	89·72	9·63	0·65	—	11·77	0·57	—	
(iii.) *Storage at 49° C. (120° F.) in a dry atmosphere. Quantity stored:* 251 *kilos. Mode of storage:* 6-*in. cartridges wrapped in silk cloth.*										
Unheated	—	Per cent.—								
		On sample	85·58	10·18	0·42	3·82	11·85	0·20	26	Not much change in appearance after storage. Slight smell of ethyl nitrite.
		Dried substance	88·07	10·59	0·44	—	12·32	0·21	—	
3 mths.	1·93	On sample	86·08	10·17	0·37	3·38	11·90	—	8	
		Dried substance	89·10	10·52	0·38	—	12·32	—	—	
6 „	2·40	On sample	—	—	0·35	3·15	11·87	—	9	
		Dried substance	—	—	0·36	—	12·26	—	—	
(iv). *Storage at 54·4° C. (130° F.) in a dry atmosphere. Quantity stored:* 251 *kilos. Mode of storage: silk cloth and rubber sheeting in wooden boxes.*										
Unheated	—	Per cent.—								
		On sample	85·58	10·18	0·42	3·82	11·85	0·20	26	After storage the sticks were yellow to dark brown in colour, and had become very brittle and porous. They smelt of nitric peroxide and ethyl nitrite.
		Dried substance	88·97	10·59	0·44	—	12·32	0·21	—	
4½ mths.	—	On sample	—	—	—	2·96	11·81	—	2	
		Dried substance	—	—	—	—	12·17	—	—	
10½ „	—	On sample	87·64	7·03	1·77	3·56	11·37	—	—	
		Dried substance	90·87	7·30	1·83	—	11·78	—	—	
12 „	9·46	On sample	89·63	3·37	2·36	4·64	10·08	11·53	¼	
		Dried substance	94·00	3·53	2·47	—	10·56	12·08	—	
(v.) *Storage at 54·4° C. (130° F.) in a wet atmosphere. Quantity of powder:* 272 *kilos. Mode of packing:* 4 *cases in* 100-*lb. boxes, the powder surrounded by oil paper and india-rubber sheeting.*										
Unheated	—	Per cent.—								
		On sample	85·58	10·18	0·42	3·82	11·85	0·20	26	After storage for 5½ months, the surface of the powder was sticky and strongly acid. The surface layers had lost most of their nitrogen and burned only with difficulty, leaving a charred residue.
		Dried substance	88·97	10·59	0·44	—	12·32	—	—	
3 mths.	—	On sample	86·63	9·37	0·38	3·62	11·90	—	8	
		Dried substance	89·88	9·72	0·40	—	12·34	—	—	
5½ „	—	On sample	—	—	—	3·32	11·19	3·90	—	
		Dried substance	—	—	—	—	11·56	4·03	—	
(vi.) *Storage at 60° C. (140° F.) in a dry atmosphere. Quantity stored:* 251 *kilos. Mode of storage: in cases.*										
Unheated	—	Per cent.—								
		On sample	85·58	10·18	0·42	3·82	11·85	0·20	26	This powder ignited spontaneously one day after the last sample was withdrawn. It yielded an alcohol extract of 50·50 per cent. (on sample). The alteration in the physical condition of the powder was not very marked after nine months, but after 10½ months (*i.e.*, just before the spontaneous ignition of the powder) it became extremely brittle and porous, falling to powder by gentle pressure. The sticks were yellow to black in colour, and smelt strongly of nitric peroxide and ethyl nitrite.
		Dried substance	88·97	10·59	0·44	—	12·32	0·21	—	
4½ mths.	—	On sample	—	—	—	2·87	11·89	—	1½	
		Dried substance	—	—	—	—	12·24	—	—	
9 „	—	On sample	—	—	—	3·98	11·35	—	½	
		Dried substance	—	—	—	—	11·81	—	—	
10½ „	28·2	On sample	91·13	1·33	2·44	5·10	9·80	30·15	In the cold	
		Dried substance	96·03	1·40	2·57	—	10·32	31·74	—	

TABLE II.—*Nitrocellulose, gelatinised with ether-alcohol. Tubular sticks of length, 105·5 cm.; external diameter, 13·90 mm.; internal diameter, 6·20 mm.*

Time of storage.	Loss of weight on storage, per cent.	——	Analytical results. Soluble in ether-alcohol.	Insoluble in ether-alcohol.	Insoluble in acetone.	Volatile.	Nitrogen.	Aqueous extract.	Heat test (mins.) at 180° F.	Physical properties.
(i.) *Storage at 54·4° C. (130° F.) in a dry atmosphere. Powder freely exposed.*										
Unheated	—	Per cent.—								
		On sample	80·92	14·24	0·45	4·39	11·78	—	56	
		Dried substance	84·63	14·90	0·47	—	12·32	—	—	
9 mths.	3·49	On sample	84·24	11·49	0·57	3·70	11·86	—	1	
		Dried substance	87·48	11·93	0·59	—	12·31	—	—	
(ii.) *Storage at 60° C. (140° F.) in a dry atmosphere. Quantity of powder: 420 kilos. Freely exposed.*										
Unheated	—	Per cent.—								
		On sample	80·92	14·24	0·45	4·39	11·78	—	56	Very little deterioration was evident from the physical condition of the cellulose after storage. The sticks had shrunk somewhat and had become slightly porous. They gave an odour of ethyl nitrite on fracture. Alcohol extract after 10½ months=12·76 per cent. (on sample).
		Dried substance	84·63	14·90	0·47	—	12·32	—	—	
4½ mths.	—	On sample	—	—	—	3·16	11·80	—	2	
		Dried substance	—	—	—	—	12·19	—	—	
6 ,,	—	On sample	85·21	11·09	0·51	3·19	11·66	—	½	
		Dried substance	88·02	11·46	0·52	—	12·04	—	—	
10½ ,,	3·55	On sample	87·82	6·60	1·72	3·86	11·45	—	½	
		Dried substance	91·34	6·87	1·79	—	11·91	—	—	

TABLE III.—*Nitrocellulose, gelatinised with ether-alcohol, stored for 12 hours daily at 46° C. (115° F.) in a moist atmosphere. Tubular sticks of length, 77 cm.; external diameter, 8·75 mm.; internal diameter, 3·55 mm.*

Method of storage.	Quantity stored.	Time of storage.	Heat test (mins.) at 180° F. (82·2° C.)	Loss of weight.	Analytical results.	Soluble in ether-alcohol	Insoluble in ether-alcohol.	Insoluble in acetone.	Aqueous extract.	Volatile matter.	Nitrogen
					Per cent.—						
		Before storage	26	—	Sample	85·58	10·18	0·42	0·20	3·62	11·99
					Dried substance.	88·97	10·59	0·44	0·21	—	12·32
Hermetically sealed in tin box.	Sample only.	6 mths.	7	0·44	Sample	89·15	6·77	0·64	1·02	3·44	11·87
					Dried substance	92·33	7·01	0·66	1·05	—	12·00
Airtight iron case	78·5 kilos	6 ,,	4	0·36	Sample	88·32	7·44	0·72	1·92	3·52	11·94
					Dried substance	91·55	7·71	0·74	1·99	—	12·38
Wooden box	94·0 ,,	6 ,,	0½	0·32	Sample	86·06	7·31	2·37	2·69	4·26	11·88
					Dried substance	89·89	7·63	2·48	2·81	—	11·69
Freely exposed ...	78·5 ,,	6 ,,	0½	6·40	Sample	89·59	5·64	0·74	1·81	4·02	11·81
					Dried substance	93·85	5·88	0·77	1·89	—	12·31

TABLE IV.—*Nitrocellulose, gelatinised with ether-alcohol, stored at 38° C. (100° F.) in a dry atmosphere. Tubular sticks of length, 77 cm.; external diameter, 8·75 mm.; internal diameter, 3·55 mm.*

Method of storage.	Quantity stored.	Time of storage.	Heat test (mins.) at 180° F. (71·1° C.)	Loss of weight.	Analytical results.	Soluble in ether-alcohol.	Insoluble in ether-alcohol.	Insoluble in acetone.	Volatile matter.	Nitrogen
					Per cent.—					
		Before storage	6	—	Sample	84·28	11·59	0·55	3·58	11·99
					Dried substance	87·41	12 02	0·57	—	12·44
Hermetically sealed in glass tube.	Sample only.	6 mths.	4	0·056	Sample	87·75	8·37	0·78	3·10	11·75
					Dried substance	90·56	8·64	0·80	—	12·13
Air-tight iron case ...	157 kilos.	6 ,,	6	0·348	Sample	86·21	10·90	0·42	2·47	11·83
					Dried substance	88·39	11·18	0·43	—	12·13
Defective iron case ...	157 ,,	6 ,,	3	0·749	Sample	—	—	0·44	2·62	11·89
					Dried substance	—	—	0·45	—	12·00
Wooden box with loosely fitting lid.	157 ,,	6 ,,	5	1·58	Sample	85·36	11·62	0·57	2·45	11·88
					Dried substance	87·51	11·91	0·58	—	11·94

TABLE V.—*Nitrocellulose, gelatinised with ether-alcohol, stored at a constant temperature of 60° C. (140° F.) in a dry atmosphere. Tubular sticks of length, 73 cm.; external diameter, 7·84 mm.; internal diameter, 3·64 mm. Specific gravity, before heating, 1·584. Mean weight of stick, 44·0 grms.*

Method of storage.	Quantity stored.	Time of storage.	Nitrogen, per cent.	Ash, per cent.	Moisture on removal from hot magazine, per cent.	Heat test (mins.) at 180° F.	Test for brown fumes at 135° C.
—	—	Before storage	12·45	0·27	1·35	14	over 60 mins.
Cartridge cases (tight)	9 kilos.	3 months	12·41	—	1·28	13	,,
,, (not tight)	,,	,,	12·37	—	0·80	11	,,
Bandoliers	,,	,,	12·33	—	0·48	10	,,

TABLE VI.—*Cellulose nitrate, gelatinised with ether-alcohol, heated for 12 hours daily to 46° C. (115° F.) in a moist atmosphere. Tubular sticks of length, 73 cm.; external diameter, 7·84 mm.; internal diameter, 3·64 mm. Specific gravity before heating, 1·584. Mean weight of stick, 44·0 grms.*

Method of storage.	Quantity stored.	Time of storage.	Nitrogen, per cent.	Ash, per cent.	Moisture, per cent.	Heat test (mins.) at at 180° F.	Test for brown fumes at 135° C.
—	—	Before heating	12·45	0·27	1·35	14	over 60 mins.
Bandoliers	20 lb.	3 months	12·42	—	5·00	13	60 mins. (faint)

TABLE VII.—*Nitrocellulose, gelatinised with ether-alcohol, stored at 45°—50° C. (113°—122° F.) in a dry atmosphere. (The results are the means of a number of concordant tests.)*

Dimensions of tubes (mm.).				Time of storage (months).								
Length.	External diameter.	Internal diameter.		0.	3.	6.	9.	12.	15.	18.	21.	24.
230·0	4·5	3·0	Zinc iodide test at 80° C. (min.)	over 30	45	50 to over 60	48	24	25	39	46	34
			Deflagration test (° C.)	176½	176½	176½	175½	176½	175	176½	175½	176½
			Nitrogen, per cent.	11·75	—	—	—	11·62	—	—	—	11·78
785·0	12·5	4·5	Zinc iodide test at 80° C. (min.)	over 30	9	over 60	over 60	over 60	4	5	7	4
			Deflagration test (° C.)	177½	177½	177	175½	177½	175½	175½	175½	176
			Nitrogen, per cent.	12·38	—	—	—	12·30	—	—	—	12·32
128·0	4·0	1·5	Zinc iodide test at 80° C. (min.)	over 30	over 60	over 60	over 60	over 60	over 60	over 60	over 60	over 60
			Deflagration test (° C.)	175½	173½	173½	173½	175½	175½	176½	174½	174½
			Nitrogen, per cent.	12·43	—	—	—	12·25	—	—	—	12·42
126·7	2·6	0·7	Zinc iodide test at 80° C. (min.)	over 30	over 60	over 60	over 60	over 60	over 60	over 60	over 60	10
			Deflagration test (° C.)	176	175½	175	176½	177	177	175½	176	175½
			Nitrogen, per cent.	12·28	—	—	—	12·34	—	—	—	12·38

(*B*) *Climatic trials in air ovens.*—On carefully comparing the foregoing results with those obtained with smaller quantities of powder, it is seen that the conditions of storage can, in most cases, be sufficiently well represented by trials carried out with quantities of about 100 grms. in boxes, designed to correspond with the mode of packing used for large quantities. The boxes are stored in air ovens, maintained at accurately regulated temperatures.

In the present trials, the conditions chosen were :—

(1) 60° C. (140° F.) in a dry atmosphere.

(2) 49° C. (120° F.) in a moist atmosphere.

The temperatures were retained at the required points by Scheibler's regulators, and were read at frequent intervals to ensure constancy. The fluctuations seldom exceeded ± 1° C.

The sampling was carried out exactly as described above, the powders being tied into bundles, which were sawn across to obtain representative samples. The bundles were weighed before and after the heating. In order to eliminate errors in weight due to the mechanical deposition of moisture in the wet trials, the bundles of powder from these trials were untied and the sticks dried for 24 hours at 38° C. (100° F.) in a dry atmosphere before weighing.

Strips of litmus paper were enclosed with the powders in the boxes, and were examined and replaced after each three months.

TABLE VIII.—*Nitrocellulose powder. No. 53.*

Tubular sticks, gelatinised, external diameter, 7·06 mm.; internal diameter, 2·98 mm. Colour, light chocolate brown, fairly homogeneous.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alteration	—	Appearance unchanged; slight smell of nitrous ester.	Appearance unchanged; smell of nitrous ester and nitric peroxide.	Sticks partly covered with mould but otherwise unaltered; slight smell of vaseline.	Slight inhomogeneity; smell as before.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.
Loss of weight (per cent.) .	0·0	2·15	6·12	—	—
Nitrogen (per cent.)—					
On sample	11·64	11·57	11·05	—	11·57
On dried substance	11·92	11·84	11·34	—	11·75
Aqueous extract (per cent.)—					
On sample	0·89	0·92	5·66	—	1·07
On dried substance	0·91	0·94	5·81	—	1·09
Abel heat test at 160° F. (71·1° C.) min.	12½	6½	2	—	20
Deflagration test (° C.)	181·0 181·5	181·0 181·0	178·5 178·0	—	183·0 183·0 183·0

TABLE IX.—*Nitrocellulose powder containing 2 per cent. vaseline. No. 55.*

Tubular sticks, gelatinised, external diameter, 7·13 mm.; internal diameter, 2·56 mm. Colour, chocolate brown, not quite homogeneous, some small light spots being visible. Smell, reminiscent of vaseline.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance unchanged; Perceptible smell of nitric peroxide and nitrous ester.	No further change; smell slightly more pronounced.	Slight inhomogeneity; very faint smell of nitric peroxide.	No further change.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	Paper reddened and partially bleached.
Loss of weight (per cent.) ..	0·0	1·89	3·02	1·27	1·96
Nitrogen (per cent.)—					
On sample	11·54	11·50	11·57	11·68	11·78
On dried substance	11·83	11·83	11·79	—	11·92
Aqueous extract (per cent.)—					
On sample	0·50	0·76	1·25	0·58	0·84
On dried substance	0·51	0·78	1·27	0·60	0·85
Abel heat test at 160° F. (71·1° C.) min.	47½	12½	8	25	18½
Deflagration test (° C.)	180·0	181·0	181·0	181·0	182·5
	181·0	182·0	181·5	182·0	181·5

TABLE X.—*Nitrocellulose powder, experimental, containing 1·5 per cent. vaseline. No. 59.*

Tubular sticks, gelatinised, star-shaped, maximum external diameter, 9·29 mm.; internal diameter, 1·68 mm. Colour, chocolate brown, free from spots.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance and homogeneity unchanged; no nitric peroxide detectable.	Appearance unchanged; strong smell of nitric peroxide.	Appearance and smell unchanged.	No change in appearance; no perceptible smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	—
Loss of weight (per cent.) ..	0·0	0·69	2·08	1·15	2·00
Nitrogen (per cent.)—					
On sample	11·84	11·45	11·41	11·72	11·64
On dried substance	12·09	11·80	11·67	12·04	11·87
Aqueous extract (per cent.)—					
On sample	0·27	0·60	1·20	0·52	1·01
On dried substance	0·28	0·62	1·23	0·53	1·03
Abel heat test at 160° F. (71·1° C.) min.	27	15	3	18	12
Deflagration test (° C.) ...	180·5	181·0	180·0	180·0	183·0
	181·0	181·5	181·0	180·0	182·0

TABLE XI.—*Nitrocellulose powder, experimental, containing 1·5 per cent. vaseline. No. 60.*

Tubular sticks, gelatinised, star-shaped, maximum external diameter, 9·77 mm.; internal diameter, 2·35 mm. Colour, chocolate brown, free from spots. Slight sweetish smell.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance and smell unchanged.	Sticks slightly disintegrated; moderately strong smell of nitric peroxide.	Appearance and smell unchanged.	Sticks greatly disintegrated; longitudinal cracks; moderately strong smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Neutral.	Paper reddened.
Loss of weight (per cent.) ..	0·0	1·35	3·04	0·85	1·69
Nitrogen (per cent.)—					
On sample	11·78	11·51	11·49	11·66	11·46
On dried substance	12·06	11·82	11·75	12·05	11·75
Aqueous extract (per cent.)—					
On sample	0·58	0·53	1·67	0·52	0·60
On dried substance	0·59	0·54	1·71	0·54	0·62
Abel heat test at 160° F. (71·1° C.) min.....	97	25	2¾	25	1½
Deflagration test (° C.)	181·0	181·5	181·0	181·5	182·0
	180·0	180·5	181·0	181·5	181·5

TABLE XII.—*Nitrocellulose powder, experimental, containing 1·5 per cent. vaseline. No. 61.*
Tubular sticks, gelatinised, star-shaped, maximum external diameter, 0·90 mm.; internal diameter, 2·21 mm. Smell, reminiscent of vaseline.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Very little change; some sticks showed slight inhomogeneity; smell unchanged.	Slight inhomogeneity in appearance; smell of nitric peroxide.	Very little change; some sticks spotted; smell unchanged.	Slight inhomogeneity but no alteration in smell.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	Not much changed.
Loss of weight (per cent.) ..	0·0	1·48	6·23	0·72	1·31
Nitrogen (per cent.)— On sample ..... On dried substance	11·60 11·93	11·53 11·89	11·45 11·72	11·67 —	11·80 12·03
Aqueous extract (per cent.)— On sample ..... On dried substance	0·53 0·54	0·63 0·66	0·90 0·92	0·51 0·53	0·75 0·76
Abel heat test at 160° F. (71·1° C.)	43	15	3½	35	9½
Deflagration test (° C.)	180·0 180·0	181·0 181·5	180·0 180·0	181·0 181·0	182·0 181·5

TABLE XIII.—*Nitrocellulose powder, experimental, containing 2 per cent. of vaseline. No. 62.*
Tubular sticks, gelatinised, external diameter, 4·15 mm.; internal diameter, 2·37 mm. Colour, brown (slightly reddish), no spots. Smell, reminiscent of vaseline.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations.....	—	Appearance unchanged; slight smell of nitric peroxide.	Slight inhomogeneity; strong smell of nitric peroxide.	Appearance and smell unchanged.	Colour much lighter; sticks very inhomogeneous (striated and pitted); smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Neutral.	Paper bleached.
Loss of weight (per cent.) ..	0·0	1·48	6·23	1·85	—
Nitrogen (per cent.)— On sample ..... On dried substance	11·47 11·72	— —	11·06 11·43	11·70 11·87	7·62 8·00
Aqueous extract (per cent.)— On sample ..... On dried substance	0·90 0·92	— —	2·33 2·41	1·33 1·35	15·61 16·39
Abel heat test at 160° F. (71·1° C.) min.	66	48	2½	34	0½
Deflagration test (° C.) ...	181·0 179·5	181·0 181·0	180·0 179·5	182·0 182·5	180·0, 180·5 180·5, 180·0

TABLE XIV.—*Nitrocellulose powder, experimental, containing 2 per cent. of vaseline. No. 63.*
Tubular sticks, gelatinised, external diameter, 4·21 mm.; internal diameter, 2·45 mm. Colour, dull brown, free from spots. Slight smell, reminiscent of vaseline.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Colour slightly paler and somewhat inhomogeneous; no smell.	Inhomogeneity much more pronounced; smell of nitric peroxide and ethyl nitrite	Colour slightly paler but still free from spots; no smell.	Slight inhomogeneity; very slight smell of nitric peroxide.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	Paper blackened.
Loss of weight (per cent.)	0·0	2·27	4·13	1·43	3·24
Nitrogen (per cent.)— On sample ..... On dried substance	12·12 12·39	12·10 12·41	11·59 11·96	12·18 12·35	12·12 12·26
Aqueous extract (per cent.)— On sample ..... On dried substance	0·69 0·71	1·02 1·05	1·70 1·75	0·82 0·83	0·65 0·66
Abel heat test at 160° F. (71·1° C.) min.	65	4½	1	1½	—
Deflagration test (° C.) ...	180·0 181·0	182·0 182·0	180·5 181·0	184·0 184·0	—

TABLE XV.—*Flameless powder. No.* 72.

Tubular sticks, gelatinised, external diameter, 3·35 *mm.; internal diameter,* 1·74 *mm. Appearance, dull brown, homogeneous. Distinct smell of ether and alcohol.*

	Unheated.	3 months at 60° C. 140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations.....	—	Appearance unchanged; strong smell of nitric peroxide.	Longitudinal streaks; strong smell of nitric peroxide.	Colour much lighter, sticks spotted and deliquescent; smell of nitric peroxide and camphor.	Sticks almost white much shrunk and pitted; strong smel of camphor.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	Paper bleached.
Loss of weight (per cent.)	0·0	3·28	15·05	3·51	36·00
Nitrogen (per cent.)—					
On sample	10·81	10·52	8·26	10·16	5·56
On dried substance ...	10·96	10·87	8·91	10·57	5·91
Aqueous extract (per cent.)—					
On sample	0·59	0·86	13·76	1·95	30·37
On dried substance	0·60	0·89	14·84	2·06	32·28
Abel heat test at 160° F. (71·1° C.) min.....	over 120	0½	Cold	0½	—
Deflagration test (° C.) ...	180·0 181·0	179·0 179·0	169·0, 169·0 very feeble.	179·0 178·5	180·0, 180·0 very feeble.

TABLE XVI.—*Flameless powder. No.* 73.

Tubular sticks, gelatinised, external diameter, 2·05 *mm.; internal diameter,* 1·07 *mm. Colour, light dull brown, free from spots. No smell.*

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations.....	—	Appearance unchanged; distinct smell of nitric peroxide.	Colour almost unaltered Longitudinal streaks; strong smell of nitric peroxide.	Sticks very inhomogeneous; much lighter in colour, and very spotted and deliquescent; smell of nitric peroxide and camphor.	Further disintegration; very much spotted; smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	Paper bleached almost white.
Loss of weight (per cent.)	0·0	6·39	20·84	—	—
Nitrogen (per cent.)—					
On sample	10·62	8·60	7·42	7·47	—
On dried substance	10·87	10·53	7·56	9·01	—
Aqueous extract (per cent.)—					
On sample	2·32	—	26·36	8·91	22·64
On dried substance	2·38	—	20·79	10·75	24·39
Abel heat test at 160° F. (71·1° C.) min.	51	5	1½	8½	1½
Deflagration test (° C.) ...	180·0 181·0	179·5 180·0	167·5, 168·5 very feeble.	178·0 178·0	176·5, 179·5, 178·0 gradual decomposition

TABLE XVII.—*Smokeless rifle powder. No.* 78.

Small square laminæ, gelatinised and blackleaded. Slight smell, resembling alcohol.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance unchanged; slight smell of nitric peroxide.	Appearance unchanged; slight smell of nitric peroxide.	Appearance unchanged; slight odour but no nitric peroxide.	Appearance unchanged; no smell.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper slightly bleached.	Not much change.
Loss of weight (per cent.) .	0·0	—	1·20	—	2·40
Nitrogen (per cent.)—					
On sample	11·56	11·59	11·74	11·54	11·60
On dried substance	11·78	11·71	11·92	11·68	11·81
Aqueous extract (per cent.)—					
On sample	0·74	1·10	—	1·17	1·51
On dried substance	0·75	1·11	—	1·18	1·54
Abel heat test at 160° F. (71·1° C.) min.	90	16	9½	58	18½
Deflagration test (°C.)	176·0 177·0	176·0 176·0	176·0 176·5	175·5 175·5	177·0 176·5

TABLE XVIII.—*Smokeless blank, experimental. No.* 80.

Thin tubular sticks, almost ungelatinised, external diameter, 2·66 *mm.; internal diameter,* 2·18 *mm. Colour, almost white. No smell.*

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance unchanged; no smell.	Appearance unchanged; no smell.	Appearance unchanged; no smell.	Appearance unchanged; no smell.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	Paper reddened and partly bleached.
Loss of weight (per cent.) .	0·0	2·34	2·91	0·32	0·61
Nitrogen (per cent.)— On sample ..... On dried substance	12·58 12·68	— —	12·52 12·58	— —	12·54 12·61
Aqueous extract (per cent.)— On sample ..... On dried substance	— —	0·60 0·60	2·01 2·02	0·60 0·61	1·10 1·11
Abel heat test at 160° F. (71·1° C.) min.	32	25	10	35	15½
Deflagration test (°C.)	184·0 184·0	181·0 181·5	185·0, 185·5 185·0	181·0 181·5	184·5 184·0

TABLE XIX.—*Smokeless blank (German experimental). No.* 81.

Small crosses, ungelatinised, maximum width, 12 *mm. Peculiar smell, somewhat reminiscent of alcohol.*

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. 120 F.) wet.)	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance and smell practically unchanged.	Colour slightly paler; no smell.	Appearance and smell practically unchanged.	No change; no perceptible smell of nitric peroxide.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	—
Loss of weight (per cent.) .	0·0	3·69	4·96	1·57	—
Nitrogen (per cent.)— On sample ..... On dried substance	12·56 12·66	12·38 12·50	12·54 12·65	12·48 12·58	12·28 12·53
Aqueous extract (per cent.)— On sample ..... On dried substance	0·67 0·68	1·58 1·60	1·80 1·82	1·08 1·09	2·88 2·89
Abel heat test at 160° F. (71·1° C.) min.	6	11½	4½	20	6½
Deflagration test (°C.)	179·0 179·5	184·0 184·0	180·5 180·5	184·0 184·5	167·0 168·0

TABLE XX.—*U.S.A. pyrocollodion for* 15*-pounder quick-firing gun.*

Multitubular sticks, gelatinised, diameter, 6·88 *mm. Appearance, light brown and translucent.*

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Sticks shrunk and not so translucent; surface frosted; strong smell of nitric peroxide.	Sticks lighter in colour and frosted; fine longitudinal cracks; strong smell of nitric peroxide.	Very much altered; almost white, opaque, considerably shrunk, and covered with deliquescent spots; smell of nitric peroxide.	Alteration still more pronounced; sticks white and opaque; deliquescent, and covered with cracks; strong smell of nitric peroxide.
Reaction to litmus	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	Paper bleached.
Loss of weight (per cent.) .	0·0	3·57	10·3	16·25	51·60
Nitrogen (per cent.)— On sample ..... On dried substance	11·72 11·90	11·38 11·68	10·36 10·72	8·02 9·58	5·33 5·69
Aqueous extract (per cent.)— On sample ..... On dried substance	0·23 0·24	2·03 2·08	7·50 7·76	5·56 6·62	33·50 33·75
Abel heat test at 160° F. (71·1° C.) min.	17	1½	1	cold	—
Deflagration test (°C.)	181·0 181·0	181·5 181·5	178·5 179·0	184·5 184·0	183·0, 182·0 Very feeble.

TABLE XXI.—*Pyrocollodion. Rifle powder (experimental).*
Small square laminæ, gelatinised and blackleaded. Mean weight, 0·00149 grm.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance unchanged; distinct smell of nitric peroxide.	Laminæ slightly distorted, but otherwise unchanged in appearance; strong smell of nitric peroxide.	Appearance unchanged; smell of nitric peroxide.	Laminæ slightly distorted, but otherwise unchanged in appearance; strong smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened and partially bleached.	Paper reddened and partially bleached.	Paper bleached.
Loss of weight (per cent.)—	0·0	—	23·0	—	4·0
Nitrogen (per cent.)—					
On sample	11·33	—	8·44	11·56	11·50
On dried substance	11·50	—	8·84	11·73	11·69
Aqueous extract (per cent.)—					
On sample	0·50	—	1·48	0·54	1·35
On dried substance	0·51	—	1·55	0·55	1·37
Abel heat test at 160° F. (71·1° C.) min.	36	1½	3½	—	—
Deflagration test (°C.)	176·0	167·0	163·0	176·0	177·0
	175·5	168·0	164·0	175·0	178·0

TABLE XXII.—*U.S.A. Pyrocollodion. No. 83, for 4·7-in. Q.F.*
Multitubular sticks, gelatinised, diameter, 10·98 mm. Appearance, dull brown, practically homogeneous.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Slightly shrunk and frosted; smell unchanged; no nitric peroxide.	No further change.	Very slight shrinkage; pale spots; smell unchanged.	Spots more marked; some longitudinal cracks; smell unchanged.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper reddened and partially bleached.	Paper almost bleached.
Loss of weight (per cent.)..	0·0	2·39	4·02	0·69	2·61
Nitrogen (per cent.)—					
On sample	12·97	12·87	12·68	12·87	12·78
On dried substance	13·13	—	13·13	—	13·20
Aqueous extract (per cent.)—					
On sample	0·75	0·95	0·95	0·95	1·03
On dried substance	0·76	1·02	0·98	1·00	1·06
Abel heat test at 160° F. (71·1° C.) min.	36	36	13	35	15
Deflagration test (° C.)	176·0	178·0	177·0	178·0	177·5
	177·0	178·0	176·5	177·0	176·5

TABLE XXIII.—*U.S.A. Pyrocollodion for 6-in. Q.F. naval.*
Multitubular sticks, gelatinised, diameter, 10·67 mm. Appearance, light brown, very frosted, and translucent.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Somewhat shrunk, but otherwise unaltered in appearance; distinct smell of nitric peroxide.	More shrunk; much lighter in colour and frosted; longitudinal cracks; smell of nitric peroxide.	Highly disintegrated; some sticks almost white, streaked and deliquescent; smell nitric peroxide.	Still further disintegrated; colour almost white; smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	Paper bleached.
Loss of weight (per cent.)..	0·0	5·54	7·90	7·80	50·66
Nitrogen (per cent.)—					
On sample—	11·64	11·37	10·76	7·22	5·63
On dried substance.....	11·79	11·68	11·14	8·88	5·92
Aqueous extract (per cent.)—					
On sample	1·16	0·74	8·08	21·65	28·41
On dried substance	1·17	0·76	8·37	26·63	29·80
Abel heat test at 160° F. 71·1° C.) min.	10	8	1½	cold	—
Deflagration test (° C.)	183·5	182·0	180·0	181·5	181·0, 181·0
	182·5	181·0	179·0	181·5	very feeble

TABLE XXIV.—*U.S.A. Pyrocollodion for 4-in. Q.F. naval.*
Multitubular sticks, gelatinised, diameter. 6·89 mm. Appearance, light brown, frosted and translucent.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Slight shrinkage; rather more frosted; distinct smell of nitric peroxide.	Slight increase in shrinkage; smell of nitric peroxide and nitrous ester.	Highly deteriorated; some sticks almost white; cracks and spots; deliquescent; smell of nitric peroxide.	Further disintegration; sticks almost white; smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened.	Paper bleached.	Paper bleached.
Loss of weight (per cent.) ..	0·0	3·70	11·61	9·17	37·66
Nitrogen (per cent.)—					
On sample	11·63	11·14	10·47	9·29	6·37
On dried substance	11·79	11·48	10·92	10·56	6·55
Aqueous extract (per cent.)—					
On sample	—	1·74	9·19	4·91	24·19
On dried substance	—	1·79	9·58	5·58	25·25
Abel heat test at 160° F. (71·1° C.)	11½	0½	—	cold	—
Deflagration test (° C.)	180·5 181·0	181·0 182·0	179·0 178·5	180·5 180·5	182·0, 183·0 very feeble

TABLE XXV.—*U.S.A. Pyrocollodion for 8-in. army gun.*
Multitubular sticks, gelatinised, diameter, 13·86 mm. Appearance, light brown, very slightly frosted, and somewhat translucent. Slight smell.

	Unheated.	3 months at 60° C. (140° F.) dry.	6 months at 60° C. (140° F.) dry.	3 months at 49° C. (120° F.) wet.	6 months at 49° C. (120° F.) wet.
Physical alterations	—	Appearance unchanged; distinct smell of nitric peroxide.	Slight shrinkage; longitudinal cracks; strong smell of nitric peroxide.	Great alteration in appearance; colour very light and opaque; white deliquescent patches; distinct smell of nitric peroxide.	Deterioration more pronounced; colour almost white; powder highly disintegrated; strong smell of nitric peroxide.
Reaction to litmus.....	Neutral.	Paper reddened.	Paper reddened and partially bleached.	Paper bleached.	Paper bleached.
Loss of weight (per cent.)	0·0	2·51	4·51	2·85	22·28
Nitrogen (per cent.)—					
On sample	11·86	11·46	11·34	11·26	9·57
On dried substance	11·73	11·76	11·59	11·65	9·98
Aqueous extract (per cent.)—					
On sample	1·14	1·10	2·58	1·13	1·27
On dried substance	1·17	1·13	2·64	1·17	1·32
Abel heat test at 160° F. (71·1° C.) min.	33½	0½	—	cold	cold
Deflagration test (° C.) ...	182·5 183·0	175·5 176·0	181·5, 182·0 182·0	180·0 179·0	180·5 181·0

Effect of a moist atmosphere on the ballistics.—The following results show that the heat test of a nitrocellulose powder may fall to a very low point, whilst the ballistics are still practically unaffected:—

Firing trials of nitrocellulose powder stored at 46° C. (wet).

	Mode of packing.	Weight of charge fired.	Temp. of charge.	Muzzle velocity.	Pressure (tons per square in.).	Heat test of powder (180° F.).
		kilos.	° C.	f.s.		
Unheated	.....	15·649	27	2763	15·20	26
"	.....	15·649	26	2720	14·35	
"	.....	15·649	26	2741	14·75	
After 6 months	Air tight iron case	15·649	26	2791	15·80	4
"	"	15·649	26	2783	15·85	
"	"	15·649	26	2768	15·50	
"	"	15·649	26	2817	16·50	
"	"	15·649	26	2792	15·30	
"	Wooden box	15·618	27	2718	15·10	0½
"	"	15·645	27	2725	15·10	
"	"	16·413	27	2738	15·80	
"	"	15·411	27	2702	14·90	
"	"	15·597	27	2784	15·05	

When the powder was directly exposed to the wet atmosphere the ballistics commenced to suffer, as shown by the following data:—

		kilos.	° C.	f.s.		
Unheated	.....	15·649	26	2741	14·75	26
After 6 months	Freely exposed	15·521	26	2702	14·40	0½
"	"	15·521	26	2645	13·55	
"	"	15·521	26	2564	13·00	
"	"	15·521	26	2586	13·10	

London Section.

STUDIES OF BASIC CARBONATES.

BY W. A. DAVIS.

(This J., Aug. 31, 1906, pp. 788 *seq.*)

ERRATA.

P. 791, col. 1, line 40; *for* "Arzfuni" *read* "Arzruni."
P. 793, col. 2, line 5 from bottom; *for* "products" *read* "product."

P. 794, col. 1, line 6; *for* $OH.MgCO_3,2H_2O$ *read* $OH.MgCO_3H,2H_2O$.

Line 9, *for* $OH.MgCO_3H$ *read* $OH.MgCO_3H,2H_2O$.

P. 795, col. 1, line 39; *for* Krystall *read* Krystalle.

P. 796, *read* heading of col. 3, Table III., thus:—"Concentration $OH.MgCO_3H,2H_2O$ per litre," &c.

The asterisk in heading of col. 5, Table IV., refers to the analyses at top of p. 797, whilst the footnote refers to the asterisk on p. 797, col. 1, line 31.

P. 798, col. 1, line 7; *for* $Mg(CO_3Na)$ *read* $Mg(CO_3Na)_2$.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 916.)

ENGLISH PATENTS.

Atomising liquids; Centrifugal fans or machines for ——. P. Kestner, Lille, France. Eng. Pat. 20,698, Oct. 12, 1905.

THE improvement claimed consists in constructing the casing, in which the atomising fan works, of such large dimensions internally, that the mist produced by the fan is not thrown violently against the walls of the casing and condensed to liquid, but has room to fall slowly to the bottom of the casing. By this arrangement the atomised liquid remains for a comparatively long period in intimate contact with the air or gas, so that very complete humidification or washing is attained.—W.H.C.

Kilns; Vertical ——. E. Schmatolla, Berlin. Eng. Pat. 21,116, Oct. 18, 1905.

SEE Addition of Sept. 26, 1905, to Fr. Pat. 352,549 of 1905; this J., 1906, 267.—T. F. B.

FRENCH PATENTS.

Vapours [Water, alcohol, ether, &c.]; Separation of ——, *soluble in sulphuric acid and mixed with air.* H. de Chardonnet. Fr. Pat. 361,648, July 26, 1905.

THE mixture of air and vapour is driven by fans, capable of producing a pressure equal to from 80 to 120 mm. of water, through a series of leaden chambers or towers in which a mist of sulphuric acid is produced by suitable atomisers. The towers are provided with coils through which water or steam is circulated to produce any desired temperature. The towers are arranged in series, in the first of which water only is absorbed by the mist of sulphuric acid, and in the last only the alcohol or ether. From the liquid condensing in the last chamber, the alcohol or ether is recovered by distillation.—W. H. C.

Multiple effect evaporator; Process for causing the liquid to trickle down the tubes in a ——. F. J. L. E. Lancelle. Fr. Pat. 365,945, May 5, 1906.

IN ordinary evaporators the liquid is introduced below the lower tube-plate, and rises up the wide central tube to a level slightly above the upper tube-plate; the tubes are consequently always full of liquid, and the bubbles of vapour are generated against the pressure of this liquid. According to the specification, the liquid is introduced through an injector placed at the lower end of the central tube. The liquid is projected vertically upwards, and falls as a spray upon the upper ends of the evaporator tubes, down which it trickles. The level of the liquid is not allowed to rise above the lower tube-plate, and the vapour is generated much more easily, as the tubes contain no column of liquid the pressure of which has to be overcome.—W. H. C.

Heating and evaporating liquids by means of steam Apparatus for ——. D. B. Morison. Fr. Pat. 366,413 May 19, 1906. Under Int. Conv., May 24, 1905.

SEE Eng. Pat. 10,817 of 1905; this J., 1906, 462.—T.F.B

Kinetic energy of a moving fluid; Process for transforming the chemical energy of a combustible into the ——, *and apparatus therefor.* A. Vogt. Fr. Pat. 366,301 May 15, 1906.

SEE Eng. Pat. 3607 of 1905; this J., 1906, 746.—T. F. B

Drying or converting liquids into the solid state; Process and apparatus for ——. J. Kunick. Fr. Pat. 366,286 May 16, 1906. Under Int. Conv., March 3, 1906.

THE cylinder, on the surface of which the material is to be dried, is encased in a shell, and a current of air is forced through the annular space between the two. The rapid current of air enables the evaporation to be conducted at a low temperature, so that the solids are not overheated and injured. Several cylinders may be employed. If the drying is conducted at temperatures in the neighbourhood of 40° C., the current of air must be previously heated, but at higher temperatures this is not necessary.—W. H. C.

Dryer. Aktiebolaget-Separator. Fr. Pat. 366,546, May 23, 1906.

THE claim is for a centrifugal drying machine in which the perforations of the drum are made conical, and are provided with brushes or scrapers to remove any solid which may accumulate in and stop up the orifices.—W.H.C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 921.)

Oxygen, carbon dioxide, and steam; Rates of action of —— *on carbon.* P. Farup. VII., page 983.

ENGLISH PATENTS.

Agglomerates, paint material, fuel briquettes, and the like; Manufacture of ——. R. A. Le Maitre, Ixelles-Brussels, Belgium. Eng. Pat. 15,818, Aug. 2, 1905.

SEE Fr. Pat. 350,951 of 1905; this J., 1906, 10.—T. F. B.

Briquettes; Manufacture of weather-proof —— *by means of binding materials soluble in water.* R. Bock, Smichow, Austria. Eng. Pat. 23,902, Nov. 20, 1905.

SEE Addition of Nov. 18, 1905, to Fr. Pat. 325,708 of 1902; this J., 1906, 466.—T. F. B.

Petroleum; Manufacture of solidified —— *for use as fuel.* J. M. A. Stillesen, Brooklyn, U.S.A. Eng. Pat. 38, Jan. 1, 1906.

SEE U.S. Pat. 809,998 of 1906; this J., 1906, 140.—T. F. B.

[*Suction*] *Gas-producing plants.* H. J. Grice, Acocks Green, Worcester. Eng. Pat. 19,410, Sept. 26, 1905.

Two suction gas producers, each of which can supply all the gas required by the engine, are connected through suitable valves to a common washing and cleaning plant. Whilst one producer is in use, the other is held in reserve. When it is necessary to shut off the first, to clean out the clinker, the valve controlling the reserve producer is opened slightly, and the generation of gas is allowed to proceed in it until it is in full working condition, whereupon the valve is opened fully, and the first producer is shut off. —H. B.

Gas manufacture. R. G. Shadbolt, Grantham, Lincs., and C. B. Tully, London. Eng. Pat. 21,124, Oct. 18, 1905.

The process of blending producer gas and coal gas, described in Eng. Pat. 16,955 of 1905 (this J., 1906, 917), is modified by causing the producer gas, before it mixes with the coal gas, to pass through a mass of incandescent coke or the like, whereby the carbon dioxide in the producer gas is to a large extent reduced to the monoxide. In carrying out the process in a bench of horizontal retorts, one of the retorts may be employed as a reducing retort, being connected at the rear end, by a vertical channel, with the top of the gas generator, and at the front with an ascension pipe leading to the hydraulic main. By this arrangement the producer gas is led through incandescent coke, contained in the retort, on its way to the hydraulic main.—H. B.

[*Suction*] *Producer gas generators.* T. W. S. Hutchins, Manchester, and J. B. Wilkie, Liverpool. Eng. Pat. 22,974, Nov. 9, 1905.

The vertical pipe conveying the hot gas from the top of the producer to the foot of the scrubber is wound externally with a helix of fibrous material, on to which water is fed; and the pipe is surrounded by a wider pipe, open at the top, and communicating at the bottom with the space beneath the fire in the producer. When the producer is in action, the air supply is drawn down the latter pipe, and carries with it the steam given off by the wet fibrous material. The producer is closed below the fire grate, by a horizontal plate on to which water is fed, and the steam generated from it likewise mingles with the air supply.—H. B.

Gas retort; Introduction of steam or gas into a ——. G. A. Heckert, Munich, Germany. Eng. Pat. 25,045, Dec. 2, 1905.

See Fr. Pat. 360,032 of 1905; this J., 1906, 406.—H. B.

Producer gas plants. Tangyes, Ltd., and J. H. Pitt, Smethwick, Staffs. Eng. Pat. 26,763, Dec. 22, 1905.

The improvements claimed consist essentially in the combination, with the gas plant, of a heated chamber, on to the walls of which the gas-charged water from the drain-box of the scrubber of the gas plant is delivered, in order to expel evil-smelling gases from the water, and render it fit for re-use. In applying the method to a suction gas plant in connection with a gas engine, the water from the scrubber is delivered into a tank, pumped thence through the water jacket of the engine cylinder, delivered hot in the form of a spray on to the outside of the exhaust-gas box, and, thus purified, is led into a tank and again delivered into the scrubber. The carbon monoxide, &c., expelled from the water, may either be allowed to escape along with the exhaust gases, or may be kept apart from the latter for use. This system enables the usual circulating tanks for the engine to be dispensed with. —H. B.

Gasifying raw combustible materials; Method of and apparatus for ——. P. Hoering and W. Wieland, Berlin. Eng. Pat. 2245, Jan. 29, 1906.

Gas is generated from combustible materials, such as peat and the like, containing large quantities of water, by first carbonising them in a vertical still or retort, and then producing gas from the coked substance in a generator situated beneath the retort, and separated from the latter by a valve, the generator being fed periodically from the retort. The retort is heated externally either by the hot producer gases, or by the combustion of the distillation gases. To prevent damage to the separating valve by the heat of the coke in the retort, the latter is provided centrally with a vertical pipe, open at both ends, and extending from near the top to near the separating valve; the steam generated in the upper parts of the fuel is thus led down, and discharged into the coke near the valve, cooling the coke, and then mingling with the distillation gases. Alternatively, the valve, or the portion of the retort casing near it, may be water-cooled, the steam generated being passed into the apparatus. The gases and steam liberated in the retort may be led down into the generator either directly, or after having been burned in fire-tubes surrounding the retort.—H. B.

Suction gas producers. F. Bauke, Berlin. Eng. Pat. 8276, April 5, 1906.

See Fr. Pat. 363,348 of 1906; this J., 1906, 842.—T. F. B.

Gas retorts. T. Jerratsch, Schwerin, Germany. Eng. Pat. 8433, April 7, 1906.

See Fr. Pat. 365,162 of 1906; this J., 1906, 919.—T. F. B.

Gas generators; Suction ——. F. Bauke, Berlin. Eng. Pat. 8778, April 11, 1906.

See Fr. Pat. 365,364 of 1906; this J., 1906, 920.—T. F. B.

Protective gas; Production of non-oxidising ——, *for use in conjunction with petroleum and other combustible liquids.* C. Martini and H. Hüneke, Hanover. Eng. Pat. 10,948, May 10, 1906. Under Int. Conv., May 15, 1905.

See Addition of Oct. 31, 1905, to Fr. Pat. 337,733 of 1903; this J., 1906, 363.—T. F. B.

[*Air-*] *Carburetting process, and apparatus therefor.* F. Grünewald, Schöneberg, Germany. Eng. Pat. 12,127, May 24, 1906.

Air is carburetted at ordinary atmospheric temperatures by passing it through a rotating drum containing a network of intersecting bars, which are kept constantly wetted with a thin film of "viscous liquid fuel" (*i.e.*, liquid hydrocarbon having a sp. gr. exceeding 0·7).—H. B.

Carburetting apparatus. F. Grünewald, Schöneberg, Germany. Eng. Pat. 12,128, May 24, 1906.

"Non-absorbent balls, preferably spherical and of such a size that the interstices between them are not filled by the liquid," are used as filling material for the carburetting chamber of an apparatus for carburetting air by means of liquid hydrocarbon.—H. B.

Incandescing bodies for electric incandescent lamps; Manufacture of ——. A. Just and F. Hanaman, Budapest, H. Landesberger and I. Salzmann, Vienna, and Verein. Electricitats A.-G., Budapest, Hungary. Eng. Pats. 20,175 and 20,175A, Oct. 5, 1905.

See Fr. Pat. 358,272 of 1905; this J., 1906, 213.—T. F. B.

French Patents.

Washer for coal and other materials. Heyl and Patterson, Incorporated. Fr. Pat. 364,640, Jan. 23, 1906.

The washer consists essentially of an oscillating table, the foundation of which consists of a series of transverse laths, alternately fixed and movable. The laths placed at one end of the table are close together, and have only one side inclined, whilst those at the other end are further apart, with the intervals gradually diminishing between them, and have both their faces inclined. The finest impurities are removed at the former end of the table. —A. G. L.

Fuel; Method of preparing solid ——. S. Börlin. Fr. Pat. 365,762, April 30, 1906.

Lumps of calcined magnesium carbonate are mixed in

petroleum until they have absorbed as much as they will take up (about three times their own weight), and, after draining, they are ready for use as fire-lighters, &c.—C. S.

Coke ovens; System of high-temperature ——. E. Ippolito. Fr. Pat. 365,868, March 7, 1906. Under Int. Conv., March 9, 1905.

Fig. 1

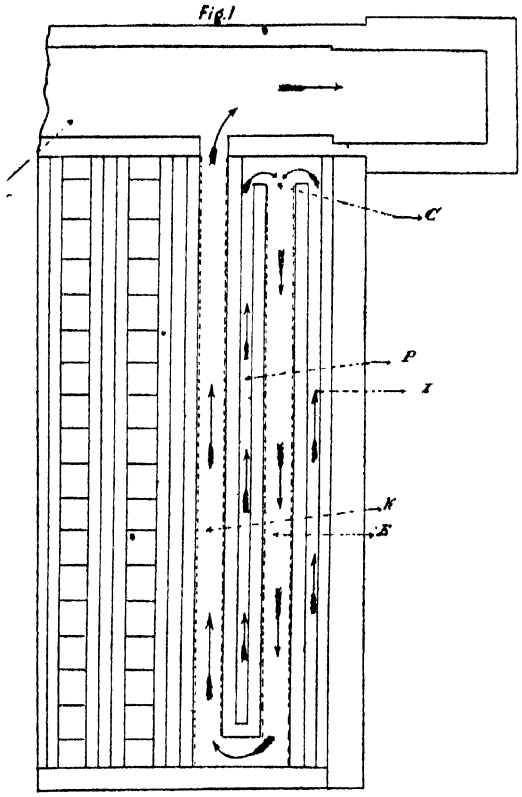
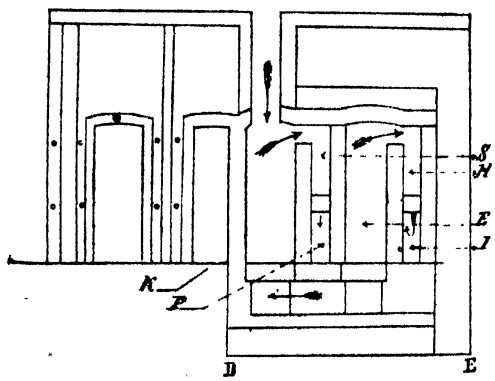


Fig. 2

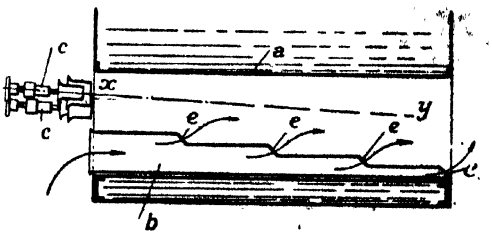


THE system is shown in the accompanying illustrations, of which Fig. 1 is a plan and Fig. 2 is an end view, partly in section. All the gases issuing from the oven, E, heat the horizontal channels, H and I, and then heat the sole of the oven on issuing from the horizontal channel at C. In a similar manner the gases from the oven, K, traverse the horizontal channels, S and P, and unite with the gases from E at C, whence they pass under the sole of both E and K, to escape into the collector, W, leading to the chimney stack; that is to say, the gases from the two ovens are concentrated in order to heat the soles of both. The horizontal channels may be replaced by vertical ones.—C. S.

Coke oven. O. A. Gobbe. Fr. Pat. 366,002, May 8, 1906. Under Int. Conv., May 15, 1905.

THE principle involved is the utilisation of the gases distilled from the coal for transmitting the calories liberated by the red hot coke to the coal under distillation, the requisite heat for keeping the apparatus at work being furnished by burning a little coke, coke-oven gas, or other gas. The oven consists of a number of ovens joined in pairs, and communicating by means of conduits fitted with regulating bells and an aspirator. Each oven is provided with a bell for admitting air to the upper part of the oven, two charging orifices, and a conduit leading to a tank for the surplus gas. Conduits with regulator bells are provided under the sole of the ovens, for the admission of air under the sole.—C. S.

Boiler fire-box for liquid or gaseous fuels. A. and S. Seigle. Fr. Pat. 361,597, July 1, 1905.



THE ordinary fittings being removed from the flue, *a*, the liquid or gaseous fuel is injected by two or more injectors, *c*, *c*, in the direction indicated by the line, *x*, *y*. At the bottom of the flue, *a*, is placed an air chamber or casing, *b*, the upper surface of which is stepped as shown, and provided with rows of openings, *e*, in each of the steps. The air necessary for combustion is drawn through these openings by the natural draught in the direction indicated by the arrows, so that the gaseous fuel burns progressively along the whole length of the flue.—W. H. C.

Heat energy; Apparatus for the production of —— *in a closed receiver.* M. Castelnau. Fr. Pat. 365,509, April 23, 1906.

THE apparatus consists of a strong closed receiver, into which a combustible gas or liquid (*e.g.*, petrol) and a gaseous or liquid supporter of combustion (*e.g.*, compressed or liquefied air or oxygen) are forced simultaneously by means of a system of three pumps. A certain proportion of water is also injected into the receiver. The combustible mixture is ignited electrically or otherwise, thereby producing a mixture, at high pressure, of steam and the products of combustion, which is led off from the receiver to drive a motor.—H. B.

Smoke: Process of washing and laying ——. J. F. P. Kestner. Fr. Pat. 365,453, April 21, 1906. Under Int. Conv., May 5, 1905.

SEE Eng. Pat. 9549 of 1905; this J., 1906, 555.—T. F. B.

Gas containing suspended dust or smoke; Process for the rapid washing of ——. J. F. P. Kestner. Fr. Pat. 365,452, April 21, 1906. Under Int. Conv., May 5, 1905.

SEE Eng. Pat. 9548 of 1905; this J., 1906, 464.—T. F. B.

Gaseous mixture containing hydrogen and methane; Manufacture of a ——. P. Sabatier. Fr. Pat. 361,616, July 7, 1905.

IN the patentee's earlier French patents (this J., 1905, 1164), are described processes for producing a mixture

of hydrogen and methane by (1) decomposing water-gas in presence of reduced nickel, iron, or cobalt, at 300°—500° C., and (2) causing steam to react upon the carbonised metals at 400°—500° C. According to the present invention the two operations are conducted simultaneously; a mixture of steam and water-gas is led over the reduced metals at 400°—500°, and from the product any useless constituents, such as carbon dioxide, may be removed if desired. Instead of water-gas, any gas containing carbon monoxide, with or without hydrogen, may be employed; *e.g.*, producer gas, blast-furnace gas.—H. B.

Gas producer. G. Viarmé. Sixth Addition, dated March 31, 1906, to Fr. Pat. 309,432, March 27, 1901.

An annular steam generator, situated at the base of a suction gas producer, is provided with lateral holes for escape of the steam, and with a hole in the bottom through which the excess of water may drop into the enclosing ash-box. An outlet pipe at the base of the ash-box allows the water to flow out into a receiver, whereby the workman is enabled to judge of the sufficiency or otherwise of the water supply. In order that the suction of the producer may not disturb the free flow of the water from the ash-box, the wall of the latter is perforated at a point above the water outlet; the water thus flows out at a pressure equal to, or but little inferior to, that of the atmosphere. —H. B

Gaseous mixtures; Centrifugal separator for ——. E. Mazza. Fr. Pat. 365,534, April 24, 1906. Under Int. Conv., April 29, 1905.

See Eng. Pat. 7421 of 1906, this J., 1906, 841.—T.F.B.

Sulphuretted hydrogen; Process for removing —— from gas. E. Burschell. Fr. Pat. 366,047, May 9, 1906.

To remove sulphuretted hydrogen from gas in the wet way, the gas is washed with an alkaline solution of ferric salt, obtained, for example, by dissolving 3 parts of potassium tartrate in 100 parts of water, and adding an excess of ferric hydroxide containing caustic potash or potassium carbonate. The ferric hydroxide is at first dissolved partly by the tartrate; as the dissolved portion is precipitated in the form of sulphide by the sulphuretted hydrogen in the gas, fresh quantities pass into solution, the dissolving and precipitation proceeding as long as any ferric hydroxide remains. The sulphide of iron produced is then oxidised in the air, with liberation of sulphur and formation of ferric hydroxide, soluble in the liquid as at the start.—H. B.

Sulphur and cyanides from spent oxide, &c.; Process and apparatus for the extraction of ——. J. J. M. Bécigneul. Third Addition, dated April 7, 1906, to Fr. Pat. 345,071, July 23, 1904. VII., page 985.

Calcium carbide; Method of making ——. H. L. Hartenstein. Fr. Pat. 365,800, May 1, 1906.

See U.S. Pat. 819,219 of 1906; this J., 1906, 544.—T.F.B.

Calcium carbide and method for its manufacture. H. L. Hartenstein. Fr. Pat. 365,801, May 1, 1906.

See U.S. Pat. 819,220 of 1906; this J., 1906, 544.—T.F.B.

Calcium carbide; Method of protecting ——. H. L. Hartenstein. Fr. Pat. 365,802, May 1, 1906.

See U.S. Pat. 819,221 of 1906; this J., 1906, 544.—T.F.B.

Calcium carbide; Process and apparatus for making ——. H. L. Hartenstein. Fr. Pat. 365,803, May 1, 1906.

See U.S. Pat. 819,222 of 1906; this J., 1906, 544.—T.F.B.

Filaments for incandescence lamps; Manufacture of ——. J. Canello. Fr. Pat. 361,602, July 3, 1905.

See U.S. Pat. 829,568 of 1906; this J., 1906, 919.—T.F.B.

Luminous bodies for electric incandescence lamps; Process for making ——. H. Kuzel. First Addition, dated July 26, 1905, to Fr. Pat. 359,025, Jan. 9, 1905.

See Eng. Pat. 15,462 of 1905; this J., 1906, 307.—T.F.B.

Filaments for incandescence lamps. A. Just and F. Hanaman. Third Addition, dated Feb. 14, 1906, to Fr. Pat. 347,661, Nov. 4, 1904 (this J., 1905, 431 and 1220, and 1906, 843).

Tungsten filaments obtained as in the original patent are amorphous, and therefore break readily. By incorporating with the tungsten a small proportion of certain more readily fusible metals, such as chromium, vanadium, tantalum, thorium, &c., the filament during the final heating fuses so far as to assume a crystalline character, with interlacing needles, whereby its fragility is overcome. The process consists in forming into filaments a mixture of finely pulverised tungsten, a small proportion of one of the metals mentioned, and an organic binder; carbonising the mixture; eliminating the carbon by heating the filament in a mixture of steam and hydrogen; and finally heating the filament electrically to a high temperature. —H. B.

Filaments for incandescence lamps. A. Just and F. Hanaman. Fourth Addition, dated Feb. 19, 1906, to Fr. Pat. 347,661, Nov. 4, 1904 (see preceding abstract).

A filament of carbon, or of metal, or of a mixture of carbon and metal, is coated with tungsten or molybdenum by heating it electrically in a low-pressure atmosphere of hydrogen containing a gaseous compound of the metal. A pressure of 200 mm. of mercury is suitable. It is stated that at a low pressure the deposition of the metal occur more uniformly, and the deposit has a crystalline form. Several filaments may be mounted in series, and submitted simultaneously to the process.—H. B.

Conductor; Electric ——, especially suitable for incandescence lamps. Parker Clark Electric Co. Fr. Pat. 366,236, May 14, 1906.

See U.S. Pat. 821,017 of 1906; this J., 1906, 594.—T.F.B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 921.)

Carbonisation of wood by superheated steam. F. Elfström. Teknisk Tidskrift, 1905, General Section, 289—291. Proc. Inst. Civil Eng., 1906, **164**, 60—61.

Superheated steam is introduced directly into the first member of a row of retorts; the steam, together with the gases evolved from the wood, then passes to the next retort, and so on. The greater part of the heat is required for evaporating the moisture contained in the wood, but the steam need not be so highly superheated for this purpose as for the subsequent charring of the wood. The hottest steam is therefore introduced into the retort in which the carbonisation is nearest completion, whilst the fresh wood is charged into the last retort of the series, wherein it is subjected to the action of the steam and gases coming from the other retorts. With ten large retorts connected in series, each of 20—30 cb. m. (about 700—1000 cb. ft.) capacity, carbonisation is completed in 12—20 hours, whilst drawing and charging take 4—5 hours, so that each retort can be worked off once in 24 hours. When carbonisation is complete in a retort, saturated steam is passed in for one hour; this becomes superheated to some extent, and after passing through the superheater, is used for completing the charring in the next retort. Water is next introduced, in small quantities, into the cooling retort, and afterwards, for one hour, a fine spray of water is showered upon the charcoal, which is then ready to be drawn. The mixed steam and gases from the finished retort, on their way to the superheater, are led through boiling water in a covered tank, in which the heavy oils (b. pt. 200°—250° C.) are condensed. It is stated that by working with superheated steam, the yield of oil is increased by about 17 per cent., and the oil is of much better quality, whilst the consumption of fuel does not exceed 15 per cent. of the weight of charcoal obtained; woodman's chips and saw-mill refuse can be used for fuel. —A. S.

"Cracking gas" from Baku crude oil; Examination of ——. C. Engler and L. Rosner. Oesterr. Chem. u. Techn. Zeit., 1906 [9]. Chem. Rev. Fett- u. Harz-Ind., 1906, 13, 144—145.

THE crude oil used for the distillation was brownish-black, very viscous, and had an unpleasant odour. It had a sp. gr. of 0·912 at 15° C., and on distillation in an Engler's flask gave the following results:—Benzine (at 95° to 140° C.), sp. gr. 0·775, 4 per cent.; petroleum (140° to 280° C.), sp. gr. 0·847, 31 per cent.; cracking distillate (at 280° C.), sp. gr. 0·902, 59 per cent.; and loss (gases), 6 per cent. by volume. The cracking process, carried out as far as possible under the same conditions as in practice, gave the following yield:—Cracking distillate, 78; coke, 12; and gas, 10 per cent. On the assumption that the only paraffin hydrocarbons present in the gas were methane and ethane, it was found to have the following composition by volume:—Carbon dioxide, 0·6; unsaturated hydrocarbons, 12·0; oxygen, 1·0; carbon monoxide, 2·2; hydrogen, 8·8; methane, 43·0; ethane, 31·9; and hydrogen sulphide, 0·6 per cent. A comparison of these figures with those of various naturally occurring mineral gases shows a striking agreement, and hence the author infers that the formation of natural gas and of cracking gas is due to analogous processes. The heat of combustion of the gas analysed calculated from its chemical composition is 8400 calories. The author points out that on an average about 10 per cent. by volume of the petroleum residue submitted to the cracking process escapes in the form of gas, and suggests that factories should take steps to utilise this gas.—C. A. M.

Mineral lubricating oils; Chemical constants in the analysis of ——. R. Kissling. Chem.-Zeit., 1906, 30, 932—933.

IN addition to the iodine value and Maumené figure, the author has determined the amount of asphaltum-pitch formed on heating the oils, and terms the result the "resinification number" (*Verharzungszahl*). In making a determination, 50 grms. of the oil are heated in a thermostat for 60 hours in five periods of 12 hours each, at a temperature of 125° to 135° C., the heating being discontinued for 12 hours each night. The oil and the pitch-like residue are then washed with petroleum spirit into a 500 c.c. flask, which is filled to the mark with the same solvent, and allowed to stand for 12 hours. The deposit is then collected on a weighed filter, washed with petroleum spirit, dried, and weighed. The amounts of asphaltum-pitch thus obtained with 21 representative oils ranged from 0·044 per cent. to 3·114 per cent. The iodine values were determined by Wijs' method upon 2 grms. of the oil dissolved in 25 c.c. of carbon tetrachloride, and the Maumené figures by treating 50 c.c. of the oil with 25 c.c. of sulphuric acid (100 per cent. monohydrate) in a well-isolated apparatus devised by the author. The following are typical of the comparative results:—

Oil.	Sp. gr. at 15° C.	Viscosity in Engler's apparatus at 25° C.	Solidification point.	Flashing point.	Ignition point.	Asphaltum pitch.	Iodine value.	Maumené figure.
			° C.	° C.	° C.	per cent.		° C.
American spindle ...	0·870	5·20	0	200	225	0·696	11·05	11·5
Do. refined ...	0·875	5·00	0	200	228	0·144	10·20	10·7
Russian machine ...	0·907	27·0	fluid at—15	215	255	0·250	7·20	8·1
American turbine ..	0·922	16·50	—2	220	267	1·730	10·88	15·1
Machine (? Texas) ..	0·948	13·00	—9	214	260	1·612	9·46	16·4

There was but little parallelism between the numbers in the last three columns, but the agreement between the amounts of asphaltum-pitch and the Maumené figures was closer than between the Maumené figures and iodine values. In the author's opinion but little reliance can be placed upon the iodine number as a constant, and little more upon the Maumené figure. But he considers the resinification number as a useful criterion of an oil. The amount of asphaltum-pitch formed on heating was materially reduced by refining the oil. The nature of the crude oil from which the lubricant was prepared had a considerable influence on this constant, and it would seem that in this respect Pennsylvanian and Russian oils are the best. Four turbine oils examined differed greatly as regards the formation of pitch (0·081 to 2·12 per cent.), whereas there was but little difference in their iodine values and Maumené figures. In practice the four oils behaved approximately in accordance with the indications shown by the resinification number, and the oil yielding 2·12 per cent. also dirtied the machinery through separation of the pitch after the usual lubrication whilst the turbine was not being used.—C. A. M.

Petroleum production of Roumania. Bd. of Trade J., Oct. 4, 1906. [T.R.]

THE production of Roumanian petroleum during the first half of 1906, as compared with the first half of 1905, was as follows:—

	First half, 1905. Metric tons.		First half, 1906. Metric tons.
Production of crude petroleum	272,167	..	404,358
Production of petroleum refineries.....	223,761	..	352,287
Export—			
Crude distilled petroleum	19,904	..	18,387
Lamp oil.....	39,887	..	98,913
Benzine	26,045	..	34,016

FRENCH PATENTS.

Hydrocarbons; Process for the partial dehydrogenation of ——. Soc. Anon. des Combustibles Industriels. Fr. Pat. 365,428, April 19, 1906.

IT is stated that hydrocarbons (tars, tar oils, &c.) can be polymerised or condensed to form other hydrocarbons by passing air, alone or mixed with oxygen, ozone, or some inert gas, through the heated hydrocarbon; the heat produced by the partial oxidation and condensation is said to be sufficient to complete the distillation. The products are similar to those produced by ordinary distillation at a higher temperature. The following is an example of the process: A coal tar of sp. gr. 1·1705, and elementary composition, carbon, 91·07 per cent., hydrogen, 5·36 per cent., is first heated to 105° C., and air is blown in at the rate of about 2 litres per minute per kilo. of tar; the distillation is continued until the temperature has reached 180° C., when a pitch, of the composition, carbon, 91 per cent., hydrogen, 9 per cent., and of sp. gr. 1·22, is obtained. By similarly distilling a mineral oil tar (sp. gr. 0·937), previously heated to 300° C., until the temperature is 375° C., it is stated that the products consist of a series of hydrocarbons of value as lubricants, and a pitch which is well suited to briquetting purposes. —T. F. B.

Ammonia; Extracting —— from gas-liquor. A. Fillunger. Fr. Pat. 365,769, April 30, 1906.

THE gas liquor is heated, preferably in a column apparatus, without addition of lime. The ammonia is collected, and the liquid, freed from all but a minute proportion of combined ammonia (0·05 per cent.), is pumped into a cooling tower, whence it is taken to the scrubber, to be again used in absorbing ammonia from gas. The process is repeated indefinitely, so that one and the same quantity

of gas water circulates continually, and further additions of washing water are unnecessary. Two kinds of distilling columns are shown: one adapted for use when superheated or dry steam is directly employed to drive off the ammonia; and the other, in which indirect heating by ordinary vapour is used, with or without the aid of dry steam.—E. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

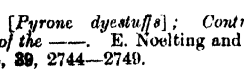
(*Continued from page* 924.)

Azo dyestuffs derived from the pyridine series. R. Baumert. Ber., 1906, **39**, 2971—2976.

The author has prepared azo dyestuffs containing the pyridine ring by combining the diazo-derivatives of *p*-amino-γ-stilbazol and *p*-amino-α-stilbazol with phenols and amines. *α-Stilbazol-p-azo-β-naphthol hydrochloride*, prepared by combining the diazo-derivative of *p*-amino-α-stilbazol with β-naphthol in alkaline solution, and subsequently acidifying with hydrochloric acid, crystallises from hot alcohol in red-brown leaflets, m.pt. 252—253° C. The dyestuff is slightly soluble in hot water, and its solution dyes silk, wool, cotton, and mordanted cotton red. *γ-Stilbazol-p-azo-β-naphthol hydrochloride* was prepared in a similar manner from *p*-amino-γ-stilbazol. It dyes rather darker shades than the foregoing compound, and melts at 257°—258° C. *α-Stilbazol-p-azoresorcinol* is only slightly soluble in water, and dyes silk and cotton yellowish-brown, wool, and mordanted cotton coffee-brown. *γ-Stilbazol-p-azoresorcinol* gives redder shades than the corresponding α-compound. *Sodium-α-stilbazol-p-azo-β-naphthol sulphonate*, obtained from Schäffer's salt dyes silk, wool, cotton, and mordanted cotton bright red. *Sodium-γ-stilbazol-p-azo-β-naphthol sulphonate* possesses similar properties to the foregoing. *Disodium-α-stilbazol-p-azo-β-naphthol disulphonate*, obtained from R salt, dyes silk, wool, and cotton bluish-red, and mordanted cotton violet. *Disodium-γ-stilbazol-p-azo-β-naphthol disulphonate* has similar dyeing properties, but produces redder shades on mordanted cotton.—J. C. C.

Isorosindone and analogous compounds [*Azine dyestuffs*]; *Constitution of* ——. H. Decker and A. Würsch. Ber., 1906, **39**, 2653—2656.

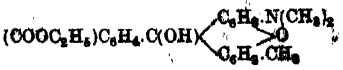
In order to decide between the para- and ortho-quinonoid formulæ for dyestuffs of the azonium class, the authors have studied the action of phenyl-magnesium bromide on isorosindone. If it possessed the para-quinonoid ketonic formula it should, like cyclaminone, yield a tertiary carbinol passing into a phenylated naphthazonium salt on treatment with acids. No such reaction, however, took place, and the conclusion is drawn that isorosindone possesses the ortho-quinonoid formula,



The molecular weight was confirmed by a cryoscopic determination in benzene solution.—J. C. C.

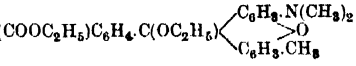
Rhodamines [*Pyrone dyestuffs*]; *Contribution to the knowledge of the* ——. E. Noelting and K. Dziewonski. Ber., 1906, **39**, 2744—2749.

Aporhodamine ethyl ester hydrochloride was obtained by passing dry hydrogen chloride through a boiling solution of the base in absolute ethyl alcohol for 8 hours. It crystallises from boiling water containing a little hydrochloric acid in bright red needles possessing a gold reflex. It is very easily soluble in cold alcohol, and fairly so in cold water. It melts at 95° C., and contains 5 mols. of water of crystallisation, of which four are lost by drying in a vacuum over sulphuric acid, and the remainder by heating to 120° C. By treatment with aqueous alkalis or moist silver oxide, a coloured base appears to be first formed, which gives a yellow solution on extraction with ether. This substance, possibly the *pseudo-carbinol base* of the aporhodamine ester



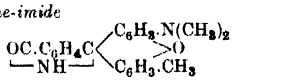
however, rapidly passes into the hydrolysed aporhodamine base, and appears not to be capable of isolation, owing to its readiness to form the lactone. When, however, the ester hydrochloride is treated with alkalis in cold alcoholic solution, the ester base is formed, the carbinol hydroxyl group becoming at the same time etherified. With ammonia in alcoholic solution, an acid carbinolimide is produced. The aporhodamine ester salt dyes tannin-mordanted cotton yellowish-red. The dyeings are stronger and a little bluer than those of aporhodamine; they are also faster to washing.

Aporhodamine ethyl ester-carbinol ethyl ether



is formed by treating the cold alcoholic solution of the ester hydrochloride with the calculated amount of potassium hydroxide. It separates as a viscid mass, which becomes crystalline after some time. It crystallises from hot alcohol in small, colourless prisms of m.pt. 105° C. It is easily soluble in cold alcohol, ether, benzene, or xylene. The substance dissolves in hot acids, with elimination of alcohol and formation of a coloured salt, identical with the original ester salt.

Aporhodamine-imide



is obtained by treating the aporhodamine ester hydrochloride with ammonia in boiling alcoholic solution. Glistening white prisms of m.pt. 227° C. separate, containing half a mol. of alcohol, which is expelled by heat. The substance dissolves in boiling dilute acids, yielding colourless salts. Saponification experiments with alcoholic potash or concentrated mineral acids were without result. Tetra-ethylrhodamine-silver nitrate and aporhodamine-silver nitrate are also described. (See also this J., 1905, 1296.)—J. C. C.

Indigo; Analysis of ——. C. Rawson. XXIII., page 1009.

Dyestuffs; Recognition and discrimination of artificial organic ——. G. Gulinow. XXIII., page 1007.

English Patents.

Dyestuffs: Manufacture of new azo ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 22,738, Nov. 6, 1905.

See Fr. Pat. 359,222 of 1905; this J., 1906, 424.—T. F. B.

Dyestuff; Production of a sulphuretted [*sulphide*] *black* —— E. Vidal, Paris. Eng. Pat. 23,733, Nov. 17, 1905.

A new dyestuff, which is applicable directly to cotton dyeing, is obtained by heating sodium sulphide and sulphur with amino-*o*-cresol or the corresponding nitro or nitroso compound for about 36 hours at a moderate temperature and in presence of water. *Example.*—Boil in an iron vessel with reflux condenser, 100 kilos. of amino-*o*-cresol, 80 kilos. of sodium sulphide, 50 to 80 kilos. of sulphur, and 800 litres of water.—D. B.

Dyestuffs; Manufacture of ortho-oxymonoazo ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 26,383, Dec. 18, 1905.

See U.S. Pat. 827,468 of 1906; this J., 1906, 922.—T.F.B.

Dyestuffs; Manufacture of new azo ——. Société pour l'Ind. Chim. a Bâle, Basle, Switzerland. Eng. Pat. 12,421, May 28, 1906. Under Int. Conv., May 29, 1905.

See Addition of May 29, 1905, to Fr. Pat. 321,040 of 1902; this J., 1906, 14.—T. F. B.

United States Patent.

Anthracene derivative [dyestuff], and process of making same. M. H. Isler, Mannheim, Germany, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 831,002, Sept. 11, 1906.

New anthracene derivatives are obtained by treating a 4-halogen-1-aminoanthraquinone, substituted in the ortho position to the amino group, *e.g.*, 4-chloro-1-amino-2-methylanthraquinone, with a mixture of nitric and sulphuric acids, and then with phenol. They are obtained in the form of crystals, insoluble in alkalis. After being sulphonated, the products dye wool in blue shades from an acid bath.—A. S.

French Patents.

Indigo; Production of finely divided ——. Badische Anilin und Soda Fabrik. Fr. Pat. 361,589, June 28, 1905.

See Eng. Pat. 12,854 of 1905; this J., 1905, 885.—T.F.B.

1.4-Dihydroxynaphthalene; Production of monoalkylethers of ——, *and mono- and disazo dyestuffs derived therefrom.* Badische Anilin und Soda Fabrik. Fr. Pat. 364,585, March 26, 1906. Under Int. Conv., Sept. 8 and 13, 1905.

See Eng. Pats. 7287 and 7287A of 1906; this J., 1906, 922.—T.F.B.

1.2-Diazonaphtholsulphonic acids and their salts; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 365,919, May 4, 1906. Under Int. Conv., April 14, 1906.

See Eng. Pat. 10,323 of 1906; this J., 1906, 751.—T.F.B.

Dyestuffs; Manufacture of red vat [anthracene] ——. Badische Anilin und Soda Fabr. Fr. Pat. 365,920, May 4, 1906. Under Int. Conv., April 18, 1906.

By condensing a diaminoanthraquinone, especially 1.5-diaminoanthraquinone or α- or β-diaminoanthraquinone, with 2-chloroanthraquinone, new vat dyestuffs are obtained. For example, 20 kilos. of 2-chloroanthraquinone, 10 kilos. of 1.5-diaminoanthraquinone, 15 kilos. of anhydrous sodium acetate, 3 kilos. of cuprous chloride, and 600 kilos. of naphthalene or nitrobenzene are boiled for 15 to 20 hours under a reflux condenser. The new compound has probably the constitution—

$$C_{14}H_7O_2(2)NH(5)C_{14}H_6O_2(1)NH(6)C_{14}H_7O_2,$$

three anthraquinone residues being united by means of two imino groups. It is filtered off, washed with toluene, then with hydrochloric or glacial acetic acid, and finally with water. When treated with strong or fuming sulphuric acid, with or without addition of boric acid, it yields dyestuffs giving greyish-green to Bordeaux-red shades on wool from an acid bath. With an alkaline hyposulphite (hydrosulphite) solution, it forms a yellowish-red vat, in which cotton is dyed in red shades, very fast to alkalis, acids, chlorine, and light.—A. S.

Dyestuffs; Process for the production of polyazo ——. L. Cassella und Co. Fr. Pat. 361,590, June 28, 1905.

See U.S. Pat. 807,119 of 1905; this J., 1906, 65.—T.F.B.

Dyestuffs; Process for the production of trisazo ——. L. Cassella und Co. Fr. Pat. 361,624, July 12, 1905.

See Eng. Pat. 14,787 of 1905; this J., 1906, 368.—T.F.B.

Dyestuffs; Process for the production of polyazo ——. L. Cassella und Co. First Addition, dated July 24, 1905, to Fr. Pat. 361,590, June 28, 1905.

See U.S. Pat. 807,119 of 1905; this J., 1906, 65.—T.F.B.

Dyestuffs; Process for preparing red, deep red to violet, sulphide ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,608, July 4, 1905.

See Eng. Pat. 14,543 of 1905; this J., 1906, 260.—T.F.B.

Dyestuffs; Process of making o-hydroxyazoazo ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,649, July 26, 1905.

See U.S. Pat. 827,468 of 1906; this J., 1906, 932.—T.F.B.

Dyestuffs: Process for preparing red, deep red to violet, sulphide ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Aug. 5, 1905, to Fr. Pat. 361,608, July 4, 1905.

See Eng. Pat. 14,543 of 1905; this J., 1906, 260.—T.F.B.

Dyestuff suitable for preparing lakes; Process for making an azo ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 366,110, May 11, 1906. Under Int. Conv., July 12, 1905.

Anthranilic acid is diazotised and combined in alkaline solution with 2.6-naphtholsulphonic acid: the resulting dyestuff gives a yellowish-red solution in water, and forms brilliant red lakes with metallic salts, very fast to light.—T. F. B.

Vegetable bodies; Process for the extraction of substances [Dyestuffs, tanning matters, &c.] from ——. J. Clarion. Fr. Pat. 361,656, Aug. 1, 1905.

The process claimed consists in subjecting the vegetable substances, in a finely divided condition, first to maceration with a suitable solvent, and subsequently to pressure in a screw or other form of press, or in a mill. The process is repeated as often as is necessary to ensure complete extraction, and can be arranged so that the materials are treated first with the weak liquor from a previous extraction, and subsequently by weaker liquors or by the pure solvent.—W. H. C.

Dyestuffs; Manufacture of new azo ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 365,582, April 25, 1906. Under Int. Conv., Sept. 30, 1905.

Azo dyestuffs giving yellowish-red to scarlet shades on unmordanted cotton are obtained by combining one molecule of the tetrazo-derivative of the *p-p*-diaminodiphenyl ether of quinol either with two molecules of 2-amino-5-naphthol-7-sulphonic acid or its substitution derivatives, or first with one molecule of this acid or its derivatives and then with one molecule of another suitable compound, or *vice versa*. The *p-p*-diaminodiphenyl ether of quinol, $(NH_2)C_6H_4.O.C_6H_4.O.C_6H_4(NH_2)$, is obtained by treating *p*-chloronitrobenzene with the potassium salt of quinol, and reducing the resulting nitro-derivative.—A. S.

Anthracene derivatives [dyestuffs]; Manufacture of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 366,005, May 8, 1906. Under Int. Conv., Sept. 1, 1905.

The new derivatives are obtained by nitrating α-β-dianthraquinonylamine (see Fr. Pat. 357,138 of 1905; this J. 1906, 66), and reducing the resulting nitro-compounds. They form vat dyestuffs dyeing unmordanted cotton in green shades. For example, 20 kilos. of α-β-dianthraquinonylamine are mixed with 110 kilos. of 95 per cent. nitric acid, the temperature not being allowed to rise above 40° C. The mixture is subsequently heated to 60°—70° C.; the resulting brown solution deposits golden-yellow leaflets of the nitro-compound. The latter when heated with phenylhydrazine yields a green dyestuff, giving olive-green shades on cotton when dyed in a vat containing glucose and caustic soda.—A. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 926.)

Quinaldine; Dyeing properties of the products of condensation of —— with aldehydes. E. Noelting and E. Witte. Ber., 1906, **39**, 2749—2751.

The authors have investigated the dyeing properties of benzalquinaldine, $C_9H_6N.CH:CH.C_6H_5$, and its deriva-

tives. A 3 per cent. solution of the hydrochloride dyes tannin mordanted cotton intensely yellow; wool and silk are only very slightly coloured. Bulach's *p*-nitrobenzalquinaldine dyes similarly but greener; the *o*-nitrobenzalquinaldine, m. pt. 147° C. (hydrochloride, m. pt. 275° C.) and *m*-nitrobenzalquinaldine, m. pt. 233° C., also dye tannin mordanted cotton yellow, and have scarcely any affinity for wool or silk. The piperonal- and nitropiperonal-derivatives give similar shades. The introduction of the amino-group into benzalquinaldine notably increases the dyeing properties. The condensations were effected by heating equal molecules of the bases and the aldehyde with a little concentrated hydrochloric acid on the water-bath for 10 hours. *p-Dimethylaminobenzalquinaldine* was obtained by heating equimolecular quantities of the components for three-quarters of an hour to 150° C. Pale yellow leaflets were obtained by recrystallisation from alcohol, and brownish-yellow, flat needles from benzene. The compound, which is a strong base, m. pt. 177° C., dissolves to a claret-red solution in dilute acids. It is soluble in alcohol, glacial acetic acid, benzene, &c. A yellow *polyhydrochloride* is precipitated by passing hydrogen chloride through the benzene solution; this becomes red on drying in a vacuum over potassium carbonate. *p-Aminobenzalquinaldine* obtained from *p*-aminobenzaldehyde and quinaldine, or by reduction of the corresponding nitro-compound, is at first colourless, but on drying, becomes bright red, m. pt. 154° C. The *hydrochloride*, m. pt. 273° C., forms red needles; it dyes tannin mordanted cotton red, and wool silk orange. 3:4-Dihydroxybenzalquinaldine described by Nencki is a basic and a mordant dyestuff. The hydrochloride dyes wool, silk, and tannin mordanted cotton orange-red, and the base gives with Scheurer's mordanted cotton strips the following shades: aluminium, brownish-red; iron, dark-brown to black; cerium, thorium, zirconium, yttrium, uranium, chromium, bismuth, and titanium, brown to violet-brown; cobalt, nickel, zinc, and cadmium, a light or Havanna brown. These lakes are fairly fast to soaping. The acetyl derivative of dihydroxybenzalquinaldine crystallises in yellow needles, m. pt. 165° C. It is soluble in alcohol, acetic acid, or chloroform, with difficulty in ether or benzene, insoluble in water. It dyes tannin mordanted cotton yellow, but the compound is not very stable, and the dyeings gradually become orange, approaching the shade of the non-acetylated substance.—J. C. C.

Coal-tar dyestuff lakes; Fastness to light of different ——. E. Valenta. Chem.-Zeit., 1906, **30**, 901—904.

The following is a list of the dyestuffs examined by the author, arranged in order of their fastness to light. *Reds:* Alizarin Red, Pigment Scarlet 3 B and G, Fast Orange O, Permanent Red 6B, Autol Red BGE, Cotton Scarlet extra, Permanent Red 4B, Lake Red P, Autol Red BL, Astazine Red B, Pigment Red G, Pigment Red B, Brilliant Lake Red R, Astazine Red G, Pigment Bordeaux N, Autol Red BLP, Eosine acid ("Eosinsäure") L, Permanent Orange, Pigment Orange R, azo dyestuff from nitranilinesulphonic acid and β-naphthol, Lithol Red GG and R, Brilliant Carmine L, Lake Red C, and Pigment Purple A. *Yellows:* Alizarin Yellow 5G, Pigment Fast Yellow G and R, Pigment Chrome Yellow L, Pigment-Chlorin GG, and Flavazine 3GL. *Blues and violets:* Indanthrene S, Alkali Blue, Oxamine Blue GN, Lanacyl Violet 3B, Oxamine Copper Blue RR, Immedial Pure Blue, Victoria Blue GN, and Acid Violet PW. *Greens:* Light Green SL and Lake Green BW. In the majority of cases the dyestuffs were precipitated with barium and aluminium hydroxides, and in a few instances as calcium and tin lakes. Dyestuffs deficient in salt-forming groups such as Pigment-Chlorin GG, Pigment Chrome Yellow, Pigment Orange, Pigment Red, and Pigment Bordeaux, were mixed with water with or without the addition of salt solutions such as barium or calcium chlorides. Victoria Blue was precipitated with tannin and tartar emetic in the usual manner.—D. B.

Fats from refuse material. A. Löb. XII., page 995.

Turkey-red oils; Analysis of ——. Herbig. XXIII., page 1002.

English Patents.

Textile fabrics; Washing machines for ——. H. Dydynski, Whaley Bridge, Derbyshire. Eng. Pat. 6871, March 22, 1906.

To obviate the destructive action of the beaters in machines for washing textile fabrics, the goods saturated with the cleansing liquid are drawn out of the washing vessel, and acted upon, whilst suspended in a slack state, by beaters rotating in a direction contrary to that in which the material is travelling. The beaters are preferably arranged so that they act on both sides of the fabric, but when two beaters only are used, their striking edges are placed out of line with one another, to divert the direction of the suspended cloth, and prevent undue tension.—D. B.

Cloth or other fabrics; Drying cylinders for ——. F. Farnworth, Ramsbottom, Lancs. Eng. Pat. 20,279, Oct. 7, 1905.

The cylinders are constructed of tinned iron or other suitable metal, and are provided with a rough surface by electrically depositing copper or other suitable metal on the outside face, so that the cloth in drying will adhere to the surface, and in this manner be prevented from shrinking.—D. B.

Formaldehyde-sulphoxylates [*Discharges*]; *Manufacture of* ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 3222, Feb. 9, 1906.

Ketone-sulphoxylates may be transformed into the more stable formaldehyde-sulphoxylates by treating them with formaldehyde. For instance, to a solution containing 140 parts of acetone-sodium sulphoxylate in 1 litre of water are added, whilst stirring, 75 parts of formaldehyde of 40 per cent. strength. The combination occurs rapidly, and the product may be obtained in a solid form by evaporating in a vacuum, when the acetone distils off.—D. B.

French Patents.

Silk fibres [*Cellulose-coated silk fibres retaining their tenacity when wet*]; *Manufacture of water resisting artificial* ——. Soc. Anon. pour l'Etude Ind. de la Soie Serret. Fr. Pat. 363,949, March 7, 1906.

Fibres, having the same tenacity in the wet as in the dry state, are produced by coating natural silk fibres with cellulose by passing them through a solution of the latter. To protect them against the action of the solvents employed, the silk fibres may be treated with formaldehyde or other compounds having a similar action upon them. The fibres thus coated are spun either together with one another, or with uncoated silk fibres. In the latter case, the uncoated fibres are preferably stretched while being spun or twisted with the coated fibres, so that when the yarns produced are submitted to tension, the strain may be chiefly borne by the uncoated fibres.—E. B.

Cellulose solutions, adapted for use in the manufacture of artificial fibres, resembling in appearance silk; Manufacture of ——, *and of such fibres.* E. W. Friedrich. Fr. Pat. 364,066, March 12, 1906. Under Int. Conv., March 13, 1905.

Basic copper salts in ammoniacal solution have the property of dissolving cellulose, but the solutions produced are not sufficiently concentrated to be applicable to the manufacture of fibres. By substituting for the cellulose, however, certain of its derivatives, namely, oxycellulose, hydrocellulose, hydrated cellulose, or colloidal cellulose, solutions of suitable concentration (containing 10 per cent. or more of the cellulose derivative) may readily be prepared. The best results are obtained with cellulose compounds obtained by subjecting cellulose to the action of either an oxidising agent, caustic soda-lye at 30° B., or an acid, such as sulphuric acid at 50° B.,

and then, after washing, again treating the products with one of these reagents, but a different one from that previously applied. Compared with the cupro-ammoniacal solutions of cellulose hitherto prepared for the same purpose, the solutions of the products in an ammoniacal or alkylaminic solution of a basic copper salt, such as the basic carbonate, sulphate, phosphate, or acetate, have the advantage, it is stated, of remaining unchanged and fit for use in the manufacture of fibres for a relatively long time. Textile fibres are produced from them by the usual methods.—E. B.

Artificial silk; Machine for spinning ——. E. Mertz. Fr. Pat. 364,912, April 4, 1906.

The pipe which supplies the silk solution under pressure is surrounded by another pipe in which a refrigerating liquid circulates. In one form of apparatus the spinning machine consists of a hollow comb-shaped vessel, which is connected to the supply of solution by a pipe and tap. The tooth portion consists of a number of glass tubes with capillary openings. The spinning apparatus are placed in tanks containing an acid solution in order to give the thread a certain consistence, and these tanks are themselves placed in cooling tanks. The threads from the required number of spinnarets are led through a guide, which, by means of an elliptical arrangement of wheels, is made to move to and fro in front of a revolving bobbin, so as to wind the thread into the shape of a bobbin with conical ends. The winding rollers dip into a suitable washing liquid. Another form of spinning apparatus consists of a tube in the shape of a truncated cone. In this is placed a spindle of the same shape which has several fine longitudinal grooves on it. This spindle is pressed into the truncated portion of the other tube by means of a rubber pad. The solution enters at the lower part, and is forced through the grooves on the spindle, which form capillary openings when the spindle is forced into the outer tube. In another form each capillary opening is furnished with a tap so that any desired number of threads can be spun together. By means of conical driving pulleys the speed of the machine can be altered, and so the fineness of the fibres obtained may be varied.—A. B. S.

Viscose; Process for forming pliable threads, ribbons, bands, &c., from ——. M. Müller. Fr. Pat. 365,776, April 30, 1906. Under Int. Conv., May 1, 1905.

See Eng. Pat. 10,094 of 1906; this J., 1906, 753.—T. F. B.

Cleaning fabrics with benzene or other volatile degreasing agents; Process for ——. E. Weiss. Fr. Pat. 366,547, May 23, 1906.

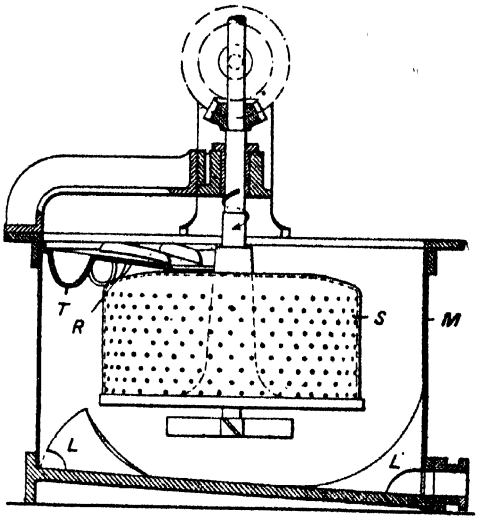
Textile fabrics are cleaned with benzene, to which is added a saponified solution of oleine or other vegetable or animal fats in alcohol. This solution is prepared by adding a hot mixture of 4 volumes of ammonia of sp. gr. 0·910, and 1 volume of alcohol to 4 volumes of oleine, and heating the whole to boiling. Solutions saponified by caustic soda or potash, and containing the above-mentioned quantity of ammonia, may also be used.
—J. C. C.

Wool, silk, and other fibres; Process for treating by carbonisation rags of ——. S. Roberts. Fr. Pat. 365,880, April 21, 1906.

See Eng. Pat. 4593 of 1905; this J., 1905, 1225.—T. F. B.

Turbine [Dyeing apparatus] for circulating liquors in a dye-vessel of large capacity. Gebrueder Wansleben and L. Hwass. Fr. Pat. 364,281, March 15, 1906. Under Int. Conv., Nov. 3, 1905.

The textile materials to be dyed are placed in the perforated rotary cage, S (see figure), of a centrifugal machine. The motion of the cage, acting in conjunction with the resistance offered by the sides of the cage, and aided by the directing action of a number of curved blades, L, attached to the bottom of the vessel, causes the dye-liquor present in the latter to rise up against the sides, and to overflow into perforated pockets, T, arranged for its reception in the cover, R, surmounting the apparatus. Thence the liquor flows into the cage, S, from which it is



projected, through the textile materials being dyed, into the outer vessel, M. As, in dyeing by this method, a relatively large volume of dye-liquor, namely, about 15 times that of the materials to be dyed, is needed, it is expedient to employ vessels of large size. These are made by increasing the height rather than the diameter of the smaller-sized centrifugal machines.—E. B.

Fibrous materials in hanks; Machine for dyeing ——. C. Corron. Fr. Pat. 364,692, March 29, 1906.

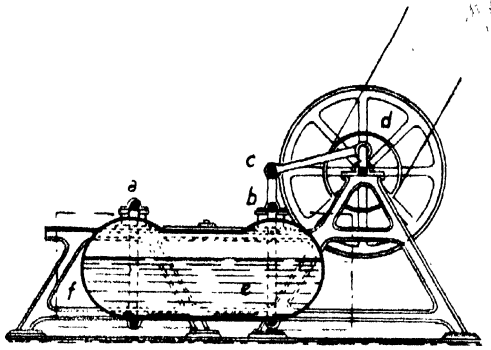
This machine consists of a series of dye-vats placed side by side. The framework supporting the hank reels can be lifted out of each tank by means of a hydraulic piston placed centrally in the tank, and, for convenience in moving the hanks from one vat to another, sliding pieces fitted with rollers are fixed to each end of the framework. These are pushed under the frame when the latter is in the vat, but can be pulled out when the framework is lifted, and the frame can then be run along on these rollers upon a pair of rails placed above the vats.
—A. B. S.

Artificial silk or other textile material wound on bobbins; Machine for washing or dyeing ——. E. Mertz. Fr. Pat. 364,913, April 4, 1906.

The bobbins carrying the material are supported at each end by bearings fixed to two endless vertical chains. These chains can be revolved intermittently by means of gearing connected with a lever and cam arrangement. The edges of the bobbin reels are in contact with a vertical plate faced with caoutchouc, and placed on one side of them. The reels press against this, and are thus caused to revolve on their axes during the upward motion. The liquid to be applied is forced over the uppermost bobbin through a perforated pipe, and is caught in a vessel placed beneath the bobbin. This vessel is also perforated, and the liquid thus falls on to the next lower bobbin, and so on to the bottom. The material is thus submitted to a liquid becoming more and more pure as it rises to the top of the machine. The bobbins are removed at the top, and fresh ones inserted at the lower part of the endless chain.—A. B. S.

Textile fibres; Arrangement for treating [Bleaching, dyeing, &c.] —— with liquids. R. Hausdorf. Fr. Pat. 366,250, May 15, 1906.

Textile fibres are treated with liquids in the various operations of washing, boiling, bleaching, and dyeing in a rectangular vessel with curved and perforated ends. This is fixed to a bar, *e*, which is connected by hanging bars with the shafts, *a* and *b*, and can be brought into



vertical and horizontal motion by means of the crank, *d*. The vessel is fixed in a bath containing the liquid, and the mode of agitation ensures the contact of the liquid with every portion of the fabrics.—J. C. C.

Hosiery; Machine for printing the ("circulaire") tubular fabrics of ——. Soc. Anon. de Blanchiment, Teinture, Impressions, et Apprets de St. Julien. Fr. Pat. 364,806, March 31, 1906.

To keep the material at a constant width during the printing of hosiery in the form of a tube, a stretching apparatus, previously adjusted to the correct width, is placed within the tube, and the whole is set on two supporting rollers placed close together. The end of the stretcher nearest the printing rollers takes the form of two thin plates, which pass between the two supporting rollers, nearly to the point where the printing cylinder and the press-roll come in contact, so that the material in passing from the stretching device to the printing cylinder has no opportunity of contracting or shrinking.—A. B. S.

Felts and other textile fabrics; Process for rendering —— waterproof. C. A. McKerrow, W. B. Hart, and W. S. Mallandain. Fr. Pat. 366,518, May 23, 1906.

Felts and similar fabrics are rendered waterproof by immersing them in a solution of glue or gelatin, and fixing the latter by the aid of bichromates, alums, ferric salts, sulphate of zinc or magnesium, and other similar salts. The material after immersion in the glue bath may be also exposed to the action of formaldehyde vapour, whereby a similar effect is produced.—J. C. C.

Drying apparatus [for fabrics]; Vacuum ——. E. Gessner. Fr. Pat. 365,656, April 23, 1906.

See Eng. Pat. 7928 of 1906; this J., 1906, 845.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 881.)

English Patent.

Dyeing, cleaning, washing, and the like [Feathers]; Apparatus for ——. J. J. Brossard. London. Eng. Pat. 16,902, Aug. 21, 1905.

In this invention, which is especially applicable to the machine described in Eng. Pat. 18,194 of 1904 (this J., 1905, 1011), the casings, within which the dyeing or cleaning is effected, are corrugated on their internal periphery, and provided with perforations passing through the convex portions of the corrugations, the object being to prevent the deterioration to delicate goods caused by the rotary motion of the casings. For the treatment of goods requiring a great amount of washing, a longitudinal partition or rubbing board is provided within the casings, which is perforated through the convex portions of the corrugations.—D. B.

French Patents.

Dyeing hair; Process for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,635, July 19, 1905.

See Eng. Pat. 14,212 of 1905; this J., 1906, 532.—T. F. B.

Dyeing hair, fur, and other articles; Process for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 366,427, May 19, 1906.

Pyrogallolsulphonic acid is used instead of pyrogallol for dyeing hair and fur. The process is carried out in either neutral or slightly alkaline solution. It is advantageous to add a mild oxidising agent, such as hydrogen peroxide, to the solution, and dark shades of brown may be obtained by treating the hair, &c., after having been freed from excess of pyrogallolsulphonic acid, with solutions of iron salts.—J. C. C.

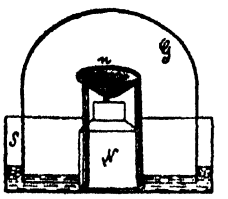
Leather and skins; Process for printing in colour on ——. A. Dubois. Fr. Pat. 365,361, April 18, 1906.

Leather and skins are printed by any suitable apparatus with alcoholic solutions of the requisite dyestuff, *e.g.*, 50 grms. of Magenta dissolved in 1 litre of alcohol. It is stated that the colours do not spread beyond the limits of the design, either during or after printing, and that they are quite fast to water and light. The printed leather is preferably coated with varnish. Any kind of undressed leather is suitable for this process, either dry or chromed. —T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 929.)

Sodium hydroxide solution; Explosion in Küster's apparatus for the preparation of pure ——. A. Harpf and H. Fleissner. Z. chem. Apparatenkunde, 1906, 1, 534—535. Chem. Centr., 1906, 2, 994. (See this J., 1904, 1027.)



The apparatus used by the authors is shown in the accompanying figure, wherein *n* is a funnel-shaped dish of nickel gauze of very narrow mesh, which is supported on a tripod above the nickel bottle, N. The glass-bell, G, rests on glass rods in the glass dish, S, which is filled with water to above the lower end of G. Pieces of sodium are placed in *n*, and a strong solution of sodium hydroxide falls slowly into the bottle, N. After being in use for four days, during which time large gas bubbles escaped from the bell from time to time, a violent explosion occurred on the fifth day. The authors suggest that the explosion was one of oxy-hydrogen gas, the ignition of the gas being effected by the heat of formation of the sodium hydroxide. When the bell was replaced by a glass bottle, the neck of which was fitted with a cork, through which passed a tube for the removal of the oxy-hydrogen gas as it formed, no explosions occurred on using the apparatus.—A. S.

Sodium hydroxide solution; Explosion in Küster's apparatus for the preparation of pure ——. F. W. Küster. Z. chem. Apparatenkunde, 1906, 2, 535—536. Chem. Centr., 1906, 2, 994—995.

The author points out that the explosion described by Harpf and Fleissner (see preceding abstract) could not have been due to oxy-hydrogen gas, since at the time when it occurred there could have been only pure hydrogen

in the apparatus. At the ordinary temperature, sodium does not become notably warm in an atmosphere of water-vapour, and local rise of temperature is prevented by the rapid heat conduction throughout the mass of the metal. Two explosions were observed by the author when water was dropped very slowly, and with cooling, upon pieces of bright sodium in an atmosphere of pure hydrogen. Explosions do not occur when the metallic sodium deliquesces in a moist atmosphere without any appreciable rise of temperature, but are caused, even with the well-cooled metal, if overheating occurs at any point, *e.g.*, by contact with a drop of liquid water. The apparatus used by Harpf and Fleissner differs in one important point from that described by the author. In the author's apparatus, the sodium is held in a funnel of nickel gauze of the usual shape with an angle of 60° at the apex. The sodium hydroxide solution formed flows to the apex, and drops therefrom into the bottle below. The greasy impurities of the sodium remain adhering to the walls of the funnel, and do not hinder the dropping of the solution from the apex of the funnel. The pieces of sodium cannot move down to the apex of the funnel. Harpf and Fleissner, on the other hand, use instead of a funnel, a dish of narrow-mesh nickel gauze. After the greasy impurities separate out from the sodium, it is quite possible for a few drops of sodium hydroxide solution to collect on the bottom of the dish; these would be gradually diluted by condensation of water, and might cause the explosion.—A. S.

Barium and calcium carbonates; Behaviour of —— at high temperatures. H. E. Boeke. Z. anorg. Chem., 1906, **50**, 244—248.

FINKELSTEIN has recently stated (Ber., 1906, **39**, 1585; this J., 1906, 534) that barium carbonate does not melt at 1350° C., whereas Le Chatelier had given its melting point as 795° C. (Bull. Soc. Chim., 1887, **47**, 300.) The author shows that these conflicting statements are due to the fact that the two authors worked under different conditions. When heated in an open crucible, barium carbonate loses carbon dioxide, and then melts at about 900° C., but when heated in a current of carbon dioxide, fusion does not take place even at 1380° C. It appears that barium carbonate undergoes some kind of transformation at 811° C., since when heated in an atmosphere of carbon dioxide, a marked diminution in the rate at which the temperature rises is observed.

When crystals of aragonite (sp. gr. 2·943) are slowly heated in an electric "microscope-furnace," they become opaque at 470° C.; after cooling, the crystals are found in their original form, being thus artificial pseudomorphs of calcite after aragonite. The transformation temperature varies with the rate of heating; at 445° C. aragonite is converted completely into calcite in one hour, whilst Mügge found that the transformation proceeds slowly even at 410° C. On heating powdered calcium carbonate under a pressure of 30 atmospheres of carbon dioxide, it dissociates partly at 1400°—1450° C., but does not fuse; the residue contained 68 per cent. of calcium carbonate and 32 per cent. of lime.—A. S.

Zinc carbonate and precipitated cadmium carbonate; Knowledge of precipitated, basic ——. M. Kohn. Z. anorg. Chem., 1906, **50**, 315—317.

FRESHLY-PRECIPITATED cadmium carbonate will also completely precipitate cold solutions of ferric salts, but cold solutions of chromium nitrate, uranyl nitrate, and aluminium nitrate, only to a very slight extent.—A. S.

Lead oxide; Different modifications of ——. R. Ruer. Z. anorg. Chem., 1906, **50**, 265—275.

THE author has investigated the two differently-coloured modifications of lead oxide. A specimen of lead oxide, purchased as "chemically pure," had a brownish-yellow colour; after being heated to between 520° and 620° C. (corr.) it acquired a light yellow colour, which it retained on cooling. On rubbing the light yellow oxide, even with the exercise of only a moderate pressure, the brownish-yellow colour returned, but the light yellow colour was not affected by a hydrostatic pressure of up to 3200 atmospheres. The brownish-yellow oxide does not owe its colour to the presence of a higher oxide, for large, light yellow, transparent crystals of pure lead oxide, when pressed with a glass rod in an atmosphere of hydrogen, acquired a reddish colour. The author is of the opinion that the ordinary brownish-yellow oxide is transformed between 520° and 620° C. into the light yellow oxide, which is unstable at the ordinary temperature, but which appears stable on account of the extremely low rate of transformation into the darker coloured modification. On rubbing, accompanied by pressure, the strains produced cause an acceleration of the rate of transformation, and the brownish-yellow oxide, stable at the ordinary temperature, is slowly formed. The red lead oxide prepared according to Geuther's directions (this J., 1884, 179) behaves, in general, similarly to the brownish-yellow oxide described above, but is not so readily converted into the light yellow modification on heating. The light yellow oxide is about twice as soluble in water as Geuther's red oxide—about $1{\cdot}03\times10^{-4}$: $0{\cdot}56\times10^{-4}$ grm. equivalents per litre at 22° C.—A. S.

Chromates of mercury, bismuth, and lead. A. J. Cox. Z. anorg. Chem., 1906, **50**, 226—243.

THE author has made use of the phase rule in an investigation of the chromates of mercury, bismuth, and lead. For example, in the systems under consideration, the components will be the oxide of the metal, chromium trioxide, and water. If two chromates are present, there will be four phases—chromates, solution, and vapour, and therefore according to the phase rule, only one of the three conditions—temperature, pressure, and concentration—can be altered without disturbing the equilibrium. By working at constant temperature, the only possible displacement of the equilibrium on altering the concentration is by the disappearance of one of the chromates, after which the concentration of the solution will alter with the dilution. In other words, if, on diluting, the concentration of the solution remains constant this is due to the presence of two compounds in the solid phase, the relative proportions of which alter, whereas if the concentration of the solution changes on dilution, the solid phase must consist of one definite compound. By working in this manner the existence of the following chromates was proved, and the compounds were isolated: Mercuric chromates, $HgCr_2O_7$, $HgCrO_4$ and $3HgO_4CrO_3$; lead chromates, $PbCr_2O_7$ and $PbCrO_4$; bismuth chromates, $Bi_2O_3,4CrO_3$ and $Bi_2O_3,2CrO_3$. These salts possess definite hydrolytic dissociation pressures, *i.e.*, they can only exist if the solution contains some free acid, the minimum amount for the several salts being as follows:—$HgCr_2O_7$, 10·46; $HgCrO_4$, 0·46; $PbCr_2O_7$, 6·87; $PbCrO_4$, 0·00002; $Bi_2O_3,4CrO_3$, 7·80; and $Bi_2O_3,2CrO_3$, 0·00001 grm. mol. of chromic acid per litre at 25° C.—A. S.

Stannic sulphate; Compounds of —— with the sulphates of the alkaline-earth metals and of lead. R. F. Weinland and H. Kühl. Ber., 1906, **39**, 2951—2953.

WHEN sulphuric acid solutions of stannic sulphate and calcium, strontium, barium, or lead sulphate are mixed and concentrated by evaporation till the liquid fumes, transparent cubic crystals separate, having the composition (for the calcium salt), $Sn(SO_4)_2$; $CaSO_4$, $3H_2O$. The water appears to be constitutional, as it can only be driven off at temperatures which decompose the salt. The crystals can be washed with acetone, but are decomposed by boiling with water.—J. T. D.

Carbon; Rates of action of oxygen, carbon dioxide, and steam on ——. P. Farup. Z. anorg. Chem., 1906, **50**, 276—296.

THE author determined the rates of action, under similar conditions, of oxygen, carbon dioxide, and steam on carbon. It was found that at about 850°C. the velocity of the reaction is about the same with carbon dioxide as with steam. With oxygen the same velocity is attained at about 450° C. The temperature-coefficients of the reactions were determined, and from the value obtained for the reaction of oxygen with carbon, the velocity of this reaction at 850° was estimated by extrapolation, and found to be 8×10^6 times as great as that of the reactions of

carbon with carbon dioxide and steam, respectively. The results obtained by Nernst and Wartenburg for the dissociation of carbon dioxide and steam at high temperatures (Nachr. der K. Ges. Wissen. zu Göttingen, Mathemat.-physik. Klasse, 1905, Heft 1.) show that pure oxygen at atmospheric pressure and 850° C. has a concentration about $0{\cdot}7 \times 10^6$ times as great as in the gases mentioned at the same temperature and pressure. There appears, therefore, to be a certain relation between the oxygen concentration and the reaction-velocity in the three reactions studied. The author discusses the nature of this relation, but is unable to supply a satisfactory explanation.—A. S.

Fluorine; Action of —— on chlorine, and a new mode of formation of hypochlorous acid. P. Lebeau. Compt. rend., 1906, **143**, 425—427.

FLUORINE and chlorine do not combine directly. Liquid chlorine dissolves fluorine, but when the chlorine is frozen, the fluorine is evolved. In presence of water, fluorine oxidises chlorine, with production of hypochlorous acid. —J. T. D.

Metal acid anhydrides; Action of liquefied ammonia on ——. A. Rosenheim and F. Jacobsohn. XXIV., page 1010.

Phosphoric acid; Quantitative volatilisation of —— from its salts. P. Jannasch and E. Heimann. XXIII., page 1007.

Salt purification in Utah. Mining World, Sept. 8, 1906. [T.R.]

IN the evaporation and subsequent treatment of salt water from the Great Salt lake in Utah, the brine is evaporated by solar heat. The refining is carried on by the drying method, which depends upon heating the salt and driving off the magnesium salts in a fine pulverulent condition by a current of air. The refining process as practised near Salt Air, Utah, is a continuous one, the salt being led to a rotating cylinder about 30 ft. long by 6 ft. in diameter, in the inner part of which is fixed an iron cylinder, about 12 or 16 ins. in diameter, charged with superheated steam. An exhaust fan carries off the water vapour, and the fine dust of magnesium chloride and magnesium sulphate. The salt thus treated is not entirely purified, as the magnesium salts are not entirely removed. The salt for table use has to be treated by a second and third grinding, sifting, and blowing. In 1905, Utah produced 177,342 barrels of salt, valued at $135,465. The output of the whole country was 25,966,122 barrels, valued at $6,095,922.

Alkali Works Regulation Act, 1906. [T.R.]

CERTAIN chemical works not hitherto liable to registration are now required to be registered, and are subject to inspection by the Local Government Board's inspectors. In order to ascertain what works throughout England and Wales have thus become subject to registration, a circular letter has been sent by the Local Government Board to the town clerks of boroughs and clerks of district councils asking to be supplied with information so far as regards works carried on within the limits of the district. These include smelting, gas-liquor, nitric acid, chlorine, hydrochloric acid, sulphide, alkali waste, lead deposit, sulphocyanide, picric acid, paraffin oil, bisulphite, tar, zinc, and chemical manure works.

ENGLISH PATENTS.

Cyanogen compounds and by-products; Production of —— from humus. W. F. Cooper, Watford, Herts. Eng. Pat. 2047, Jan. 26, 1906.

HUMUS, such as peat, farmyard or stable manure, or the product obtained by boiling certain carbohydrates with acid, is treated with nitric acid. Hydrocyanic acid is stated to be evolved, together with some nitrous fumes, on distillation. The gases are collected, and treated in any convenient manner for the separation of impurities, and for the production of the desired cyanide compound. The residue left after distillation is stated to form a by-product, valuable as a manure.—E. S.

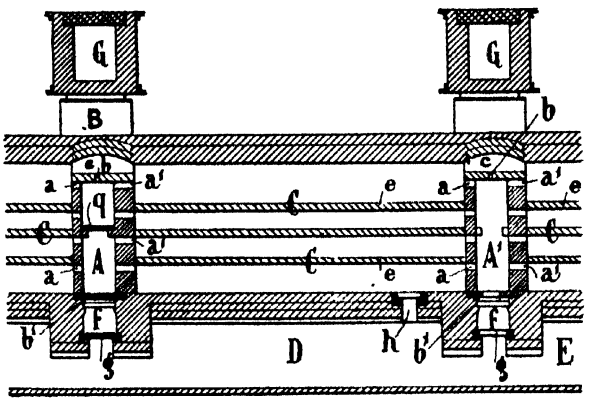
Copper solutions; Purification of ammoniacal ——. A. Lecœur, Rouen, France. Eng. Pat. 8910, April 12, 1906.

SEE Fr. Pat. 362,986 of 1906; this J., 1906, 808.—T. F. B.

FRENCH PATENTS.

Oven for calcining alumina at a high temperature, and generally applicable for calcining light pulverulent materials. Soc. Electro-Métall. Franç. Fr. Pat. 364,736, March 29 1906.

A SERIES of ovens, C, divided into chambers by horizontal partitions, *c*, on which the alumina to be calcined is placed in thin layers, are separated by combustion-chambers, A, A^1. The furnaces are arranged in a double row, back to back, separated by a division wall in which several separate charging-shoots for each bed are arranged, and the fronts are provided with doors for observing and withdrawing the material. The gaseous fuel enters from one of the mains, G, by the conduit, B, into the cross channels, *c* and *f*, from which it enters the combustion-chamber, A, by the ports, *b* and b^1, and burns in the air which enters by the ports, *a*. The products of combustion pass through



the ports, a^1, into the chamber, C, over the material on the shelves, and into the next combustion-chamber, A^1, by the ports, *a*. The combustion-chambers have passages, *f*, closed by the dampers, *g*, leading into the flue, D, which communicates with the chimney flue, E. They are also provided with tiles, *q*, to adjust the distribution of the hot gases to the ovens. The ovens are worked in series; the gas and air enter and burn in the first combustion-chamber, whose damper, *g*, is closed, pass over the material in the first oven, C, through the next combustion-chamber, and so on to the last of the series, from which they enter the flue, D, either through the ports, *f* or *h*. The principle of the ovens is that the alumina or other material, spread out in thin layers, remains stationary, and the zone of combustion is progressively moved forward as the contents of each chamber become completely calcined.—W. H. C.

Alumina; Furnace for calcining ——. A. Lambert Fr. Pat. 365,744, April 28, 1906.

THE furnace adopted is stated to be on the principle of Hoffmann's furnace, in which chambers containing successive shelves in stages, on which the alumina to be calcined is thinly spread, and heated from above and from below, are arranged in such manner that the gases may circulate throughout. Through openings in the walls that separate the chambers, heated gases are admitted in such quantity as not to disturb the powdery charge,

these openings communicating with vertical channels leading to pipes conveying the gases of combustion. Dampers are so placed as to give control throughout to the direction and force of the currents of gases. It is claimed that the arrangements made permit of the complete utilisation of the heat of the gases of combustion, and of the heat of the calcined alumina.—E. S.

Carbonic acid; Production of —— [from gases of combustion]. G. A. Schütz. Fr. Pat. 365,606, March 3, 1906.

See Eng. Pat. 25,867 of 1903; this J., 1905, 79.—E. S

Iodine; Process for the rapid extraction of —— from liquids containing iodine compounds. Soc. Franç. "La Norgine." First Addition, dated March 30, 1906, to Fr. Pat. 361,499, May 23, 1905. (See this J., 1906, 864.)

Vaseline oil, charged with iodine, is agitated with, for instance, a solution of sodium sulphite, until the colour is discharged. The de-iodised oil may then be separated, and more iodised oil added, and so on, until a concentrated solution is obtained. From the separated saline solution the iodine is set free and recovered by known means.—E. S.

Sulphur and cyanides from spent oxide, &c.; Process and apparatus for the extraction of ——. J. J. M. Bécigneul. Third Addition, dated April 7, 1906, to Fr. Pat. 345,071, July 23, 1904. (See this J., 1904, 1216; 1905, 1067; 1906, 583.)

To the hot toluene solution of the sulphur derived from the spent oxide, obtained as described in the main patent, cold water is admitted, as the solution descends through tubes into a separator having a funnel-shaped bottom. The sulphur is thus thrown down as a powder, and does not adhere to and clog the tubes through which it passes. In the receptacle, the toluene and water separate, the former rising, whilst the sulphur deposits at the bottom, and is withdrawn. Other alterations or additions relate to details of the apparatus.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 929.)

English Patents.

Glass furnaces. H. G. Slingluff, Allegheny, Pa., U.S.A. Eng. Pat. 12,159, May 24, 1906. Under Int. Conv., June 29, 1905.

See U.S. Pat. 804,775 of 1905; this J., 1905, 1232.—T.F.B.

Muffle furnaces [for enamelling]. O. Forsbach, Cöln-Mülheim, Germany. Eng. Pat. 10,852, May 9, 1906.

See Fr. Pat. 366,021 of 1906; following these.—T. F. B.

French Patents.

Glass; Apparatus for the mechanical production of sheet ——. E. Fourcault. Fr. Pat. 366,383, May 18, 1906. Under Int. Conv., June 8, 1905.

In the apparatus described, the fined glass passes from the tank to a channel, surrounded with some heat-insulating material, such as sand, to prevent the glass from cooling. The channel is provided with a number of points of delivery for the glass, which is heated by burners opening into small chambers separating the drawing holes, and by other burners that can be used in the drawing holes themselves at the moment of starting. The drawing holes are heated by conduction through the walls of the small chambers, and by the direct action of the flame through adjustable openings. Above the drawing holes, drawing rolls are arranged, the diameter of which diminishes towards the ends, so that the rolls only act upon the edges of the sheets, and ensure the maximum pull with the minimum of pressure, the rolls only coming in contact with the sheet when the latter has already solidified. In each of the drawing holes is a special form of delivery, in the form of an inverted funnel, which allows the glass to be drawn from a depth, at which the consistency of the metal is better suited to drawing. The drawing slit of the delivery is constricted at the extremities in order to reduce the size of the swellings that form on the edges of the sheets.—W. C. H.

Muffle furnace [for enamelling]. O Forsbach. Fr. Pat. 366,021, May 9, 1906.

In the furnace described, the reheated air for combustion passes, prior to its mixture with the gases for heating, through channels arranged at the side of the flues which pass round or envelope the muffle, and is led from these channels into the furnace, by a channel arranged under the furnace, so that it enters this at a temperature about equal to that of the furnace. The details of the construction of a muffle furnace working on this principle are described.—W. C. H.

German Patent.

Iron; Process for enamelling ——. L. Hermsdorf and R. Wagner. Ger. Pat. 166,672, July 26, 1904.

In order to improve the fire-resisting qualities of the enamel, and to render it opalescent, two glazes are used, one containing phosphoric acid, and the other calcium compounds, whereby calcium phosphate is formed during the enamelling process. Suitable compositions for glazes are: (1) Potassium carbonate, 9·2; sodium carbonate, 12·2; alumina, 10·0; phosphoric acid, 14·0; boric acid, 13·8; silica, 40·4; and nickel oxide, 0·4 per cent. (2) Potassium carbonate, 5·3; sodium carbonate, 14·3; sodium fluoride, 5·2; aluminium fluoride, 3·5; alumina, 5·9; calcium fluoride, 16·9; boric acid, 14·9; silica, 33·6; and nickel oxide, 0·4 per cent. The glazes are mixed in the proportions of 100 parts of the first to 10—25 parts of the second. If a white glaze be desired, the nickel oxide is left out.—A. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 930.)

Concrete; "Flow" of —— under pressure. J. H. Woolson. Eng. News, New York, 1905, 459. Proc. Inst. Civil Eng., 1906, **164**, 86.

Steel tubes, 4 ins. in diameter, 12 ins. long, and from ⅛ in. to ¼ in. thick, were filled with a finely crushed stone concrete, which was allowed to set for 17 days. In the thicker tubes, the rods of concrete were able to bear a load of 150,000 lb. without injury, except a shortening of less than ¼ in. Two of the rods in the thinner tubes, however, began to show a marked deformation at about 120,000 lb., whilst at 150,000 lb. they were compressed 3¼ ins. and 3½ ins. respectively, and their diameters increased to about 5 ins. When the metal tubes were sawn apart, and removed, the concrete, though still quite solid, was found to have taken the exact shape of the distorted tube, thus indicating that under pressure it had behaved like a plastic material.—A. S.

Concrete; Effect of moisture on reinforced ——. Maynard. Rev. Techn., Paris, **26**, 453—457. Proc. Inst. Civil Eng., 1906, **164**, 87.

The author determined the variation in volume of a Portland cement mortar when placed in: (1), dry air; (2), damp air; (3), a limited quantity of fresh water; (4), fresh water frequently changed; (5), a limited quantity of sea-water; and (6), sea-water frequently changed. In the first case the volume gradually decreased with age; in the second, third, and fifth cases, it increased more or less rapidly; whilst in the fourth and sixth cases

an increase was at first apparent, but soon attained a maximum, after which a steady decrease took place, owing to the dissolving out of calcium hydroxide by the continually renewed water. In the case of structures in reinforced concrete, the variation in volume of the iron bars is dependent on stress and temperature alone, and is quite uninfluenced by the presence of moisture. Thus, as the climatic conditions vary, the stresses in the reinforced structure will also vary. If the thickness of the concrete envelope be considerable, the variation in stresses is great; whilst, if not, fissures are apt to form in the envelope, through which the moisture can gain access to the iron, which it rapidly corrodes. For instance, in a tank of reinforced concrete which had been exposed to the action of sea-water for 3½ years, many of the thin bars of iron were found to have been completely eaten away, a lustrous deposit of magnetic oxide of iron, Fe_3O_4, alone being left. It would seem that reinforced-concrete structures should be protected with some covering impervious to moisture wherever possible.—A. S.

Cement trade of Belgium. For. Off. Ann. Series, No. 3720. [T.R.]

THE prices for cement during the whole of 1905 remained very low, with a very small margin of profit. The Belgian cement industry has, for several years past, been unremunerative, and consequently cement has had to be sold at very low prices. This is due to: (1) overproduction; (2) the practical closure of the French market; (3) the establishment of numerous works in countries which previously imported large quantities from Europe. The cement trade at the present time (August, 1906) is decidedly active, and prices are becoming more and more steady. The export statistics of Belgian cement during the first six months of 1906 show a fair increase over those of the corresponding period of 1905. Down to June 30, 1906, the exports amounted to 380,355 tons, compared with 319,769 tons in the first six months of 1905. The augmentation is mainly due to large exports to Germany, which in the six months amounted to 66,325 tons; those of the first six months of 1905 being only 22,523 tons. The exports during the same period and the corresponding period of 1905 to the United States of America amounted respectively to 41,332 and 24,703 tons, the increase of 1906 being accounted for by the San Francisco earthquake, and the increasing use of cement-concrete. The exports to the United Kingdom fell off very considerably, declining from 113,067 tons in 1905 to 79,949 tons in 1906. The United Kingdom, however, still remains the principal market for Belgian cement, though not to such an overwhelming extent as heretofore. The Colonies also show a certain falling-off, though only of minor importance.

Principal exports of Belgian cement in 1905 compared with 1895.

Country.	1895.		1905.
	Tons.		Tons.
United Kingdom..	1,736	..	196,584
Argentine Republic	17,032	..	66,192
Brazil	17,259	..	41,912
Canada	15,175	..	12,172
Cape Colony.....	1,336	..	10,246
Chile	1,633	..	9,805
Cuba	2,319	..	7,320
Egypt	2,090	..	24,225
France	14,496	..	9,600
Germany	1,548	..	55,557
India	8,795	..	12,063
Mexico	1,506	..	22,108
Natal	..	..	9,367
Netherlands	29,506	..	79,449
Portugal	4,910	..	13,378
Spain	2,078	..	19,086
United States of America	137,335	..	49,550
Total of all exports	[illegible]	..	678,826

Principal exports of Belgian cement during the years 1904-05.

Country.	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£
United Kingdom	231,213	221,964	196,584	188,720
Argentine Republic	38,290	36,758	66,192	63,548
Cape Colony	14,148	15,581	10,246	9,844
Canada	15,278	14,667	12,172	11,692
Brazil	32,675	31,368	41,912	40,240
Egypt	15,321	15,708	24,225	23,264
Germany.....	3,094	2,970	55,557	53,340
Mexico	24,952	23,953	22,108	21,228
Netherlands	58,599	56,255	79,449	76,276
Spain	14,912	14,315	19,086	18,328
United States of America	66,659	63,993	49,550	47,572
Other countries ..	73,153	67,230	101,745	98,197
Total	588,294	564,762	678,826	652,249

Cement trade of Japan. Chamber of Comm. J., Oct., 1906. [T.R.]

THE amount of cement exported during the last 10 years was as follows:—

	Quantity. Kin.		Value. Yen.
1896	2,322,644	..	25,372
1897	938,188	..	16,257
1898	2,108,686	..	36,955
1899	4,648,722	..	62,632
1900	15,088,419	..	194,469
1901	17,815,512	..	245,081
1902	22,840,563	..	308,349
1903	41,749,234	..	596,204
1904	39,085,471	..	548,497
1905	31,614,437	..	395,392

1 kin = 1·323 lb. 1 yen = florin.

Up to the end of May this year the value of cement exported had reached over 423,000 yen, whilst the figures for the corresponding period of the two preceding years were 198,000 yen and 217,000 yen respectively. That is to say, the quantity exported during the first five months of this year exceeded that for the whole of last year.

FRENCH PATENTS.

Bricks; Manufacture of light ——, *composed of clay or marl and vegetable materials.* B. Giscard. Fr. Pat. 366,291, Feb. 17, 1906.

ACCORDING to the process described, bricks and similar bodies can be produced, of relatively light weight, by combining with clay or marl such substances as sawdust, bran, various straws, maize heads, oat or wheat husks, various kinds of fodder, foliage, shavings and wood charcoal, oakum, cork, &c., all ground very fine.—W. C. H.

Stone and marble; Manufacture of artificial ——. T. M. Thom. Fr. Pat. 365,652, April 20, 1906. Under Int. Conv., April 20, 1905.

SEE Eng. Pat. 8804 of 1905; this J., 1906, 537.—T. F. B.

Building materials. W. Spittler. Fr. Pat. 366,095, May 11, 1906.

THE building materials described are made of coarse particles of wood (shavings, fibres, bark, &c.) stuck together so as to form a thoroughly solid body, which is refractory and impermeable to sound, by means of some known agglutinant used in the manufacture of artificial stone and wood, such as magnesium chloride, burnt magnesia, &c.—W. C. H.

Cement to resist sea-water; Process for the manufacture of a ——. E. Bougleux. Fr. Pat. 365,869, March 12, 1906. Under Int. Conv., March 12, 1905.

THIS cement is made by adding "hydraulites," such as

puzzuolana, trass, &c., to the cement materials. The addition may be made: (1) To the raw cement materials before they are introduced into the kiln; (2) as a very fine powder introduced into rotary kilns, before, during, or after the formation of the clinker, or in the case of ordinary cement kilns, during the burning whilst the material is still red; (3) and also with or without the preceding additions, during the grinding of the clinker, either hot or cold.—W. C. H.

Cement; Process and apparatus for burning —— in rotary tubular furnaces. T. M. Morgan. Fr. Pat. 365,523, April 24, 1906.

SEE Eng. Pat. 6046 of 1906; this J., 1906, 848.—T. F. B.

Cement; Process and apparatus for the manufacture of ——. B. E. Eldred. Fr. Pat. 365,579, April 25, 1906.

BY this process, the two operations of calcining and of fritting the raw materials for the production of Portland and other cements, are carried out as two distinct phases of the manufacture, and in separate furnaces, since a relatively low temperature is sufficient for the calcining process, and a high temperature is necessary for the fritting process. By means of a regenerative system the heat of the gases escaping from the fritting furnace is used to heat the gas and air employed in heating that furnace, and similarly the heat of the gases escaping from the calcining furnace is used to heat the gas and air supplied to it. The apparatus for manufacturing cement according to this process consists of two furnaces heated by producer gas, in each of which the temperature, condition of the fire, and the rate of supply of material, can be regulated independently and without alteration of the corresponding conditions existing in the other furnace. The two furnaces may be entirely separate, or they may be combined into a single structure, in which case their adjacent ends are fitted into a common hood or box.
—W. C. H.

Cement for coatings, pavements, and mosaics, especially applicable for binding together mother-of-pearl. H. Gombaud. Fr. Pat. 366,122, May 12, 1906.

A CEMENT for coatings, pavements, and mosaics, and specially applicable for binding together mother-of-pearl, is composed of commercial magnesia, powdered marble, or "other silicious product," and of mother-of-pearl flakes, bound together with a solution of magnesium chloride, to which is added 10 per cent. of zinc sulphate, and 10 per cent. of potassium silicate, with or without the addition of colouring material and wood sawdust.—W. C. H.

Cement; Manufacture of Portland ——. H. Peters. Fr. Pat. 366,600, May 26, 1906. Under Int. Conv., Sept. 22, 1905.

SEE Eng. Pat. 19,180 of 1905; this J., 1906, 885.—T. F. B.

GERMAN PATENT.

Cork substitute; Process for the manufacture of a ——. J. Fuchs. Ger. Pat. 167,780, Jan. 25, 1905.

THE process claimed consists in acting upon copper or nickel, or oxides of these metals, with acetylene under the influence of pressure and heat. Copper or nickel, or an oxide of one of these metals, is placed in a rotating drum of aluminium, and heated to 230° C. Acetylene under a pressure of 15 cm. of mercury is then introduced, and a similar pressure is exerted on the drum. The contents of the drum are stated to be converted into a compact, light brown mass ("cuprene"), which can be cut or moulded into any desired form. It has a specific gravity half as high as that of cork, and an elasticity equal to that of the latter. It is stated to be suitable for use as a filling for walls and floors, being a non-conductor of heat and serving to deaden sounds, and also for filling the tyres of bicycles and automobiles.—A. S.

X.—METALLURGY.

(*Continued from page* 935.)

Steel; Structure of hardened and tempered ——. E. Heyn and O. Bauer. Mitth. königl Materialprüfungsamt zu Gross-Lichterfelde West, 1906, **24**, 29—59.

THE authors' investigations were made with a tool-steel of eutectoid composition (0·95 per cent. of carbon). In the first series of experiments, test-pieces of the steel were hardened by quenching in cold water from a temperature of 900° C., and were then tempered by reheating for varying periods of time at temperatures ranging from 100° to 640° C. In the second series of experiments the test-pieces were quenched in different liquids from a temperature of 900° C. The test-pieces after treatment were examined with respect to hardness, solubility in dilute sulphuric acid, and behaviour on etching with alcoholic hydrochloric acid (1 c.c. of acid in 100 c.c. of absolute alcohol). Microphotographs are appended to the paper. The results obtained showed that in the transition from martensite to perlite on tempering at successively higher temperatures, there is a well-defined intermediate stage (corresponding to a tempering temperature of 400° C), for which the authors propose the name *osmondite*. Troostite is retained as the generic name for the stages between martensite and osmondite, and sorbite for those between osmondite and perlite. Osmondite is more soluble in 1 per cent. sulphuric acid than troostite or sorbite. When troostite or osmondite is dissolved in 10 per cent. sulphuric acid, the residue contains no iron carbide, but some "free carbon," the greatest quantity being obtained with osmondite. A special name is needed for this form of carbon; it is not present in the steel, but is produced on dissolving the metal in dilute acid. Iron carbide is found in the insoluble residue only in the case of sorbite. The coloration of tempered steels on etching with alcoholic hydrochloric acid, as also the coloration of troostite and osmondite in hardened steel, is due to a film of "free carbon" which is deposited on the surface; the coloration is accordingly deepest with osmondite. The results of the second series of experiments indicate that all forms of quenching of the steel under examination are equivalent to an ideal undercooling, with consequent complete conversion of the perlite into martensite, followed by a more or less marked tempering effect, with formation of troostite or of troostite and osmondite, the intensity of this tempering being dependent upon the rate of cooling.—A. S.

Steels containing 0·5 and 0·8 per cent. of carbon; Heat treatment of ——. C. E. Corson. Bull. Amer. Inst. Min. Eng., 1906, 725—742.

THE experiments were made with acid open-hearth steels containing 0·50 and 0·75 per cent. respectively of carbon. The test-pieces were heated to temperatures up to 900° C., and then cooled in the air, and also immersed in ashes and in lime. In general the results obtained were analogous to those obtained with other grades of steel examined by different investigators. As the time occupied in cooling increased, the tensile strength and contraction decreased, whilst the elongation showed a slight increase. Micrographs illustrating the structure of the test-pieces are given in the paper. Sauveur (Metallographist, 2, 267) has stated that "hot work, as such, has no influence upon the structure of the metal. Indirectly, however, by retarding crystallisation until a lower temperature is reached, it may have considerable effect on the structure, but the same results could be attained by heat treatment alone, *i.e.*, by reheating the unworked metal to the temperature from which the worked piece was allowed to cool undisturbedly. In order to test this statement, two test-bars were prepared from one and the same ingot. One, after being cooled, was reheated in a coke furnace to cherry-redness; and the other was hammered until it had cooled to cherry-redness (about 1250° F.). The two bars were then cooled side by side in the air. The results were as follows:

Treatment.	Tensile strength.	Elongation on 4 in.	Reduction of area.
	lb. per sq. in.	per cent.	per cent.
(1) Hammered for about 2 mins. to cherry-redness (2) Cooled, and then re-heated to match No. 1 as it left the hammer ...	109,271	15	26
	106,271	15	33

—A. S.

Steel ingots; Segregation in ——, and its effects on the mechanical properties of steel. J. E. Stead. Brit. Assoc., Section G, York, 1906. Engineering, 1906, **82**, 405.

THE author gives a general summary of the present position of our knowledge on segregation in steel, and its effects on the mechanical properties of the metal. He states in conclusion that although segregation should be avoided, it is not so great an evil as is frequently asserted, unless accompanied by unsoundness. Unsoundness without segregation will equally lead to premature failure. In the author's experience of the steel rails which break when in use on English railways, not more than one-sixth are axially segregated, and even in these it is doubtful whether the rails were not initially unsound. The cause mainly responsible for failure is unsoundness, either internally or externally. The author's opinion is that the only reliable method of producing perfectly sound steel is by compression of the molten metal in the mould, but fairly good results can also be obtained by the addition of aluminium or silicon.—A. S.

Iron and steel structures; Protecting —— with paper. L. H. Barker. Paper read before the Amer. Soc. for Testing Materials, June 30, 1905. Proc. Inst. Civil Eng., 1906, **164**, 41—42.

NUMEROUS experiments with different kinds of paints did not give satisfactory results. Good results were obtained, however, by the use of "paraffin paper." The iron is carefully cleaned from rust by means of stiff wire brushes, then a kind of "tacky" paint is applied, and the paper is pressed tightly on the painted surface, the joints of the paper being made to slightly overlap. The paper, as soon as it is in place, is ready for the first coat of paint. After exposure to smoke for two years and three months, it was found that the paper and the first or adhesive coat of paint were quite intact, and in many places the paint was still not dry; the surface of the steel was just as when painted. Steel protected in this way was also not affected by exposure to dampness and sewer gases.—A.S.

Platinum-silver alloys. [*Separation of platinum from gold, iridium*, &c.] J. F. Thompson and E. H. Miller. J. Amer. Chem. Soc., 1906, **28** [9], 1115—1132.

IT has long been known that platinum, alloyed with silver, will dissolve to some extent in nitric acid, but conflicting results have been obtained by different workers. Thus Winkler (Z. anal. Chem., 1874, 368) regards the strength of acid as of small importance, whilst J. Spiller (this J., 1897, 539), recommends acid of sp. gr. 1·42. Both find that a residue is left, whereas N. W. Perry (Eng. and Min. J., Jan., 1879) states that the whole dissolves. To account for these and other results the authors have made a study of the melting points and cooling curves, microstructure, specific gravities, and electrical conductivities of a series of alloys, the platinum contents of which ranged from 0·5 to 57 per cent. Great care was taken to free the platinum used from iridium, and to render the alloys quite homogeneous. For their analysis the parting method, with sulphuric acid, was employed, but it was found necessary, where the platinum amounted to 20 per cent. or more, to dissolve the residue, after weighing, in *aqua regia*, and precipitate the silver retained, which amounted in one case to 2·7 per cent. No appreciable amount of platinum is dissolved by the acid during the time of heating. (Compare Delépine, this J., 1906, 304.) It was found that in no case would the alloy dissolve completely in nitric acid (sp. gr. 1·1 and 1·4); some platinum was always dissolved with the silver, and some silver always remained with the residues. The separation of platinum from gold, iridium, &c., in one operation, by alloying with silver and parting with nitric acid, is therefore impossible. From a study of the cooling curves and microstructure, the authors conclude that the alloys consist of a number of platinum-silver compounds of different solubilities, the relative proportions of which depend on the rate of cooling. Hence the irregular results obtained in parting with nitric acid.—F. SODN.

Carbon in steel; New colorimeter for the determination of ——. C. H. White. XXIII., page 1007.

ENGLISH PATENTS.

Tin; Process for extracting —— from ore. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 10,943, May 25, 1905.

TIN ore or oxide is exposed to the action of producer- or water-gas whilst being heated and agitated, preferably in a closed horizontal vessel to which a slow, rotatory movement is communicated.—E. S.

Pyritic ores containing gold, silver, or other valuable metals; Treatment of ——. W. Blackmore and A. Howard, London. Eng. Pat. 17,839, Sept. 4, 1905.

THE pyritic ores are roasted at about 800° F. in the presence of air and steam admitted in such proportions as to oxidise the sulphides, as far as possible, into sulphates. The sulphurous gases emitted in the process are absorbed by water, and the solution is used in lixiviating the roasted ore. Or, the roasted ore may be washed with water containing about 5 per cent. of sulphuric acid, the object being to remove sulphates of iron, copper, cobalt, and nickel, the latter metals being recovered by usual means. The residual ore is then treated to obtain the precious metals by the cyanide or chlorination methods. If the ores contain lead or zinc, the residues are further treated by smelting processes to recover them. Reference is made to Eng. Pat. 28,992 of 1904 (this J., 1906, 481).

—E. S.

Lead and silver; Process for obtaining —— from their ores. J. Asbeck, Westerwald, Germany. Eng. Pat. 23,408, Nov. 14, 1905.

SULPHIDE ores of lead and silver, containing, in addition, sulphides of copper and iron, are decomposed by treatment with a fused halogen salt, *e.g.*, sodium chloride or zinc chloride, to which oxide of lead or of zinc is added, in quantity at least equivalent to the amount of copper or iron in the ore. The lead and silver are afterwards separated in the metallic state by means of the electric current or by the addition of an electro-positive metal, *e.g.*, zinc. The function of the added zinc oxide or lead oxide is to convert the copper and iron compounds into oxides, and to prevent the formation of chlorides of these metals, which, if formed, would afterwards be partly reduced, thus contaminating the silver and lead obtained, and would also, as far as they remained unreduced, spoil the bath for another treatment of a fresh quantity of ore.

—A. G. L.

Metalliferous ores or compounds; Treatment of —— preparatory to smelting the same. F. Heberlein, London. Eng. Pat. 26,277, Dec. 16, 1905.

METALLIFEROUS (iron or manganese) ores or compounds, in a fine state of division, are mixed with coal or other fuel, moistened with water if necessary, and then burnt, preferably in a tip-apparatus, of conical or spherical form, using an air-blast of gradually increasing force. The sintered mass obtained is treated as usual in a blast-furnace.—A. G. L.

Ores; Process and apparatus for smelting ——, and converting mattes. A. M. Day, Salt Lake City, U.S.A. Eng. Pat. 3528, Feb. 13, 1906.

SEE U.S. Pats. 812,186 and 812,765 of 1906; this J., 1906, 269.—T. F. B.

Iron compounds; Method of desulphurising and nodulising substances containing ——. T. C. King, New York. Eng. Pat. 60, Jan. 1, 1906.

SEE Fr. Pat. 362,145 of 1906; this J., 1906, 642.—T. F. B.

Iron ores; Treatment of small mine or waste products of calcined —— *for the more complete extraction of iron therefrom.* A. Hodgkinson, Stoke-on-Trent. Eng. Pat. 4999, March 1, 1906.

IT has been found that the calcined waste products of ironstone seams known as "small mine," and the calcined pieces of stone or rock containing iron, left on the mine hearths after the puddle or furnace mine has been removed, cannot be worked up except when the proportion of moisture present is not less than 3 nor more than 35 per cent. According to the present patent, the waste is either heated or moistened until the proportion of water is within the limits mentioned; it is then moulded into blocks, and pressed, whereby lumps are produced which, after being annealed, can be utilised in puddling or other furnaces. Reference is directed to Eng. Pat. 4537 of 1889 (this J., 1890, 519).—A. S.

Iron; Processes for converting cast —— *into steel or malleable iron.* M. A. Hunter, Philadelphia, U.S.A. Eng. Pat. 8507, April 9, 1906.

SEE Fr. Pat. 365,159 of 1906; following these.—T. F. B.

Filters for separating water or solution from solids, such as slimy ores, pulp, and the like. G. Ridgway, Kalgoorlie, W. Australia. Eng. Pat. 11,623, May 18, 1906.

A NUMBER of flat, hollow filter-frames are attached by radiating arms to a central rotating spindle, and are rotated above an annular trough. The spindle is hollow, and is divided into three separate compartments, each of which has a separate outlet, and is also connected to each of the filter-frames by a separate valved pipe. In two of these compartments a vacuum is maintained, and in the third a pulsating movement is set up by a plunger which produces a vacuum and a pressure alternately. The annular trough is divided by partitions into three or more compartments: the first contains the "pulp," the second the wash water, and the last serves to receive the exhausted material, which falls through the open bottom into trucks placed underneath. At the outer side of each filter-frame is a roller, which runs on an undulating track forming the outer edge of the annular trough. Three corresponding concentric, undulating tracks are placed round the spindle between it and the inner side of the annular trough; each of these tracks guides and operates a roller or lever which opens or closes a valve on one of the pipes leading from the filter-frame to one of the chambers in the hollow spindle. The apparatus works as follows, the cycle of operations of only one filter-frame being described for the sake of simplicity, and starting with the filter-frame, which has a permeable lower face, in the position which it occupies just before entering the pulp compartment of the trough. As the frame moves round and approaches the division, the roller is raised by the elevation of the undulating outer track, and the frame is lifted over the division wall, and lowered into contact with the pulp in the following compartment of the trough, at the same time the valve on the pipe which communicates with the first vacuum chamber is opened by its roller passing over an elevation on its own undulating track, and some of the pulp is sucked on to the lower surface of the frame. It is held there by the suction, and the strong liquor passes through into the first vacuum chamber. As the frame approaches the next division, it is lifted over as before, and lowered into the washing liquid in the next compartment. At the same time the connection to the first vacuum-chamber is closed and that to the second is opened, so that the washing liquid is drawn through the adhering cake of material into a separate chamber. Finally, the frame is again lifted over the next division, and passes over the discharge compartment. The connection to the pulsating chamber is now opened by the roller, as in the other cases, and that to the second vacuum chamber closed, and the alternate pressure and vacuum applied to the filter-frame loosens the cake, which falls into the truck placed below. The contents of the pulp and wash-water compartments may be kept in motion by suitable agitators, and the levels kept constant by float chambers. The pulp-, washing-, and discharge-chambers may also be arranged in a line instead of in a circle.—W. H. C.

Aluminium and its alloys; Soldering of ——, *and a solder therefor.* M. Gruber, Berlin. Eng. Pat. 12,599, May 30, 1906.

THE solder contains 10 parts of copper, 2 of aluminium, 25 of zinc, 60 of tin, and 3 of cadmium. It is stated to have a low melting point, and is applied, with the aid of paraffin as a flux, by means of a soldering bit.—E. S.

UNITED STATES PATENTS.

Cast-iron articles; Method of making ——. A. W. Slocum, Assignor to C. V. Slocum, Pittsburg, Pa. U.S. Pat. 830,536, Sept. 11, 1906.

MOLTEN cast iron from a melting furnace is mixed with 1 per cent. or less of titanium oxide, and then cast. The titanium oxide is reduced by the carbon of the cast iron. —A. S.

Scrap-brass; Process of treating ——. H. J. Krebs, Wilmington, Del. U.S. Pat. 830,601, Sept. 11, 1906.

THE brass is melted in a cupola furnace, the zinc being oxidised and volatilised, and the purified copper subsequently discharged. From the oxidation products, the coarser particles are first removed by settling; then, after cooling, the zinc oxide is collected in bags or the like, and the residual fume is treated with an acid solution for the production of a zinc salt.—A. S.

Scrap-brass; Process of treating ——. H. J. Krebs, Wilmington, Del. U.S. Pat. 831,010. Sept. 11, 1906.

THE process is essentially the same as that described in U.S. Pat. 830,601 (see preceding abstract), except that no provision is made for collecting zinc oxide from the cooled fume, the latter being treated directly for the production of a zinc salt.—A. S.

Ores; Apparatus for cyaniding ——. T. L. Rankin, Sackett Harbor, N.Y. U.S. Pat. 830,615, Sept. 11, 1906.

THE ore is treated with cyanide solution in two rotary leaching cylinders with a valved connecting pipe. The cylinders are lined with wood, and have spiral wooden ribs starting at each end and ending near the middle. Compressed air is admitted to the first cylinder, and when the leaching operation in this is finished, the valve in the connecting pipe is opened, and the excess of compressed air allowed to pass into the second cylinder, to assist the leaching process therein. The foul air and "gases" from the leaching cylinders are led into the bottom of a receptacle containing a liquid capable of absorbing the "gases," the air being subsequently allowed to escape. This receptacle has a perforated partition above the inlet for the air and "gases," and is packed with "obstructing substances" above the partition.—A. S.

FRENCH PATENTS.

Copper; Process of extracting —— *from minerals.* G. R. M. Sweeting. First Addition, dated June 6, 1905, to Fr. Pat. 360,071, Feb. 11, 1905 (this J., 1906, 485).

THE liquid left in the anode compartment at the end of the electrolysis, by which the copper is deposited, is evaporated by hot waste gases passing through a flue above the tank. On allowing the liquid to cool, ferric sulphate crystallises out, and sulphuric acid, of a strength up to 66° B., is left in the mother liquor. The ferric sulphate obtained is then distilled in retorts heated to a white heat for the production of colcothar and fuming sulphuric acid as usual.—A. G. L.

Castings of copper and copper alloys; Process for the production of dense and homogeneous ——, *by means of the addition of an alkali carbonate.* Laboratorium für Chem. Feuerschutz- und Löschmittel Conrad Gautsch G.m.b.H. Fr. Pat. 365,733, April 28, 1906.

In order to produce sound castings of copper, bronze, &c., and to readily introduce iron or steel into such alloys, a small quantity (0·2 to 0·4 per cent.) of sodium bicarbonate is added to the metal, preferably partly before and partly after the fusion. The salt is added in addition to the phosphorus used for deoxidation, but without the subsequent use of a current of air for re-oxidation.—A. G. L.

Washer; Mechanical —— *for all minerals.* J. Nicholls. Fr. Pat. 364,771, Feb. 2, 1906.

Fig. 1

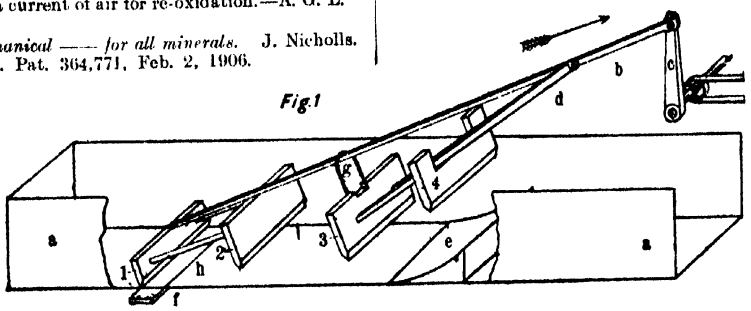
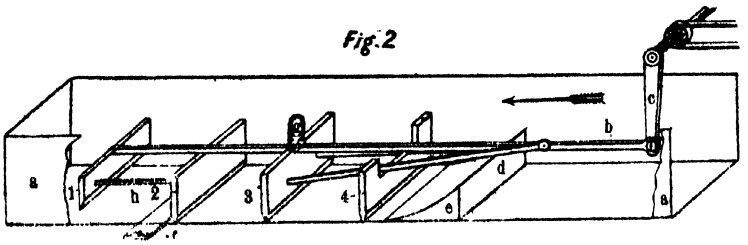
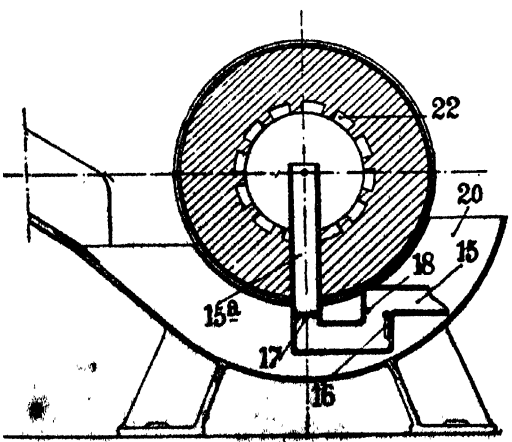


Fig. 2



The washer consists of a tank, *a*, in which the mineral to be treated is stirred up with water by means of a shaft capable of a reciprocating motion. Directly attached to this shaft are two rabbles, 1 and 2, whilst a number of others, 3 and 4, are attached to two arms, *d*, pivoted on the shaft, the end rabble, 3, being also guided by the staple, *g*, which slides along the shaft. The rabble, 1, is not quite as wide as the others, and hence does not come into play until the shaft has been raised to some extent.—A. G. L.

Rotary furnace for treating minerals and all combustible bodies. A. Ducco. First Addition, dated March 10, 1906, to Fr Pat. 364,366, March 10, 1906.



The addition consists in arranging the interior channels or flutings, 22, so that they form only a slight angle with the axis of the rotary cylinder, and in providing a cylindrical extension at the discharge end furnished with an interior helical blade which delivers the treated material into a closed chamber provided with a discharge hopper. The charging device is shown in the figure, and consists of a tube, 15, 15A, bent as shown, and provided with self-closing and opening flap-valves, 16 and 17, one of which always remains closed and shuts off communication with the external air. As the cylinder rotates, the pipe, 15, scoops up some of the material from the trough, 20, which material falls into the bend. As the cylinder continues to rotate, and the pipe, 15A, comes into its highest position, the flap, 16, falls on to its support, 18, and closes the open end to the air. At the same time the flap, 17, opens, and the material in the bend drops down the pipe, 15A, into the cylinder.—W. H. C.

Furnaces; Metallurgical ——. A. Farkas and J. de Moya. Fr. Pat. 365,940, May 5, 1906.

Rapid heating or fusion of minerals or metals is effected by introducing into a closed furnace, gas from one or more independent producers, and at the same time blowing in air from one or more tuyères. By varying the proportions of air and gas, any desired degree of oxidation or reduction may be obtained. No chimney is necessary. —A. G. L.

Cast iron or cast steel; Process of producing —— *by means of the basic converter.* Soc. Anon. des Mines du Luxembourg et des Forges de Sarrebruck. Fr. Pat. 364,785, March 31, 1906.

A basic mineral capable of evolving a large quantity of gas when heated, preferably limestone, is added to the charge in the converter before or during the blow; the temperature is then raised so as to evolve the gas, and to cause the lime to combine with the phosphoric acid produced, after which the temperature is allowed to fall to a point convenient for casting.—A. G. L.

Steel; Manufacture of —— *in the Bessemer converter or Talbot furnace, with basic or neutral linings.* H. J. B. Picaud. Fr. Pat. 364,837, April 2, 1906. Under Int. Conv., April 3, 1905.

To the mass in the converter or furnace a flux, such as fluorspar, is added. This addition increases the rapidity with which the lime takes up the phosphoric anhydride formed during the blow to such an extent that the metal

is free from phosphorus before it has become completely decarburised. The resulting slag can be used as a fertiliser in the same way as ordinary Thomas slag.—A. G. L.

Iron; New method for the production of reduced —— in the spongy state. F. C. W. Timm. Fr Pat. 365,878, April 7, 1906. Under Int. Conv., April 10, 1905.

Carbon dioxide is passed through a producer containing an incandescent mass of coke, which reduces it to carbon monoxide. This is then passed whilst hot through the iron-bearing mineral to be reduced, and in reducing this becomes converted into twice the initial quantity of carbon dioxide. Half of the gas having been removed through suitable flues, the remainder goes through the same cycle again, until, after about 10 minutes, the producer has become too cold to work. The process is then interrupted, and another producer interpolated in place of the first, which is in the meanwhile revivified by blowing air through it at such a rate as to produce mainly carbon dioxide. The products of combustion produced in this way are made to heat the carbon monoxide on its way to the mineral-containing chamber, by means of a Cowper stove; or else they serve to heat the chamber itself.—A. G. L.

Cast-iron; Process for converting —— into steel or wrought iron. M. A. Hunter (*née* Webb). Fr. Pat. 365,159, April 10, 1906.

The process consists in heating the cast iron, in bars or pigs, to a temperature approaching but below its melting-point (about 925° to 980° C.), and then treating it with liquid, vaporised, or atomised sulphuric acid. This treatment eliminates most of the carbon, and changes the physical characteristics of the metal so that it can be forged.—A. G. L.

Iron; Process of casting ingots of —— without the addition of appreciable quantities of aluminium or silicon, and without air-holes at the surfaces. Rheinische Metallwaaren- u. Maschinenfabrik. Fr. Pat. 365,345, April 17, 1906. Under Int. Conv., May 17, 1905.

Sound ingots of iron and mild steel are obtained without the use of appreciable quantities of aluminium or silicon, by casting in moulds which widen considerably towards the top, so as to allow of the ready escape of the air-bubbles liberated during the cooling at the sides of the moulds.—A. G. L.

Steel; Process for the manufacture of ——. V. Defays. Fr. Pat. 365,671, April 26, 1906. Under Int. Conv., April 29, 1905.

One or more Siemens-Martin furnaces are arranged close to one or more gas producers in order to be able to utilise the sensible heat of the producer for the conversion of the iron into steel. This is done by charging the producer not only with the usual combustibles (coke, &c.), but also with the cast iron and materials, such as ferric oxide, lime, &c., designed to assist in the process. On blowing air through the producer, the iron melts and runs into a holder at the bottom of the producer, from which it flows into the Siemens-Martin furnace.—A. G. L.

Metalliferous substances; Nodulising and treating ——. T. C. King. Fr. Pat. 365,432, April 20, 1906. Under Int. Conv., May 4, 1905.

The object of the invention is to form the metalliferous substances into nodules, containing the metals in the form of oxides, without using any binding agent which shall either leave objectionable impurities in the nodules or sensibly diminish their content in metal. To this end, the finely-divided materials are either mixed with water only, or else with a binding agent, *e.g.*, tar, hydrocarbons, or carbohydrates, which is volatile at a moderate temperature. The mixture is then heated at about 650° C., and agitated so as to form itself into nodules of the required size. This treatment also removes any sulphur, arsenic, &c., present in the materials, and the resulting nodules are very porous. (*Cf.* U.S. Pat. 794,673, this J., 1905, 894; and Fr. Pat. 366,413, this J., 1905, 1311.)—A. G. L.

Minerals; Process for the treatment of ——. J. Savelsberg. First Addition, dated April 21, 1906, to Fr. Pat. 351,535, Feb. 15, 1905 (this J., 1905, 894).

The invention claimed in the principal patent is now applied to minerals containing sufficient sulphur without further admixture, and to minerals whose treatment does not require the addition of sulphur, *e.g.*, iron ores. Such minerals are simply mixed with carbon, and treated with the air-blast in a converter until they have become sintered together, and can be treated as usual in a blast furnace. The invention is, of course, especially applicable to such minerals as occur in a finely-divided condition.—A. G. L.

Magnetic material and process of making same. R. A. Hadfield. Fr. Pat. 365,615, May 4, 1906. Under Int. Conv., June 8, 1905.

See Eng. Pat. 22,130 of 1905; this J., 1906, 592.—T. F. B.

Alloy for bearings; Metallic ——. Siemens und Halske A.-G. Fr. Pat. 366,060, May 10, 1906. Under Int. Conv., May 22, 1905.

See Eng. Pat. 10,513 of 1906; this J., 1906, 816.—T. F. B.

German Patents.

Zinciferous ores and metallurgical products; Process for the treatment of ——. Zinkgewinnungs-Ges. m. b. H. Ger. Pat. 165,455, March 24, 1905.

The zinciferous material, after being roasted if necessary, is treated with sulphuric acid, and from the solution the zinc is precipitated as hydroxide by means of sodium hydroxide. The residual solution is causticised with lime for the regeneration of sodium hydroxide. If the original material contains a sufficient quantity of lime, it is used in place of fresh lime for causticising the residual solution. In the case of ores containing dolomite, the solution obtained by treatment with sulphuric acid is divided into two portions in such a manner that the quantity of magnesium contained in one part is equivalent to the amount of zinc contained in the other. The first portion is treated with sodium hydroxide, and the precipitate of zinc and magnesium hydroxides is used to precipitate the zinc from the second portion.—A. S.

Zinciferous ores and metallurgical products; Process for the treatment of ——. Zinkgewinnungs-Ges. m. b. H. Ger. Pat. 169,138, May 24, 1905. Addition to Ger. Pat. 165,455, March 24, 1905 (see preceding abstract).

The solution of zinc and magnesium sulphates obtained by treating the material with sulphuric acid is divided into two portions. From the first portion, zinc and magnesium hydroxides are precipitated by quicklime, and the zinc is dissolved out of the precipitate by treatment with a solution of sodium hydroxide and sodium sulphate. The solution is used for leaching a fresh quantity of ore with sulphuric acid diluted with sodium sulphate solution, whereby the sodium zincate is converted into sodium sulphate, and the whole of the zinc and the magnesium are precipitated as hydroxides. The precipitate is used for treating the second portion of the solution first obtained, the magnesium hydroxide precipitating the zinc as hydroxide.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 937.)

(*A.*)—ELECTRO-CHEMISTRY.

Ferromanganese anodes in solutions of caustic potash. G. R. White. J. of Physical Chem., 1906, 10, 502—513. Chem. Centr., 1906, 2, 999.

In the anodic electrolysis of ferromanganese in alkaline solutions, there is formed sometimes permanganate and sometimes manganate. It has been found that the

formation of manganate is due to the presence of reducing impurities. If these latter be absent, permanganate only is formed both in 2 per cent. and 10 per cent. caustic potash solutions; reduction to manganate then takes place only on increasing the temperature to 95° C. The reduction is effected by the action of hydrogen liberated at the cathode; a spontaneous evolution of oxygen was never observed. On electrolysing at 95° C. alkali ferrate is produced as well as manganate, and iron is deposited at the cathode. Anodes of metallic manganese are readily oxidised to permanganate. Manganous hydroxide, $Mn(OH)_2$, formed by the action of caustic potash on manganese, can be oxidised electrolytically to manganese dioxide, but not to permanganate. The anodic formation of permanganate must therefore proceed directly, without the intermediate production of compounds of a lower degree of oxidation. A. S.

Copper; Electrolytic determination of ——. F. Foerster. XXIII., page 1007.

Lead; Electrolytic separation of — — from acetic acid solutions. R. C. Snowden. XXIII., page 1007.

English Patents.

Accumulators; Electric ——. H. N. Warren, G. Busschots, and J. M. Wood, Liverpool. Eng. Pat. 17,674, Sept. 1, 1905.

This invention relates to an improvement in the manufacture of accumulators, which consists in incorporating in the mixture used for covering the plates, or in the electrolyte, one or more compounds of selenium, such as the selenates or selenites of ammonium, potassium, or sodium, or selenious acid, for the purpose of preventing the "sulphating" of the plates or elements.—B. N.

Active material; Use of a special —— for manufacturing accumulators. C. Jeantaud, Paris. Eng. Pat. 52, Jan. 1, 1906. Under Int. Conv., Jan. 5, 1905.

This invention relates to the use of a novel form of lead, its oxides, or salts, unalloyed or mixed with ordinary lead or its compounds, in the manufacture of electric accumulators. The lead is obtained by the electrolysis of a mixture of a solution of an alkali plumbate with an alkali plumbite, the density of the solution being 15° B. With a current density of not less than 2 ampères per sq. dm. of cathode surface, the novel form of lead is deposited on the cathode as dullish-grey crystals, having a smaller electro-chemical equivalent than that of other substances now used. This form of lead is said to give an E.M.F. about 5 per cent. higher than ordinary lead, and to have nearly double the capacity of the ordinary metal.—B. N.

Insulating material; Manufacture of [electrical] ——, and the coating of metal and other surfaces therewith. J. Connolly, Manchester. Eng. Pat. 3345, Feb. 10, 1906.

Soft stearine pitch is applied in a melted or dissolved condition to the surface to be coated, and is then heated to a temperature exceeding 200° C., but not above 300° C. An arrangement is described for passing wires or the like through the stearine pitch, the coated material being then passed upwards between heated surfaces, which converge above towards the wire. The covered material is thus gradually raised in temperature, and the pitch assumes lacquer-like properties, becoming tough and incapable of being melted or dissolved.—B. N.

Furnaces; Electrical ——. B. Platschiek, Paris. Eng. Pat. 23,526, Nov. 15, 1905.

See U.S. Pat. 826,962 of 1906; this J., 1906, 936.—T. F. B.

Persulphates; Process for electrolytically producing ——. E. Teichner and P. Askenasy, Nuremberg, Bavaria. Eng. Pat. 2823, Feb. 5, 1906.

See Fr. Pat. 351,613 of 1905; this J., 1905, 896.—T. F. B.

Ozone; [Electrical] Production of ——. E. Applegarth and J. R. Quain, London. Eng. Pat. 3905, Feb. 16, 1906.

The ozoniser comprises an inner glass tube containing an electrode in a vacuum; surrounding this is a double outer glass tube, the ends of the two outer tubes being sealed together so as to form an annular space between them, which is made vacuous, and in which the second electrode is placed. The gas to be ozonised is circulated, by means of a fan, between the outer surface of the inner tube and the inner surface of the double tube. The electrodes are suitably connected to a transformer and generator, the latter also driving the fan.—B. N.

Electrolytic apparatus. F. McDonald, Johnsonburg, Pa., U.S.A. Eng. Pat. 4716, Feb. 26, 1906.

See U.S. Pat. 814,864 of 1906; this J., 1906, 380.—T.F.B.

French Patents.

Filaments for incandescence lamps. A. Just and F. Hanaman. Third and Fourth Additions, dated Feb. 14 and 19, 1906, to Fr. Pat. 347,661, Nov. 4, 1904. II., page 976.

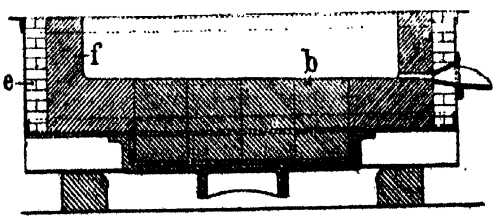
Electrolysis without porous diaphragm; Process and apparatus for ——. G. Rambaldini. Fr. Pat. 364,826, April 2, 1906. Under Int. Conv., April 3, 1905.

In order to maintain a uniform *régime* in the electrolysis, without diaphragms, of a solution giving one soluble product and one product which is gaseous or solid, it is necessary to adopt special measures for the regeneration of the electrolyte. The present invention consists in adding, in the form of a solution, only a portion of fresh electrolyte, equivalent to that decomposed in contact with the electrode at which a soluble product results; the other portion of the fresh electrolyte, equivalent to that decomposed at the electrode at which the insoluble or gaseous product is formed, being added as anhydrous salt. The regeneration of the electrolyte can be carried out in an auxiliary vessel or vessels through which the electrolyte or its two fractions are caused to circulate. In the apparatus which is employed for carrying out the process, the electrodes are disposed horizontally in superposed layers of the electrolyte, which are separated solely by their difference in density. The removal of one or both fractions of the electrolyte is carried out by causing a circulation of the two superposed layers. Any gaseous products formed at the electrodes are withdrawn by covering the electrodes with bells, or by using a closed cell.—R. S. H.

Electrolysis of liquids; Apparatus for ——. L. Londei. Fr. Pat. 364,978, April 6, 1906. Under Int. Conv., Sept. 29, 1905.

The two electrodes are separated by a diaphragm of metal or other good electrical conductor, which consists of a number of ribs or channels of Y-shape so disposed that the upper rib forms a sealed joint with the rib immediately beneath it. The diaphragm is insulated from the electrodes.—R. S. H.

Electrolytic vat [for fused salts]. A. Lambert. Fr. Pat. 365,423, April 19, 1906.



The vat is specially intended for the electrolyses of fused salts, and differs from the ordinary carbon-lined iron vessels in the following particulars: Blocks, *b*, of well-conducting carbon form a part of the base of the vat, these

blocks being in good contact with the terminals of the current and with the electrolyte, the object being to ensure good electrical conductivity, and consequently diminished loss of energy. The sides of the vat are lined with stamped carbon, *f*, and are provided with exterior protecting walls, *e*, to increase the thermal insulation.
—R. S. H.

Superheating compound. H. L. Hartenstein. Fr. Pat. 365,799, May 1, 1906.

See U.S. Pat. 819,218 of 1906; this J., 1906, 544.—T.F.B.

Melting furnace; Electric ——. H. L. Hartenstein. Fr. Pat. 365,805, May 1, 1906.

See U.S. Pat. 819,224 of 1906; this J., 1906, 544.—T.F.B.

Furnace; Electric resistance ——. J. F. Bottomley and A. Paget. Fr. Pat. 365,839, May 2, 1906. Under Int. Conv., May 5, 1905.

See Eng. Pat. 9522 of 1905; this J., 1906, 222.—T.F.B.

(*B.*)—ELECTRO-METALLURGY.

Iron; Electrolytic deposition of —— from aqueous solutions of ferrous chloride and sulphate. A. Ryss and A. Bogomolny. Z. Elektrochem. 1906, **12**, 697—703.

The authors have sought the most favourable conditions for obtaining thick deposits of iron by electrolysis. Pure solutions of ferrous ammonium sulphate behave best when the solution contains 70 grms. of crystallised salt per litre of water; increase of temperature above that of the atmosphere is deleterious, and the current density at the cathode should not exceed 0·5 ampère per sq. dm. With ferrous chloride a solution containing 1 kilo. of the salt per litre of water, a temperature of 60° to 70° C., and a maximum current density of 0·4 ampère gives the most favourable results. The electrolyte is always somewhat dirty from the formation of ferric hydroxide, which is also harmful to the metal deposition. Additions of a mixture of sodium bicarbonate and magnesium sulphate to the above electrolytes give improved results. The authors specify the following as the most suitable conditions: A current density of 0·3 ampère per sq. dm., an electrolyte containing 200 grms. of pure ferrous chloride or 200 grms. of crystallised ferrous ammonium sulphate per litre of water; in each case with an addition of 50 grms. of magnesium sulphate and 5 grms. of sodium bicarbonate.—R. S. H.

Iron silicides; Formation of —— in the electric furnace. B. L. Vanzetti. Gaz. chim. ital., 1906, **36** [1], 498—513.

In the interior of the silicious mass obtained from an electric furnace in which coke, sand, and lime were heated together at a temperature of about 3000° C., the author found metallic buttons having the sp. gr. 5·76—6·20, a hardness of about 7 on Mohs' scale, and the composition, FeSi. The chemical characters of the substance point to its being a chemical individual, as also does the absence of magnetic properties. The 3 per cent. of iron in the state of ferric oxide in the coke, doubtless combines first with carbon, the latter being subsequently displaced by silicon formed by reduction of the silica present.

Similar experiments at a temperature higher than 3000° yielded masses varying in appearance and sp. gr. (3·96—5·54), and more readily acted on by reagents than the compound FeSi. One of the buttons thus obtained had a sp. gr. approximately equal to that of the compound, $FeSi_2$, but its composition did not correspond with this formula.

If there be present, besides iron, another element which has an affinity for silicon, the latter combines with the two metals in proportions governed by the reacting masses and by their affinities. In one case, for instance, when a little copper found its way into the furnace, the metallic globules formed had the greyish-yellow, crystalline appearance characteristic of copper silicide, the crystals of which were found, by microscopic examination, to be mixed with other crystalline forms. These globules reacted in the cold with dilute nitric acid (1:1), with evolution of dense, red fumes and deposition of gelatino silica. The copper was present in amount greater th that corresponding with the formula, Cu_2Si.—T. H. P

Palladium; Electrical resistance of ——. F. Fisch Ann. der Physik, 1906, **20**, 503—526. Science Abstrac 1906, **9A**, 481.

When hydrogen is occluded by a palladium wire, t electrical resistance of the latter rises abruptly at first after as much hydrogen has been absorbed as would thirty times the volume of the wire at atmospheric pressu the increase of resistance becomes proportional to t amount of hydrogen occluded, until 950 volumes have be absorbed, after which the rate of increase is retarded. a state of saturation, palladium contains about 1000 vol of occluded hydrogen; an increase in the quantity hydrogen above this limit produces no further increase resistance. The maximum increase of resistance 60 per cent. The resistance is proportional to the formul $a+bH$, where H is the number of volumes of hydrog absorbed, a is 1·0292, and b is 668×10^{-6}. When a pall dium wire absorbs hydrogen, it expands to the extent 2539×10^{-8} cm. per cm. and per vol. absorbed, until t saturation point is reached, after which the expansion relatively greater. When the occluded hydrogen expelled, the wire becomes shorter than it was originall but the original resistance is recovered exactly.—A. S.

English Patents.

Electrodeposition of metals. I. E. Lewis, Stoke Newingto and J. A. Corey, Twickenham. Eng. Pat. 17,72 Sept. 1, 1905.

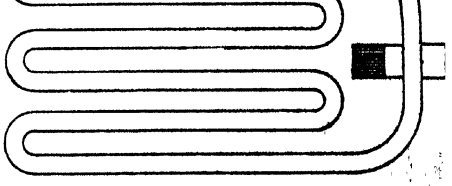
See U.S. Pat. 786,978 of 1905; this J., 1905, 504.—T. F.

Furnaces; Electric transformer ——. O. Frick, Stoc holm. Eng. Pat. 25,771, Dec. 11, 1905.

See Fr. Pat. 355,456 of 1905; this J., 1905, 1179.—T. F.

Furnaces; Electric ——. G. Gin, Paris. Eng. Pa 1019, Jan. 15, 1906.

Instead of an annular, circular, or square chann previously used as the crucible and secondary in inducti



electric furnaces, a folded channel (see Fig.) is employ This increases the ohmic resistance in greater propor than the self-induction or the mutual induction.—B. N

French Patents.

Electric furnace for the transformation of cast iron i steel. G. H. Gin. Second Addition, dated Jan. 1906 (under Int. Conv., Dec. 18, 1905), to Fr. P 342,101, March 30, 1904.

In the channel type of furnace (Fr. Pat. 342,101; this 1904, 904 and 1225), an electric current is induced in t charge of metal instead of being led in and out by mea of terminals. The induction system adopted in t present addition comprises simple or multiple iron co disposed around a portion of the annular channels in t hearth of the furnace; on that arm of the iron core wh is exterior to the furnace the primary coils are wou A special disposition is described in which the curre induced in three parallel channels, connected at th

extremities, flow in such directions that the central channel is traversed by an electric current of double the intensity of that in the two outer channels. In this case two iron cores with a common exterior arm are provided; upon the exterior arm the two primary coils are wound so that the current in them flows in opposite directions. —R. S. H.

plants examined in his previous research, the author concludes that there is no connection between the nature of an oil and the presence of a lipolytic enzyme. The following results were obtained with the oils from *Linaria reticulata* (37·5 per cent. of oil) and celandine (*Chelidonium majus*) (46·6 per cent. of oil), the seeds of both of which were lipolytically active:—

Oil from	Oil.				Fatty acids.				
	Sp. gr.	Saponification value.	Iodine value.	Free fatty acids.	sp. gr. at 19° C. / 19°	Iodine value.	Solidification point.	Melting point.	Acetyl value (Lewkowitsch).
				per cent.			° C.	° C.	
Linaria reticulata	0·9217 at 20°/18° C.	188·6	140·0	—	0·903	148·5	8·5—18	14—22	12·3
Chelidonium majus	0·9170 at 19°/18° C.	198·2	—	50·4	0·902	127·5	4—6	7—16	12·6

Furnaces; Electric —. F. T. Snyder. Fr. Pat. 366,362, May 17, 1906.

See U.S. Pat. 825,359 of 1906; this J., 1906, 817.—T. F. B.

Electrolytic deposits; Methods adopted for obtaining — *on recessed moulds.* E. Friedheim. Fr. Pat. 364,737, March 30, 1906.

The small auxiliary anodes which penetrate into the recesses are enclosed in an insulating covering provided with perforations, with the object of preventing the formation of short circuits between the anodes and the cathode.—R. S. H.

Metallic deposits; Process for producing electrolytic —. L. Trunkhahn. Fr. Pat. 366,270, May 16, 1906.

See Eng. Pat. 11,498 of 1906; this J., 1906, 817.—T. F. B.

Sodium chloride; Process of electrolysing —. E. Castel. Fr. Pat. 364,847, April 2, 1906.

The chlorine and hydrogen generated in the electrolysis of sodium chloride are led separately to the two electrodes of a gas cell in which they serve to generate an electric current. The current is applied to reduce the expenditure of energy incurred in the electrolysis of the sodium chloride. The hydrochloric acid formed in the gas cell is utilised for extracting roasted copper matte, and the cuprous chloride thus obtained, with addition of sodium chloride, is subsequently electrolysed for the winning of the copper.—R. S. H.

German Patents.

Metallic deposits; Process for the preparation of electrolytic —, *especially on wire, by the use of a tubular anode.* A. Grünbaum. Ger. Pat. 165,875, June 26, 1904.

The wire to be plated is suspended within the tubular anode in the loops of hook-shaped supports connected to the negative pole of the battery, whereby, it is claimed, short circuits are avoided, and the resistance of the wire is diminished.—A. S.

Aluminium articles; Process for the electrolytic coating of — *with tin.* Basse und Fischer, G.m.b.H. Ger. Pat. 169,310, Oct. 6, 1904.

The aluminium articles are first electrolytically coated with nickel, and afterwards with tin.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 938.)

Fats; Enzymic hydrolysis of —. S. Fokin. Chem. Rev. Fett- u. Harz-Ind., 1906, **13**, 130—133; 163—166; 192—194; 219—221; 238—240. (This J., 1904, 259, 614, 1152.

From an analysis of the oils of the seeds of two of th

All the plants yet known to contain lipase are poisonous; yet not all the seeds of plants containing alkaloids are able to hydrolyse fats, notable exceptions being *Heliotropum europeum, Cynoglossum officinalis, Digitalis purpurea, Buxus sempervirens,* and *Abrus precatorius.* The hydrolysis apparently effected by the two last is to be attributed to the presence of bacteria and mould-fungi. All starch-containing seeds are believed to produce diastase on germinating, and analogy would suggest the production of lipase in oil-containing seeds; but this was not borne out by the results of experiments with the seeds of *Linaria bipartita,* or with linseed, poppy, or mustard seeds. As regards the effect of germination of seeds which undoubtedly produce the enzyme, the author confirms the conclusion of Hoyer (this J., 1904, 550) that it has no influence upon the enzymic activity of castor seeds. On the other hand, certain small seeds have their lipolytic power doubled or trebled by the process of germination. The stimulating effect was greatest with the smallest seeds (*Linaria marrocana*), and became less with the increase in size to *L. purpurea,* then to celandine seed, and finally to castor seed.

Celandine seed (Chelidonium majus).—The characteristic property of the seeds of this plant is that no addition of soluble acids is necessary, the acids in the seeds themselves being sufficient for the hydrolysis. Acids of any considerable degree of concentration (*e.g.*, $\frac{1}{4}$ normal) destroy the enzyme, as is also the case with castor seeds; but variations of 25 to 100 per cent. (on the weight of the oil) of acids of a concentration of $\frac{1}{25}$ to $\frac{1}{100}$ normal have only a slight influence upon the yield of free fatty acids, whereas in the case of castor seeds the influence of this factor is very great. The optimum for the proportion of water is also very different from that required by castor seeds. With the latter the maximum of hydrolysis to be reached with a proportion of 1 to 0·5 per cent. of seeds is 60 to 66 per cent. Only in one experiment in which the glycerol water was removed was a yield of 82·5 per cent. obtained. On the other hand, celandine seeds, used even in the proportion of 0·5 to 0·3 per cent., gave as much as 90 per cent. of free fatty acids, without this precaution being taken. The difference between the lipase in celandine seeds (and in those of *Linaria* plants) and the lipase in castor seeds is also shown by the following facts:—(1) Connstein, Hoyer, and Wartenberg (this J., 1902, 1541) hydrolysed butter fat by means of castor seeds to the extent of 67 per cent. of the theoretical amount; with celandine seeds 95·7 per cent. was easily obtained. (2) Cocoanut oil was hydrolysed to the extent of 91·6 per cent. by means of castor seeds, and the unattacked portion isolated and treated with celandine seeds (20 per cent.), which decomposed it to the extent of 92·6 per cent. Separate experiments showed that these seeds hydrolysed laurin to the extent of 91 per cent., and caprylin to the extent of 78·4 per cent. (3) The glyceride of sebacic acid was hydrolysed (73·7 per cent.) by celandine seeds, but not acted on at all by castor seeds. (4) Glycol esters of cotton-seed oil fatty acids were hydrolysed (86·3 per cent.) by celandine seeds, but not attacked by castor seeds. These results disprove the conclusion of Connstein,

Hoyer, and Wartenberg (*loc. cit.*) that lipase cannot hydrolyse the glycerides of lower fatty acids. The completeness of the reaction depends upon the action of the liberated fatty acids upon the enzyme and upon their solubility in water. It is noteworthy that the esters of polyvalent alcohols (glycol, mannitol, &c.) with fatty acids can be hydrolysed by the celandine enzyme, whereas the monovalent alcohols usually act as a poison upon it, this effect increasing with their solubility in water. The nature of the acid has a great influence, and glycerides of aromatic acids (*e.g.*, benzoic acid) are quite unacted upon by the enzyme. The seeds of the celandine contain from 400 to 500 times more lipase than is required to hydrolyse the whole of the oil they contain. One part of the seed is able to hydrolyse more than 180 parts of oil, and one part of the seed flour (completely freed from fat, but containing the husks) more than 300 parts of oil.

Castor seeds.—It was found that the reaction took place much more rapidly in working with large quantities. Thus 20 kilos. of oil were hydrolysed in 7½ days, whilst 30 grms. required 27 days. In working with solid fats the process is promoted by the gradual addition of a certain amount of petroleum spirit or other naphtha distillate. Thus ox-tallow treated with 10 per cent. of castor seeds yielded after this addition 94·4 per cent. of free fatty acids in a day; whilst lard with 8·3 per cent. of seeds gave 90·5 per cent. of fatty acids. Experiments on the use of different soluble acids showed that:—(1) A concentration above $\frac{1}{10}$ *N* checks the reaction or considerably weakens the enzyme. (2) Oxalic, caprylic, and caproic acids lead to a very slight hydrolysis. On the other hand, the two last promote the reaction if they are dissolved beforehand in the oil (to the extent of 7 per cent.). (3) Amino-acids, asparagin, &c., do not promote hydrolysis. (4) Hydrocyanic, phosphoric, and nitric acids destroy the enzyme, but hydrofluoric acid is not poisonous. (5) In the case of such weak solutions as $\frac{1}{10}$ to $\frac{1}{100}$ *N*, complete dissociation of the acid must be assumed, though Hoyer holds a contrary view. One part of castor seeds freed from husks can hydrolyse 125 parts of fat, and one part of the seed meal (freed from oil) 375 parts. If a suitable fat, *e.g.*, olive oil, be used for the hydrolysis, the liberated fatty acids form a thick emulsion with water, and it is then hardly necessary to use mechanical means to promote the action of the enzyme. The products of the reaction need a thorough purification from impurities. The fatty acids can be freed from the seed-pulp without much difficulty by mechanical means, but the purification of the glycerol is much more difficult. A certain proportion of impurities from the seeds can be precipitated by means of lime or baryta water, or by basic lead acetate or tannin solution, but no satisfactory method has yet been devised for the separation of the remainder. The ordinary precipitants for proteids and alkaloids give no precipitate with the crude glycerin.

From several experimental determinations, the author concludes that the reaction with lipase is not reversible. One experiment on a large scale, in which 1 per cent. of castor seeds was used with 20 kilos. of oil, showed that the reaction was greatly accelerated by removing the glycerol water and replacing it by fresh acidified water. The liberated fatty acids have also an influence on the process, which is promoted by their removal. By repeated treatment the yield from different oils and fats in the author's experiments was, on the average, as high as 99 per cent. In certain cases there was a decrease in the proportion of free fatty acids, but this was attributed to combination of these acids with certain basic decomposition products of the proteids of the seeds. Wilhelmy's general formula for catalytic reactions—

$$\frac{1}{t} \mathrm{Lg} \frac{A}{A-x} = K$$

also holds good for the action of lipase, provided that the amounts of the substances used in the experiments are large enough to check the influence of external conditions upon the reaction. (See also this J., 1903, 639, 873, 1094, 1137.)—C. A. M.

Fats from refuse material. A. Lb. Chem.-Zeit., 1906, 30, 935—936.

Fats from leather refuse.—The cuttings or shavings of leather from tanneries and boot factories often contain considerable amounts of fat, introduced during the manufacturing processes, and capable of being recovered by extraction with petroleum spirit, leaving a nitrogenous residue suitable for working up into manure. There is considerable variation in the proportion of fat in different kinds of leather. Thus sole leather is practically free from fat, whilst upper-leather contains from 8 to 28 per cent., the amount in horse-skin being less than that in calf-skin "Whitening" shavings contain up to 35 or 40 per cent. of fat, which is lighter in colour, richer in stearine, and has less unsaponifiable matter than the fat from upper-leather. Thus the following results were obtained with different samples:—

	Saponification value.	Unsaponifiable matter.	Solidification point of fatty acids.
		per cent.	° C.
Fat from—			
"Whitening" shavings	185—188	up to 5	35—36
Upper-leather ,, .	139—140	,, 30	29—30

Since the extraction of the fat from the fine whitening shavings by themselves is very difficult, whilst the upper-leather yields an inferior fat, it is customary to mix the cuttings. Hence different "leather-extraction fats," as the author terms these products, to distinguish them from *dégras*, have similar properties, notwithstanding their various origin. They are dark brown or black, have a characteristic tan-like odour, and are solid at the ordinary temperature. They invariably contain a large proportion of unsaponifiable matter, and a considerable amount of free fatty acids. Filtered samples gave the following results:—Acid value, 85·7 and 73·7; saponification value (nine samples), 165 to 177·4; glycerol, 4·61 and 5·3 per cent.; unsaponifiable matter (seven), 11·1 to 15·0; and iodine value (one), 62·3. These fats yield dark-coloured soaps, the value of which is further reduced by the large amount of unsaponifiable matter. They form emulsions with water, and to separate the fat again it is necessary to treat the mixture for several hours with sulphuric acid and common salt at 96° C., and then to allow it to stand for 12 hours. The water can also be removed, all but about 3 or 4 per cent., by means of centrifugal force. A sample, of a light-yellow colour, contained 24 per cent. of water, 0·15 per cent. of ash, 11·40 per cent. of unsaponifiable matter, and 64·45 per cent. of saponifiable fat. The dark colour of leather-extraction fats is scarcely improved by even long-continued bleaching, and hence they are usually added to other fats (preferably bone-fat containing 97 to 98 per cent. of fat), in the proportion of 10 to 15 per cent. The addition is easily detected by the odour, but is not always clearly indicated by analysis, though the proportion of unsaponifiable matter is raised.

Distillation of the fatty acids of leather-extraction fat gives light yellow products suitable for the stearin and soap industries. They contain more stearin than the original fats, whilst the amount of unsaponifiable matter remains unaltered. A commercial sample had a saponification value of 144 and solidification point of 34° C., and contained 28 per cent. of unsaponifiable matter. A second sample contained 13·5 per cent. of unsaponifiable matter.

Fats from wool refuse.—The waste fragments from the spinning and weaving of wool contain a large amount of the fat used in lubricating the wool. The amount ranged from 12 to 27 per cent. in the author's samples. "Wool-extraction fats" vary widely in composition. They are black, fluid or semi-solid, contain a large proportion of unsaponifiable matter, and have a characteristic odour. The author obtained saponification values of 100 to 168, and from 14 to 45 per cent. of unsaponifiable matter. A typical sample gave the following results:—Acid value, 76; saponification value, 110; iodine value, 49; unsaponifiable matter (mineral oil), 43 per cent.; neutralisation value of fatty acids, 193; and iodine value of fatty acids, 88. The fat was therefore judged to consist of 40 per cent. of free fatty acids (claim), 17 per cent. of neutral fat, and 43 per cent. of mineral oil. Such

products can, at best, only be used for oiling wool again, or in the manufacture of inferior articles.

"*Wool-fat press-cake*"—These press-cakes contain from 16 to 22 per cent. of wool-fat, and 2 to 3 per cent. of nitrogen. The extracted fat can be utilised in the same way as ordinary wool-fat.—C. A. M.

Sesamé oil; Colour reactions of ——. P. Soltsien. Chem. Rev. Fett- u. Harz- Ind., 1906, **13**, 138.

Additional evidence in support of the conclusion that the furfural and tin reactions are not due to one and the same substance in sesamé oil is furnished by the author's experiments. Although the two substances can be separated from the oil by treatment with 90 per cent. alcohol, yet a thorough extraction with hydrochloric acid (sp. gr. 1·125) removes the substance that reacts with furfural, whilst the residual oil still gives an intense tin reaction. The latter reaction is also quite independent of Bishop's reaction, so that even when a sesamé oil no longer gives the furfural or Bishop's reaction, there is still a possibility of identifying it by means of the tin reaction. (This J., 1903, 1017.)—C. A. M.

Beef fat; Detection of —— in lard. P. Soltsien. XVIII*A*., page 1000.

Turkey-red oils; Analysis of ——. W. Herbig. XXIII., page 1009.

Soap in India. Bd. of Trade J., Oct. 4, 1906. [T.R.]

In the Review of the Foreign Trade of India in 1905–06, the steady growth in the imports of soap is noted. There are indications that there is an increasing appreciation of the merits of soap among the natives of India, and it is said that the trade is one with great possibilities.

English Patent.

Fatty substances; Process for the preparation of easily and durably emulsifiable ——. R. Wallbaum, Charlottenburg, Germany. Eng. Pat. 4116, Feb. 19, 1906.

See Ger. Pat. 167,847 of 1904; this J., 1906, 767.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 941.)

(*A*.)—PIGMENTS, PAINTS.

Coal-tar dyestuff lakes; Fastness to light of different ——. E. Valenta. V., page 980.

English Patent.

Lithopone; Obtaining —— from complex ores and other substances. L. Brunet, Brioude, France. Eng. Pat. 4199, Feb. 20, 1906.

See Fr. Pat. 360,518 of 1905; this J., 1906, 486.—T. F. B.

French Patents.

Lakes derived from monoazo dyestuffs; New series of ——, and process for their manufacture. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,647, July 26, 1905.

See Eng. Pat. 15,170 of 1905; this J., 1906, 325.—T. F. B.

Dyestuff suitable for preparing lakes; Process for making an azo ——. Meister, Lucius, und Brüning. Fr. Pat. 366,110, May 11, 1906. IV., page 979.

(*B*.)—RESINS, VARNISHES.

Varnishes; Theory of ——. A. Tixier. Monit. Scient., 1906, **20**, 726—730. (See also this J., 1904, 670.)

It is impossible to assign (as Coffignier does) a fixed melting point to a gum-resin; the melting point is greatly influenced by the mode of heating and even by the shape of the containing vessel; and although it has been maintained by Violette and others that a copal is not rendered soluble by heating until it has undergone a loss of 25 per cent. of its weight, the author has shown that by fusing in such a manner as to retain part of the volatile products, the loss need not exceed 10 per cent. The method for estimating the oil in a varnish (Coffignier) is open to serious objections. A layer of the varnish is allowed to dry on a glass plate, the film is extracted with amyl alcohol, and the insoluble residue is assumed to be linoxyn, the numbers obtained being made to agree with the known weight of oil by assuming a constant absorption of 6 per cent. of oxygen. The author's experiments show that linseed oil may absorb from 5 to 18 per cent. of oxygen whilst drying, so that no constant can be assumed; also that, contrary to the statement of Coffignier, the product obtained as above does not exhibit the properties of linoxyn.—M. J. S.

English Patent.

Turpentine; Treating —— to render it uninflammable. G. H. Harrison, Stourbridge. Eng. Pat. 21,954, Oct. 28, 1905.

The treatment consists in mixing turpentine with about 20 per cent. of carbon tetrachloride.—A. S.

French Patent.

Turpentine substitute; Preparation of a ——. A. Pollet. First Addition, dated April 12, 1906, to Fr. Pat. 354,425, May 20, 1905 (this J., 1905, 1118).

The turpentine substitute prepared according to the process described in the main patent, by mixing turpentine with rectified petroleum, is mixed with sufficient carbon tetrachloride to bring the specific gravity of the product up to 0·860. It is stated that the carbon tetrachloride destroys the characteristic odour and bluish tint of the petroleum.—A. S.

(*C*.)—INDIA-RUBBER, &c.

India-rubber; Influence of the resin-content on the combined sulphur in ——. R. Ditmar and A. Wagner. Gummi-Zeit., 1906, **20**, 1280—1282. (See this J., 1906, 769.)

In connection with the experiments of R. Ditmar on the vulcanisation of rubber with approximately constant proportions of sulphur and rising proportions of resin, the authors have determined the free and combined sulphur in the specimens in question. The free sulphur is found to increase from 1·6 per cent. to 2·4 per cent. as the resin increases from 5 to 23 per cent. This increase, together with the fact that the resin extracted by acetone was decidedly less than that originally added, is taken to prove that india-rubber resin is itself capable of vulcanisation with formation of products insoluble in acetone.—W. A. C.

French Patents.

Antimony compounds for use as pigments, &c.; Process for the preparation of ——. E. Chatillon. First Addition, dated April 19, 1906, to Fr. Pat. 353,565, April 20, 1905 (this J., 1905, 1023).

By adding suitable proportions of sulphur-containing substances to the charge of antimony ore, and adjusting the amount of alkaline-earth compounds added to the product, the process described in the main patent is modified so as to obtain antimony pigments mixed with free sulphur and lime or baryta, for use in the vulcanisation of rubber.—A. S.

Benzene and other volatile products evolved in certain industrial operations [Waterproofing with rubber]; Process and apparatus for the recovery of ——. A. E. Vincent. Fr. Pat. 361,603, July 3, 1906.

The patent relates especially to a process and apparatus for recovering the vapours of benzene, toluene, &c., evolved in the drying of fabrics coated with rubber solution. The drying table is enclosed in a closed bell,

into which hot air from a superheater is forced. The hot air takes up the vapours of the volatile solvent, and carries them along through a heat interchanger to one or more condensers, where the benzene, &c., is deposited. The cold air is led back to the heat interchanger, where it serves to cool a further quantity of hot air laden with benzene vapour; it then passes through one or more superheaters, back to the closed bell. The circulation of the air is effected by means of a pump or fan.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 942.)

Tan liquors; New and accurate method for the determination of free acid in ——. A. W. Heppenstedt. XXIII., page 1009.

Fats from refuse material. A. Löb. XII., page 995.

ENGLISH PATENTS.

Hides and leather; Apparatus for treating ——. W. R. Smith, Buffalo, U.S.A. Eng. Pat. 18,500, Sept. 13, 1905. Under Int. Conv., Sept. 13, 1904.

SEE U.S. Pat. 795,942 of 1905; this J., 1905. 935.—T.F.B.

Extracts containing tannin; Decolorisation of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1850, Jan. 24, 1906.

SEE Fr. Pat. 362,780 of 1906; this J., 1906, 770.—T.F.B.

FRENCH PATENT.

Vegetable bodies; Process for the extraction of substances [*Dyestuffs, tanning matters, &c.*] *from* ——. J. Clarion. Fr. Pat. 361,656, Aug. 1, 1905. IV., page 979.

XV.—MANURES, &c.

(*Continued from page* 942.)

ENGLISH PATENTS.

Cyanogen compounds and by-products; Production of —— from humus. W. F. Cooper. Eng. Pat. 2047, Jan. 26, 1906. VII., page 984.

Phosphoric and silicic acid; Process for rendering mixed combinations of —— easily [*citrate-*] *soluble.* P. A. Newton, London. From Dr. Wolters Phosphat Ges. m. b. H., Schoenebeck on the Elbe, Germany. Eng. Pat. 9183, April 18, 1906.

RAW phosphates are melted with artificial alkali silicates and lime in a regenerative Siemens' furnace, and the molten product is run directly into cold water. Under such conditions, nearly all the phosphoric acid present is stated to be citrate-soluble. The alkali silicates used may be obtained by heating together raw phosphates with sand, lime, and alkali sulphates with addition of reducing agents. It is preferred to use the materials approximately in the following proportions:—Tricalcium phosphate, 40 per cent.; silica, 30 per cent.; lime, 14 per cent.; and soda, 16 per cent. (Reference is made to Eng. Pat. 21,175 of 1897. See also Fr. Pat. 335,509 of 1903; this J., 1904, 261.)—E. S.

FRENCH PATENTS.

Fertiliser; Dry —— from by-products or residues from sugar works. E. Lallemant. Fr. Pat. 365,448, April 20, 1906.

To obviate the difficulties and inconveniences attending the use of these by-products and residues in the damp state, the inventor proposes to dry, crush, and screen them. This may be effected by forming the damp mass into briquettes, which are left in the air to dry, or dried at a moderate temperature in a kiln, &c.; or by mixing the mass with a suitable proportion of quicklime or roasted gypsum, in lumps. The product may also be incorporated with other fertilising materials before use. —C. S.

Manure from peat; Process and apparatus for obtaining ——. C. H. J. van Haeften. Fr. Pat. 366,107, May 11, 1906. Under Int. Conv., May 12, 1905.

SEE Eng. Pat. 10,023 of 1905; this J., 1906, 327.—T.F.B.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 945.)

Beetroots; Progress in methods of extraction of juice from ——. H. Claassen. Sixth Internat. Congr. Appl. Chem., Rome, 1906; Z. Ver. deut. Zuckerind., 1906, 805—809.

To ensure a higher degree of purity of diffusion juice, either the dissolved non-sugar in the cell juice must be rendered insoluble and thus retained in the beet slices, or solution of solid non-sugar must be avoided. In order to render non-sugar insoluble (*i.e.*, to coagulate albuminoid matter), the beetroot slices are either heated in steam or hot air to about 75° C. before extraction, or they are brought to the same temperature immediately on contact with the juice. The author points out, however, that juice does not begin to diffuse through the cell walls of the beetroot until a temperature of 55° C. has been attained, and that in the ordinary diffusion process not more than 5—10 minutes is required on the average to raise the temperature from 55° to 75° C. During this period only a small quantity of sugar, and very little albumin, pass into solution. Moreover, it has not been proved that the process of first heating the slices to 75° C. gives dry fodder slices containing a greater proportion of the total albumin content of the beetroot than that contained in the slices obtained by the ordinary diffusion process. Hence the author considers it preferable to work in such a manner that the amount of solid non-sugar dissolved is reduced to a minimum. Of the solid, more or less soluble non-sugar, *e.g.*, pectin substances, organic calcium and potassium salts, the amount dissolved increases with the temperature and dilution of the extracting liquor and with the duration of the extraction. Hence the purest juice is obtained by Steffen's original steeping process (heating the ground beetroot with undiluted juice), but this method presents the disadvantage that the sugar is not thoroughly extracted from the root. Instead of the beetroot juice, the author recommends the use of the diffusion waste waters. (For details of this process see this J., 1906, 327.)—L. E.

Maltodextrin-γ, an intermediate product of the hydrolysis of starch by diastase. C. Rheinfels. XVII., page 998.

Sachs-Le Docte process for sugar analysis; Further remarks on the ——. A. Le Docte. XXIII., page 1010.

Sugar industry of Belgium. Chamb. of Comm. J., Oct., 1906. [T.R.]

THERE are in Belgium about 125 factories and a large number of refineries. The sugar industry is one of those for which the country itself can produce almost all the requisite raw materials. Only the factories on the frontiers import beetroots from Holland and France. This importation amounted to 317,173 tons in 1905, compared with 125,572 tons in 1904. Belgium consumes nearly 20 per cent. of the sugar produced. The exports amounted in 1905 to 94,225 tons of raw beet-sugar, compared with 130,031 tons in 1904, and 43,714 tons of refined sugar in 1905, against 54,922 tons exported during the preceding year. The production of the last sugar crop in Belgium is considered to be 25 per cent. better than that of the year 1904. This increased production results from the extension of the area under cultivation, and partly also

from an increased yield per hectare. The percentage of sugar in the roots was equal to that obtained in the previous year. However, last season ended with losses on the part of most of the factories, and the sugar makers propose to combine to lower the purchase price of beet-roots during next season.

ENGLISH PATENT.

Dextrine; Apparatus for moistening ——. W. H. Uhland, Ges. m.b.H., Leipzig-Gohlis, Germany. Eng. Pat. 14,535, July 23, 1906. Under Int. Conv., July 21, 1905.

SEE Fr. Pat. 363,623 of 1906; this J., 1906, 859.—T. F. B.

FRENCH PATENTS.

Fertiliser; Dry —— from by-products or residues from sugar works. E. Lallemant. Fr. Pat. 365,448, April 20, 1906. XV., page 997.

Starch which swells up in water and gelatinises; Method of preparing ——. J. Kantorowicz. Fr. Pat. 365,834, May 2, 1906.

THE starch is stirred into a concentrated solution of an alkali salt (for example, sodium sulphate), with which it does not gelatinise, and is then treated with a solution of caustic alkali and of the same alkali salt as already mentioned. At the end of ten minutes the saline solution is expelled by the aid of a press, and the starch is dried and pulverised. The alkali may be previously neutralised by an acid, or converted into an alkali salt by the addition of a salt of ammonium, magnesium, or calcium. A typical formula for the treatment is: starch, 1000 parts; caustic soda (35° B.), 40; concentrated solution of sodium sulphate, 100 parts.—C. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 947.)

Barleys; Determination of proportion of husks in exhibition ——. A. Cluss and J. Schmidt. Woch. f. Brau., 1906, **23**, 480—481.

IN connection with the valuation of the coarseness and fineness of the husks by expert judges at an exhibition of barley, the authors have determined the proportion of husks by two chemical methods, *viz.*: the sulphuric acid method, as used in Vienna, and Luff's method. The tests showed that Luff's method gave results corresponding in all respects with the opinions of the judges, but that the results of the sulphuric acid method differed to an extraordinary extent from the other valuations. The results of the Luff method were also in complete harmony with the determinations of "crude fibre," starch, and extract in the barley. The sulphuric acid process is therefore quite valueless, but, on the other hand, Luff's process is scarcely suitable for the valuation of large numbers of samples in a short time as in the case of exhibitions. The differences, also, between the results afforded by barleys of distinctly different degrees of fineness, are not sufficiently pronounced to form a basis for a convenient scale of valuation.—J. F. B.

Maltodextrin-γ, an intermediate product of the hydrolysis of starch by diastase. C. Rheinfels. Woch. f. Brau., 1906, **23**, 510—511.

MALTODEXTRIN-γ, was first obtained by Grüters from the products of hydrolysis of starch by oxalic acid (this J., 1904, 875). Its position in the series of starch degradation products lies intermediate between maltose and the maltodextrin-β of Ling and Baker (this J., 1897, 154), which is identical with the achroo-dextrin III. of Prior (this J., 1896, 915). The author has now shown that this maltodextrin-γ is also a product of diastatic hydrolysis, and he has isolated it from the mixture of conversion products obtained by the action of diastase on starch paste at a temperature of 70° C., saccharification being allowed to proceed until a red iodine reaction was no longer obtained. After an elaborate series of fractionations with mixtures of alcohol and water, a maltodextrin-γ fraction of about 12 grms. was obtained from 1 kilo. of starch. This maltodextrin-γ had the constants $[\alpha]_D$ = 167·7°, R = 60·1 per cent. of maltose. In other fractions not quite free from sugar, the quantity of maltose was roughly estimated by the osazone test, and the constants for the maltodextrin portion, corrected for maltose, worked out at $[\alpha]_D$ = 163°—167°, R = 58—62 per cent. of maltose. If instead of referring the constants to the total dry substance of the syrups, the calculations be based on the "dextrose equivalents," the above values for maltodextrin-γ become $[\alpha]_D$ = 170°—173°, R = 61—64 per cent., which are probably nearer the truth. The author's maltodextrin-γ was fermented by Frohberg yeast to the extent of 50 per cent., whereas the similar maltodextrin prepared by Grüters, by hydrolysis with oxalic acid, was only fermentable to the extent of 24 per cent.—J. F. B.

Alcoholic fermentation; The chemical mechanism of ——. III. E. Buchner and J. Meisenheimer. Ber., 1906, **39**, 3201—3218.

THE authors communicate further particulars on the fermentation of sugar effected by the expressed cell juice of bottom fermentation yeast. The question of the production of glycerol and succinic acid as by-products of cell-free fermentation was carefully studied by means of control determinations of the quantities of these bodies already present in the juice, the analytical methods being checked by the addition of known quantities. From the results the authors conclude that succinic acid is not formed in the course of the fermentation of sugar by yeast cell-juice, but that glycerol is produced in large quantities. In different experiments quantities of glycerol corresponding to 5·4—16·5 per cent. of the quantity of alcohol were found. The authors incline to the view that the glycerol is formed in some indirect manner from the sugar, especially since the quantity of sugar disappearing is always greater than the sum of the carbon dioxide and alcohol. This question of the credit and debit account of the sugar has been studied by the authors on similar lines to those previously followed by Harden and Young (this J., 1904, 450), with cell-juice from top fermentation yeast. These authors showed that a considerable proportion of the sugar which apparently disappears when determined according to its cupric-reducing power is really converted into a non-reducing polysaccharide, which can be redetermined as reducing sugar after hydrolysis by acid. This polysaccharide is apparently not glycogen, but is a product of the action of some reverting enzyme in the yeast juice. The results of the authors with juice from bottom fermentation yeast confirm those of Harden and Young. In making up the sugar accounts, the quantity of sugar originally present in the juice and the quantity remaining after fermentation were included. To these were added, on the one side, the quantity of sugar added to the juice, and, on the other side, the quantity of sugar corresponding to the alcohol and the carbon dioxide. The losses found when the residual sugars were determined by the direct reduction of Pavy's solution amounted to 24—42 per cent. of the total. But when the residual sugars were determined by Pavy's solution, after hydrolysis by acid, the losses only amounted to 2—11 per cent. of the total sugar. Hence the authors conclude that the presence of a reverting enzyme in the juice is established, the proportion of polysaccharide thereby produced being estimated at 6—19 per cent. Apart from this reversion, a portion of the sugar losses must be put down to the production of glycerol. An examination of the alcohol produced by the fermentation of sugar by yeast cell-juice yielded only minute traces (about 0·01 per cent.) of fusel oil.—J. F. B.

(Beer) Final attenuation; Determination of the —— within 24 hours. F. Schönfeld. Woch. f. Brau., 1906, **23**, 489—491.

THE ordinary methods of determining the final attenuation of worts take several days, the quickest method hitherto practised, namely, by using 2 per cent. of yeast, requiring 48 hours. This latter period can, however, be reduced to one-half by taking 10 per cent. of yeast, of good attenuating power, that has been well pressed. Flasks holding

400 c.c. are charged with 200 c.c. of wort and 10 per cent. of yeast, and are placed in a water-bath at a temperature of 25° C. This need not be exactly maintained, but 29°—30° C. will give results below the truth. The proportion of yeast given is found to be the most suitable, since it furnishes the same results in 24 hours as are obtained with 0·5 and 2 per cent. of yeast in a correspondingly longer time. On the other hand, 20 per cent. of yeast gives higher results, which are inaccurate owing to the formation of alcohol by the autofermentation of the yeast.—C. S.

Acetic acid fermentation. E. Buchner and R. Gaunt. Annalen, 1906, **349**, 140—184.

"ACETON-DAUER" preparations were made from acetifying bacteria obtained by skimming the films off various culture media infected with beer-vinegar bacteria. The nature of the medium and the conditions of cultivation appeared to have a considerable influence on the activity of the preparations obtained. Whereas those obtained from bacteria grown in beer dregs were almost devoid of formentative power, those prepared from bacteria cultivated in unhopped wort were fairly active. Cultivation of the bacteria at temperatures of 10°—22° C. had a favourable influence on the activity of the "dauer" preparations as compared with cultivation at 28° C. The manner of treating the living bacteria was also important; when the masses of bacteria were simply separated by the centrifugal, and treated direct in the wet state with acetone, the "dauer" preparations were not nearly so active as when the masses were drained on porous plates before treatment with acetone. On the other hand, the sterility of these latter preparations was not perfect, owing to the resistance of the semi-dry, leathery masses to the penetration of the acetone. Several experiments showed, however, that the error introduced by the presence of traces of living cells in the "dauer" preparations was quite negligible when toluene was added.

In carrying out the fermentations, the "dauer" preparations were rubbed to a paste with 2—4 per cent. alcohol, with the addition of chalk and 4 per cent. of toluene. The mixtures were then exposed in flasks to a current of sterilised air for three days at a temperature of 28° C. In all cases the quantity of acetic acid produced was corrected by the results of similar experiments carried out with preparations in which the enzymes had been destroyed by heat. The yields of acetic acid so obtained were not very large; the highest recorded was 4 per cent. of the quantity of "dauer" preparation (after the treatment with acetone, and before mixing with the alcohol, chalk and toluene) taken; in most cases the yield was much smaller, *viz.*, 0·5—2 per cent. The "dauer" preparations, like the living bacteria, were capable of oxidising propyl alcohol to propionic acid. The authors conclude that there is no longer any room for doubt that the acetifying bacteria owe their oxidising properties to the presence of an enzyme, an oxydase. Apparently all three forms of oxydase are secreted by the bacteria, *viz.*, oxygenase, peroxydase, and catalase. As in the case of the lactic bacteria, juices prepared by trituration and pressure were devoid of fermentative properties.—J. F. B.

Lactic acid fermentation. E. Buchner and J. Meisenheimer. Annalen, 1906, **349**, 125—139.

The authors have further extended their studies on the enzyme secreted by the lactic acid bacillus, *B. Delbrücki* (see this J., 1903, 374). The bacilli were cultivated in a mixture of unhopped beer wort and rye-malt wort containing about 20 per cent. of sugar. The wort was sown with pure cultures of *B. Delbrücki*, and was fermented at a temperature of 40°—50° C. for 8—10 days. The bacteria were then separated by means of a centrifugal apparatus, washed with water, and drained on clay plates. The preparations were treated with acetone and then with ether, and were finally dried *in vacuo*. In this way, "aceton-dauer" preparations of dry, dead bacteria cells were obtained, which were perfectly sterile, but which retained the enzymes in the active state. The fermentations were started by grinding 10 grms. of "dauer" preparation with 10 grms. of sand, 2·5 grms. of chalk, and 2·5 c.c. of water for about 10 minutes, and mixing the mass with a solution of 10 grms. of cane sugar in 40 c.c. of water. The mixtures were incubated at 43° C. for six days in presence of 2 c.c. of toluene; yield: 2·1 grms. of the lactate. Attempts to prepare an active "press-juice," in the same way as yeast "press-juice," failed, owing either to the insolubility of the enzyme or to the failure to break up the cells to a sufficient extent. The residue after trituration and pressure, when treated with acetone, gave a "dauer" preparation of unimpaired activity.

Both cane sugar and maltose were fermented by the lactic acid enzyme, and evidence was obtained that the preliminary hydrolysis of these bioses by inverting enzymes also secreted in the cells. The product in all cases consisted of inactive lactic acid, although the same bacteria in the living state produced *l*-lactic acid.—J. F. B.

Vinegar; Test for distinguishing between fermentation vinegar and wood ——. E. Schmidt. XXIII., page 1009.

Spirituous essences in the Cape of Good Hope; Marking of ——. Bd. of Trade J., Oct. 4, 1906. [T.R.]

THE present Customs Union Tariff provides that when medicinal and toilet preparations and essences, syrups, and tinctures contain more than 3 per cent of proof spirit, they shall be entered under item 36 B of the Tariff as spirits, and pay a duty of 20s. per imperial gallon.

It would greatly facilitate the work of the Customs Department, and assist importers, if this fact could be brought to the notice of manufacturers and suppliers of these articles, in order that they may take steps to always indicate on their invoices those preparations that contain spirit, and give the total quantity in gallons and fractions thereof of the liquid contents, as duty is not levied on the proof gallon under item 36 B of the Tariff.

ENGLISH PATENTS.

Wine must, beer, beetroot juice, and the like; Treatment of ——. E. Monti, Turin, Italy. Eng. Pat. 18,138, Sept. 7, 1905.

SEE Fr. Pat. 357,770 of 1905; this J., 1906, 113.—T. F. B.

Fusel oil and components of fusel oil; Process for making ——. F. Ehrlich, Berlin. Eng. Pat. 6640, March 20, 1906. Under Int. Conv., March 31, 1905.

THE process consists in subjecting hydrolysed or peptonised albuminous substances, or decomposition products of albumin rich in leucine, to the action of yeast in the presence of carbohydrates, such as molasses, potatoes, &c. Leucine yields isoamyl alcohol, and isoleucine gives *d*-amyl alcohol. The products of the fermentation are distilled, and the fusel oil separated from the distillate. (See this J., 1905, 683.)—W. P. S.

FRENCH PATENTS.

Diastatic malt extracts; Method of rendering —— durable by converting them into a solid state. Deutsche Diamalt Ges. m. b. H. Fr. Pat. 365,971, May 7, 1906.

THE concentrated liquid extract of diastase is mixed to a paste with the flour of malted grain, and moulded, the product having a higher diastatic power than the original extract.—C. S.

Brewing; Method of and plant for ——. H. Breker. Fr. Pat. 365,497, April 23, 1906.

CONTINUOUS mashing and the production of wort are effected in three principal vessels, two of which are exactly alike, and serve, each in turn, alternately for mashing and boiling the wort, whilst the third serves to filter the wort between these two operations, so that the only break in the continuity of the work is while any of the vessels is being cleaned out.—C. S.

Filter [for beer]. K. H. Loew. Fr. Pat. 365,582, April 24, 1906.

THE claims relate to an upright filter-press surrounded by a casing supported by trunnions on a frame, so that it can be inclined at any angle to permit access to the interior.

The inlet and outlet orifices form part of the casing, and are provided with flanges to which the supply and delivery pipes can be accurately attached. The cage or press is formed of sections to facilitate the assembling and taking apart of the filter, and the cover plate is arranged so that it can adjust itself to any irregularities of the filtering mass, and is provided with means, such as a pump or ram, by which it can be raised or lowered.—W. H. C.

Wood cellulose and similar products; Processes for converting —— into fermentable sugar for the manufacture of spirits or alcohol, or for other purposes. A. Classen. Fr. Pat. 365,595, Jan. 31, 1906.

See Ger. Pat. 161,644 of 1904; this J., 1905, 1078.—T. F. B.

Fusel oils and their components; Method of producing ——. A. Sultan and I. Stern. Fr. Pat. 365,619, March 23, 1906. Under Int. Conv. March 31, 1905.

Hydrolysed or peptonised albumin, or amino-acids, are treated with ferments (distillery yeast) in presence of carbohydrates (preferably in the form of distillery wort). The fusel oil produced in the fermentation is separated from the ethyl alcohol in the usual way. If desired, suitable salts may be added to the liquid to be fermented. (See Eng. Pat. 6640 of 1906; preceding these.)—C. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 950.)

(*A.*)—FOODS.

Beef fat; Detection of —— in lard. P. Soltsien. Chem. Rev. Fett- u. Harz-Ind., 1906, **13**, 240—241.

Notwithstanding the fact that Kreis and Hafner (this J., 1904, 755) showed that the respective crystals had a different composition, the microscopic detection of beef fat in lard has been found uncertain by various observers. To the well-known objections to the method the author adds the further one that flat tabular crystals may also be obtained from beef fat. If 1 grm. of the fat be dissolved in 10 c.c. of ether, and the solution left at below 15° C., and the deposit of crystals mixed with paraffin oil, slightly pressed under the cover glass, and examined under the microscope, apparently only the usual tufts of needles will be present. The author asserts, however, that a second form of crystals, in platelets resembling those from lard "stearin," can be detected in places where the paraffin oil has not touched the glass, or has evaporated. These by-crystals can also be seen under the same conditions in the crystals deposited from a solution of lard in petroleum spirit. (See also Dunlop, this J., 1906, 458.)—C. A. M.

Standards of purity for food products in U.S.A. Bd. of Trade J., Sept. 27, 1906. [T.R.]

A circular has recently been issued by the U.S. Department of Agriculture, establishing the standards of purity required for certain food products. The standards established by this circular supersede, and are supplemental to those proclaimed in December, 1904, and March, 1906.

English Patents.

Foods; Process for preserving liquid ——. Société "Le Lait," Paris. Eng. Pat. 7936, April 2, 1906. Under Int. Conv., April 3, 1905.

The liquid to be preserved is heated and agitated in an atmosphere of oxygen under pressure, the heating being continued for 30 minutes, at a temperature of from 70° to 95° C.—W. P. S.

Food for infants or convalescent adults, and process of manufacturing the same. E. de Pass, London. From Société "Le Lait," Paris. Eng. Pat. 10,480, May 4, 1906.

See Fr. Pat. 361,595 of 1905; following these.—T. F. B.

Drying or condensing apparatus [Milk, &c.]. G. A. Kammermann, Glockenthal, Switzerland. Eng. Pat. 10,608, May 5, 1906. Under Int. Conv., May 9, 1905.

See Fr. Pat. 365,970 of 1906; following these.—T. F. B.

French Patents.

Margarine; Manufacture of ——. E. A. Pellerin. Fr. Pat. 361,614, July 7, 1905.

In the process described, the operation of mixing the fat and water, in the presence of an emulsifying agent, is stopped precisely at the moment when an emulsion of the fat in the aqueous liquid is obtained. The paste obtained is of finer texture than that exhibited by an emulsion in which the aqueous liquid is emulsified in the fatty matters. It is stated that the margarine thus prepared, has a taste more nearly approaching that of butter than one prepared by the reverse method of emulsification.—W. P. S.

Malted milk for use as infants' food; Process of making ——. E. Terrien. Fr. Pat. 361,595, Oct. 20, 1905.

Seventy grms. of rice- or wheat flour are added to a mixture consisting of one-third of a litre of milk and two-thirds of a litre of water. The mixture is heated to a temperature of 100° C. for 15 minutes, then cooled to 80° C., and treated with an infusion of malt; the latter is prepared by heating 20 grms. of crushed malt with a little water to a temperature of 60° C. for 15 minutes. After adding 50 grms. of sugar, the whole mixture is once more boiled. When cold, it is ready for use.—W. P. S.

Malted milk for use as infants' food; Process for making ——. Société "Le Lait." First Addition, dated April 9, 1906, to Fr. Pat. 361,595, Oct. 20, 1905. (See preceding Patent.)

The proportion of milk to water employed in the process described in the principal specification may be varied according to the use to which the food is put (infants, adults, invalids, &c.). The prepared article may also be preserved under pressure in an atmosphere of oxygen, sterilised, or evaporated to a syrup, or completely dried to form a powder.—W. P. S.

Condensing apparatus [Milk, &c.]; Process for removing the pellicle of condensed material detached from the exterior surface of the hollow rotary drying drums by the scrapers in ——. G. A. Kammermann. Fr. Pat. 365,970, May 7, 1906. Under Int. Conv., May 9, 1905.

A roller is placed parallel and close to the drum just below the point at which the pellicle is detached by the scraper. The roller is rotated by gearing in the opposite direction to that in which the drying drum revolves, and draws off the pellicle in a continuous manner, depositing it in a receptacle placed below. If preferred, two parallel rollers may be used, one being placed slightly below the other, and they may have an endless band of cloth passed round them to assist in gripping and removing the pellicle.—W. H. C.

Cereals, &c.; Treatment of —— to form a flour for bread-making. F. Braunbeck. Fr. Pat. 365,827, May 2, 1906.

Cereals, such as wheat, rye, barley, oats, rice, and maize, or peas, beans, &c., are heated with water, and then ground to a paste, which is dried on rollers heated to a temperature of from 100° to 200° C. The flaky product scraped off the rollers is ground to form a flour.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

French Patent.

Water; Continuous process for the removal of sulphuric acid from ——. H. Reisert. Fr. Pat. 365,449, April 20, 1906.

The water is led from an upper reservoir into the bottom of a tank, which is divided into a number of compartments

400 c.c. are charged with 200 c.c. of wort and 10 per cent. of yeast, and are placed in a water-bath at a temperature of 25° C. This need not be exactly maintained, but 29°—30° C. will give results below the truth. The proportion of yeast given is found to be the most suitable, since it furnishes the same results in 24 hours as are obtained with 0·5 and 2 per cent. of yeast in a correspondingly longer time. On the other hand, 20 per cent. of yeast gives higher results, which are inaccurate owing to the formation of alcohol by the autofermentation of the yeast.—C. S.

Acetic acid fermentation. E. Buchner and R. Gaunt. Annalen, 1906, **349**, 140—184.

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In carrying out the fermentations, the "dauer" preparations were rubbed to a paste with 2—4 per cent. alcohol, with the addition of chalk and 4 per cent. of toluene. The mixtures were then exposed in flasks to a current of sterilised air for three days at a temperature of 28° C. In all cases the quantity of acetic acid produced was corrected by the results of similar experiments carried out with preparations in which the enzymes had been destroyed by heat. The yields of acetic acid so obtained were not very large; the highest recorded was 4 per cent. of the quantity of "dauer" preparation (after the treatment with acetone, and before mixing with the alcohol, chalk and toluene) taken; in most cases the yield was much smaller, *viz.*, 0·5—2 per cent. The "dauer" preparations, like the living bacteria, were capable of oxidising propyl alcohol to propionic acid. The authors conclude that there is no longer any room for doubt that the acetifying bacteria owe their oxidising properties to the presence of an enzyme, an oxydase. Apparently all three forms of oxydase are secreted by the bacteria, *viz.*, oxygenase, peroxydase, and catalase. As in the case of the lactic bacteria, juices prepared by trituration and pressure were devoid of fermentative properties.—J. F. B.

Lactic acid fermentation. E. Buchner and J. Meisenheimer. Annalen, 1906, **349**, 125—139.

The authors have further extended their studies on the enzyme secreted by the lactic acid bacillus, *B. Delbrücki* (see this J., 1903, 374). The bacilli were cultivated in a mixture of unhopped beer wort and rye-malt wort containing about 20 per cent. of sugar. The wort was sown with pure cultures of *B. Delbrücki*, and was fermented at a temperature of 40°—50° C. for 8—10 days. The bacteria were then separated by means of a centrifugal apparatus, washed with water, and drained on clay plates. The preparations were treated with acetone and then with ether, and were finally dried *in vacuo*. In this way, "aceton-dauer" preparations of dry, dead bacteria cells were obtained, which were perfectly sterile, but which retained the enzymes in the active state. The fermentations were started by grinding 10 grms. of "dauer" preparation with 10 grms. of sand, 2·5 grms. of chalk, and 2·5 c.c. of water for about 10 minutes, and mixing the mass with a solution of 10 grms. of cane sugar in 40 c.c. of water. The mixtures were incubated at 43° C. for six days in presence of 2 c.c. of toluene; yield: 2·1 grms. of the lactate. Attempts to prepare an active "press-juice," in the same way as yeast "press-juice," failed, owing either to the insolubility of the enzyme or to the failure to break up the cells to a sufficient extent. The residue after trituration and pressure, when treated with acetone, gave a "dauer" preparation of unimpaired activity.

Both cane sugar and maltose were fermented by the lactic acid enzyme, and evidence was obtained that the preliminary hydrolysis of these bioses by inverting enzymes also secreted in the cells. The product in all cases consisted of inactive lactic acid, although the same bacteria in the living state produced *l*-lactic acid.—J. F. B.

Vinegar; Test for distinguishing between fermentation vinegar and wood ——. E. Schmidt. XXIII., page 1009.

Spirituous essences in the Cape of Good Hope; Marking of ——. Bd. of Trade J., Oct. 4, 1906. [T.R.]

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It would greatly facilitate the work of the Customs Department, and assist importers, if this fact could be brought to the notice of manufacturers and suppliers of these articles, in order that they may take steps to always indicate on their invoices those preparations that contain spirit, and give the total quantity in gallons and fractions thereof of the liquid contents, as duty is not levied on the proof gallon under item 36 B of the Tariff.

ENGLISH PATENTS.

Wine must, beer, beetroot juice, and the like; Treatment of ——. E. Monti, Turin, Italy. Eng. Pat. 18,138, Sept. 7, 1905.

SEE Fr. Pat. 357,770 of 1905; this J., 1906, 113.—T. F. B.

Fusel oil and components of fusel oil; Process for making ——. F. Ehrlich, Berlin. Eng. Pat. 6640, March 20, 1906. Under Int. Conv., March 31, 1905.

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FRENCH PATENTS.

Diastatic malt extracts; Method of rendering —— durable by converting them into a solid state. Deutsche Diamalt Ges. m. b. H. Fr. Pat. 365,971, May 7, 1906.

THE concentrated liquid extract of diastase is mixed to a paste with the flour of malted grain, and moulded, the product having a higher diastatic power than the original extract.—C. S.

Brewing; Method of and plant for ——. H. Breker. Fr. Pat. 365,497, April 23, 1906.

CONTINUOUS mashing and the production of wort are effected in three principal vessels, two of which are exactly alike, and serve, each in turn, alternately for mashing and boiling the wort, whilst the third serves to filter the wort between these two operations, so that the only break in the continuity of the work is while any of the vessels is being cleaned out.—C. S.

Filter [for beer]. K. H. Loew. Fr. Pat. 365,582, April 24, 1906.

THE claims relate to an upright filter-press surrounded by a casing supported by trunnions on a frame, so that it can be inclined at any angle to permit access to the interior.

employed for the same purpose. Thus, 30 kilos. of methenyl-*o*-toluylenediamine and 70 kilos. of nitrocellulose are treated with alcohol in the usual manner of celluloid manufacture; the former component may be replaced by an equal weight of methylethenyltrichloramidine. (Compare Eng. Pat. 8077 of 1906; this J., 1906, 608.)—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 952.)

Narceïne; Investigation on ——. *I. Alkylnarceïnes and alkylhomonarceïnes.* R. Tambach and C. Jaeger. Annalen, 1906, **349**, 185—200.

Titanium; Reactions of —. H. Grossmann. Chem.-Zeit, 1906, **30**, 907.

The author has studied the behaviour of titanium chloride with organic acids and their salts. Potassium cyanide gives a black insoluble precipitate, which becomes gradually lighter in colour on standing, but more rapidly when heated, being eventually converted into titanic acid, a reaction which precludes the existence of titanium double cyanides, $R_3Ti(CN)_6$. Potassium ferrocyanide develops a reddish-brown precipitate, which after shaking for a short time assumes a permanent orange-yellow colour. Potassium ferricyanide gives a dark brown precipitate, becoming light green on standing. Sodium acetate changes the violet colour of titanium chloride to dark green, which appears brown by reflected light. On heating the solution, a basic acetate separates which oxidises slowly on exposure. Acetic and formic acids are without action; sodium formate gives a dark green solution, depositing a basic salt on heating, which rapidly oxidises to form titanic acid. Oxalic acid gives a reddish-brown solution, from which alcohol separates a precipitate. Gallic acid gives a similar solution and a brownish-red precipitate on boiling. Xanthate, salicylate, and succinate of sodium form yellow, yellowish-brown, and green precipitates respectively. Tartaric acid is without action, but in the presence of alkali hydroxide a dark blue solution is obtained. Sodium tartrate gives a yellowish-green precipitate soluble in an excess of the reagent. Citric acid behaves similarly to tartaric acid.

—D. B.

Alypine; Distinctive reactions of ——. P. Lemaire. XXIII., page 1009.

Formic acid; Determination of —— by means of permanganate. J. Klein. XXIII., page 1010.

Camphor production of Japan. For. Off. Ann. Series, No. 3713. [T.R.]

Formosan camphor, though plentiful, grows to a great extent in places which are still practically inaccessible owing to the savage tribes who occupy the districts. In Japan, on the other hand, where there is no such artificial impediment, the supply is being gradually exhausted. Camphor is now obtained from the leaves of the tree as well as the bark; the former yield about 1½ per cent.

The amount of crude camphor produced in 1905 was:—

	lb.
Formosa	4,800,000
Japan	1,226,607
Total	6,026,607

Of this, 837,333 lb. were refined in Kobe and Osaka, and 400,000 lb. sold to native druggists for use in Japan. The refined drug was nearly all exported.

English Patents.

Dialkylbarbituric acids; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,718, Nov. 17, 1905.

In Eng. Pat. 14,161 of 1905 (this J., 1905, 1188) the production of dialkylbarbituric acids by treating dialkylmalonyldiurethanes with sodium ethylate and alcohol is described; it is now found that this condensing agent may be replaced by other condensing agents, such as ammonia, alkalis, sulphuric acid, or organic bases, in aqueous or alcoholic solution. The condensation of dialkylmalonyl chlorides with urethanes to dialkylmalonyldiurethanes does not take place quantitatively, but other products are formed, all of which can, however, be converted into dialkylbarbituric acids by treatment with any of the above-mentioned condensing agents. It is not necessary to isolate the first condensation products, since these can, in the crude condition, be easily condensed to the pyrimidine ring as described.—T. F. B.

Salicylic acid derivative [*Cinnamylsalicylic acid*]; *Manufacture of a new* ——. H. S. Wellcome, London, H. A. D. Jowett and F. L. Pyman, Dartford. Eng. Pat. 7125, March 24, 1906.

Cinnamylsalicylic acid may be prepared by heating, to 100° C., equimolecular proportions of cinnamyl chloride and salicylic acid for about three hours; after recrystallisation, the acid has a m. pt. of 155° C. The methyl, ethyl, and other esters of cinnamylsalicylic acid are obtained in a similar manner from cinnamyl chloride and a salicylic ester. The salts of the acid with organic and inorganic bases, especially those with quinine and sodium hydroxide, are also claimed. All the foregoing compounds find application in medicine.—T. F. B.

Camphor from isoborneol; Manufacture of ——. G. B. Ellis, London. From Chem. Fabr. von Heyden, A. G., Radebeul, Saxony. Eng. Pat. 10,407, May 3, 1906.

See Fr. Pat. 365,974 of 1906; following these.—T.F.B.

French Patents.

Δ_1-Cyclogeranic acid; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,637, July 19, 1905.

See U.S. Pat. 805,924 of 1905; this J., 1906, 39.—T. F. B.

Camphor from isoborneol; Preparation of ——. C. F. Boehringer und Soehne. Second Addition, dated April 24, 1906 (under Int. Conv., June 1, 1905), to Fr. Pat. 352,888, March 31, 1905.

In a previous patent (see this J., 1905, 249) the oxidation of isoborneol by means of chlorine was described. It is now found that camphor technically free from chlorine can be obtained by a similar process from borneol.

—F. Shdn.

Isoborneol esters; Direct process for preparing —— from hydrochloride or hydrobromide of pinene. Chem. Fabr. von Heyden Akt.-Ges. Fr. Pat. 365,814, May 1, 1906. Under Int. Conv., Sept. 4, 1905.

See Eng. Pat. 10,999 of 1906; this J., 1906, 714.—T. F. B.

Camphor from isoborneol; Preparation of ——. Chem. Fabr. von Heyden Akt.-Ges. Fr. Pat. 365,974, May 7, 1906.

Isoborneol can be oxidised to camphor in a satisfactory manner by nitric acid containing a small amount of nitrous acid. The nitric acid can be treated previously with a little sodium nitrite or some easily oxidisable substance. (See this J., 1905, 1188.)—F. Shdn.

Guaiacol, creosote, or their homologues or derivatives; Process for preparing new esters from ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 365,683, April 26, 1906. Under Int. Conv., May 5, 1905.

See U.S. Pats. 822,339 and 824,901 of 1906; this J., 1906, 653 and 827.—T. F. B.

400 c.c. are charged with 200 c.c. of wort and 10 per cent. of yeast, and are placed in a water-bath at a temperature of 25° C. This need not be exactly maintained, but 29°—30° C. will give results below the truth. The proportion of yeast given is found to be the most suitable, since it furnishes the same results in 24 hours as are obtained with 0·5 and 2 per cent. of yeast in a correspondingly longer time. On the other hand, 20 per cent. of yeast gives higher results, which are inaccurate owing to the formation of alcohol by the autofermentation of the yeast.—C. S.

Acetic acid fermentation. E. Buchner and R. Gaunt. Annalen, 1906, **349**, 140—184.

"ACETON-DAUER" preparations were made from acetifying bacteria obtained by skimming the films off various culture media infected with beer-vinegar bacteria. The nature of the medium and the conditions of cultivation appeared to have a considerable influence on the activity of the preparations obtained. Whereas those obtained from bacteria grown in beer dregs were almost devoid of formentative power, those prepared from bacteria cultivated in unhopped wort were fairly active. Cultivation of the bacteria at temperatures of 10°—22° C. had a favourable influence on the activity of the "dauer" preparations as compared with cultivation at 28° C. The manner of treating the living bacteria was also important; when the masses of bacteria were simply separated by the centrifugal, and treated direct in the wet state with acetone, the "dauer" preparations were not nearly so active as when the masses were drained on porous plates before treatment with acetone. On the other hand, the sterility of these latter preparations was not perfect, owing to the resistance of the semi-dry, leathery masses to the penetration of the acetone. Several experiments showed, however, that the error introduced by the presence of traces of living cells in the "dauer" preparations was quite negligible when toluene was added.

In carrying out the fermentations, the "dauer" preparations were rubbed to a paste with 2—4 per cent. alcohol, with the addition of chalk and 4 per cent. of toluene. The mixtures were then exposed in flasks to a current of sterilised air for three days at a temperature of 28° C. In all cases the quantity of acetic acid produced was corrected by the results of similar experiments carried out with preparations in which the enzymes had been destroyed by heat. The yields of acetic acid so obtained were not very large; the highest recorded was 4 per cent. of the quantity of "dauer" preparation (after the treatment with acetone, and before mixing with the alcohol, chalk and toluene) taken; in most cases the yield was much smaller, *viz.*, 0·5—2 per cent. The "dauer" preparations, like the living bacteria, were capable of oxidising propyl alcohol to propionic acid. The authors conclude that there is no longer any room for doubt that the acetifying bacteria owe their oxidising properties to the presence of an enzyme, an oxydase. Apparently all three forms of oxydase are secreted by the bacteria, *viz.*, oxygenase, peroxydase, and catalase. As in the case of the lactic bacteria, juices prepared by trituration and pressure were devoid of fermentative properties.—J. F. B.

Lactic acid fermentation. E. Buchner and J. Meisenheimer. Annalen, 1906, **349**, 125—139.

The authors have further extended their studies on the enzyme secreted by the lactic acid bacillus, *B. Delbrücki* (see this J., 1903, 374). The bacilli were cultivated in a mixture of unhopped beer wort and rye-malt wort containing about 20 per cent. of sugar. The wort was sown with pure cultures of *B. Delbrücki*, and was fermented at a temperature of 40°—50° C. for 8—10 days. The bacteria were then separated by means of a centrifugal apparatus, washed with water, and drained on clay plates. The preparations were treated with acetone and then with ether, and were finally dried *in vacuo*. In this way, "aceton-dauer" preparations of dry, dead bacteria cells were obtained, which were perfectly sterile, but which retained the enzymes in the active state. The fermentations were started by grinding 10 grms. of "dauer" preparation with 10 grms. of sand, 2·5 grms. of chalk, and 2·5 c.c. of water for about 10 minutes, and mixing the mass with a solution of 10 grms. of cane sugar in 40 c.c. of water. The mixtures were incubated at 43° C. for six days in presence of 2 c.c. of toluene; yield: 2·1 grms. of the lactate. Attempts to prepare an active "press-juice," in the same way as yeast "press-juice," failed, owing either to the insolubility of the enzyme or to the failure to break up the cells to a sufficient extent. The residue after trituration and pressure, when treated with acetone, gave a "dauer" preparation of unimpaired activity.

Both cane sugar and maltose were fermented by the lactic acid enzyme, and evidence was obtained that the preliminary hydrolysis of these bioses by inverting enzymes also secreted in the cells. The product in all cases consisted of inactive lactic acid, although the same bacteria in the living state produced *l*-lactic acid.—J. F. B.

Vinegar; Test for distinguishing between fermentation vinegar and wood ——. E. Schmidt. XXIII., page 1009.

Spirituous essences in the Cape of Good Hope; Marking of ——. Bd. of Trade J., Oct. 4, 1906. [T.R.]

THE present Customs Union Tariff provides that when medicinal and toilet preparations and essences, syrups, and tinctures contain more than 3 per cent of proof spirit, they shall be entered under item 36 B of the Tariff as spirits, and pay a duty of 20s. per imperial gallon.

It would greatly facilitate the work of the Customs Department, and assist importers, if this fact could be brought to the notice of manufacturers and suppliers of these articles, in order that they may take steps to always indicate on their invoices those preparations that contain spirit, and give the total quantity in gallons and fractions thereof of the liquid contents, as duty is not levied on the proof gallon under item 36 B of the Tariff.

ENGLISH PATENTS.

Wine must, beer, beetroot juice, and the like; Treatment of ——. E. Monti, Turin, Italy. Eng. Pat. 18,138, Sept. 7, 1905.

SEE Fr. Pat. 357,770 of 1905; this J., 1906, 113.—T. F. B.

Fusel oil and components of fusel oil; Process for making ——. F. Ehrlich, Berlin. Eng. Pat. 6640, March 20, 1906. Under Int. Conv., March 31, 1905.

THE process consists in subjecting hydrolysed or peptonised albuminous substances, or decomposition products of albumin rich in leucine, to the action of yeast in the presence of carbohydrates, such as molasses, potatoes, &c. Leucine yields isoamyl alcohol, and isoleucine gives *d*-amyl alcohol. The products of the fermentation are distilled, and the fusel oil separated from the distillate. (See this J., 1905, 683.)—W. P. S.

FRENCH PATENTS.

Diastatic malt extracts; Method of rendering —— durable by converting them into a solid state. Deutsche Diamalt Ges. m. b. H. Fr. Pat. 365,971, May 7, 1906.

THE concentrated liquid extract of diastase is mixed to a paste with the flour of malted grain, and moulded, the product having a higher diastatic power than the original extract.—C. S.

Brewing; Method of and plant for ——. H. Breker. Fr. Pat. 365,497, April 23, 1906.

CONTINUOUS mashing and the production of wort are effected in three principal vessels, two of which are exactly alike, and serve, each in turn, alternately for mashing and boiling the wort, whilst the third serves to filter the wort between these two operations, so that the only break in the continuity of the work is while any of the vessels is being cleaned out.—C. S.

Filter [for beer]. K. H. Loew. Fr. Pat. 365,582, April 24, 1906.

THE claims relate to an upright filter-press surrounded by a casing supported by trunnions on a frame, so that it can be inclined at any angle to permit access to the interior.

than is the case with any other explosive, being only 1·9 per cent. at a density of 0·45. With Norwegian ballistite, on the other hand, although the volume of methane at the commencement is only 0·04 per cent., at a density of 0·45, it is 11 per cent. As might be expected from the large quantity of methane found in the case of Norwegian ballistite, the volume of hydrogen falls from over 20 per cent. to about 9 per cent. In the case of Italian ballistite the hydrogen rises from about 8 per cent. to about 10 per cent. In both explosives the nitrogen is practically constant at about 12 and 16 per cent. respectively, but there is a very great difference as regards the water. In Norwegian ballistite the water is practically constant at 14 per cent., whilst in Italian ballistite, commencing at density 0·05 with a volume of 20 per cent., it falls at density 0·45 to about 24 per cent. No other explosive approaches Italian ballistite in respect to the large volume of aqueous vapour formed, especially at low densities. In the case of five of the explosives, there is, with increasing density, a very considerable decrease in the volume of the

Fig. 1.

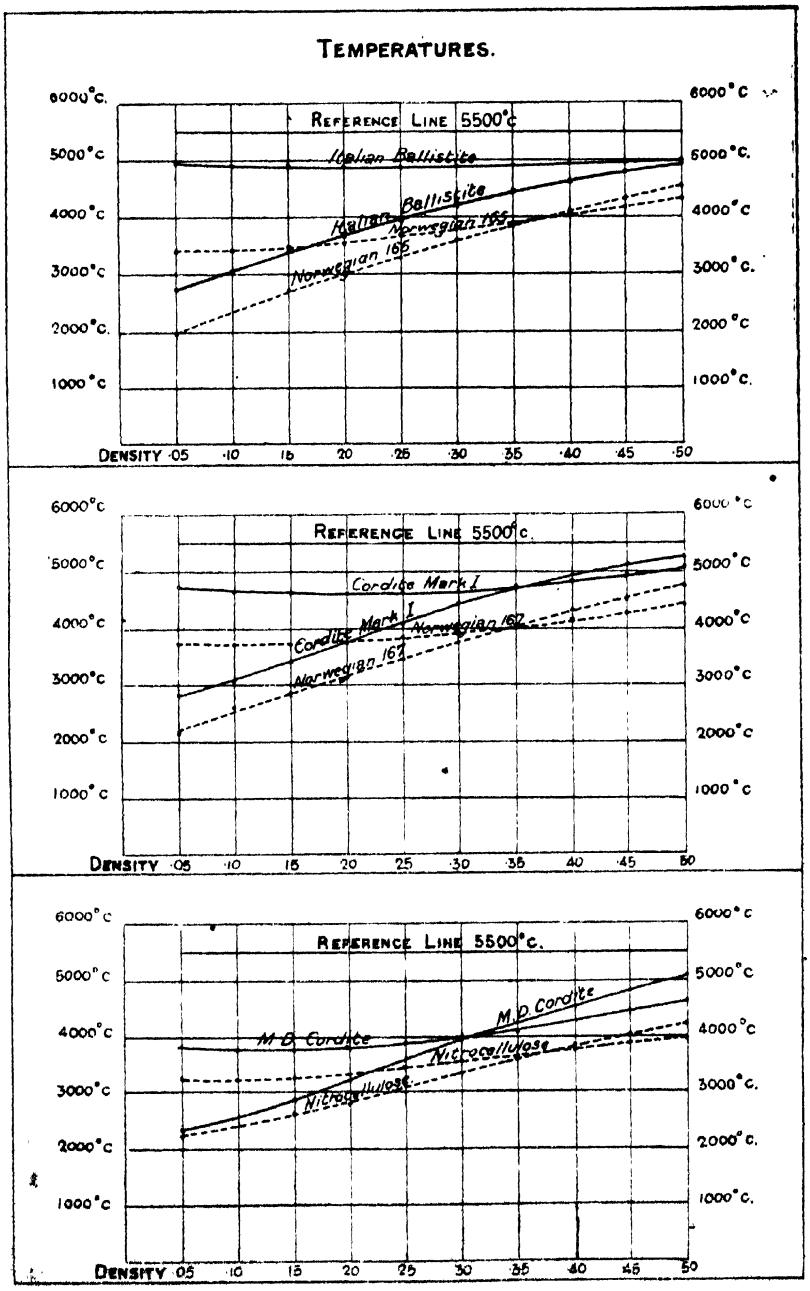


FIG. 2.

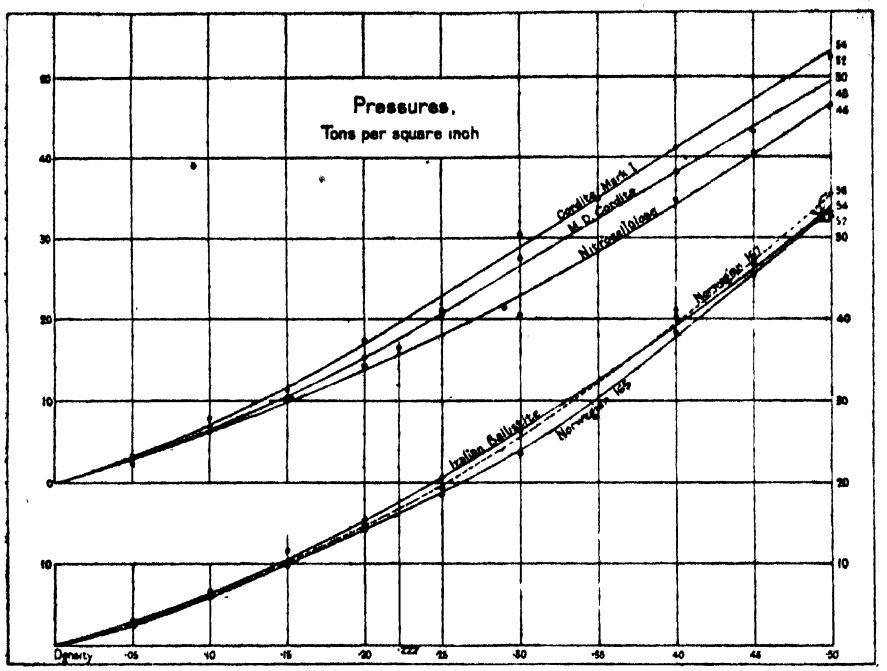
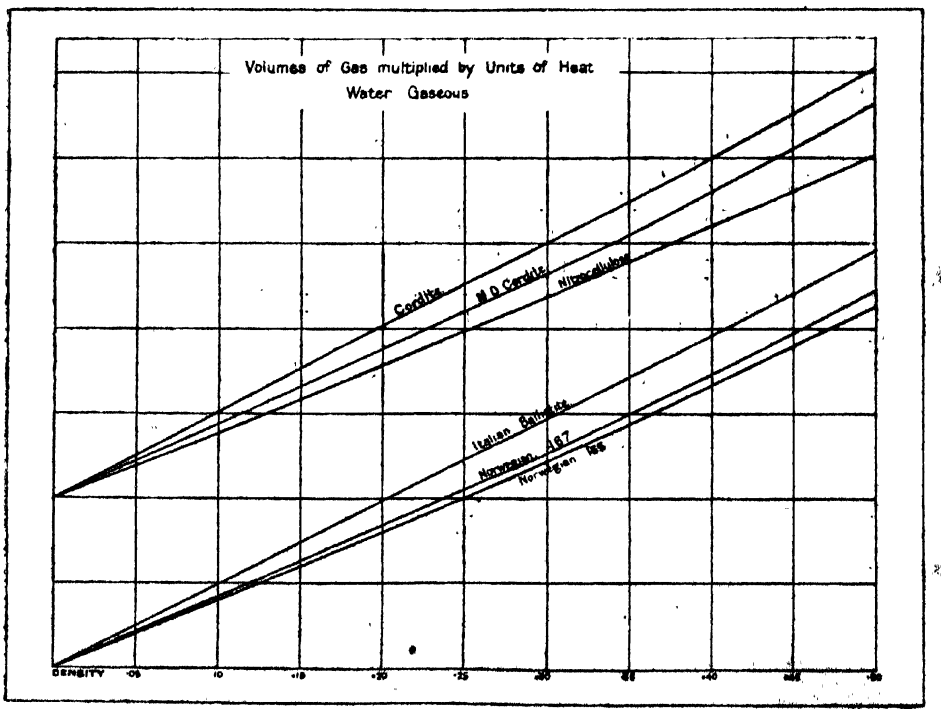

Pressures.
Tons per square inch
Cordite Mark I
M.D. Cordite
Nitrocellulose
Italian Ballistite
Norwegian 1907
Norwegian 1895
Density

FIG. 3.


Volumes of Gas multiplied by Units of Heat
Water Gaseous
Cordite
M.D. Cordite
Nitrocellulose
Italian Ballistite
Norwegian 1907
Norwegian 1895
DENSITY

permanent and total gases; but with Italian ballistite, throughout the range of the experiments there is hardly any change. In regard to the relation between the density of charge and the pressure developed by the explosion, some abnormal pressures have been obtained with some explosives at high densities, but these pressures are far above those with which artillerists are concerned. Fig. 2 gives these pressure curves. In order to determine whether these slight increments of pressure in the Norwegian ballistites, and the much more abnormal increments in Explosives II. and VI. at densities of 0·5 are real, or due to partial detonation, or to wave action on the crusher-gauge during explosion, the author has calculated for the whole of the explosives the value of the products (volume of gas multiplied by units of heat, water gaseous), because, supposing there to be no detonation or violent motion of the gases, the pressure on the walls of the explosive cylinder should be dependent, in a vessel impervious to heat, solely on the quantity of gas and on the amount of heat generated by the explosion. The results are shown on Fig. 3. These curves practically confirm the pressure-curves of explosives I., II., V., and VI., and they equally show that the abnormal pressures of II. and VI. at densities of 0·5 are not confirmed.

Temperature of explosion.—This was calculated by two different methods. Knowing the units of heat (water gaseous), generated by the explosion, and the specific heat of the gases, the temperature of explosion is given by the equation:

$$t = \frac{\text{grm. units of heat}}{\text{specific heat}} \quad (1).$$

From the known pressure at any given density and the pressure, p_o, when the volume of gas generated is reduced to 0° C. and 760 mm., we have the equation

$$t = \frac{p - p_o}{0{\cdot}00367 . p_o} \quad (2).$$

At low charge densities it has been found that the temperatures calculated by means of equation (1) are very much higher than those obtained by equation (2). The variation is clearly shown on referring to the accompanying figure (see p. 1004). It will be noted that for each explosive two temperature curves are given (see Fig. 1). Beginning at a density of 0·05, the upper curve, in each instance, embodies the temperatures as calculated by equation (1), the lower, those calculated by equation (2). Thus, beginning with equation (1), Italian ballistite, which shows the highest temperature, commences at the density of 0·05, with 4943° C., this temperature hardly varying at all till the density of 0·25 is reached, when it slowly but regularly increases to about 5000° C. at density 0·45. Cordite Mark I. commencing at 4742° C., with a very slight fall, is practically constant up to density 0·30, after which it rises rapidly to a temperature of 5065° C. at a density of 0·50. In the case of the temperatures given by equation (2), however, remarkable differences are met with. At the higher densities and pressures, there is generally a very fair agreement in the temperatures obtained from the two formulæ; but as the density and pressure diminish, the divergence becomes in all cases considerable, but is much greater with the explosives which develop very high temperatures, and which give rise to large percentages of carbon dioxide. The author's explanation of this divergence is as follows: The nascent gases are generated at temperatures approximately as given by equation (1), and by the upper curve of each explosive as shown in the figure. Under the low densities and pressures at the very high temperatures, the carbon dioxide and probably some water are partially dissociated, giving rise to the fall in temperature exhibited by the results obtained from equation (2) at low densities. The great difference between, for instance, Italian ballistite and Nitrocellulose R.R. at a density of 0·1 is due, first, to the difference of the temperature at which the nascent gases are generated, and secondly, to the proportion of carbon dioxide which is subject to dissociation. Formula (1) gives for Italian ballistite at density 0·1 a temperature of nearly 5000° C. while the percentage of carbon dioxide is 38·2. The same formula gives for the nitrocellulose, at the same density, a temperature of formation of 3200° C., whilst the percentage of carbon dioxide is only 19·45. The dissociation of carbon dioxide commences at about 1300° C., and the very much higher temperatures of formation of the gases of Italian ballistite, combined with its double percentage of carbon dioxide, appears to be sufficient to explain the results obtained with this explosive. If reference be made to the curves, it will be seen that whilst at density 0·1 there is, with Italian ballistite, a difference of about 1800° C. between the two formulæ, there is, with the nitrocellulose, a difference of only under 800° C. At the density of 0·45 the differences between the two formulæ are as follows: Italian ballistite, 150° C.; Cordite Mark I, 200° C.; Cordite MD, 320° C.; Norwegian ballistite (167), 250° C.; Norwegian ballistite (165), 130° C.; and nitrocellulose, 180° C. With Italian ballistite alone, at the density of 0·45, the temperature derived from equation (2) is lower than that derived from equation (1).—G. W. McD.

Explosives Ordinance in Belgium. Bd. of Trade J., Sept. 27, 1906. [T.R.]

The "Moniteur Belge" of August 3 publishes a Royal Decree modifying previous decrees and establishing new regulations relative to the production, storage, sale, and carriage of explosives. The "Moniteur" may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

English Patent.

Explosives for use in torpedoes and the like. O. Silberrad, London. Eng. Pat. 437, Jan. 6, 1906.

Secret document under Section 44, Patents, &c., Act, 1883.—T. F. B.

French Patent.

Explosives of great safety; Process for the manufacture of ——. F. Volpert. Fr. Pat. 365,709, April 27, 1906.

The safety explosives described are characterised by the addition to the explosive of mixtures of ammonium chloride or other salts of ammonium, with salts of acids of manganese, chromium, and chlorine, especially the permanganates, chromates, bichromates, chlorates, and perchlorates of fixed alkalis and alkaline-earths, in quantities equivalent to, or nearly equivalent to 0·5 per cent. of the explosive mixture. The salts of the metal acids may be replaced partially, by approximately equivalent quantities of metal nitrates, especially alkali and alkaline-earth nitrates. Or the additions of ammonium chloride, &c., may be made in quantities not approaching equivalence.—W. C. H.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 957.)

APPARATUS, &c.

French Patent.

Methane and other light gases; Apparatus for detecting the presence of —— in mines, and for indicating their quantity. J. McCutcheon. Fr. Pat. 365,441, April 20, 1906. Under Int. Conv., Dec. 1, 1905.

See Eng. Pat. 24,900 of 1905; this J., 1906, 954.—T. F. B.

INORGANIC—QUANTITATIVE.

Potassium; Separation and determination of —— by means of perchloric acid. Pisani. Nouveaux Remèdes, 1906. **22**. 250.

A WEIGHED quantity of mixed potassium and sodium salts is treated with excess of perchloric acid, and evaporated to dryness on the water-bath. The dried residue is heated over the naked flame to complete the conversion into perchlorates. Sodium perchlorate is then dissolved out by means of 36 per cent. alcohol, in which solvent potassium perchlorate is insoluble. The latter is thrown on a filter, washed with 36 per cent. alcohol, dissolved in water in a tared capsule, evaporated to dryness, and weighed. The alcoholic solution of sodium perchlorate is also evaporated, and the residue weighed separately.—J. O. B.

Phosphoric acid: Quantitative volatilisation of —— from its salts. P. Jannasch and E. Heimann. Ber., 1906, **39**, 2625—2628.

THE authors add to the phosphate (0·5 grm.) in a flask about 6—8 c.c. of a liquid formed by mixing 30 c.c. of saturated cane sugar syrup and 10 c.c. of sulphuric acid (1 vol. acid and 1 vol. water). The mixture is carefully heated in an open air bath, and a stream of air passed through the flask till carbonisation is complete, and the mass is dry. Then the flask is connected to a receiver, heated to the highest temperature the flask will bear, and a stream of chlorine passed through till no more condensable products come over. Oxygen is now substituted for chlorine till all carbon is burnt. After cooling, 3—4 c.c. of the acid sugar solution are added, and worked round the flask, and the whole process repeated. In this way, the authors have volatilised the phosphoric acid completely from ammonium and magnesium phosphates, and they are now working out the details of the process and its extension to other phosphates.—J. T. D.

Carbon in steel; New colorimeter for the determination of ——. C. H. White. Bull. Amer. Inst. Min. Eng., 1906, 743—748.

EQUAL weights of the steel under examination and of a standard steel are dissolved in equal volumes of solvent, the solutions are diluted to a definite volume, and poured into hollow glass wedges, as nearly as possible of equal size, and with the sides inclined at the same angle. These wedges are mounted in a box so that they can be moved vertically, up or down, and there is a narrow, horizontal slit in both the front and the back wall of the box, to allow of the direct passage of light through the wedges at one zone only. A graduated scale is mounted alongside each of the wedges. When the wedges are so adjusted that the colours are of equal intensity, the percentage of carbon in the steel under examination can be readily calculated from the ratio between the thickness of the two wedges at the illuminated zone, or between the distances of the thin ends of the wedges from this zone. Suppose, for example, the standard steel contains 0·3 per cent. of carbon, and after the wedges have been adjusted until the colours match, it is found that the scale on the side of the standard reads 72, and the scale of the other wedge reads 60; then the proportion (60:70 = 0·30:x) shows that the steel under examination contains $\frac{72 \times 0 \cdot 30}{60} = 0 \cdot 36$ per cent. of carbon.—A. S.

Copper; Electrolytic determination of ——. F. Foerster. Ber., 1906, **39**, 3029—3035.

USUALLY copper must be deposited from nitric acid solution, so that towards the end of the operation the evolution of hydrogen, and consequent pulverulent character of the last deposited copper, may be prevented. By working with a single accumulator, however, the E.M.F. (2·05 volts.) is so lessened that no hydrogen is evolved, even in a sulphuric acid solution, nor can salts of cadmium, cobalt, nickel, iron, or zinc be electrolysed, whilst copper sulphate, which requires a voltage of only 1·49, is easily decomposed. The author has thus obtained good separations of copper from these metals, using about 0·25 grm. of copper as sulphate in 100 c.c., acidified with 10 c.c. of 2 *N*-sulphuric acid, a Winkler's gauze cathode, and a spiral wire anode. About eight hours are required, however, for complete deposition; but this time can be shortened to an hour or an hour and a quarter, by working at 80° C. In this case, when deposition is complete (shown by the fall of the current from about 0·35 to 0·05 ampère, or by the cessation of oxygen-evolution at the anode), the electrodes are lifted gradually out of the bath, and washed as they rise, so that the hot acid and air shall not attack the deposited copper. Separations from nickel, cadmium, or zinc are easily effected in this way; but not more than 0·1 grm. of iron per 100 c.c. may be present, or its alternate oxidation and reduction interfere with the deposition of the copper. Nor may more than a few centigrammes of nitric acid be present. —J. T. D.

Lead; Electrolytic separation of —— from acetic acid solutions. R. C. Snowden. J. of Physical Chem., 1906, **10**, 500—501. Chem. Centr., 1906, **2**, 1021.

ON electrolysing lead acetate solutions under ordinary conditions, feathery crystals of lead are deposited, which do not adhere firmly to the cathode. If the cathode be rapidly rotated, however, then, just as in the case of silver nitrate solutions (this J., 1905, 896), adherent deposits are obtained. With the cathode rotating at 2500 revolutions per minute in a solution containing 1 grm-equivalent each of lead acetate and free acetic acid per litre, a current-density of up to 0·5 ampère per sq. dm. can be used, whilst, if 1 per cent. of gelatin be added to the electrolyte, satisfactory results can be obtained with a current-density three times as strong.—A. S.

ORGANIC—QUALITATIVE.

Dyestuffs; Recognition and discrimination of artificial organic ——. G. Gulinow. Z. Farben-Ind., 1906, **5**, 337—343.

FROM an investigation of the different schemes constructed for the identification and classification of organic dyestuffs (see Witt, Chem. Ind. **9**, 1; also this J., 1886, 249; Weingärtner, Chem.-Zeit., 1887, **11**, 135 and 165; also this J., 1887, 451; Green, this J., 1893, **3**, and 1905, 1034; and Rota, Chem.-Zeit., 1898, **22**, 437; also this J., 1898, 798), the author concludes that the most satisfactory method of analysis is that based on the reduction of the dyestuff with either zinc dust in acid or alkaline solution, or stannous chloride and hydrochloric acid. In applying this reaction to dyestuffs generally, the behaviour with other reducing agents has been studied, the results of which are contained in the subjoined tables. Thus, zinc dust in neutral solution and hydrosulphite N.F. have been employed with advantage in determining to what chemical group a dyestuff belongs (*e.g.*, triphenylmethane derivatives, see Table I), whilst to ascertain the chemical properties, the ether reaction was found to furnish useful information. In carrying out the new scheme of analysis, the unknown dyestuff is in the first place examined for the presence of a sulphur group. Some sulphur dyestuffs may be recognised by their physical properties, such as imperfect solubility and evolution of hydrogen sulphide, whilst others are completely soluble in water, fail to liberate hydrogen sulphide, or exhibit an alkaline reaction, and give a precipitate with tannin. As dyestuffs in the form of bisulphite compounds react with lead paper, a test for the presence of sulphurous anhydride should invariably be made. If the dyestuff does not belong to the sulphur or oxyketone groups, it is further investigated for solubility, and the solution reduced with zinc dust and hydrochloric acid. Should a precipitate be formed, the reduction is effected in alkaline solution. The reduced solution is filtered, and subjected to oxidation with persulphate, to ascertain whether the dyestuff can be regenerated.

TABLE I.

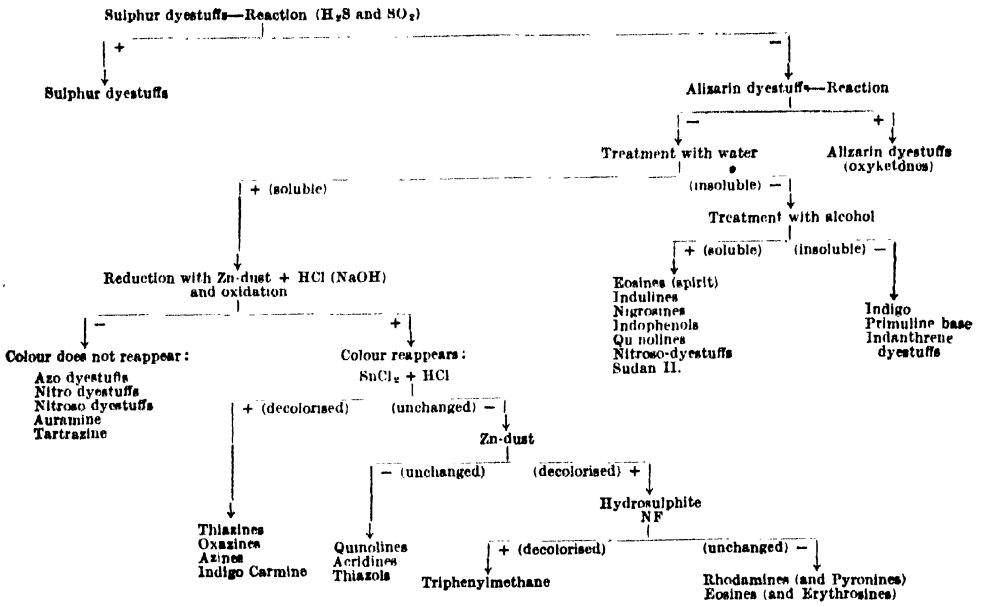


TABLE II.

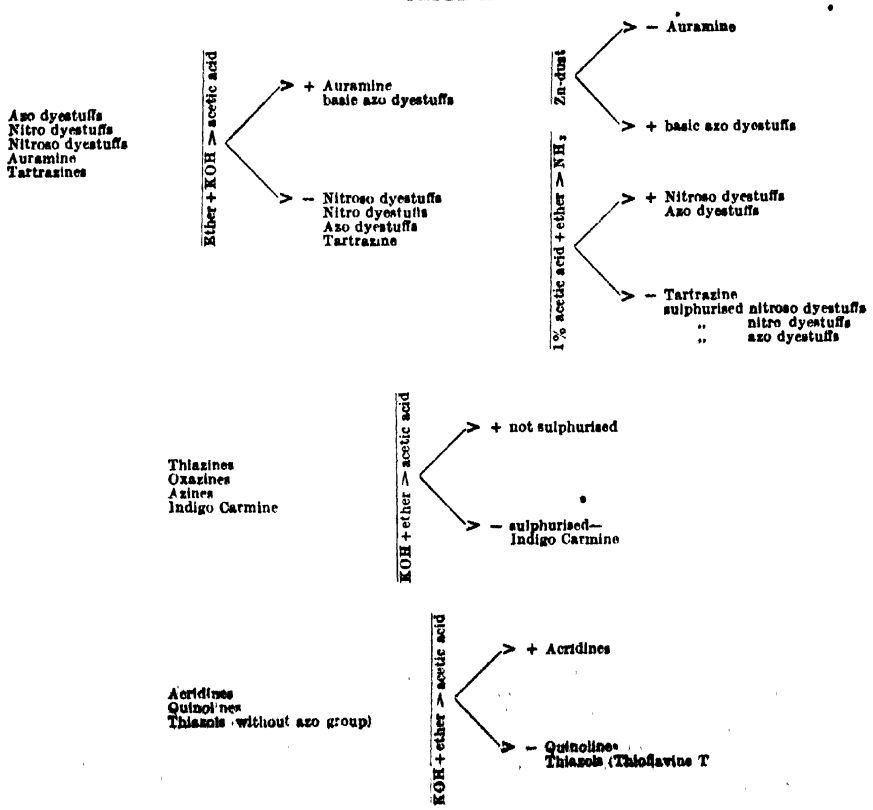
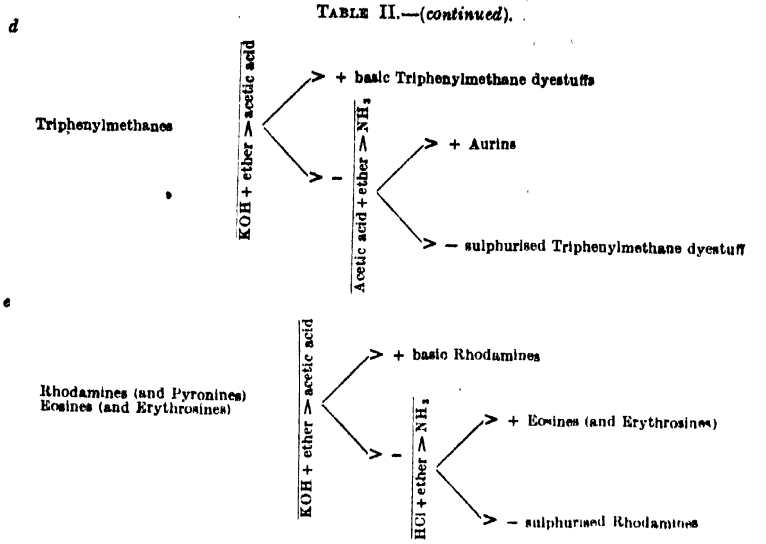


TABLE II.—(*continued*).



—D. B

Vinegar; Test for distinguishing between fermentation vinegar and wood ——. E. Schmidt. Z. angew. Chem., 1906, **19**, 1610—1612.

THE author describes two modifications of Rothenbach's test for the identification of vinegar produced by the fermentation of alcohol (Z. Unters. Nahr. u. Genussm., 1902, 817). These modifications are stated to make the test more delicate, so that it can be applied to mixtures of the two sorts of vinegar. One method, devised by Kraszewski, consists in making the vinegar alkaline by caustic soda, and then shaking out with amyl alcohol. The amyl alcohol is evaporated, the residue is dissolved in water, acidified by sulphuric acid, and tested with iodine solution. If the sample consisted of or contained fermentation vinegar, a precipitate or turbidity is produced after the addition of the iodine, and cooling. It is stated that the approximate proportion of fermentation vinegar can be judged by the result. The second method, proposed by the author, consists in distilling off 100 c.c. of the sample, and testing the residue with iodine. These methods depend on the presence in fermentation vinegars of by-products of bacterial life, which, being of the nature of alkaloids, give precipitates with iodine. Wood vinegars, made by diluting "vinegar essence," give no turbidity with iodine.—J. F. B.

Alypine; Distinctive reactions of ——. P. Lemaire. Rép. Pharm., 1906, **18**, 385—387.

WHEN warmed gently with strong cobalt nitrate solution, a few particles of alypine (benzoyltetramethyldiaminopentanol hydrochloride) give a fine blue colour; cocaine hydrochloride gives a similar colour. A solution of 0·05 grm. of alypine in 20 drops of water gives an almost immediate crystalline precipitate with 9 c.c. of 10 per cent. zinc chloride solution. Under similar conditions holocaine hydrochloride gives an immediate white precipitate which rapidly aggregates to oily droplets; cocaine hydrochloride, stovaine, and β-eucaine hydrochloride, are unaffected; subcutine slowly deposits a few needle-shaped crystals. When a particle of alypine is treated with 1 c.c. of sodium hypobromite reagent, a white precipitate is formed, which aggregates to oily drops. On warming, no reddish-brown colour is produced, such as is given by subcutine, nirvanine, holocaine hydrochloride, or orthoform. A one per cent. solution of alypine, when treated with two or three drops of 2 per cent. iron alum solution, does not give a violet colour, like subcutine or nirvanine, nor a red-brown colour, like orthoform.—J. O. B.

ORGANIC—QUANTITATIVE.

Indigo; Analysis of ——. C. Rawson. J. Soc. Dyers and Col., 1906, **22**, 306—307.

THE author criticises the paper by W. P. Bloxam (this J., 735), in which it is stated that the permanganate method of analysis is inaccurate. The author maintains, however, that this method as worked by himself and his colleagues gives reliable figures. The volumetric and the gravimetric "hyposulphite" processes recommended by the author in 1885 are two other reliable methods, and although the combined gravimetric and volumetric hyposulphite method involves somewhat long and tedious operations, the same objection applies to Bloxam's "tetrasulphonate" method.—J. C. C.

Tan liquors; New and accurate method for the determination of free acid in ——. A. W. Heppenstedt. J. Soc. Dyers and Col., 1906, **22**, 316. (See also this J., 1905, 1096.)

FIFTY c.c. of the liquor to be analysed are diluted to 500 c.c. To 200 c.c. are added 20 c.c. of a quinine solution made by dissolving 15 grms. of pure quinine in 110 c.c. of previously neutralised 95 per cent. alcohol and diluted with water to 200 c.c. After mixing thoroughly and filtering, the filtrate is titrated with *N*/10 caustic alkali, using phenolphthalein as indicator. The number of cubic centimètres used, multiplied by 0·066, gives the direct percentage of acid, reckoned as acetic acid, in the original liquor.—J. C. C.

Turkey-red oils; Analysis of ——. W. Herbig. Chem. Rev. Fett- u. Harz-Ind., 1906, **13**, 187—190; 211—213; 241—244.

IT is shown that decomposition of a Turkey-red oil with cold hydrochloric acid for the determination of the total fat gives results differing but little from those obtained on treatment with boiling hydrochloric acid. In order to obviate the confusion that is found in commerce with regard to the exact meaning of, *e.g.*, "50 per cent. Turkey-red oil," the author recommends that it shall be accepted that the percentage invariably refers to the percentage of total fat. The following method of determining this, in conjunction with a determination of the combined sulphuric acid, is stated to give closely concordant results: 10 grms. of the Turkey-red oil are heated in a flask with 50 c.c. of water until the fat has dissolved, and the liquid then treated with 25 c.c. of "dilute" hydrochloric acid, and boiled for three to five minutes. When cold, the contents of the flask are washed into a separating funnel

with water and ether, the amount of the latter being about 200 c.c., and the whole vigorously shaken. The aqueous layer is drawn off, and the ethereal solution washed with three successive portions of water, which takes from 30 minutes to one hour. The united aqueous liquids are heated to boiling, and after all ether has been expelled, the sulphuric acid is precipitated as barium sulphate. The bulk of the ethereal layer is distilled at a low temperature, the residue transferred to a weighed beaker, and the remainder of the ether allowed to evaporate spontaneously. The residue of fat is heated for one or two minutes over a free flame until bubbles cease to appear, and is then dried for 30 minutes at 105° C., and weighed.—C. A. M.

Beetroot analysis; Which is the best method for ——? F. Sachs. Z. Ver. deut. Zuckerind., 1906, 918—924.

On scientific grounds the method of alcoholic extraction for beetroot analysis is the best; owing, however, to the great care required in its execution, it can only be recommended for practical purposes as a means of occasional control of a simpler process. For the same reason the methods of cold and warm alcoholic digestion are unsuitable in cases where a large number of analyses is to be performed. The method of warm aqueous digestion also requires too much time and care; it is useful for purposes of control. The author recommends the following (Sachs-le Docte) process, a modification of the cold aqueous method, as being rapid and sufficiently exact. The beetroot is made into a very fine pulp by means of Keil and Dolle's conical beetroot borer or other similar instrument. After the pulp has been thoroughly mixed with the hand in order to remove any lumps which may have escaped grinding, 26 grms. (for German saccharimeters) are weighed into a tared metal beaker of about 250 c.c. capacity, which is provided with an india-rubber cover; 177 c.c. of water, containing 5—6 c.c. of lead acetate solution (of about 30° B.), are then added, and the mixture is thoroughly shaken several times. The solution is filtered, the filtrate treated with a few drops of acetic acid, and polarised in a 400 mm. tube. The reading gives the average content of sugar in the beetroot. For French polarimeters 32·58 grms. of pulp and 171·2 c.c. of water and lead acetate solution are employed, the observed reading being halved. In the case of polarimeters for which 20 grms. is the normal weight, 20 grms. of pulp and 182·3 c.c. of water and lead acetate solution are taken. The author quotes experiments which show that, provided the pulp is properly prepared, digestion is complete and practically instantaneous. He shows, also, that the error introduced by taking 177 c.c. of water in all cases (*i.e.*, with samples of varying sugar and juice content) is practically negligible.—L. E.

Sachs-le Docte process; Further remarks on the ——. A. Le Docte. Z. Ver. deut. Zuckerind., 1906, 924—931. (See preceding abstract.)

The author gives a detailed description of the Sachs-le Docte method for beetroot analysis, together with diagrams of the apparatus required.—L. E.

Formic acid; Determination of —— by means of permanganate. J. Klein. Ber., 1906, **39**, 2640—2641.

The author points out that in 1887 he published a method for this determination, in which the formic acid or formate was added to a known amount of boiling alkaline solution of permanganate of known strength. After reaction, excess of oxalic acid was added, then dilute sulphuric acid, and the oxalic acid in excess was finally determined by permanganate.—J. T. D.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 958.)

Metal acid anhydrides; Action of liquefied ammonia on ——. A. Rosenheim and F. Jacobsohn. Z. anorg. Chem., 1906, **50**, 297—308.

The authors have studied the action of liquefied ammonia on the acid anhydrides of chromium, molybdenum, tungsten, uranium, arsenic, vanadium, and antimony. In no cases were amino compounds produced, but in all cases where reactions took place, salts of imino-acids were obtained. Ammonium salts and, in some cases, lead and potassium salts of the following acids were prepared: Iminochromic acid, $NH{:}CrO(OH)_2$, iminomolybdic acid, $NH{:}MoO(OH)_2$, iminotungstic acid, $NH{:}WO(OH)_2$, and iminometa-arsenic acid, $NH{\cdot}O(AsO.OH)_2$. No definite compounds could be obtained by the action of liquefied ammonia on uranium, antimony, and vanadium compounds.—A. S.

Hydrogen sulphide; Liquid —— as a solvent. U. Antony and G. Magri. Gaz. chim. ital., 1905, **35**, [1], 206—226.

As a solvent liquefied hydrogen sulphide has somewhat similar properties to those of carbon bisulphide, alcohol, ether, and benzene; its ability to cause ionisation is far less marked than that of water and other strongly dissociating solvents. Electrically, it is non-conducting. It does not dissolve salts of strong bases, but non-metallic compounds are dissolved in it, giving conducting solutions. Solutions of iodine in liquefied hydrogen sulphide possess very considerable conductivity, those of phosphorus iodide are conducting to a lesser extent, whilst those of the haloid compounds of other non-metals show only moderate conductivity. Solutions of certain organic substances—for example, iodoform and tetramethylammonium iodide—yield solutions having conductivities which indicate that organic compounds may become ionised in liquefied hydrogen sulphide.—A. S.

New Books.

Technologie et Analyse Chimiques des Huiles, Graisses, et Cires. Par le Dr. J. Lewkowitsch, M.A., &c. Traduit de la troisième édition anglaise, spécialement revue et augmenté par l'Auteur, par Emile Bontoux, Directeur technique de la Société Anonyme de Savonnerie Marseillaise. Tome I. H. Dunot et E. Pinat, Editeurs, 49, Quai des Grands-Augustins; Paris, 1906. Price 20 fr.; bound 21.50 fr.

This, the first volume of the complete French edition of this work, is of 8vo size, and contains 564 pages of subject matter, with 53 illustrations. Additional matter is incorporated in this edition by the author, and some special French methods by the translator with the author's approval. (See also this J., 1904, 802, and 1905, 214).

Technologie der Fette und Oele. Handbuch der Gewinnung und Verarbeitung der Fette, Oele, und Wachsarten des Pflanzen- und Tierreichs. Unter Mitwirkung von G. Lutz, O. Heller, Felix Kessler, und anderen Fachmännern. Herausgegeben von Gustav Hefter, Director der Aktiengesellschaft zur Fabrikation vegetabilischer Oele, Triest. Erster Band. Gewinnung der Fette und Oele. Julius Springer's Verlag, Berlin. 1906. Price M. 20. Bound, M. 22.50.

8vo volume, containing 705 pages of subject matter with 346 illustrations, and 10 tables, followed by an alphabetical index of authors and subjects. The subject matter of Vol. I. is arranged according to the following scheme: I. General. Occurrence, Formation, and Uses of the Natural Oils, Fats, and Waxes II. The Constituents of Oils, Fats, and Waxes. III. Chemistry, Properties, and Behaviour of Oils, Fats, and Waxes. IV. Production and Further Working up of Oils and Fats Generally. V. Extraction of Vegetable Oils and Fats. VI. Extraction of Animal Oils and Fats. VII. Extraction of Waxes and Refuse Fats. VIII. Purification of Oils, Fats, and Waxes. (i.) Removal of Mechanical Impurities. (ii.) Removal of Albumins, &c. (iii.) Removal of free fatty acids. (iv.) Removal of colouring matters. (v.) Removal of odourous matters. (vi.) Methods for securing better preservation, improved flavour, &c. (vii.) Methods for raising the melting point or reducing the solidifying point of fats and oils, &c.

JOURNAL OF THE
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No. 21.—Vol. XXV. **SUPPLEMENT.** **NOVEMBER 15, 1906.**

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Official Notices.

DECENNIAL INDEX, 1896—1905.

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Change of Style.

His Majesty has been pleased to confer the honour of Knighthood on Lt.-Col. Frederic Louis Nathan, R.A., Superintendent of the Royal Gunpowder Factory, Waltham Abbey.

Death.

Odling, Francis J., Prince's Bridge, Melbourne, Vic., Australia. Sept. 10.

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 21,734. Simpson. Heating. Oct. 15.
,, 22,742. Cooper, Cooper, and Greig. Furnaces. Oct. 15.
,, 22,760. Whiteman (Hooven). Centrifugal separators.* Oct. 15.
,, 22,783. Quinan. *See under* XXII.
,, 23,019. Kestner. Apparatus for atomising liquids and simultaneously mixing them with air or gas. [Belg. Appl., Oct. 18, 1905.]* Oct. 17.
,, 23,049. McKenzie and McLauchlan. Filters for filtering by percolation as applied to acids, alkalis, water, or sewage.* Oct. 18.
,, 23,532. Fitzgerald and Barratt. Cooling composition. Oct. 23.
,, 23,606. Grossmann. Apparatus for evaporating at less than atmospheric pressure. Oct. 24.
,, 23,966. Johnson (Badische Anilin und Soda Fabrik). Apparatus for measuring fluids. Oct. 27.
,, 23,974. Fraser and Vaughan. Distillation of frictional liquids and apparatus therefor. Oct. 27.
[C.S.] 14,809 (1905). Humphrey. Process and apparatus for separating gases. Oct. 24.
,, 21,594 (1905). Buck, Buck, and Buck. Steam drying cylinders. Oct. 24.
[C.S.] 24,309 (1905). Lean (Maschinenbau Anstalt Humboldt.). Continuously cooling and drying moist air in large quantities. Oct. 24.
,, 837 (1906). Monkhouse and Burstall. Apparatus for measuring the flow of gases and liquids. Oct. 31.
,, 4600 (1906). Von Mylius and Von Mylius. Smoke-consuming furnaces. Oct. 31.
,, 6062 (1906). Clark. Agitating apparatus for use in evaporating, distilling, gas-washing, pulping, and the like. Oct. 24.
,, 9502 (1906). Loew. Filters. Oct. 24.
,, 11,724 (1906). Boult (Manvers and Phillips). Apparatus for creating and maintaining a vacuum. Oct. 24.

II.—FUEL, GAS, AND LIGHT.

[A.] 22,777. Thompson (Cons. f. Elektrochemische Ind.). Tungsten filaments for electric incandescence lamps. Oct. 15.
,, 22,913. Cons. f. Elektrochem. Ind. Tungsten filaments for electric incandescence lamps. [Ger. Appl., Oct. 16, 1905.]* Oct. 16.
,, 23,067. Claughton. Gas-producing apparatus used with gas engines. Oct. 18.
,, 23,080. Willis (Sales). Gas generator. Oct. 18.
,, 23,119. Bourdos, Rothschild, and Sutcliffe. Manufacture of incandescing bodies or filaments for electric lamps. Oct. 18.
,, 23,215. Cottrell. Vaporisation of oil fuel. Oct 19.
,, 23,334 and 23,336. Coolidge. Electric conductors applicable as incandescing bodies for electric lamps. [U.S. Appl., May 9, 1906.]* Oct. 20.
,, 23,335. Arsem. Electric conductors for use as incandescing bodies in electric lamps. [U.S. Appl., May 9, 1906.]* Oct. 20.
,, 23,407. Bonthrone. Production of combustible gas for industrial purposes. Oct. 22.
,, 23,542. Robin. Incandescent mantles. [U.S. Appl., March 20, 1906.] Oct. 23.
,, 23,828. Lee. Manufacture of metallic filaments for incandescent electric lamps. Oct. 26.
,, 23,950. Nemerovsky. Incandescent gas mantles. Oct. 27.
[C.S.] 14,972A (1905). British Thomson Houston Co. (General Electric Co.). Manufacture of electric lamp filaments from thorium. Oct. 31.
,, 18,723 (1905). Brown. Furnaces for gas retorts. Oct. 24.
,, 21,135 (1905). Klonne. Coke ovens. Oct. 24.
,, 24,522 (1905). Clark. Mantles for incandescent gas lamps. Oct. 31.
,, 26,666 (1905). Dibdin and Woltereck. Production of permanent illuminating and heating gas. Oct. 31.
,, 6062 (1906). Clark. *See under* I.
,, 7499 (1906). Bormann. Suction gas generators. Oct. 24.
,, 9501 (1906). Tait. Combustible gaseous fuel for the generation of motive power. Oct. 24.
,, 11,660 (1906). Jones. Coke ovens. Oct. 31.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 23,381. Wildenhayn. Process of producing tar oil emulsions. Oct. 22.
,, 23,514. Goddard and Gush. Distillation or treatment of heavy mineral oils. Oct. 23.
,, 23,682. Crutch. Manufacture of halogen compounds of benzine and other halogen carbon, and hydrogen-carbon compounds. Oct. 24.
,, 23,780. Tompkins, and Clayton Aniline Co. Manufacture of trichlorethylene and hexachlorbenzene. Oct. 25.
[C.S.] 7934 (1906). Hesse. Purifying pitch oils and other ethereal oils obtained by the destructive distillation of resinous substances. Oct. 24.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 22,771. Lake (Farbwerk Mulheim vorm. Leonhardt und Co.). Manufacture of salicylthioglycolic acid. Oct. 15.

[A.] 22,781. Imray (Meister, Lucius, und Brüning). *See under* XIIIA.
„ 22,872. Imray (Meister, Lucius, und Brüning). Manufacture of concentrated liquid dyestuffs or easily liquefiable pastes from sulphurised dyestuffs. Oct. 16.
„ 23,682. Crutch. *See under* III.
„ 23,780. Tompkins, and Clayton Aniline Co. *See under* III.
„ 23,864. Lake (Chem. Fabr. Griesheim Elektron). Manufacture of sulphurised dyestuffs and intermediate products.* Oct. 26.
[C.S.] 21,175 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of amido-oxysulphonic acids of phenylnaphthimidazole or homologues or derivatives thereof. Oct. 24.
„ 4097 (1906). Ransford (Cassella und Co.). New sulphur colours and process for making the same. Oct. 31.
„ 20,633 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 31.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 22,796. Meisel. Rendering fabrics opaque to Röntgen rays.* Oct. 15.
„ 22,828. Burger and Appleyard. Solution for finishing textiles, leather, and similar materials. Oct. 16.
„ 23,083. Newton (Bayer und Co.). Dyeing with sulphur dyestuffs. Oct. 18.
„ 23,555 and 23,556. Von Ordody, and Westdeuts. Thomasphosphatwerke. Production of long fibres suitable for spinning from willow bark and other bast-containing material. Oct. 23.
„ 23,683. Donnersmark'sche Kunstseiden und Acetatwerke. Manufacture of elastic threads. [Ger. Appl., Oct. 25, 1906.]* Oct. 24.
„ 23,761. Schiefner. Process of treating jute fibres. Oct. 25
[C.S.] 21,311 (1905). Milan. Machines for dyeing or treating with liquids, raw cotton, loose wool or silk, and like loose fibre. Oct. 24.
„ 21,768 (1905). De Hatvany-Deutsch. Method of obtaining textile fibre from reeds and the like. Oct. 31.
„ 23,509 (1905). Nicholas. Apparatus for cleaning, dyeing, or otherwise treating wool, textiles, and the like. Oct. 24.
„ 25,752 (1905). Lake (Soc. Anon. Coop. per la Stagionatura e l'Assaggio delle Sete ed Affini). Treatment of silk with thiourea or its salts or derivatives. Oct. 24.
„ 3025 (1906). Bousfield (Soc. Anon. Fabr. de Soie Artificielle de Tubize). Manufacture of artificial silk. Oct. 31.
„ 10,517 (1906). Fischer, Arnold, and Illig. Centrifugal machines for removing oil from wool, cotton waste, and the like. Oct. 24.
„ 12,117 (1906). Wilkinson. Apparatus for bleaching or dyeing hanks, cops, or other fibrous materials. Oct. 24.
„ 14,344 (1906). Wood. Apparatus for cleaning, dyeing, or treating wool, hair, cotton, and other fibrous or textile material. Oct. 24.
„ 15,300 (1906). Paechtner. Dressing or sizing for yarns and other textile materials. Oct. 31.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 22,887. Robeson. Treatment of waste sulphite liquor.* Oct. 16.
„ 23,049. McKenzie and McLauchlan. *See under* I.
„ 23,130. Raschen, Shores, Warcing, and United Alkali Co., Ltd. Purification of sulphuric acid and recovery of by-products. Oct. 18
„ 23,410. Tcherniac. Manufacture of sodium cyanide. Oct. 22.
„ 23,533. Thompson (Ellis). Obtaining its constituents from ammonium chloride. Oct. 23.
[A.] 23,676. Johnson (Felix, Fournier, et Cie.). Manufacture of a decolorising substance. Oct. 24.
„ 23,835. Hutton and Smith. Manufacture of hydrocyanic acid and its salts. Oct. 26.
„ 23,905. Ryan. *See under* IX.
„ 23,967. Chem. Fabr. Phœnix. Extraction of sulphur. [Ger Appl., Nov. 15, 1905.]* Oct. 27.
[C.S.] 21,949 (1905). Digby. *See under* XI.
„ 8362 (1906). Bellowitsch. Manufacture of ferrocyanides from gas purifying masses and the like. Oct. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 3353A. Sankey. Manufacture of silica, cements, crucibles, and other articles. Oct. 17.
„ 23,124. Frollo. Cement.* Oct. 18.
„ 23,375. Wolfsholz. Manufacture of artificial stone and other building materials from cement, concrete, and the like.* Oct. 22.
„ 23,450. Bamber. Manufacture of Portland and other cement. Oct. 22.
„ 23,905. Ryan. Utilisation of gaseous and solid lime kiln products. Oct. 26.
[C.S.] 18,806 (1905). Schumacher. Manufacture of artificial stone from slag. Oct. 31.
„ 21,816 (1905). Hughes. Apparatus for drying bricks, timber, &c. Oct. 31.
„ 2207 (1906). Boult (Coln-Musener Bergwerks Akt.-Ver.). Manufacture of artificial stone blocks, pipes and briquettes from slag. Oct. 24.
„ 3970 (1906). Lukacs. Artificial stone slabs. Oct. 24.
„ 7927 (1906). Gordon. Manufacture of bricks. Oct. 24.
„ 17,569 (1906). Apperley and Hullinghorst. Manufacture of artificial stones and other plastic articles. Oct. 24.

X.—METALLURGY.

[A.] 22,799. Simpson. Treatment of metals. Oct. 15.
„ 22,889. Fairweather (Koemgsberg). Apparatus for extracting gold by the cyanide process. Oct. 16.
„ 22,971 and 22,972. Herbert and Eden. Annealing muffles or furnaces. Oct. 17.
„ 23,230. Simpson. Treatment of metals. Oct. 19.
„ 23,293. Galbraith. Manufacture of steel by the Bessemer or pneumatic process. Oct. 20.
„ 23,449. Goldschmidt and Goldschmidt. Detinning tinplate scrap and other tinned waste materials. [Ger. Appl., Oct. 24, 1905.]* Oct. 22.
„ 23,509. Hannay and Wilson. Treatment of metallic ores. Oct. 23.
„ 23,544. Lake (Latour). Process for bronzing copper. Oct. 23.
„ 23,558. Simpson. Treatment of metals. Oct. 23.
„ 23,567. Dietzsch and Paull. Separation of ores.* Oct. 23.
„ 23,663. Cowper-Coles. Recovery of gold from cyanide solutions. Oct. 24.
„ 23,664. Cowper-Coles. Removal of scale and oxide from metallic surfaces. Oct. 24.
„ 23,727. Crowley and Payne. Alloy or spelter for surfacing brass, copper, or white metal. Oct. 25.
„ 23,869. Bergquist. Apparatus for sintering fine ore. Oct. 26.
[C.S.] 20,884 (1905). Kuhne. Production of metals, metalloids, or their alloys. Oct. 24.
„ 21,060 (1905). Simpson and Bourcoud. Manufacture of iron and other metals. Oct. 24.
„ 21,549 (1905). Slater. Extraction of gold, silver, and other metals. Oct. 31.
„ 21,634, 21,635, and 21,650 (1905). Peck. Centrifugal ore separators. Oct. 31.
„ 21,639 (1905). Adams. Centrifugal ore concentrators. Oct. 31.
„ 21,663 (1905). Adams. Centrifugal ore separators. Oct 31.
„ 22,235 (1905). Baker and Smith. Treatment of sulphide ores. Oct. 31.
„ 26,711 (1905). Sulman, Picard, and Ballot. Separation of minerals. Oct. 24.

[C.S.] 2506 (1906). King's Norton Metal Co., Bayliss, Brownsdon, and Smith. Solvent for lead and alloys of lead Oct. 31.
„ 7655 (1906). Kuzel. Improvement of the electrical resistance of metals. Oct. 24.
„ 9750 (1906). O'Brien (Chambaud) Aluminium alloys Oct. 31.
„ 12,130 (1906) Grunewald. Case-hardening iron and steel. Oct. 24.
„ 17,328 (1906). Minerals Separation, Limited (Chapman). Ore concentration. Oct. 31.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 22,752. Connor and Stubbs Electrodes.* Oct 15
„ 22,794. British Thomson-Houston Co (General Electric Co.) Electric furnaces Oct. 15
„ 22,920. Hatfield Electrolytic cells. Oct 17
„ 23,379. Lindblad and Stalhane. Transformer furnaces [Appl. in Sweden, May 8, 1906.]* Oct. 22
„ 23,413 Leitner. Active materials for electric accumulators. Oct 22
[C.S.] 20,770 (1905) Hatfield, and Reason Manufacturing Co. Cathodes Oct. 24.
„ 21,534 (1905) Jungner Electrodes for electric accumulators Oct. 24.
„ 21,535 (1905). Berglund. Insulation of accumulators with alkaline electrolyte Oct 24.
„ 21,949 (1905). Digby Electrolytic manufacture of hypochlorite solutions Oct 31
„ 18,565 (1906). Schneider. Accumulators Oct 24.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 23,534. Thompson (Bottaro). Manufacture of fatty acids Oct. 23
„ 23,559. Scott Distillation of glycerin and apparatus therefor. Oct. 23.
„ 23,768. Common, and The Hull Oil Manufacturing Co. Means for use in the emulsion of oils. Oct. 25

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints

[A.] 22,781. Imray (Meister, Lucius, und Bruning) Manufacture of colour lakes. Oct. 15
„ 23,687 Allendorff. Method of rendering lithopone insensitive to the action of light.* Oct 24
[C.S.] 3446 (1906). Lance and de Joannis. Manufacture of paint material. Oct. 24.

(*B.*)—Resins; Varnishes.

[A.] 23,650. Joly Resins, gum resins, and the like. Oct 24
[C.S.] 7934 (1906). Hesse. *See under* III.

(*C.*)—India-Rubber.

[A.] 23,290. Roland and Fry Preservative composition for india-rubber, gutta-percha, and compounds thereof. Oct. 20.
„ 23,681. Ellis (Les Produits Chimiques de Croissy, J. Basler et Cie.). Regeneration of rubber waste, and improving the quality of caoutchouc. Oct. 24.
[C.S.] 4002 (1906). Penther. Separation of caoutchouc from fibrous materials combined therewith. Oct. 31.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 22,828. Bürger and Appleyard. *See under* V.
„ 23,789. Desgeorge and Lebreil. Treatment of casein and other albuminous substances. Oct. 25.
[C.S.] 9629 (1906). Pichard and Pichard. *See under* VI.

XV.—MANURES, &c.

[A.] 23,055. Oxford. *See under* XVII.
[C.S.] 1970 (1906). Sidebotham. Manure. Oct. 31.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 22,934. Foll. Apparatus for drying yeast. Oct. 17.
„ 23,055. Oxford Preparation of dry preserved yeast for fermenting purposes, together with foods, and a fertiliser and insecticide. Oct. 18.
„ 23,113. Davidson and Burra. Hop extracting apparatus.* Oct. 18.
„ 23,678 Zimmer Brewing beer. Oct. 24.
[C.S.] 6770 (1906) Hilliard. Removal of noxious elements from the higher alcohols in whisky. Oct 24
„ 15,046 (1906) Russell Filter for beer and other sedimentary liquids. Oct 24.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*) Foods

[A.] 22,983 Lee Food preparation. Oct. 17.
„ 23,055 Oxford *See under* XVII.
„ 23,169. Dunmch. Preparation of a dry coffee extract Oct 19
[C.S.] 5564 (1906) Paul Manufacture of baking powder Oct. 24
„ 13,178 (1906) Frings. Manufacture of fermentation vinegar. Oct 31.
„ 17,116 (1906). Williams. Preparation of proteids from ground nuts. Oct. 24

(*B.*)—Sanitation; Water Purification.

[A.] 23,049 McKenzie and McLauchlan. *See under* I.
„ 23,105 Gardner and Gardner. Purification of sea water for use with power plants, &c. Oct. 18.
[C.S.] 27,275 (1905) Lucas. Bacterial treatment of sewage. Oct. 24
„ 1636 (1906). Garfield Screening apparatus for sewage and other waste waters. Oct. 31
„ 9002 (1906). Allen. Apparatus for purifying water and other liquids. Oct 24
„ 11,980 (1906). Brindley and Von Foregger. Regenerating and purifying vitiated air. Oct. 31.

(*C.*)—Disinfectants.

[A.] 23,055. Oxford *See under* XVII.

XIX.—PAPER, PASTEBOARD, &c.

[C.S.] 14,575 (1906) Hutcheson. Apparatus for imparting a linen-like finish to paper. Oct. 24.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 22,810. Koch. Manufacture of camphene.* Oct. 15
„ 23,648. Newton (Bayer und Co.) Manufacture of halogen substitution derivatives of fatty acids. Oct. 24
„ 23,875. Weizmann, and The Clayton Aniline Co. Manufacture of pinene hydrochloride and of isobornyl esters and products therefrom. Oct. 26.
[C.S.] 7934 (1906). Hesse. *See under* III.
„ 14,438 (1906). Chem. Fabr. Grunau, Landshoff, und Meyer, A.-G. Manufacture of concentrated formic acid. Oct. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 5276 (1906). Shepherd, and Griffin and Sons, Limited. Treatment of photographic prints on "self-toning" paper. Oct. 24.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 22,783. Quman. Method and apparatus for drying guncotton, nitrocellulose, and similar bodies.* Oct. 15.
[C.S.] 13,860 (1906). Dobbs and Pitman. Machines for making grains or flakes of explosive or gunpowder. Oct. 31.
„ 16,725 (1906). Claessen. Manufacture of smokeless gunpowder. Oct. 31.
„ 17,891 (1906). Westfalisch-Anhaltische Sprengstoff A.-G. Nitroglycerin explosives. Oct. 24.

Death.

Odling, Francis J., Prince's Bridge, Melbourne, Vic., Australia. Sept. 10.

Liverpool Section.

Meeting held at Liverpool on Wednesday, October 10, 1906.

DR. JAMES T. CONROY IN THE CHAIR.

THE CHEMICAL TRADE OF ENGLAND AND GERMANY—A COMPARISON.

BY JAMES T. CONROY, B.SC., PH.D.

The progress of chemical science and industry is a subject of interest to all of us, and to place on record the progress made and to further, as far as possible, the development of chemical industry are to be counted amongst the chief objects of our Society. In viewing the results attained it is not sufficient to consider merely from a purely scientific point of view how far the industry has advanced; it is further essential to take count of its growth from the commercial standpoint, to note alterations in volume of trade, the increase in earning-power, and the additional employment opened out for wage-earners. These strictly utilitarian points are perhaps the more important from a national point of view; they are points which ought to appeal to all members of the Society, and I thus propose in my address this evening to bring before you some facts and figures bearing on the subject I have got together during recent years. I choose this subject the more readily because I feel there is considerable lack of knowledge and much misconception with regard to many questions bearing on our trade in chemical and allied products, and because a study of the official returns of this country does not, unfortunately, afford much help in making our position clear. F. Evershed has already called attention (this J., 1903, 22, 398) to the unsatisfactory manner in which our Board of Trade returns—so far as regards chemical manufactures and products—are made up, and how insufficient they appear when compared with the corresponding returns made in Germany and France and, I might add, in most other countries. On this occasion improvement was foreshadowed, and I am glad to say that during the last two years a number of additions have been made to the official lists. Nevertheless, even our improved lists leave much to be desired. The lists are not compiled on any scientific basis; a very large proportion of the returns is comprised under the heading "——unenumerated," and our system of classification renders it a matter of extreme difficulty, if not impossibility, to make a comparison of our business with that of other countries. This difficulty of making proper comparison was strongly impressed upon me when giving evidence some two years ago before the Departmental Committee on Industrial Alcohol, when Sir Henry Primrose, the Chairman of the Committee, said that from our Statements of Trade he did "not see any figures that would seem to make up £3,170,000, or anything like that amount, under the head of chemicals." The figure £3,170,000 was the value, given in my *précis* of evidence, of our then imports of chemicals from Germany. As a matter of fact, our own Board of Trade figures showed at this time a value of only some £600,000, of which bleaching powder, saltpetre, and soda compounds contributed 20 per cent., and "other chemicals" the remaining 80 per cent. This sum, however, does not include medicines and aniline dyes, alizarin, indigo, &c., which are grouped with chemical products in Germany and also in this country in making up the annual returns relating to chemical industry. If now we turn to the Board of Trade list, so as to include aniline dyes, what do we find? Out of a total of—in round figures—£1,000,000, we find Germany credited with less than one-tenth; the bulk is shown as coming from Holland. Our returns are here transparently at fault, and in this item investigation by the Board of Trade has substantially confirmed the accuracy of the German figures.

With this corroboration I feel considerable confidence in taking the German figures as correct, and in much that follows I have gone to German sources for my information. These German figures will not, of course, give values representing the trade of this country except in so far as they relate to trade between Germany and ourselves. They will, however, tell us this, and do so in a clear and detailed fashion. They will further enable us to learn something of the German method of classification and better help us, after consideration of the German chemical trade as a whole, to grasp our own position. Dealing with the figures in this order will, I hope, afford that comparison with what others are doing which is often the surest guide to our own progress, and, more especially, to our own possibilities of progress.

Trade in chemicals between England and Germany.—With this introduction I will draw your attention to Diagram 1., which represents the trade between this country and Germany over a period of 15 years in all substances included in the German official list under "Drogen, Apotheken, und Farbwaaren." It will, I think, be a revelation to most of you. In 1890–92 the interchange of chemical products between the two countries was equal, each exporting to and importing from the other goods of the value of some £2,400,000 annually. To-day our exports to Germany stand at less than £1,200,000, whilst their exports to us have exceeded £3,500,000. The picture is startling and disquieting, and did the course of our trade with Germany represent that with the rest of the world our position as chemical manufacturers would be serious indeed. Fortunately, it does not. On the whole our industry is progressing; whether the progress is what it ought to be remains to be seen. To this point I will return later; for the present I propose to trace to some considerable extent the nature of the dealings between the two countries. For this purpose I have tabulated (Table I) the exports and imports in various chemicals for the two years 1895 and 1905, choosing these years so as to give the latest available information as to our present trade. I may say that figures for any other two years, or any series of years from 1892 onwards, would tell the same tale, possibly varying slightly for individual items, but not in any way affecting the general view. The diagram is, I feel sure, sufficient proof of this. In preparing the table, I have followed the German system of classification. In this system, the various materials are divided into the two main divisions: raw materials, and manufactured products. These main divisions are further subdivided into six classes, or groups, as follows (the values in parenthesis give the number of headings appearing in each group in 1895 and 1905 respectively):—

	No. of Headings.
I.—*Raw materials.*	
A.—Raw materials for the chemical industry	(12—14)
B.—Drugs for medicinal purposes and perfumery	(15)
C. Resins and leather waste ..	(6—7)
D. Ferments and fining materials ..	(5—4)
E. Crude colour materials	(11—12)
F.—Tanning materials	(8—10)
II.—*Manufactured articles.*	
A.—Elements, bases, acids, and salts..	(60—66)
B.—Ethers and essential oils, medicines, and perfumery..	(18—22)
C.—Resin oils, varnishes, lacquers, &c.	(9)
D.—Explosives and matches	(7)
E.—Pitch, tar, and tar products ..	(9)
F.—Writing and drawing materials and colours	(29—34)

On the whole, the classification is sound and good; exception may, however, be taken to the inclusion of certain items appearing in some of the groups, and for such instances I would refer to Mr. Evershed's paper. The total import and export figures under the above headings somewhat exceed the values given in the various yearly returns from which Diagram I. has been prepared, inasmuch as they include, in addition to Drog., Apoth., and Farbwaaren, certain minerals and ores, such as pyrites, manganese, &c., and also tar, pitch, resins, and asphalt.

Examining these figures in detail, we see that, as might be expected, the international trade in raw materials forms but a small percentage of the total interchange. The period covered is not long enough to show the great changes which have taken place in this branch. These changes are more particularly noticeable in quinine bark, galls, and gums, and are clearly shown in the Appendix to Mr. Tyrer's presidential address (this J., 1896, 495). London, once the chief market for quinine bark, lost this distinction many years ago, and, in the matter of galls, I read only a few months ago that, instead of buying in London or Hamburg, the consumers are to-day purchasing direct in Shanghai. Our own returns bear this out; our export of galls in 1905 amounting to only £13,197, as against £37,632 in 1904 and an average of well over £50,000 for previous years. In regard to gums, whilst the German purchases have more than doubled during the last ten years, the quantity bought from us has fallen to about one-half, the bulk now being drawn direct from British East Indies and Egypt. Of course our export business in these articles was, so to say, merely in the nature of brokerage, but the changes are unsatisfactory, inasmuch as they tend to lessen our control over and touch with the respective markets, and also to diminish our oversea trade.

Passing now to manufactured articles, we find in Class A that, apart from "unenumerated" products, potassium compounds account for, say, one-half the German exports to this country, having risen from £266,000 in 1895 to £350,000 in 1905. The potassium salts industry is, however, practically a German monopoly, and our increased imports of these salts should be all to our benefit, being to a large extent—one might almost say—in the nature of raw material.

As regards soda and bleaching powder, the position is not so satisfactory, for whereas in 1895 there was a balance in our favour, there is now a much larger balance in favour of Germany. This is, no doubt, mainly due to the introduction of electrolytic methods in the manufacture of alkali and bleach, and to the immense impetus which such introduction has given to the working up in Germany of potassium chloride for the production of caustic potash. In this connection, some interesting figures were published in the early part of last year by Hasenclever, who stated that, of the 260,000 tons of bleaching powder representing the world's production, one-half was now produced electrolytically. The total bleach production in Germany now exceeds 60,000 tons per annum, and of this 65 per cent. is prepared electrolytically, and in the main from potassium chloride.

Amongst other chemicals in Class A, the group comprising benzoic acid, citric acid, tartaric acid, tannic acid, salicylic acid, and oxalic acid represents an important and growing item, having risen from £123,300 in 1895 to £140,000 in 1905. Of this sum, two-thirds is due to tartaric acid, of which commodity we take nearly two-thirds of Germany's total export. Germany is, of course, a wine-producing country, and we might expect to find a well-developed industry for the working up of the lees for tartaric acid. It would appear, in fact, that the capacity of the works is well in excess of the home supply of raw material, and that constantly increasing supplies of "weinstein" are being imported from France, Italy, and Spain. Our own returns now include tartaric acid and cream of tartar under separate headings. Great expansion is shown in nearly all the other articles included in this class (A), and it appears to me that in many cases we are importing finished chemicals, the demand for which ought to be satisfied by home manufacture. We have, however, no figures to show the full extent of our requirements in these articles; still less do we know the extent to which they are manufactured in this country, and thus cannot say whether we are allowing Germany to supply a small or a large percentage of our wants.

Turning now to Germany's imports from us (Class A), we find, at first glance, an apparently satisfactory state of affairs, for, excluding unenumerated, we note a rise from, roughly, £460,000 to £600,000. Dissection of the figures shows, however, that this rise is accounted for by the two items, ammonium salts and iodine. As regards ammonium salts, our exports to Germany in 1905 were much above the average value for the preceding 10 years, whilst, in the case of iodine, the chances are that most of it was merely passing through this country in transit from Chili. Excluding these, our trade in other chemicals shows a slight loss, such loss being most noticeable in the cases of barium and strontium salts (£4500), borax (£29,200), phosphorus (£11,300), and white arsenic (£4400)—in all £49,400. There are satisfactory gains in copper sulphate and in chromates; other gains are trifling compared with the gains in exports by Germany shown under the same headings.

Passing now to group B, that is, to materials usually associated with pharmacy, we find—again excluding unenumerated—that, whilst our exports to Germany have only increased by £17,000, their exports to us have more than doubled, and show a gain of over £60,000. The only satisfactory item in this list falls under the heading of "other alkaloids," and here I am glad to say we appear to more than hold our own. We have suffered big drops in our exports of essential oils and quinine, and in both these lines Germany shows marked gain.

Turning to the unenumerated articles under Classes A and B (not given separately in 1895), it will be seen that the German exports to this country form a very considerable item (about £350,000), and many times exceed the imports from us. Under this heading are included many chemicals, some of which represent a large annual value. As to their nature, the "Chemical Trade Journal" affords considerable light. Amongst the more important items may be mentioned acetone, formaldehyde, pyrogallic acid, and thorium nitrate. The latter industry alone must have represented a considerable profit to Germany (our imports for the last three months of 1905 amounted to over £8000), so long as the German Syndicate had control of the ore supply. This will be evident when I state that, as soon as competition was threatened, the price of thorium nitrate was dropped from 53 to 27 marks per kilo.

Classes C (resin oils, varnishes, &c.) and D (explosives) show loss to England, and gain to Germany; they may be passed over without further comment.

Group E, dealing with coal tar derivatives, such as benzol, anthracene, naphthalene, &c., requires notice, emphasising as it does the complaints recently made by Sir George Livesay as to the unsatisfactory conditions of the English tar market. Our loss here is considerable, and is largely owing to the fact that Germany is now able to supply from its own gas works and coke ovens much of the raw material necessary in the aniline colour industry. It may further be noted that Germany is drawing continually increasing quantities of its imports in these products from Austria-Hungary. This competition has not only hit us as regards quantity, but it has also had a most disastrous effect on prices. Thus, the average price for light oils imported into Germany is now only £10 per ton, as against £22 10s. in 1895, and £30—£31 in the two succeeding years. It is worthy of special note that Germany has now developed a considerable export trade in these oils, and that whereas ten years ago and earlier their export price was well below the import price, it is now some 25 per cent. higher. The German imports of anthracene have also fallen to one-fifth to one-quarter of the 1895–9 figures; in the case of naphthalene, however, a large increase is to be noted. This is probably due to the development of the artificial indigo industry, but not entirely so. The exports of naphthalene now reach nearly 3000 tons, and for years past the export price has been almost double that of the import. In both instances the better prices obtained for the export

article are probably due to a greater purity of product, and our tar distillers might find it worth their while to look further into this question.

We now come to Class F, which deals with the aniline and coal tar synthetic dyestuffs, and with pigments generally. This is the most important branch of the German chemical trade, accounting for approximately 40 per cent. of the total chemical exports from Germany, and for 50 per cent. of the chemical exports to this country.

Alizarin, aniline dyes, and indigo are now exported from Germany to England to the extent of over £1,350,000 per annum, an increase of over 50 per cent. compared with the figure for 1895. Our exports to Germany are now less than £30,000, a drop of over £250,000 from the figure of 10 years ago, when natural indigo still held its own, and was sold through this country. Instead of selling indigo to this value, we now buy the artificial product to the value of £178,500.

The other items in this class are in the main inorganic pigments, such as white lead, zinc white, ultramarine, &c. Here we have in all a slight gain of some £14,000 in our exports as compared with 10 years ago; this, however, drops into insignificance beside the German gain of over £200,000.

The picture is sufficiently depressing. As previously stated, it does not represent the course of our chemical trade generally, but, whilst this is so, the trade between ourselves and Germany is fairly typical, certainly as regards exports, of what Germany is doing.

German chemical trade.—Diagram II. indicates the course of German trade over a period of 20 years, and shows at a glance the dimensions and nature of the traffic in raw materials and finished products. The total German imports of chemicals to-day amount to £21,500,000, of which sum a trifle over two-thirds is for raw material. The exports have now a value of over £27,000,000, nearly 90 per cent. of which represents manufactured products. The diagram shows that the import trade has doubled in the period considered, and that the exports have even increased more rapidly still. Whilst the increase in the value of imports is, however, almost entirely for raw material, the increase in exports is, in the main, confined to finished products. The importance of the various sub-groups, and the nature of the changes in these, is shown in Table 2. Of the imports of raw material, more than half the value falls in Class A, and, of this group, nitre is responsible for two-thirds of the total. The other more important items are pyrites and manganese ore, and the figures for these for the two countries are instructive. They are as follows:—

	Pyrites.			
	England.		Germany.	
	Tons.	£	Tons.	£
1895	582,463	987,165	288,000*	291,000*
1905	698,746	1,152,759	540,000	1,056,350

* Included alum ore.

	Manganese ore.			
	England.		Germany.	
	Tons.	£	Tons.	£
1895	131,519	296,948	22,200	56,450
1905	238,700	490,612	258,000	552,350

The pyrites figures alone, as affording an index of the manufacture of sulphuric acid, are sufficient to show the rate of progress and development in the two countries. Sulphuric acid plays a considerable part in many important processes, and Hasenclever's figures for the output and use of the acid in Germany in 1904 will be of interest. The acid made is given as 1,300,000 tons of 60° acid, made up as to 1,100,000 tons from pyrites, and 200,000 tons from blend and gas residuals. Its destination is stated to be: 5—600,000 tons for superphosphate, 150,000 tons for ammonium sulphate, and 250,000 tons (=19 per cent.) by contact process, for dyes and explosives, and the remaining 3—400,000 tons for sodium sulphate, aluminium sulphate, &c. The ammonium sulphate figure gives some idea of the present extent of the gas and coke oven industries in Germany, whilst the 250,000 tons for dyes and explosives illustrates the important connection between these finer chemicals and the heavy chemical trade.

Of imported manufactured materials, we find that Class A accounts for one-third of the total value, and that, in this particular group, ammonium sulphate and iodine are responsible for slightly more than one-half. (Three-fifths to two-thirds of the ammonium sulphate is supplied by England.)

Coming now to the export trade in manufactured products, we find that, at the present time, the value of substances falling in Classes A and F far outdistances the value of the goods falling outside these groups. Group A, amounting to nearly £7,000,000, accounts for approximately 30 per cent. of the total export, and, of this sum, the various potassium compounds are responsible for nearly £2,500,000. Class F, comprising the various coal tar dyes, alizarin and indigo, together with other pigments, organic and inorganic, amounts to 40 per cent. of the exports in finished goods, totalling very nearly £10,000,000, of which over £5,000,000 is for aniline dyes, and over £2,000,000 for alizarin* and indigo. This group, and the associated group E, have undergone the most marked changes in the course of trade during the 20 years considered. Whilst the other groups show more or less steady increases in both exports and imports, these two groups show marked rise in exports accompanied by fall in imports. Prior to 1897, the imports of tar oils and tar products considerably exceeded the exports, whilst to-day the value of the exports is nearly treble that of the imports.

These figures indicate a most healthy condition of the German chemical industry; it is interesting to see whether this view is borne out by other available information.

In the first place, I will give some statistics relating to the number of workpeople employed in the whole chemical (and associated) industries, together with the average wages paid, and the number of processes in operation. These figures are published from year to year by the "Association for the Protection of Chemical Interests," in connection with the system of accident insurance followed in Germany, and undertaken by the above-mentioned association. I would again refer to Mr. Tyrer's address for further details regarding the aims and work of this Society.

Year.	No. of processes.	No. of workpeople.	Average wage. Marks per annum.
1885	4,162†	70,991	(760)
1890	5,043	87,498	821·25
1895	5,947	114,581	894·00
1900	7,169	153,001	1012·00
1905	8,278	185,820	1030·00

† 1886 year.

This table shows remarkable progress, the number of men employed having almost trebled in the last 20 years. It further teaches that the condition of the workpeople has vastly improved, the rate of wages having risen 25 per cent., and that the annual wages bill now amounts to nearly £10,000,000 sterling.

Other information indicates that there is considerable difficulty in finding sufficient labour to meet the requirements of the industry; in fact, during the second quarter of the present year, lack of workers in the sulphuric acid industry is recorded, notwithstanding advances in wages of from 8—15 per cent. In the aniline dye industry, it has also been found necessary to make very liberal concessions to the workpeople to maintain the manufacture in full swing.

The part played by the various sub-divisions of the

* England and British India take nearly one-half of the alizarin exported from Germany.

industry in furnishing employment is shown in Table 3, which gives the details for the years 1892 and 1902 respectively. With the exception of gunpowder all the divisions show, in general, a very marked increase in employment, the greatest activity being found in the manufacture of aniline dyes, other coal tar derivatives, essential oils, varnishes, rubber, and mineral waters. This is in accord with the import and export statistics already given.

Further confirmation of the growth of the industry is to be found in the increase in invested capital, and in the sum paid annually as dividend. The figures, so far as they relate to limited liability companies, are as follows :—

Year.	No. of companies.	Paid up capital.	Dividend.	Average rate per cent.
		£	£	
1886	82	8,127,042	582,995	7·17
1890	82	9,903,655	1,260,460	12·50
1895	95	12,396,045	1,575,427	12·7
1900	121	17,424,650	2,147,707	12·3
1904	143	22,350,850	3,109,785	13·8

The growth of invested capital is probably not so great as the figures would indicate, owing to part of the increase arising from the conversion of private concerns into limited companies. Nevertheless, the table is of interest, and shows the large annual profits made. These profits vary much for the different industries, and even for different works manufacturing similar products, and it must not be assumed that all works give satisfactory returns. As a matter of fact, in 1904, 26 of the works represented in the table paid no dividend at all, and only 52 paid over 10 per cent. Whilst the heavy chemical trade and the manufacture of fine and pharmaceutical chemicals yield handsome returns, the greatest results have been achieved in the aniline dye industry. There are 31 aniline colour works in Germany, but the bulk of the trade is in the hands of five firms, forming two large combinations. The combined nominal capital of these five firms is nearly £5,000,000, and the net annual profits £2,000,000, 60 per cent. of which is paid in dividends, the remainder going to depreciation and reserve. The average dividend of the aniline dyeworks has exceeded 20 per cent. for years past, and the dividend paid by individual firms has in some cases exceeded 30 per cent. The firm of Bayer alone employs 5200 workpeople, whilst the Badische Anilin und Soda Fabrik employs 7251. The average working day is nine hours in the case of the first-mentioned firm, and 10 hours in that of the second, which latter, in 1905, paid an average wage of 4·01 marks per day, as against 3·38 marks in 1895. The Badische firm began business in 1865, and started with only 40 men. The progress has indeed been great.

England's chemical trade.—And now, gentlemen, what can we show? We have successful firms in this country, some remarkably so, and able to present a rate of growth comparable with that of the more successful in Germany and other countries. Still our progress as a whole falls far short of that of Germany, and is not what it ought to be. I must further add that we are working to a large extent in the dark. Where can we find details similar to those given above as to employment, number of processes in operation, and the relative importance of the various branches of our industry? At present it cannot be done, but I am glad to say that there are hopes of improvement in this respect shortly. I refer to the Industrial Census which the President of the Board of Trade proposes for 1908. The announcement that such a census was to be taken has aroused opposition in certain quarters. Personally I feel that the information such a census affords should, if properly used, be of great help to all manufacturers in this country. Very full information of this kind has been available in Germany and the United States for some years past, and in these countries, at all events, the publication has not hindered progress. Whilst welcoming the proposed census, I might at the same time express a hope that the information will be collected and tabulated in such fashion as to render comparison with the figures of other nations easy; the inquiry, at present being conducted by representatives of our Board of Trade in Germany, would rather indicate that such will be the case. Our present census figures certainly leave much to be desired, in so far as they relate to chemical industry.

Coming to such figures as we have, that is, to the trade returns, I have already pointed out how far they are wanting in exactness. Improvement is, however, taking place, and I am glad to see that, in the last issue (fifty-third) of the "Statistical Abstract or the United Kingdom," an attempt has been made to classify our imports and exports into raw material and manufactured products, and to group the individual items under definite headings, whereas, in previous issues, the articles were merely listed in alphabetical order. According to the classification at present adopted by the Board of Trade, the total values of English imports and exports of chemicals, drugs, dyes, and colours (including tanning materials), for the years 1895 and 1905, were as follows :—

	1895.	1905.
Imports	£8,714,360	£9,624,638
Exports—		
English and Irish prod.	11,463,304	14,536,857
Foreign and Colonial	2,309,209	1,473,578
	£13,772,513	£16,010,435

Examination of the lists, however, shows that many articles which, I think most people will agree, ought to be classed amongst chemicals, appear under other headings. Thus salt, which is prepared in an industry long regarded as chemical, and which finds a considerable outlet in alkali manufacture, is classed amongst "other food and drink." Aerated waters (artificial) also fall in the same group. These are grouped with chemical substances in Germany, and certainly chemicals play an important part in the manufacture of artificial mineral waters. Isinglass and yeast are further to be found under the same sub-heading, whilst essential oils are grouped with the various saponifiable oils under "oil seeds, nuts, oils, fats, and gums."

Classification is always a matter of difficulty, and no system—without useless elaboration—will be found perfect. Much depends on the point of view as to whether the origin or the presumed destination or use of a product is to determine its place in the system. In the English classification, undue importance appears to be given to the destination of the individual articles—this is, however, a matter for argument. Of more importance is the grouping into raw material and manufactured products, and, considering the weight attached to this point in recent controversies, one would have expected at least an approximately correct classification here. Instead of this, we find essential oils and turpentine under "Raw materials and articles mainly unmanufactured," whilst boracite, Peru bark, the various tanning barks, myrobalans, and galls appear as "Articles wholly or mainly manufactured." These last-mentioned articles are entirely natural in their occurrence and origin, and have not undergone any manufacturing operation; the sole labour expended has been that of collecting. They represent a considerable percentage of our imports and also of our exports of foreign and Colonial produce, and, for this reason, correct classification is a matter of some importance. You will thus see that our figures are not directly comparable with those of Germany. Much addition is necessary, and also certain elimination, soap and artificial manures not appearing with the other chemicals in the German list already given.

I have made an attempt to compare our trade with that of Germany, adopting the German classification as a basis and taking the same years, 1895 and 1905, as before. The result is embodied in Table 4, but I do not wish too great importance to be attached to this table, because of the impossibility of separating raw products from manufactured materials in the cases where "unenumerated," generally of large value, appears in our list. I have ranked such "unenumerated goods" as manufactured products, both when appearing as chemicals and as drugs, though in the latter case I feel certain that much is in the nature of raw material.

article are probably due to a greater purity of product, and our tar distillers might find it worth their while to look further into this question.

We now come to Class F, which deals with the aniline and coal tar synthetic dyestuffs, and with pigments generally. This is the most important branch of the German chemical trade, accounting for approximately 40 per cent. of the total chemical exports from Germany, and for 50 per cent. of the chemical exports to this country.

Alizarin, aniline dyes, and indigo are now exported from Germany to England to the extent of over £1,350,000 per annum, an increase of over 50 per cent. compared with the figure for 1895. Our exports to Germany are now less than £30,000, a drop of over £250,000 from the figure of 10 years ago, when natural indigo still held its own, and was sold through this country. Instead of selling indigo to this value, we now buy the artificial product to the value of £178,500.

The other items in this class are in the main inorganic pigments, such as white lead, zinc white, ultramarine, &c. Here we have in all a slight gain of some £14,000 in our exports as compared with 10 years ago; this, however, drops into insignificance beside the German gain of over £200,000.

The picture is sufficiently depressing. As previously stated, it does not represent the course of our chemical trade generally, but, whilst this is so, the trade between ourselves and Germany is fairly typical, certainly as regards exports, of what Germany is doing.

German chemical trade.—Diagram II. indicates the course of German trade over a period of 20 years, and shows at a glance the dimensions and nature of the traffic in raw materials and finished products. The total German imports of chemicals to-day amount to £21,500,000, of which sum a trifle over two-thirds is for raw material. The exports have now a value of over £27,000,000, nearly 90 per cent. of which represents manufactured products. The diagram shows that the import trade has doubled in the period considered, and that the exports have even increased more rapidly still. Whilst the increase in the value of imports is, however, almost entirely for raw material, the increase in exports is, in the main, confined to finished products. The importance of the various sub-groups, and the nature of the changes in these, is shown in Table 2. Of the imports of raw material, more than half the value falls in Class A, and, of this group, nitre is responsible for two-thirds of the total. The other more important items are pyrites and manganese ore, and the figures for these for the two countries are instructive. They are as follows:—

	Pyrites.			
	England.		Germany.	
	Tons.	£	Tons.	£
1895	582,463	987,165	288,000*	291,000*
1905	698,746	1,152,759	540,000	1,056,350

* Included alum ore.

	Manganese ore.			
	England.		Germany.	
	Tons.	£	Tons.	£
1895	131,519	296,948	22,200	56,450
1905	238,700	490,612	258,000	552,350

The pyrites figures alone, as affording an index of the manufacture of sulphuric acid, are sufficient to show the rate of progress and development in the two countries. Sulphuric acid plays a considerable part in many important processes, and Hasenclever's figures for the output and use of the acid in Germany in 1904 will be of interest. The acid made is given as 1,300,000 tons of 60° acid, made up as to 1,100,000 tons from pyrites, and 200,000 tons from blend and gas residuals. Its destination is stated to be: 5—600,000 tons for superphosphate, 150,000 tons for ammonium sulphate, and 250,000 tons (=19 per cent.) by contact process, for dyes and explosives, and the remaining 3—400,000 tons for sodium sulphate, aluminium sulphate, &c. The ammonium sulphate figure gives some idea of the present extent of the gas and coke oven industries in Germany, whilst the 250,000 tons for dyes and explosives illustrates the important connection between these finer chemicals and the heavy chemical trade.

Of imported manufactured materials, we find that Class A accounts for one-third of the total value, and that, in this particular group, ammonium sulphate and iodine are responsible for slightly more than one-half. (Three-fifths to two-thirds of the ammonium sulphate is supplied by England.)

Coming now to the export trade in manufactured products, we find that, at the present time, the value of substances falling in Classes A and F far outdistances the value of the goods falling outside these groups. Group A, amounting to nearly £7,000,000, accounts for approximately 30 per cent. of the total export, and, of this sum, the various potassium compounds are responsible for nearly £2,500,000. Class F, comprising the various coal tar dyes, alizarin and indigo, together with other pigments, organic and inorganic, amounts to 40 per cent. of the exports in finished goods, totalling very nearly £10,000,000, of which over £5,000,000 is for aniline dyes, and over £2,000,000 for alizarin* and indigo. This group, and the associated group E, have undergone the most marked changes in the course of trade during the 20 years considered. Whilst the other groups show more or less steady increases in both exports and imports, these two groups show marked rise in exports accompanied by fall in imports. Prior to 1897, the imports of tar oils and tar products considerably exceeded the exports, whilst to-day the value of the exports is nearly treble that of the imports.

These figures indicate a most healthy condition of the German chemical industry; it is interesting to see whether this view is borne out by other available information.

In the first place, I will give some statistics relating to the number of workpeople employed in the whole chemical (and associated) industries, together with the average wages paid, and the number of processes in operation. These figures are published from year to year by the "Association for the Protection of Chemical Interests," in connection with the system of accident insurance followed in Germany, and undertaken by the above-mentioned association. I would again refer to Mr. Tyrer's address for further details regarding the aims and work of this Society.

Year.	No. of processes.	No. of workpeople.	Average wage. Marks per annum.
1885	4,162†	70,991	(760)
1890	5,043	87,498	821·25
1895	5,947	114,581	894·00
1900	7,169	153,001	1012·00
1905	8,278	185,820	1030·00

† 1886 year.

This table shows remarkable progress, the number of men employed having almost trebled in the last 20 years. It further teaches that the condition of the workpeople has vastly improved, the rate of wages having risen 25 per cent., and that the annual wages bill now amounts to nearly £10,000,000 sterling.

Other information indicates that there is considerable difficulty in finding sufficient labour to meet the requirements of the industry; in fact, during the second quarter of the present year, lack of workers in the sulphuric acid industry is recorded, notwithstanding advances in wages of from 8—15 per cent. In the aniline dye industry, it has also been found necessary to make very liberal concessions to the workpeople to maintain the manufacture in full swing.

The part played by the various sub-divisions of the

* England and British India take nearly one-half of the alizarin exported from Germany.

and all must be removed before a full and satisfactory advance can be made. In addition, steps must be taken to avoid mistakes in the future. We must not be content to wait, as we have too often done in the past, until our grievances have become acute, and then expect to effect a cure by forming a deputation to the Government of the day. No, we must act before matters have reached this stage; in other words, we require a close and continuous touch and co-operation between the Government and the representatives of the country's industries. With such co-operation, difficulties would be officially recognised as they arose, and preparations made to prevent them assuming giant and almost insurmountable proportions. There are already signs of improvement in this direction, for we now have an advisory committee of business men to the Board of Trade, and, in the near future, we are to have a Minister of Commerce. Our disabilities must, however, be made known, and united effort on our part ought to accomplish much. Our Society is, as regards chemical industry, a thoroughly representative body, and holds to-day a strong and influential position. It has shown initiative and skill in dealing with matters of public importance, and, to judge from Dr. Divers' presidential address of last July, it is prepared to continue its activities in such direction. Dr. Divers expressed the hope that "the Society may soon have a Royal Charter to work under, and so secure for its recommendation even greater consideration in legislation and other public matters than they have already received." (Presidential address, 1906.) The fulfilment of this hope rests largely with our members, and I would urge them to carefully consider the facts disclosed in this paper and to discuss what can be done to remedy the present state of affairs.

We certainly ought to have the same full information as to our industrial progress and position as is available in Germany and in the United States, for only with such information can we know where we are strong, and where weak, and discover the road in which improvement lies.

I had originally intended to say something about certain of the later discoveries and inventions in manufacturing chemistry, to refer to the number of uses, many of them important, now being found for elements and compounds which were until recently regarded as rare, and, to the manufacturer, comparatively valueless. I had also wished to discuss the industrial development now taking place in countries which, up to a year or so ago, were dependent on ourselves and others for the bulk of their supply of chemical products. All these points demand attention in considering the prospects of our present industries, and in helping us to shape our future course.

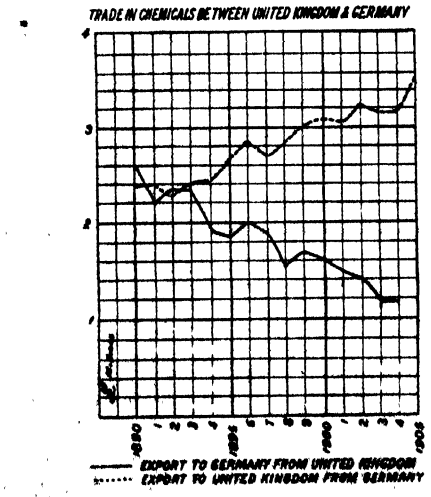


FIG. 1.

The address has, however, already reached a sufficient length, and to now go into further detail would only lead to weariness. If what I have written should lead to a better understanding of the present position of our country's trade in chemical products, and further emphasise our large and inexcusable dependence on Germany for what are looked upon as necessities in to-day's progressive age, this address will not have been in vain.

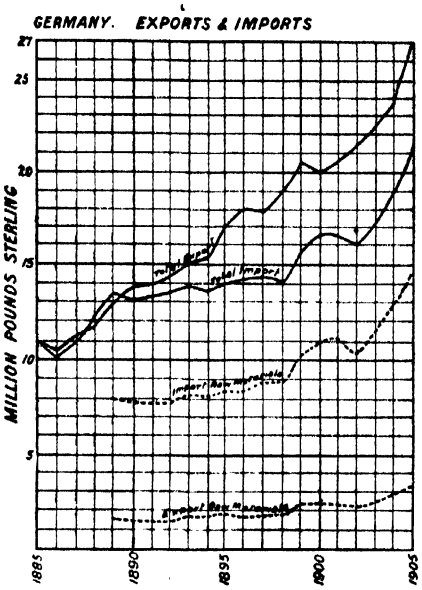


FIG. 2.

TABLE 1.

Trade in Chemicals between England and Germany.

	England exported to Germany.		England imported from Germany.	
	1895.	1905.	1895.	1905.
Raw materials.	£	£	£	£
A. Argols	—	—	21,700	44,200
B. Cantharides	—	—	600	1,100
Peruvian bark	21,600	8,100	—	—
Crude drugs	14,700	15,100	20,750	13,700
Camphor	12,600	32,000	8,500	3,100
	48,900	55,200	29,850	17,900
C. Gum arabic	53,500	16,100	—	—
D. Isinglass	—	—	—	2,000
Bone charcoal	7,200	6,600	—	—
	7,200	6,600	—	2,000
E. Cochineal	—	500	—	—
F. Galls	13,000	4,200	—	—
Quebracho extract	—	10,800	—	4,700
Other tanning extracts	7,900	6,000	—	—
	20,900	21,000	—	4,700
Total raw material	130,500	99,400	51,550	63,900

TABLE 1—(*continued*).

	England exported to Germany.		England imported from Germany.	
	1895.	1905.	1895.	1905.
Manufactured products.				
A. Potassium carbonate	—	—	28,900	41,200
,, chloride	—	—	93,500	110,000
,, hydrate	—	160	11,500	59,500
,, nitrate	—	—	115,000	81,500
,, sulphate	—	—	17,000	58,000
	—	160	265,900	350,200
Soda compounds	7,600	2,600	—	3,800
Bleaching powder and chlorates	20,200	8,300	—	54,000
	27,800	10,900	—	57,800
Bromine, iodine, and pot. salts	64,200	104,600	26,300	31,100
Ammonium carbonate, chloride and sulphate	286,000	397,000	—	9,300
Barium and strontium salts	7,000	2,500	15,400	22,900
Sod. and pot. cyanides and ferrocyanides	250	—	8,300	22,600
Sod. and pot. chromates	14,600	31,700	3,600	8,400
Borax	42,800	13,600	—	—
Alum	900	250	19,100	33,100
Antimony, lead, manganese and silver salts	700	6,000	24,200	56,600
Phosphorus	33,800	22,500	—	—
Arsenious oxide	4,700	290	—	—
Benzoic, citric, oxalic, salicylic, tannic and tartaric acids	1,500	5,000	123,300	140,000
Milk sugar	—	—	—	9,700
Magnesium carbonate and chloride	—	400	18,000	17,500
Copper and zinc vitriol	5,000	17,600	1,600	800
	489,250	612,500	505,700	760,000
B. Ether, collodion, chloroform	180	265	—	660
Essences	—	—	—	7,200
Essential oils	38,400	16,100	8,900	48,900
Potato fusel oil	—	—	—	1,200
Quinine	7,000	4,500	10,150	26,380
Other alkaloids	72,300	113,800	47,700	42,700
	117,880	134,665	66,750	127,040
A. Unenumerated	96,000	60,000	363,000	245,000
B. Unenumerated		7,800		100,000
	96,000	67,800	363,000	345,000
C.	81,000	70,000	75,000	98,000
D.	—	1,600	19,200	48,800
E.	397,000	175,000	18,000	156,000
F. Alizarin	350	4,300	171,000	173,000
Aniline dyes	28,300	20,400	656,000	1,000,000
Indigo	257,000	5,000	2,000	178,500
	285,650	29,700	829,000	1,351,500
Oxide of iron paint	5,900	7,600	—	—
Lead and zinc paints	4,000	24,000	225,000	403,500
Gold preparations	—	—	73,000	55,000
Bronze and chrome colours	—	2,000	—	40,000
Ultramarine	—	600	42,700	44,200
Cinnabar	400	2,200	24,000	5,300
Picric acid	150	3,500	—	18,000
Other colours (copper, barium, prussian blue, colours, lakes, &c.	19,000	2,700	24,000	24,000
	315,100	73,600	1,217,700	1,941,500
Total raw material	190,500	99,490	51,550	68,800
,, manufactures	1,498,220	1,184,165	2,265,350	3,471,340
Total all kinds	1,688,720	1,283,655	2,316,900	3,540,140

TABLE 2.

Imports and Exports of Chemical Materials. Germany.

	Imports.		Exports.	
	1895.	1905.	1895.	1905.
	£	£	£	£
Raw materials.				
A. Manganese ore	56,450	552,350	26,750	15,250
Nitrate of soda	3,561,250	5,544,400	161,250	215,550
Pyrites	291,150	1,056,350	—	—
Sulphur	75,350	219,950	—	—
Staassfurt salts	—	—	276,500	372,750
Other materials	234,750	450,050	97,900	162,450
	4,218,950	7,723,100	562,400	1,265,000
B. Camphor	87,850	325,500	66,350	115,650
Peruvian bark	60,700	168,650	12,050	10,350
Sponges	252,700	124,400	39,050	49,650
Unenumerated	266,150	413,900	219,600	156,650
Other materials	123,800	208,250	45,400	59,600
	791,200	1,240,700	382,450	394,100
C. Gum arabic	137,900	195,900	68,750	102,000
Gum lac and shellac	220,500	779,800	43,250	196,300
Turpentine, rosin and balsam	355,000	837,850	76,050	197,100
Other rosins, unenumerated	525,550	506,250	94,300	109,050
Other materials	155,150	390,000	101,300	207,200
	1,394,100	2,709,800	378,650	811,650
D. Wine yeast	70,800	111,400	—	—
Other yeasts	—	—	107,800	41,000
Other materials	43,200	38,750	25,000	24,850
	114,000	150,150	132,800	65,850
E. Logwood	342,750	72,500	74,000	22,850
Graphite, unformed	82,700	223,350	19,600	13,850
Heavy spar and witherite	18,950	19,450	71,200	162,400
Coloured earths	44,400	54,450	77,000	110,000
Other materials	82,500	49,450	30,750	15,150
	571,300	419,300	272,550	324,650
F. Tanning extracts	187,100	337,250	52,450	29,900
Quebracho extract	—	257,250	—	254,500
,, wood (large)	219,000	572,950	2,450	7,450
,, ,, (small)	—	36,450	—	74,650
Other woods and barks	529,600	570,450	48,200	25,900
Galls	114,900	110,550	10,150	17,750
Other materials	304,200	400,000	21,100	51,250
	1,354,800	2,284,900	134,350	461,100
Manufactured products:				
A. Ammonium carb. and chloride	50,100	83,600	58,450	89,450
,, sulphate	321,250	600,050	14,700	344,850
Potassium carbonate	24,500	24,550	221,800	209,350
,, chloride	9,550	1,600	564,900	1,106,000
,, hydrate	7,000	350	16,200	389,300
,, nitrate	19,600	46,350	252,100	261,000
,, sulphate	4,900	800	156,150	437,100
Soda compounds	14,900	14,550	376,700	467,950
Bleaching powder	8,600	1,550	28,100	138,600
Chlorates (K and Na)	33,000	54,400	29,950	28,400
Iodine	180,000	641,050	31,350	47,100
Iodine preps. and pot. iodide	26,500	45,000	173,050	262,950
Acetate of lime	—	225,600	—	1,350
Alum	1,400	1,000	67,200	152,150
Other materials	389,350	630,350	1,124,000	1,612,550
	1,010,650	2,370,800	3,124,550	5,749,000
B. Essential oils	319,250	339,100	188,000	238,100
Essences (alcoholic and ethereal)	7,200	51,200	26,350	36,700
Quinine salts and preps.	11,450	9,300	294,150	224,650
Other alkaloids	216,350	284,000	312,300	436,650
Antipyrin, &c.	—	7,350	—	55,500
Mineral waters	92,600	142,500	261,850	359,050
Tooth powders, &c., and alcoholic perfumes	33,400	20,750	252,550	264,350
Other perfumes	41,700	53,100	52,900	70,550
Other materials	73,150	79,050	135,000	409,350
	794,100	986,550	1,723,050	2,167,900

TABLE 2—(*continued*).

	Imports.		Exports.	
	1895.	1905.	1895.	1905.
A. and B. Articles unenumerated A ..		378,100		996,500
Ditto, ditto B ..	272,600	97,350	1,808,900	437,050
Ditto incompletely specified	—	—	29,350	62,500
	272,600	475,450	1,830,258	1,496,050
J. Turpentine oil, rosin oils, and camphor oils, ...	368,150	1,163,700	34,450	67,200
Lacquers, lac varnishes and shellac cement	97,000	103,650	73,300	140,600
Albumin	39,350	160,650	26,050	73,800
Gelatine	5,800	16,500	62,700	90,200
Glue and size ..	73,900	98,000	171,450	170,950
Other materials...	12,200	10,400	119,300	192,050
	596,400	1,552,900	487,250	734,800
D. Explosives			318,350	351,350
Powder	15,750	70,050	154,650	266,400
Fuses and percussion caps			623,050	1,437,650
Other materials...	19,200	15,150	114,350	165,600
	34,950	85,200	1,210,400	2,221,000
E. Aniline oil and salts	23,200	73,050	338,900	119,440
Other materials...	987,100	496,450	236,850	49,820
	1,010,300	569,500	575,750	169,260
F. Alizarin	3,500	5,400	580,300	776,600
Coal tar dyes (aniline)	183,600	239,700	3,157,800	5,032,700
Indigo	1,076,700	60,100	411,250	1,286,050
White lead	6,450	44,800	206,750	263,650
Bronze and chrome pigments	—	3,850	—	271,450
Zinc white, zinc grey, &c.	45,050	165,500	225,300	503,250
Other materials...	512,550	445,300	1,533,500	1,576,450
	1,827,850	964,650	6,114,900	9,710,150
Total manufactured articles	5,546,850	7,014,550	15,094,150	23,791,500
„ raw materials ...	8,443,850	14,527,950	1,863,200	3,325,550
	13,990,700	21,542,500	16,957,350	27,117,050

* Of which benzoic, citric, oxalic, salicylic, tannic, and tartaric acids and salts = £443,000.

TABLE 3.

Workmen in German Chemical Industry

	1892.	1902.
	"Chem. Ind.," 1893, p. 274.	"Chem. Ind.," 1903, p. 337.
Heavy chemical trade	14,583	23,384
Other chemical preparations ..	15,574	22,951
Colour materials	7,144	10,262
Aniline dyes	10,904	20,772
Other coal tar derivatives	981	3,396
Powder	2,286	2,161
Other explosives	3,277	5,648
Matches, &c.	5,216	5,979
Artificial manures	7,136	8,682
Tallow melting and soap	6,107	8,278
Stearin and wax candles	1,772	1,998
Tar distilling	2,211	3,207
Essential oils	1,635	3,117
Varnishes and cements (putty)	4,579	9,859
Rubber	8,569	19,303
Mineral waters	3,622	8,007
	95,596	157,089
In other 10 groups	6,505	8,800
	102,101	165,889

TABLE 4.

*Imports and Exports of Chemical Materials. United Kingdom.**

	Imports.		Exports.	
	1895.	1905.	1895.	1905.
Raw materials:—	£	£	£	£
A. Manganese ore ...	296,948	490,612	—	—
Nitrate of soda ..	998,897	1,104,587	—	—
Pyrites	987,165	1,152,759	—	—
Sulphur	99,367	99,973	—	—
Salt	—	—	546,219	431,311
	2,383,377	2,847,931	546,219	431,311
B. Peru bark	58,804	74,724	(40,553)	(23,992)
Opium	193,569	281,213	(94,071)	(128,508)
Sponges	158,837	220,230	(66,572)	(65,479)
	411,210	576,167	(201,796)	(217,979)
C. Gums	1,319,618	1,782,932	(777,882)	1,260,416
Asphalt	72,976	188,565	—	—
Rosin	346,798	687,842	(7,148)	(14,206)
	1,739,392	2,659,339	(785,030)	(1,274,622)
D. Isinglass	87,972	112,424	—	—
Yeast	491,351	365,860	—	—
	579,323	478,284	—	—
E. Dyewoods	527,081	119,140	(23,341)	(42,856)
Mica, French chalk, &c.	48,271	118,589	(29,759)	(57,145)
Plumbago	177,420	236,420	(24,930)	(22,724)
	752,772	474,949	(78,030)	(122,725)
F. Tanning extracts .	441,127	652,174	—	—
„ bark.....	146,491	243,580	—	—
Cutch and gambier	556,120	220,715	(200,430)	(64,617)
Sumach and valonia	553,164	366,895	—	—
Myrobalans	190,889	159,474	—	—
Unenumerated ...	277,323	297,899	(202,596)	(313,445)
Galls	59,815	24,665	(47,280)	(13,197)
	2,224,929	1,965,402	(450,306)	(391,259)
Manufactured products:				
A. Chemical manufactures and products, unenumerated	1,276,670	2,023,092	2,210,036	2,954,940
			(261,571)	(379,263)
Potassium nitrate	213,653	173,684	—	—
Alkali and soda salts	114,586	176,898	1,557,533	1,436,158
Bleaching powder	—	—	500,717	192,019
Ammonium sulphate	—	—	1,187,988	2,381,568
Copper sulphate ..	—	—	593,803	1,125,392
	1,604,909	2,796,000	6,050,077	8,090,077
			(261,571)	(379,263)
B. Drugs unenumerated	1,012,466	1,170,599	(443,805)	(401,013)
Essential oils	276,673	300,500	(52,833)	(62,556)
Perfumery	130,386	71,076	97,008	169,118
Perfumed spirits .	119,367	102,614	121,420	91,608
Medicines	—	—	1,048,310	1,464,528
	1,538,892	1,644,789	1,266,738	1,725,824
			(496,638)	(463,569)
C. Turpentine	520,065	1,104,300	—	—
D. Matches	362,900	581,698	87,319	66,406
			(103,836)	(116,888)
Gunpowder.....	—	—	181,507	164,620
	362,900	581,698	268,826	231,026
			(103,836)	(116,888)
E. Products from coal	—	—	1,573,731	1,348,491
Pitch	43,106	65,388	—	—
Tar	85,865	90,873	—	—
Methyl alcohol ...	25,809	54,262	748	16,257
	154,780	210,523	1,574,479	1,364,748

* The figures in parenthesis are for Foreign and Colonial produce; all others are for British and Irish produce.

TABLE 4—(*continued*).

	Imports.		Exports.	
	1895.	1905.	1895.	1905.
F. Aniline dyes	709,903	1,318,439	212,647	196,564
Other coal tar dyes	—	—	260,809	181,958
Indigo	1,392,534	116,902	(954,227)	(76,590)
Paints	873,911	1,433,745	1,556,579	2,167,987
			(40,735)	(30,097)
	2,976,438	2,769,186	2,030,125	2,546,509
			(994,962)	(106,687)
Total raw material ..	8,091,003	8,802,072	546,219	431 311
			(1,515,162	2,006,585
„ manufactures ..	7,158,044	9,106,496	11,190,245	13,957,684
			(1,857,007	(1,066,407)
	15,249,047	17,908,568	15,108,633	17,461,987

TABLE 5.

England and Germany—Increases in Imports and Exports, 1895—1905.

		England	Germany.
Imports.		£	£
Raw materials	1905	8,802,072	14,527,950
	1895	8,091,003	8,443,850
Increase		711,069	6,084,100
Manufactures	1905	9,106,496	7,014,550
	1895	7,158,044	5,546,850
Increase		1,948,452	1,467,700
Of which Groups A. and B.	1905	4,440,789	3,842,300
	1895	3,143,861	2,077,350
Increase		1,296,928	1,764,950
Exports.			
Raw material	1905	2,006,585	3,325,550
	1895	1,515,162	1,863,200
Increase		491,423	1,462,350
Manufactures	1905	15,455,402	23,701,500
	1895	13,593,471	15,094,150
Increase		1,861,931	8,697,350
Of which Groups A. and B.	1905	11,089,544	9,432,950
	1895	8,621,243	6,705,850
Increase		2,468,301	2,727,100

Note.—In the English figures exported salt has been ranked as a manufactured article.

DISCUSSION.

Prof. WILHELM OSTWALD said that the causes of the present situation and its cure were so well known that it was not revealing a secret to repeat them once more. They might sum up the facts by saying that Germany had managed to put more brains into her goods, or, if they preferred a more scientific expression, to combine more mental energy with the rough energies of primary material. As mental energy was the most valuable kind of energy, the value of the goods was enhanced in proportion to the percentage of the mental energy embodied in them. Now there was no doubt that the English store of mental energy was at least as great as the German one; the only difference was, therefore, that here the channels leading that energy into industry were not so broad or deep or numerous as in Germany. There seemed to exist in parts of Great Britain not only a disregard for, but even a mistrust in science or theory. In Germany everybody trusted science, even the Government. They were quite accustomed to consult a scientific expert before going into a new business. Of course there were cases in which they failed to act in this way, but then they generally fell into scrapes. Sometimes even theory led into scrapes; but it proved to be bad or incomplete theory. But the sum total of experience had convinced them of the value of theory, and their trust in it was rather too large than too small.

The common argument of the practical man against theory was that science had no practical value. This could be disproved at once by the fact that flourishing German chemical factories spent no small sum of money on scientific laboratories. Perhaps he might tell them his own experience as a theoretical inventor. Several years ago, when the newspapers had managed once more to construct the appearance of strained relations between Germany and England, one of his colleagues, a very clever, but a little too anxious man, pointed out that, in case of war, the export of saltpetre from Chili to Germany could be interrupted by England, and then they would have to stop fighting altogether. This position being unbearable to a patriotic physico-chemist, some remedy had to be discovered. Before a fortnight was gone, his assistant, Dr. Brauer, and himself had found out, experimentally, how to transform ammonia into strong nitric acid, with an output of 100 per cent. of the theoretical value. Thus, he thought, the main thing was done; but when the process was tried on a larger scale it was at once clear that *one* invention was *no* invention, every central invention requiring quite a number of secondary ones to put practical life into it. The misunderstanding of this general fact had surely led very often to a misunderstanding of the value of science.

In a year or so, however, these difficulties were got over, and an output of 85 per cent. to 92 per cent. was reached in a plant built on the scale of a small factory. Now they were building works in Westphalia to convert about 50 tons of ammonia a month into nitric acid. During this whole development (and this was the reason why he related this bit of personal experience) he never found any difficulty in getting money for these experiments on a large scale. The leading men with them were quite accustomed to spend money for costly experiments, the issue of which was uncertain, though hopeful, when the thing was based only upon laboratory experiments, *i.e.*, upon scientific evidence. To risk a considerable amount of money on such a small evidence seemed the most convincing proof of the real trust in science prevailing in Germany.

A foreigner was, of course, the last person to teach them how to develop a similar state of mind in their own land. In discussing these matters with his English friends he had been told over and over again how difficult they found it to overcome existing resistances. But he was sure these difficulties were considerable only in the beginning of the work. Once bring the carriage over the top of the hill and it would go by itself.

The CHAIRMAN said that Prof. Ostwald had emphasised, first, the belief of the German Government and people in the value of science, and secondly, the close touch between scientific men and the German Government, coupled with the readiness of the Government to deal with a scientific problem in the proper way, instead of leaving such problems entirely to politicians as they did in England. They certainly wanted closer touch between the leaders of scientific thought and the Government than they had had up to the present. They were all glad to hear that Prof. Ostwald had been so successful in his nitric acid manufacture.

The PRESIDENT of the Society expressed their indebtedness to Prof. Ostwald for the very interesting remarks he had made. He then proposed a very hearty vote of thanks to the Chairman for his address, which he thought well worthy of discussion at another time.

Dr. J. CAMPBELL BROWN, in seconding the vote of thanks, said that in order to bring industries in this country into their proper position, they must make their power as a united body felt by the Government. Whatever manufacturers felt they required, that they had to impress upon the minds of their rulers, whoever they might be; and that was the great lesson that Germany taught them.

Prof. DONNAN understood the Chairman to say that 85 per cent. of the bleach exported from Germany was made from electrically-produced chlorine. Where was

the chlorine got for the production of bleach in England as compared with Germany? If Germany were using 65 per cent. of electrolytic chlorine, why was not England? Had the Germans not so much hydrochloric acid available as the English?

The CHAIRMAN said that he would be very pleased to follow the President's suggestion and to have a discussion upon the points in this address at some future date, if the members wished it.

With regard to Prof. Donnan's question, he had no personal knowledge of what was done in Germany. He merely quoted the statement made by Hasenclever, that 65 per cent. of the bleach produced in Germany was produced electrolytically, and chiefly from potassium chloride. There were three points to be considered in looking at the commercial aspect: In the first place, electrolysis gave per unit of current a much greater output of caustic potash than it did of caustic soda. Secondly, caustic soda was very easily produced by the Leblanc process, caustic potash only with great difficulty; and thirdly, caustic potash had a relatively high selling price, and caustic soda a low one. The difficulty of making caustic potash by the old process, and the higher price of caustic potash, were the main points which made the electrolytic potash industry so profitable in Germany, and explained why electrolysis should be so much more profitable in the case of potassium chloride than in that of sodium chloride.

In conclusion, he wished to express his indebtedness to Mr. Pritchard and also to Mr. Anderson for the care they had taken in the production of the diagrams and the tables of figures.

London Section.

Meeting held at Burlington House, on Monday, June 11th, 1906.

MR. A. GORDON SALAMON IN THE CHAIR.

RECENT PROGRESS IN THE CEMENT INDUSTRY.

BY BERTRAM BLOUNT.

During the last 20 years the cement industry has undergone a process of evolution which has been of great importance and significance to itself, and, as a consequence, to those arts which utilise its product. It is not much more than 20 years ago when the manufacture of cement was carried on as an empirical trade; at the present time it is recognised as one of the largest chemical industries, and, as all chemical industries must be, is directed by the chemist and the engineer. Its increase in size is only less striking than its growth in precision; both are probably small compared with the development which may reasonably be expected. The growth may be judged by the figures for production and export given in Appendix A. Although not as complete as could be wished, they will serve to illustrate the great expansion of trade which has taken place in cement.

In the earlier days of the cement industry, manufacture was to a large extent confined to places where the natural conditions were peculiarly favourable, and even at the date chosen as a starting point (1886) many of the sources of supply which are now in active operation were either unutilised or were developed to so small an extent that their influence on the older centres of the trade was trifling. But because cement is a heavy and cheap commodity, and because with proper knowledge and skill it can be made from a great variety of raw materials very widely distributed in the earth's crust, this condition of things could not persist. In fact, the preparation of cement is naturally a local manufacture, and the conveyance of the material for long distances from a few large centres is economically anomalous. The removal of this anomaly, though of great ultimate advantage to the cement industry and to the many trades in which cement is used, has been attended by those temporary hardships which inevitably occur when the conditions of commercial success in any given industry are substantially modified. The great producing centres, especially those in this country and in Germany, which had been developed rapidly on the strength not merely of their command of their home market, but also on their reliance on a great export trade, found themselves gradually opposed in those countries to which they were accustomed to export cement by a growing local manufacture, and in consequence had to be content with a non-progressive or diminishing export, or were obliged to lower their prices in foreign markets to a point that was barely remunerative. This natural shifting of the centre of gravity of the cement industry, if it had taken place gradually, would have inflicted little injury to those manufactories whose position was economically sound; but it happened, during the time I am dealing with, that the largest single customer for exported cement —the United States—took up and developed its home manufacture on so huge a scale and with such rapidity that the European works found themselves deprived of an outlet for a large part of their product with inconvenient celerity, losing a valuable consumer before they had time to find or create other directions in which their cement might be profitably disposed of.

As a result of this alteration in trade conditions it became of urgent necessity to effect economies in manufacture, and it is the steps which have been taken for this purpose which appear particularly worth discussion, as they have brought about such alterations in the mode of manufacture as have changed the whole technique of the industry. Perhaps the simplest way of illustrating the change is to compare a works typical of what was general practice in 1886 with one which represents the practice of to-day.

There are, of course, various modifications of manufacture according to the nature of the raw materials, and twenty years ago these differences equally existed; there were works using wet raw materials and washing them to a slurry; works using dry raw materials, grinding them, and moulding the product into bricks; works using discontinuous kilns of the chamber type, and others continuous kilns of the shaft or of the ring type; works having millstones for grinding the clinker, and others employing pulverisers with metallic grinding surfaces of various design. Similarly to-day there are works in which slurry is prepared and others where the material is dried, and there are still different opinions about the best form of grinding apparatus. But in all this diversity in practice then, and similarity between practice then and now, two facts differentiate the two periods sharply. In 1886 the fixed kiln and the millstone were in general use and were generally approved; in 1906 they are obsolete and have been replaced the one by the rotatory kiln and the other by one of two types of grinding apparatus, which will be particularised later. On account of the shifting of the centre of the industry from the districts using wet raw material to those employing dry (due largely to the enormous growth of the manufacture in the United States), and on account of the fact that already there is a tendency even in the wet districts to consider whether the materials should not be dried before they are mixed, it is convenient to take as our illustration a works such as once was common on the Thames and Medway using wet raw materials, to exemplify 1886 practice, and a works such as is put up in any region where dry raw materials are available, to represent the practice of to-day.

In a typical wet process works in 1886, chalk and clay were brought to the wash-mill in their natural moist state in barrows, as quarried or dug, and there mixed in the proportion of about three to one, using a barrow-load as a unit. In some of the better equipped works the loads were weighed, but in most this was regarded as a needless refinement. No determination of the water present in the raw materials was attempted, and the very considerable variations which occur were rectified, as far as the judgment of the man in charge of the wash-mill allowed, by the occasional addition or withdrawal of

a portion of the clay. In the wash-mill the materials were made into a slurry containing 40 to 45 per cent. of water, and the flints eliminated. The slurry was sometimes passed between grinding rings, and frequently was sent from the wash-mill to wet millstones, where the coarser particles of chalk were ground. But at that date it was not universally recognised that the grinding of the raw materials must be fine, and in consequence a sample of ordinary slurry often gave a residue of several per cent. on a 40 by 40 mesh sieve. This residue consisted largely of chalk, and undoubtedly was a source of unsoundness in the finished cement. After the wash-mill (or the wet stones as might be the case) the slurry went, without further preparation as a rule, to the drying floors of chamber kilns. The use of dosage tanks was not general, in this country at least, and no opportunity was given for correcting the composition of the wash, although means of correction were certainly desirable both because of the primitive method of measuring the proportions of the raw materials, and because even when wet stones were used the chalk ground by them had little chance of being uniformly distributed throughout the mass of the slurry, so that the full advantage of the finer grinding was not obtained. The usual method of ascertaining whether a proper mixture had been obtained was to burn a small quantity in a trial kiln and examine the resulting clinker. Evidently it was then too late to correct the mixture. The use of the calcimeter was not at that date general.

The slurry, dried on the drying floors of the chamber kilns, was removed by hand and carried to the kiln. The whole of the loading of the kiln was by hand, slurry and coke being brought in barrows or skips and stacked in alternate layers until the kiln was full. The kiln was then fired, and if of average size burnt off in four or five days. Unloading the kiln was done by hand, and the clinker carried in barrows to the grinding plant. During unloading the underburnt material from the top of the charge was kept separate, as far as possible, from the bulk of well-burnt clinker, and some picking out of inferior material took place; but it will be easily understood that there were great difficulties in the way of its complete removal, even with careful and vigilant management. It was quite common to omit picking and send substantially the whole product of the kiln to the crushers.

At this period millstones were in almost universal use for grinding the clinker. They were relatively cheap to erect, but very costly to maintain, and required a number of skilled artisans to dress them. The output per pair of stones was small and the horse power required was large. In fact, as a comminuting apparatus, they have nothing to recommend them except the difficulty of reducing the percentage of coarse, gritty particles; in consequence of this difficulty, the remainder of the cement must be ground for a long time, and is thus made very fine, or "floury." When sieves are used in conjunction with the stones, this advantage tends to disappear.

The cement made in the manner described was regarded, and rightly, as an unfinished material. It needed to be matured by aëration and storage, or in works' parlance, it had to be "cooled." The notion of "cooling" no doubt arose from the accident that the cement is physically hot when it comes from the stones, and the notion was conveniently extended to the slaking of those unsaturated lime compounds which are apt to exist in a product imperfectly mixed and irregularly burnt. There is no doubt that, under the conditions then existing, this storage and maturing was of the greatest value as a safeguard to the user, and it is only now—20 years later—when, with better means of manufacture, the precaution is almost superfluous. Even now cases arise in which cement is not sound when it leaves the grinding machinery, but such instances are becoming rarer, and may reasonably be expected to disappear with the growing improvement in manufacture. The manufacturing cost of cement 20 years ago, at a typical works of fair size, say, making 500 tons a week, and run with a sufficient application of the skill and knowledge then available, may be taken at an average figure of 18s. a ton, assuming a normal price for gas coke of 11s. per ton. A large part of this cost (about 5s. 6d.) was incurred for labour, as the heavy work of loading the kiln and carrying the clinker to the grinding plant was all done by hand.

Another large item was for fuel, both for power and for burning. The high cost for power was due to the wasteful methods of raising and using steam which were then general; the necessity for employing large coal of steam quality in the absence of mechanical devices for feeding small cheap coal, the production of low-pressure steam, and the use of uneconomical engines, all tended to make the production of power dearer in those days; but as these causes of waste were equally active in all industries at that date, no special comment need be made as to their effect on the cost of manufacture of cement. It is sufficient to note that as a good deal of power is used in making cement (the amount varying from 1 to 2 h.p. per ton per week), the cost of production has fallen naturally with the lowering of the price of energy which has been achieved within the last quarter of a century.

But under the old manufacturing régime there was another serious cause of expense in the cost of the coke needed for burning the raw materials to clinker. At one time the cement maker was accustomed to make his own coke, but in more recent times his supply was obtained from gas-works. As no form of fuel could be satisfactorily substituted for coke, the cement maker was a good deal in the hands of the gas companies, and at times he experienced inconvenient pressure from high prices. These three items, labour, high cost of power, and high and uncertain cost of coke, made any permanent or substantial reduction in cost of manufacture seem unlikely as long as the methods of 1886 were in use.

A typical works of the present time differs altogether from the works of 20 years ago which I have attempted to sketch. The contrast between the two represents the vast difference in knowledge which separates the two periods. The empirical stage has closed, and the use of scientific methods is accepted and in process of establishment.

It seems not improbable that the use of materials in a wet state will be superseded, and in consequence it is convenient to take a works using dry raw materials as typical of the most advanced practice. Of course, wet raw materials will continue to be used, but they will be dried before their manufacture into cement is begun. It follows that a works using dry raw materials does not merely represent the greater part of modern manufacture, but it also exemplifies what may become universal practice.

In a modern works using dry raw materials, these are dealt with in truck-loads instead of barrows; manual labour is suppressed wherever possible. The materials are weighed approximately, crushed in crushers of the coffee-mill type, and dried in rotatory driers. The drying is as important for ensuring the proper mixture of the raw materials as is the thorough mingling with a sufficient quantity of water in the case when wet raw materials are used. Although in all cases very fine grinding and most intimate mixing are requisite, yet this necessity is more urgent with some raw materials than with others. For example, typical dry raw materials are limestone and shale, and these may vary widely in composition. If the limestone is nearly pure calcium carbonate, evidently it will need more thorough mixing with the shale than if it is siliceous and consequently already contains naturally and intimately mixed with it a large proportion of those acid oxides with which the lime must be caused to unite in order to produce cement. The extreme case is reached when, as sometimes happens, the limestone contains enough silica and alumina to form cement without the admixture of a second material. Even in this instance the limestone must be well ground and mixed, because it is rare indeed that the siliceous constituents are distributed through the mass of the calcium carbonate uniformly. The same necessity, of course, arises when marls containing an appropriate amount of clay are used instead of limestones.

In a typical modern works the grinding of the raw materials is carried out in mills either of the Griffin or Huntington class, or of the ball and tube kind. Both sorts have their merits and their advocates, and both are greatly better in economy of power and in output than

the millstones which they have replaced. The fine dry coal is mechanically transported, generally by some form of screw conveyor, to large bins, from which the kilns are fed. These bins are a characteristic necessity of a modern cement works. The necessity arises from the fact that as the rotatory kiln runs continuously there must be a store of raw material for feeding the kiln large enough to supply the kilns over Sunday and at other times when the grinding plant is not running. The bins are naturally placed above the upper end of the rotatory kilns, and their contents are fed in by a worm or similar device, so that from the time the raw material is tipped into the crusher to the time when it enters the kiln it is not touched by hand. On account of the fact that the raw materials are dried and then accurately weighed, their proportions are kept within very narrow limits. If any correction is necessary it is done at once by the addition of a small quantity of one or other of the two materials before the bins are reached. In a modern works of the kind, variations of the composition of the raw material on the site are constantly watched, and the mixture correspondingly controlled by analysis. In consequence, subsequent correction is rarely necessary.

All the preceding part of the evolution of the manufacture might have been expected to take place on these or parallel lines, even if no successful form of rotatory kiln had been devised, but the rapidity of evolution and the particular line along which it has proceeded are directly dependent on the arrival of the rotatory kiln. The history of the rotatory kiln has been written elsewhere, and I do not propose to repeat it now. It is sufficient to consider the machine as it exists. A few years ago the rotatory kiln was about 60 ft. long and 6 ft. external diameter, and had an output of about 1 ton an hour or 170 tons per week. At the time of writing the size has reached 120 ft. by 8 ft. 6 ins., and the output is not less than 400 tons per week. Thus a single kiln is capable of the output of what would have been considered a moderate sized works in 1886. At the present time the output of one particular factory is some 25,000 tons per week, equivalent to the output of 25 largish works of the old type.

The dry, finely powdered raw materials find their way mechanically down the rotatory kiln and are met by fuel propelled mechanically. The preparation of the fuel is important, and characteristic of modern practice. It may be said that powdered coal is almost universally used, and that it is conveyed into the kiln by a blast of air. The coal must be very finely powdered, and, in consequence, has first to be dried. As powdering is necessary, cheap small coal is used, a great advantage being secured over the older process, where a dearer fuel and one the supply of which was limited and local had to be employed. The small coal is dried in a rotatory drier and is mechanically taken to the grinding plant, which is one of the two types used for the raw materials, viz., mills of the Huntington or Griffin type or those of the ball and tube class. The powdered coal is carried to bins, again being transported mechanically, which hold a sufficient supply for the kilns on Sunday, during the night, and at other times when the coal-drying or grinding plant may be out of operation.

The three products of the rotatory kiln are clinker, coal ash, and burnt gases, and all escape from the kiln without manual aid. The process of unloading the clinker, which is laborious and disagreeable in fixed kilns, disappears. The automatic removal of the burnt gases is the same in both cases. The removal of the ash of the fuel is a debatable merit. There is a substantial quantity of ash reckoned on the weight of the clinker, and this in the rotatory kiln goes almost wholly up the flue; in the older method it was incorporated with the product from the kiln, and increased the output by about 3 per cent. But the advantages of the rotatory kiln are so manifest that until it is replaced by some apparatus based on a different principle it is the only burning plant worth consideration under ordinary conditions of manufacture. These advantages were apparent nearly 20 years ago, but on account of practical difficulties were not fully attainable until some 10 years later. It is peculiarly gratifying to those—and they were few indeed—who were convinced from the first that the rotatory kiln would displace the older forms, to find at the present time that the event has justified their views.

At present only one of the three products of the rotatory kiln is utilised, namely, the clinker, and as this is a description of contemporary practice, it alone need be considered. The clinker emerges at a temperature of about 1200°—1300° C., and has to be cooled. Usually this is done in an inclined revolving cylinder like the rotatory kiln, but smaller and unlined; in the best practice the cooled clinker is allowed to fall into trucks, which are run on rails to the storage bins, or on to a travelling band, or into the boot of an elevator, and by these to the bins, mechanical transport being adopted at this point as in the earlier stages of the process of manufacture. In the process of cooling, generally at the exit from the cooling cylinders, the clinker is usually sprinkled with water. This is done to slake any unsaturated lime compounds which may have resulted from imperfect mixing and burning. In a rotatory cement kiln properly run there should be almost no badly burned clinker, and as picking of such small material is evidently impracticable it is essential that this condition should be approached; hence the sprinkling with water is a precaution rather than a necessity as far as slaking lime compounds which might cause unsoundness is concerned. But the sprinkling has another object: it is done to regulate the setting time of the cement, which may be necessary for the following reason. When an ordinary mixture of raw materials is burnt in a fixed kiln a great part of the sulphur in the fuel remains as sulphate in the clinker; in a rotatory kiln the fuel is burnt almost out of contact with the clinker, and its products, even the ash, pass away. Hence the clinker contains sulphates corresponding only with the sulphur present in the raw material. As sulphates tend to lengthen the setting time, it is natural that clinker from which the sulphate derived from the fuel is excluded should set more quickly than that which contains this sulphate, and, as a matter of experience, clinker from a rotatory kiln is apt to be quick-setting. Artificial maturing by the regulated addition of water goes far to qualify this tendency.

The slightly moistened clinker is kept in the storage bins, and is transferred mechanically to the grinding plant, the absence of manual labour at this point being in striking contrast to the old plan requiring a small army of labourers with barrows to carry the clinker from the kiln to the crushers. On account of the uniformly small size of the clinker, crushers can as a rule be dispensed with, or used at most to crack up any large lumps which may have formed by the agglomeration of the small nut-like pieces of clinker into rough balls. The grinding plant is usually a duplicate of that used for the raw materials, consisting of Griffin or Huntington mills, or more frequently ball and tube mills. During the process of grinding the small quantity of water added to the clinker becomes incorporated with the finely ground cement, and performs its function of slaking any loosely combined lime and in lengthening the setting time. In some works this slaking is effected in the tube mills by blowing in steam, the purpose served being the same as that accomplished by watering the clinker. The cement is carried by screw conveyors or some similar method of transport to storage bins, and in some cases fed from these by gravity into sacks or barrels, untouched by hand throughout. To one familiar with the older type of works, nothing is more striking than the appearance of a modern works, in which full advantage has been taken of mechanical means of transport. Throughout the works there are signs of great activity, and yet an almost complete absence of men. At the crushers for the raw materials there will be a few; about the fine grinding plant one or two hands sauntering about with oilcans; on the platforms in front of the rotatory kiln a few burners, perhaps one to each pair of kilns; and a greaser or two looking after the driving gear of the kilns; in the cement grinding plant no one but the necessary oiler—and someone watching the conveyors, perhaps. The whole process of manufacture has been brought very nearly to that ideal state of industry where the man is put into his proper place of supervisor and is not used as a sentient machine.

Almost the opposite change from ancient to modern procedure in point of the process of manufacture, is the alteration which has occurred in the power plant. It would be out of place to deal with this in detail here, because the change is not characteristic of the cement industry, but is general in industry. Whereas at the earlier date (1886) power was provided by curious old steam engines working at something above atmospheric pressure and consuming almost as many pounds of coal per h.p. hour as their successors consume of steam, nowadays a cement works rightly thinks itself behind the times if it is not equipped with the most modern form of engine. I say "engine" advisedly, because the best form ultimately to be adopted has yet to be settled. Usually the cement maker has been content with compound or triple expansion reciprocating steam engines, but he is passing easily to the use of large gas engines or of Diesel oil engines. Steam turbines may present a little difficulty as their rate of rotation is inconveniently large, but they are by no means to be overlooked. Whatever the outcome, it is certain that in a modern works a modern power plant must be adopted, because the cost of power is a substantial fraction of the whole cost of cement manufacture, and the margin of profit is not so great as to permit of any but the best appliances. The same limitation makes an economical method of distributing the power of importance only second to that of its production, and in consequence electrical methods of distribution are freely used in modern cement works.

As a result of this alteration of procedure, the manufacturing cost of cement has been substantially reduced. As stated above, the cost at the works by the older methods was about 18s. per ton under ordinarily favourable conditions. By the modern method, and under similar conditions, the cost is about 13s. per ton. These figures are taken as representing fairly enough the difference in cost of the two processes. It would be easy to find exceptions to them, and no doubt examples of higher and lower cost by each process might be cited, but such citation does not affect the argument that by the adoption of modern methods a substantial economy in manufacturing cost has been obtained. Incidentally to this change, there has been, as already indicated, a shifting of the centre of gravity of the trade, and at the present time the users of wet raw materials are at some disadvantage.

The expansion of the manufacture during the period under discussion is shown by the figures given in Appendix A, already mentioned. The utilisation of this greatly increased output has been due to the general increase in engineering and structural enterprises of all kinds, and to the fact that all builders—using that term in its broadest sense, from the greatest architect to the humblest building contractor—have been gradually replacing many of their older materials of construction by cement concrete and mortar. It is beginning to be realised that lime mortar is a poor structural material, and wherever possible cement mortar is substituted for it. A great variety of systems of construction in what is known as armoured concrete have been devised and are being daily extended in use; the manufacture of artificial stone is constantly increasing, and requires great quantities of cement. These causes of increased consumption fall ultimately under two heads: (1) The greater use of cement for well-known purposes, and (2) the growing use of cement for new purposes. Both follow pretty closely the enormous increase in constructional work which has occurred during the last 20 years.

Comparison of the ancient and modern methods of manufacture being completed, it may be useful to consider the present position of the industry. The essentially local nature of the trade will be allowed on all sides, and also that wherever there are natural deposits of suitable acid and basic oxides the industry can be established if fuel is even moderately dear. It follows that profitable manufacture in this country is no longer assured by the natural advantages of excellent raw materials and cheap fuel, but depends upon the skill and enterprise of the manufacturer. Every industry goes through periods of inflation and depression, and in the former there is so great a tendency to be content with old and imperfect methods, and in the latter there is [illegible] a damaging trade; and something of the sort has occurred in this particular industry. There has been a period of depression partly due to outside causes, some of which are permanent, and partly to a want of realisation of the fact that industrial methods are changing. Some have argued from this delay in realising his new industrial position that the cement maker in this country is dead, but such a statement is not just. It must be remembered that his old position was one apparently of great security, and that more than usual prescience would have been required to foresee (*a*) that he would lose almost at a stroke his importance in the world's output, and (*b*) that with diminished resources he would have to rebuild his works. To adjust oneself to so altered a position, easy to state but most uncomfortable to occupy, certainly needs a little time, and the time has been spent in a fruitful manner. There are now in operation in the United Kingdom cement works which are on level terms with the best abroad, and the quality of their product is of equal excellence.

A discourse on recent progress in the cement industry would be incomplete if some account were not given of the relative importance at the present time of the chief varieties of hydraulic cement. Portland cement stands first, a long way ahead of any of its congeners. There is little doubt that the greater part of the Portland cement now manufactured is made from dry raw materials of the limestone and shale class; the second largest source is from wet raw materials of the chalk and clay class. One special raw material is blast-furnace slag, which is mixed with limestone and burnt to make Portland cement. The product, from its origin, has acquired the name "Eisen Portland Cement" in Germany, but there seems no good reason why it should be distinguished by any qualification. If properly made of suitable acid and basic oxides, Portland cement is Portland cement whatever may be the origin of its constituents or whatever their previous state of combination may have been. The second great group consists of so-called "natural" cements, by which is meant hydraulic cements made from raw materials which occur in nature, mixed in approximately correct proportions, and prepared by burning such materials without previous mixing or addition. Roman cement is typical of this class; American natural cements belong to the same division, but may be regarded as a separate group on account of their frequent high content of magnesia. The use of natural cements is declining relatively to the total consumption of hydraulic cement, as is shown by the following figures:—In 1904 the world's output of natural cement was about 1,000,000 tons, as against 11,000,000 tons of Portland cement. In 1886 the respective figures are 600,000 tons of natural cement and 2,500,000 tons of Portland cement. It will be seen that whereas the output of Portland cement has more than quadrupled in the period under discussion, the output of natural cement has barely doubled.

This change is due to the cheapening of Portland cement and to the growing understanding that a carefully manufactured product with its composition chemically controlled is in many respects preferable to a material which from its origin and mode of preparation must vary according to the natural fluctuations of the raw material. There is still a considerable field for natural cement at the place of its production, but on account of its mediocre quality it will not bear much freight; and it may be safely predicted that in cases where it is practicable to establish a manufacture of Portland cement, using the raw materials formerly employed for making "natural" cement, this change in the industry will occur. It has already occurred in the Cambridge district, where formerly natural cement was made, and now is replaced by Portland cement of excellent quality. The recognition of the necessity for intimate admixture of raw materials, even when of approximately correct composition, has been commented on above.

The present position of the trade in hydraulic lime is not quite similar. It is true that hydraulic lime is being steadily replaced by Portland cement for most purposes, but there are some uses in which it still holds its ground. Moreover, there are some deposits, such as those of Theil,

which could not easily be utilised for making Portland cement, because they contain so little alumina that no ordinary clayey material would bring their composition within the limits proper to Portland cement. The fact that a true hydraulic lime can be slaked and used after a long time, and that its ultimate setting is very deliberate, is of advantage in some engineering operations.

The utilisation of blast-furnace slag for the manufacture of cement is of more than a little interest. One direction in which blast-furnace slag is employed is to produce Portland cement by burning with a suitable proportion of limestone, and has already been mentioned. Another is the production of a puzzuolanic cement by mixture of granulated blast-furnace slag with lime; this mixture at one time assumed some importance, but is now not largely made; about 350,000 tons was manufactured in 1903. A third mode of turning blast-furnace slag to account is of more modern and immediate interest, and needs somewhat closer description. About six years ago, Dr. Passow, of Hamburg, discovered that when blast-furnace slag containing a fairly high percentage of lime, *e.g.*, 40—45 per cent., was cooled in a regulated manner, so that in passing from the liquid to the solid state it was reduced to a granular condition, it underwent a surprising modification of its properties. Whereas the slag, when run from the blast furnace and allowed to cool in blocks, or when granulated in water, as is done in making puzzuolanic cement, exhibits only the feeblest tendency to set, yet on being treated in the way mentioned so that the rate and mode of cooling can be controlled, this same slag when finely ground will set and attain a strength comparable with that of Portland cement. It is an advantage to add a small quantity of Portland cement, say 10 per cent., but this addition has no sensible influence on the strength of the product, its function being merely to cause the material to set more rapidly than the slag will set by itself. When asked to investigate this process I felt somewhat sceptical as to the correctness of these statements; but as a matter of fact experiment showed that they are accurate, and it must be accepted that it is practicable to prepare hydraulic cement of great strength from suitable blast-furnace slag by the regulated cooling of the slag while solidifying. A good deal of this Passow cement has been made in Germany and in the United States, and a considerable amount has been prepared in this country. A cement of this kind, on account of its cheapness and the fact that it is made from a material which has been actually fused, and, therefore, must be homogeneous and free from uncombined lime, has noteworthy merits, and should occupy an important position among cements for structural purposes.

There is another cementitious material, the present position of which calls for comment. This is puzzuolana, using the term in its widest sense. Although the oldest of all materials by aid of which hydraulic cement can be prepared, it has of late years fallen somewhat into the background, because of the great growth in importance of Portland cement. But it has uses of its own, and there are signs that these are beginning to be better understood. For example, in places where there is a supply of lime but no suitable argillaceous material for preparing Portland cement, it may be advantageous to convert the lime into an hydraulic cement by mixing with it some form of puzzuolana, such as trass or granulated blast-furnace slag, which may be imported more cheaply than Portland cement. A much larger use is as an addition to Portland cement concrete. It is well known that when Portland cement is hydrated in setting, a large part of the lime which it contains becomes liberated as calcium hydroxide, which may, under some conditions, be a source of weakness. If an active siliceous material such as a puzzuolana is added, it combines with this lime and forms with it a cement as useful as the Portland cement itself. As the use of puzzuolana turns the useless and superfluous lime into a valuable cementing material, its addition is of particular value for marine work, where resistance to the known destructive action of sea-water depends primarily on the closeness of texture of the concrete, and the absence in it of any material such as uncombined lime, which reacts easily with the magnesium salts present in the sea-water. At the present time these advantages are not so generally recognised as would be expected, and the production and use of puzzuolanic materials is not very large.

There is, however, evidence that a better understanding of the true functions of these substances is developing, and the demand for trass and its congeners may be expected to increase. That the older engineers fully understood the value of puzzuolana is shown by the following passage from Smeaton (1791):—

"On this subject I was already apprised that two measures of quenched or slaked lime, in the dry powder, mixed with one measure of Dutch Tarras, and both very well beat together to the consistence of a paste, using as little water as possible, was the common composition, generally used in the construction of the best water-works both in stone and brick; and which, after being *once set*,* would afterwards become hard, without being completely dry; nay, that it would in time grow hard, even under water."

"Having heard of a lime produced from a stone found at Aberthaw, upon the coast of Glamorganshire, that had the same qualities of setting as Tarras, I was very anxious to procure some of the stone; which I did, and burnt it into lime. I found it to require a good deal of fire to make it, by quenching, fall into a fine powder. This stone, before burning, was of a very even, but dead sky blue, with very few shining particles; but when burnt and sifted it was of a bright *buff colour*. Having made up a couple of balls, according to each of the former proportions, and also a couple of balls with common lime (by which I mean Plymouth lime), the difference of hardness after 24 hours was very remarkable; the composition of two measures of Aberthaw to one of Tarras considerably exceeded in hardness that of common lime and Tarras in equal parts. The composition of Aberthaw and Tarras in equal parts was still considerably harder, and this difference was the more apparent the longer the compositions were kept.

"The Puzzuolana is also a porous substance, and, like the Tarras, produces no effervescence with *aqua fortis*; it has much the appearance of being a volcanic production, is of a brown colour, and, as my friend, Mr. Cookworthy, told me, contains iron; it has the look of an iron ore rendered porous, or burnt to a cinder by fire. It is said to be found in large quantities in the neighbourhood of Mount Vesuvius, and in several other parts of Italy. That which was the subject of my experiments, as well as the best of what I have since caused to be imported, or have seen, was from Civita Vecchia. I have seen a kind of puzzuolana said to be brought from Naples, of a less ruddy and more grey colour, but on trial I did not find it to be near so strong as the former, for one-half of the quantity from Civita Vecchia would cause a composition of calcareous mortar to set harder in water than that from Naples would do. It is said that the ancient baths and water-works of the Romans were built with this kind of mortar, and their duration has, it seems, proved the validity of the composition; but I apprehend, unless they have the Lyas limestone in Italy,† it was reserved to the Eddystone to have those two materials first combined, and of consequence, so far as has yet appeared, the perfect composition of water mortar was now first ascertained to be a proper mixture of blue Lyas lime and puzzuolana."

A word may be said as to a product which is of future, if not of immediate, interest. This is white Portland cement. There is no cement suitable for external use which is white; all the ordinary white cements are of the plaster class, and, although excellently suited for interior work, fail when exposed to the weather, because of the fact that calcium sulphate is a soluble salt. There is a large field for a cement capable of resisting moisture, and of lending itself to decorative effects as easily as Keene's. At first sight it would seem that nothing could be easier

* "This is the term used in the application of calcareous mortar, which denotes its first step, or degree of hardening; but in this state, though it has lost its ductility, it is a very friable substance."

† "Lyas is the general term for strata of stone of the species of Aberthaw, in several countries."

then to supply this architectural requirement. It is well known that the colour of Portland cement depends on the oxide of iron which it contains, and it is also known that the iron compounds contribute little to the strength of the cement, and are not essential in inducing proper combination of the acid and basic oxides during burning; they can be replaced by corresponding compounds of alumina, and these are white. It follows that to make a white cement identical in its mechanical properties with Portland cement, all that is required is to use raw materials free from iron, and to prevent the introduction of iron from the fuel or grinding apparatus. It is not difficult to obtain raw materials that contain mere traces of iron, and it is quite practicable to avoid this contamination during manufacture, and after a few trials Portland cement very nearly white can be prepared. But as the colour approaches white, the influence of various small impurities becomes apparent, and to obtain a true Portland cement approaching Keene's cement in purity of tint is not quite an easy matter. Still, it has been and can be done, and a product prepared admirably adapted for ornamental purposes.

I now come to the second part of this paper, namely, that dealing with the advance in methods of control which has taken place during the last 20 years. This advance has naturally taken place *pari passu* with the improvement in manufacture, the two being so intimately interwoven that they have acted alternately on each other as cause and effect. Perhaps at the beginning of the period, say, in 1886, as there was about that time a considerable increase in the frequency with which tests were applied and an increase in the reliance placed on them, improvement in manufacture owed a good deal to the greater activity in testing; more recently the rate of improvement in manufacture has been at least as great as the rate of improvement in testing, and some of the alterations for the better in testing have been made in order that the system of testing may be sufficiently searching and exact correctly to appraise modern cements, the great bulk of which are excellent, and some even a little ahead of present demand, though not of present need.

It is interesting to compare a specification of 1886 with one now current, and for that purpose I have chosen one much used at the former date, and have placed it in company with the British Standard Specification as at present used. These are given in Appendix B.

It will be seen that the improvement is great. The points of chief importance are the increased fineness required, the specification of a proper chemical composition, and the insistence on a quantitative test for soundness. Incidentally there is, in the later specification, recognition of the fact that a sand test in necessary, and there is created a beautiful blank by the abolition of that monstrous survival, the weight per bushel test. Cement faithfully complying with the British Standard Specification, is some 100 per cent. better than a cement which complied without much margin with the 1886 specification, and is about 30 per cent. cheaper.

But although the current British specification is in all respects an improvement on its forerunners, it is not to be considered a perfect document. As one who had some part in producing it, I admit this freely, but I say without reservation that it has proved to be a useful working compromise, satisfactory in the main to the great bulk of consumers and manufacturers. No doubt there are clauses which may stand in need of modification or amendment, and recognition of this is shown by the impending re-assembly of the committee to prepare a revised edition.

Quite apart from this matter of revision, I may perhaps be allowed to indicate the direction in which the specification of the future should be carried.

To begin with, neat tests should be abolished. Sand tests should be on a weaker mixture than 1:3, and the sand should be finer; quite possibly a sand of much greater variety of grain, approximating to an ordinary building sand, might be made the standard. The tests for fineness and soundness should be a good deal more rigorous than at present, and the stipulations as to chemical composition should be extended to the limits defined by modern knowledge. With a specification constructed on these lines, cement in cases of urgency might be passed on its soundness, fineness, and chemical composition, leaving its mechanical strength for determination at leisure.

Improvement in the *nature* of methods of testing has not been great. There has been a substantial improvement in the application of well-known processes such as the customary mechanical and chemical modes of evaluation, but there has been little alteration in essence. For example, there has been no successful attempt to appraise cement from its proximate composition, although that is the natural and right method of deciding its quality.

The most pressing and practical of all the questions relating to the composition of cement is the determination of what is called "free lime," and many have been the prescriptions put forward for the purpose. On examination all fail, and there is at the present time absolutely no method of determining by any chemical process whether a given cement contains free lime or not. There is no known method of dissolving "free lime" from cement without acting on the somewhat labile calcium compounds which constitute the cement itself. A clever attempt on different lines was made by Keiser and Forder, which consists in treating the cement with a small quantity of water with the view of completely hydrating the lime, and driving off any excess of water which may have united with the calcium silicates and aluminates, by heating to a temperature of 185° C; this temperature is chosen as being below the temperature of decomposition of calcium hydroxide, while above that at which the water not combined with full lime is expelled. I carried out a series of experiments with this method when it was published and abandoned it with some reluctance. Its radical defect appears to be that, under the prescribed conditions, a portion at least of the calcium silicates, aluminates, and ferrites are decomposed, and yield calcium hydroxide, which, by this method, is of course counted as if it had been derived from the hydration of CaO itself.

Fortunately, although it has hitherto been found impracticable to determine "free lime" chemically, the evil effects which its presence involves can be detected mechanically with simplicity and certainty. The old-fashioned cold water pat test for soundness is happily obsolete, and the various forms of hot test which depend on qualitative observations, and whose results are expressions of opinion and not of measurement, may be reckoned obsolescent. Of quantitative soundness tests there are two which, used at an appropriate temperature, give excellent results, namely, the Bauschinger and the Le Chatelier tests. The whole subject was investigated by a Committee appointed by the International Society for Testing Materials. As Chairman of that Committee I had the duty of collating the results obtained by my colleagues in their examination of the merits of these tests. The figures showed incontestably that admirable data could be obtained by either method. On the ground of its greater simplicity, the Le Chatelier test was preferred, and although I hold that the direct method of measurement in the Bauschinger apparatus has much to recommend it, yet I concur fully in the preference expressed by the Committee for the use of the Le Chatelier test in every-day work. Partly as the result of this inquiry, the Le Chatelier test has become general in this country, and is prescribed in the British Standard Specification. It constitutes a valuable safeguard against the production or acceptance of unsound cement, and represents one of the most notable improvements in methods of testing in recent years. Messrs. Dounan and Barker have recently devised a method for determining the total dilatation of cement, which for laboratory use may be of much service.

In the period of which this paper treats much progress has been made in a knowledge of the chemistry of cement. Prior to 1886 there were many conflicting theories and little real knowledge. The condition of things may perhaps be judged that at so recent a date it was possible to put forward an hypothesis cited by Le Chatelier in the delicately ironical words:—"M. Mercerom has proposed an entirely original theory which attributes the hardening to the desiccation of the clay under the influence of the heat disengaged by the hydration of the lime." It was Le Chatelier himself who, in 1887, first communicated a

definite statement based on sound experimental evidence as to the chief compounds present in Portland cement, and added to that a coherent explanation of the principal changes which these undergo when cement sets. Since then other chemists, notably the Newberrys, have extended and consolidated this work, and recently also Clifford Richardson.

The two chief methods which have been successfully employed in investigating the chemistry of cement are the synthetic and the microscopical. All analytical methods have failed, as they have failed when applied to the determination of the proximate composition of natural rocks. By synthesis three calcium silicates, $CaOSiO_2$, $2CaOSiO_2$, $3CaOSiO_2$, have been prepared and are recognised as individual bodies; the four aluminates, $CaOAl_2O_3$, $3CaO_22Al_2O_3$, $2CaOAl_2O_3$ and $3CaOAl_2O_3$, have similarly been prepared and identified. It is generally accepted that of these, tricalcium silicate, $3CaOSiO_2$, is the essential constituent of Portland cement. The constituent of next importance is a basic aluminate, but there is still some difference of opinion as to whether this body should be represented by the formula $3CaOAl_2O_3$ or $2CaOAl_2O_3$. The remaining silicates and aluminates are of minor moment, and their presence in Portland cement clinker may be regarded as due to the natural imperfection of the raw materials employed and the limitation of the means of uniting these raw materials under the conditions of manufacture at present obtaining; in short, if a mixture of tricalcium silicate and tri- (or di-) calcium aluminate in suitable proportions could be industrially prepared, it would be an ideal cement. The silicates and aluminates going to make up commercial Portland cement clinker, whether essential or subsidiary, are not necessarily present in the clinker as separate individuals. There is good reason to believe that they exist as solid solutions, and that these solid solutions may have been mingled whilst the clinker was plastic, and have separated out when it cooled. The two chief minerals which have been recognised in cement clinker have received the names alite and celite, and according to the best current knowledge consist respectively of a solid solution of tricalcium aluminate in tricalcium silicate, and one of dicalcium aluminate in dicalcium silicate. Of these two substances alite alone is of value in the setting of the cement. It is generally accepted that in normal Portland cement clinker containing only moderate quantities of ferric oxide, magnesia, and alkalis, these minor constituents play quite a subsidiary part. No doubt they contribute to the fusible magma from which the main minerals crystallise, but the fact that what is truly Portland cement can be prepared from materials in which they are absent is sufficient proof of their relative insignificance. Whether any modification of this very clear and simple view of the constitution of Portland cement clinker may later be found necessary or not, it is in my judgment the nearest approach to the truth yet obtained, and on account of its philosophic basis, no less than because of its experimental foundation, it is as far in advance of the explanations current 20 years ago concerning the chemistry of cement as the manufacture of to-day is ahead of that at the same earlier date.

It will be observed that this theory does not necessarily apply to cements, such as Roman cement, less basic than Portland cement, or containing substantial quantities of constituents which are subsidiary in Portland cement, as, for example, natural cements rich in magnesia. Each of these will have to be examined on its merits, but although the inquiry will be far from a repetition of the Portland cement investigation, yet its successful prosecution will be greatly aided by the knowledge already at our disposal.

Correspondingly with the establishment of a good working hypothesis of the constitution of Portland cement clinker, has grown a reasonable explanation of the chief changes which occur when Portland cement sets, and it may fairly be said that this explanation has been reached during the period with which I am dealing. The underlying idea is derived from researches on the setting of plaster of Paris which is known to be due to the dissolution of a more soluble form of calcium sulphate and the deposition of a less soluble form in felted crystals, the dissolution and deposition being successively accomplished by the agency of a quantity of water small relatively to the mass of solid matter dissolved and deposited. This idea can be applied to those constituents of Portland cement which are soluble in water and will form hydrated crystalline products, provided that the substances dissolved have a transient greater solubility than the substances deposited. Now, in Portland cement the most important constituent, alite (*i.e.*, a solid solution of tricalcium aluminate in tricalcium silicate), is affected by water; and celite, the second large constituent, is but little influenced. Alite when acted on by water is decomposed according to the equation:—

$$n[2(3CaOSiO_2)]+m[3CaOAl_2O_3]+n[9H_2O]+m[12H_2O]=n[2(CaOSiO_2)5H_2O]+n[4CaOH_2O]+m[3(CaOAl_2O_3)12H_2O],$$

n and m being written in merely to recall the fact that alite may contain various proportions of its two components, tricalcium silicate and tricalcium aluminate. It is believed that the tricalcium aluminate, once liberated from its solid solution in tricalcium silicate, goes through the stages of hydration, dissolution in a more soluble form, and deposition in a less soluble form, by the action of a relatively small quantity of water as an intermediary,* precisely as does hemi-hydrated calcium sulphate when plaster of Paris sets. The behaviour of the tricalcium silicate is not quite so simple. On liberation from its solid solution it is decomposed, yielding hydrated monocalcium silicate and calcium hydroxide. Both crystallise and form a hard coherent mass. It must be assumed that one or both substances possess two degrees of solubility if the plaster hypothesis is to be used. Unfortunately, there is not, as far as I know, any direct evidence on this question. The dual solubility of hydrated monocalcium silicate has not been established, and that of calcium hydroxide, though it exists, is dependent on alteration of temperature, and is not a transient phenomenon occurring at the time of dissolution. It is possible that these two substances are mutual solvents, and communicate to each other the necessary property of transition from a higher unstable solubility to a lower stable solubility. If no proof of this is forthcoming, the plaster theory may have to be displaced.

Precisely as in the case of the constitution of clinker, so in that of the setting of cement derived from it, no serious attempt has been made to deal with other cements than Portland. The setting of that noteworthy product, Passow cement, to which I have already alluded, has not been explained, and is certainly worthy of study, if only for the fact that it is accompanied by the combination of a proportion of water so small as to appear quite inadequate for hydration.

There is an ample field for investigation, and, with the present-day view that the manufacture of cement is a great chemical industry, workers will be forthcoming, properly trained and equipped, and in adequate numbers, to carry to a fruitful conclusion researches whose outlines I have endeavoured to indicate.

In the foregoing part of this paper I have endeavoured to sketch the progress which has been made during the last 20 years in the methods of manufacture, in the methods of controlling and appraising the quality of the product, and in knowledge of the chemical changes concerned in the production of cement clinker and in the setting and hardening of cement. I may now, perhaps, be permitted to indicate on what lines, in my opinion, further progress is likely to be made, gathering together the statements on the question which have been made as commentary on particular aspects of the question.

It is practically certain that the distribution of the industry will continue until every considerable centre of trade will have its local supply of cement. It is equally probable that the consumption of cement will increase at a rapid rate. Unless and until it is replaced by an equivalent cementitious material, it will become the standard binding agent and will gradually displace lime for all ordinary building operations. In addition, it is

* I do not know whether any direct experiments on this point have been made.

more than likely that there will be a great development in the use of armoured concrete, which from its monolithic character is admirably fitted for massive and permanent structures, especially such as must be fireproof. Concrete, by itself, or reinforced with steel, will become the most important of all structural materials, and will be the one to which the builder turns naturally when first considering what method of construction to adopt in any given case. Huge quantities of cement will be needed for the preparation of this concrete, and that cement must, if possible, be a good deal cheaper than it is now.

Several improvements, not involving any great change in existing arrangements, though necessitating some departure from current practice, may be expected. The first, and perhaps the most important, is the drying of wet raw materials before mixing. At present water is added to these wet materials so liberally that approximately twice as much water as is naturally present has to be driven off. There are certain practical reasons why it is easier to work with a slurry than to abolish the preparation of slurry, to dry the chalk and clay, and to mix them precisely as limestone and shale are mixed in the dry process; but in my opinion the advantages of working by the dry method are so substantial that they will lead to its adoption. Another direction in which improvement is to be looked for is the better utilisation of the waste heat of the kilns. The total number of heat units escaping is enormous, and in the case of dry raw materials the temperature of the waste gases is relatively high. A good deal of saving should be effected by using these gases either direct under a boiler or in a producer.

Whatever may be the details of operation, the fundamental necessity for finely grinding and intimately mingling the raw materials remains, because at the temperature of a rotatory kiln the clinker is merely plastic and the acid and basic oxides can only unite slowly. If the plasticity is modified so that the mass is a little more fluid, the rate of union will be increased and the size of the particles may be larger. To reap the full benefit of the greater mobility of the particles at a high temperature, the whole mass must be fluid. As soon as this state is reached the need for grinding the raw materials disappears and the rotatory kiln becomes an obsolete machine. In the furnace of the future the raw materials without grinding, or mixing, perhaps without even drying, will be tipped in by the truck-load, and tapped out as liquid Portland cement.

There is no physical difficulty in fusing Portland cement. Years ago Michaëlis fused the raw materials in an oxyhydrogen blow-pipe flame and obtained an excellent product containing 70 per cent. of lime and perfectly sound, and at the present time no competent experimenter would hesitate to undertake the preparation of fused Portland cement in quantity if he were not too seriously restricted in expenditure of money. But to pass from this experimental achievement to the manufacture of fused Portland cement is a step of some magnitude. Several attempts have been made, notably by Messrs. Hurry and Seaman, to adapt the blast furnace to this end. A blast furnace is an ideal apparatus for the purpose, because it is a fairly efficient thermal device, is of simple construction, and can handle large quantities of material; it also has sufficient capacity to ensure tolerable uniformity of product in spite of moderate irregularities in burden. Unfortunately, the temperature normally attainable in a blast furnace is below the fusing point of clinker, and some modification must be made to reach and surpass this point. In the Hurry and Seaman process the temperature is raised by working at a pressure of 10—20 lb. above that of the atmosphere, the furnace necessarily being closed so as to prevent the waste gases escaping below this pressure. Evidently this is a device to increase the partial pressure of the oxygen in the air injected, from 0·2 atmosphere to 0·33—0·47 atmosphere, which moderate increase proved to be sufficient to fuse clinker somewhat low in lime. As the lime content is raised the clinker becomes less fusible, until at the saturation point, represented by the equation—

$$\frac{CaO}{SiO_2 + Al_2O_3} = 3,$$

a temperature greatly above that obtainable in an ordin blast furnace is needed. Therefore, if the Hurry a Seaman system is adopted the furnace must be work under a somewhat heavy pressure, which may invol difficulties in constructing an apparatus capable at or of remaining tight to this pressure and of supporting t high temperature necessary. An alternative is to increa the partial pressure of the oxygen by using a gas rich than air in oxygen. This seems to me a possible solutic but at present the cost of air enriched in oxygen is t high for its use in the manufacture of so cheap a mater as cement to be practicable.

There remains the method of raising the charge to temperature somewhere near its melting point by a bla of air at the ordinary pressure or at the highest workal pressure (and, of course, at the highest feasible tempe ture), and then completing the raising of the temperatu to the fusing point of the clinker by some other metho To introduce a limited quantity of air rich in oxyg below the plane at which ordinary air is injected mig serve if sufficient fuel remained at this point to be utilis by the extra oxygen; should that be already burnt, fu would need to be injected together with the enriched a Quite possibly the secondary heating could be don electrically; the heated charge in a semi-plastic sta would descend into the crucible of the furnace, where i temperature would be raised to its fusing point. Agai the difficulty in realising this possibility depends on t fact that cement is terribly cheap.

However it may be accomplished, the commerci preparation of Portland cement by fusing the raw materia together is the task now before the manufacturer. Th advantages are substantial. Every kind of raw materi —sandy clay, flinty chalk, irregular limestone—can b used provided that the ultimate composition of the whol charge is correct. All need of preparation of these ra materials is abolished. The materials are tipped in b the same wholesale methods that obtain with a blas furnace. A single furnace will give the output of a good sized factory. The proportion of the raw material can be so adjusted that the fused cement will be of pre cisely calculated composition, approaching theoretica perfection, and, from its mode of preparation, absolutel sound. It can be granulated by air or steam so that i is readily ground. The whole process of manufactur will be reduced to a simplicity not easy to surpass.

Until that new era comes we must accept what progres has been made, and certainly there is no cause for dis content. The very appearance of a modern works with well-kept machinery, dust-removing appliances the kilns kept almost like engines, and the engines kep like a gun, is a sufficient contrast with the wonderful ol collections of tumbledown sheds full of discarded mill stones and toothless harrows, and having nearly as much cement on the floor and in the air as was in the warehouse where clinker grit formed a large percentage of the lubri cant, and which were provided with power by an asthmati prime mover easily recognisable as a steam engine by mar observation of any gland or joint. The systematic and business-like control of a modern works, the high technical equipment of its staff, the constant resort to scientific methods of inquiry, are equally distinctive, and of even greater importance for the successful prosecution of a vast and growing chemical industry. I venture to think that whilst that spirit of investigation and enterprise, which has done so much during the last 20 years, continues to prevail, progress will be continuous and of solid advan tage to the consumer and producer alike.

APPENDIX A.

England.

*Production of Portland cement.**

	Tons.
1890	1,000,000
1902	2,068,600

* Ton = 2,240 lb. Barrels = 374 lb. net.

Exports of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1886	425,880	2 0 5	860,633	2,555,280	1.62
1888	611,328	1 17 10	1,146,429	3,667,968	1.51
1902	303,252	1 14 4	520,512	1,819,512	1.37
1905	456,558	1 11 7	721,786	2,739,348	1.26

GERMANY.

Production of Portland cement.

	Tons.
1886	950,000
1890	1,525,000
1903	3,333,300

Exports of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1886	360,100	1 17 0	667,000	2,160,600	1.48
1894	362,000	—	—	2,172,000	—
1901	551,800	1 14 9	960,000	3,310,800	1.39
1902	688,400	1 10 3	1,041,460	4,130,400	1.21
1903	730,700	1 5 9	937,550	4,384,200	1.03
1904	625,300	1 7 9	871,150	3,751,800	1.11

FRANCE.

Production of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1890	266,600	—	—	1,600,000	—
1898	500,000	1 11 3	781,250	3,000,000	1.25
1903	583,300	1 4 0	699,960	3,500,000	0.96

Exports of Portland cement.

Year.	Tons.	Barrels.
1891	176,660	1,060,000
1900	229,000	1,374,000
1905	273,200	1,639,200

UNITED STATES.

Production of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1886	25,000	2 8 9	[illegible] 60,940	150,000	1.95
1890	55,830	—	—	335,000	—
1894	133,126	—	—	798,757	—
1898	615,380	—	—	3,692,284	—
1902	2,871,774	1 10 3	4,346,683	17,230,644	1.21
1904	4,417,047	1 2 6	4,865,650	26,505,881	0.90

Imports of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1886	107,533	1 8 0	150,587	645,197	1.12
1890	333,600	—	—	2,000,000	—
1891	500,000	—	—	3,000,000	—
1901	166,770	1 12 9	272,020	994,624	1.31
1902	403,558	1 11 0	630,648	2,439,948	1.24
1903	183,360	1 11 3	286,184	1,101,561	1.25

CANADA.

Production of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1896	13,064	2 5 0	29,394	78,385	1.80
1900	48,687	2 8 3	117,274	292,124	1.93
1901	52,844	2 4 6	117,865	317,066	1.78
1902	97,432	2 3 3	214,295	594,594	1.73
1903	104,623	2 5 9	239,707	627,741	1.83
1904	150,060	1 15 3	265,206	900,358	1.41
1905	255,805	1 15 6	453,698	1,533,628	1.42

Imports of Portland cement.

Year.	Tons.	Value per ton.	Total value.	Barrels.	Value per barrel.
		£ s. d.	£		$
1900	57,077	1 16 3	103,876	342,463	1.45
1901	70,721	1 18 6	136,374	424,324	1.54
1902	86,474	2 0 3	173,679	518,846	1.61
1903	101,616	1 15 6	180,860	609,700	1.42

PRODUCTION OF PORTLAND CEMENT.

	Tons.	Barrels.
Russia—		
1890	133,330	800,000
1898	333,300	2,000,000
1901	491,660	2,950,000
1903	416,660	2,500,000
Belgium—		
1890	116,560	700,000
1892	133,330	800,000
1903	250,000	1,500,000
Switzerland—		
1894	116,500	699,000
1900	200,400	1,202,400
1902	172,300	1,038,800
Denmark—		
1898	66,600	400,000
1904	282,000	1,692,000
Sweden—		
1894	55,330	335,000
1898	83,330	500,000
1904	125,500	753,000
Japan—		
1892	46,000	276,000
1897	100,000	600,000
Austria—		
1898	166,666	1,000,000
Italy—		
1898	133,300	800,000
1899	176,000	1,056,000

Estimated World's Production.

	Tons.	Barrels.
1886	2,500,000	15,000,000
1892	4,170,000	25,000,000
1898	6,000,000	36,000,000
1903	10,700,000	64,000,000

APPENDIX B.

Specifications for Portland cement.

	1886.	British Standard, 1904.
Fineness :		
On sieve 50 by 50..	10 per cent.	—
76 by 76..	—	3·0 per cent.
180 by 180..	—	22·5 per cent.
Specific gravity :		
At works	—	3·15
After delivery	—	3·10
Weight per bushel	116 lb.	—
Soundness	Pats warmed and watered.	Le Chatelier test. Expansion after 24 hours—12 mm. Expansion after 7 days' aeration—6 mm.

	1886.	British Standard, 1904.
Tensile strength:		
Neat 1¼ by 1¼—		
2 days	350 lb.	—
4 days	500 lb.	—
7 days	750 lb.	—
1 by 1 section—		
7 days	—	400 lb.
28 days	—	500 lb.
3 Sand, 1 cement 1 by 1:		
7 days	—	120 lb.
28 days	—	225 lb.
Analysis	—	Required.
Bulking	Required.	—

Discussion.

The Chairman suggested that, as Mr. Blount had indicated that the Standards Committee was to meet very shortly, it would be well if some competent authority were to make suggestions on that head, which would certainly receive consideration at the hands of the Committee. They would also like to hear any views as to the possibility of the future improvements to which allusion had been made.

Mr. J. L. Spoor said he thought up to the present time a rotary kiln could not burn a ton of cement with so low a percentage of fuel as the best form of vertical kiln. A few months ago he examined Mr. Edison's rotary kiln at his works at Stewartsville, N.J. It was 150 ft. long, and he had seen it make 1000 tons a week of excellent cement. It was a dry process, and was using under 17 per cent. of fuel, which was the best record in the world. At the present time English practice could not compete with that, but of course it must be remembered that we were dealing with rather different materials. The materials they had in the Lehigh valley were exceedingly well adapted both for grinding and burning cheaply. Then there was a vertical kiln which was taking its raw material in the shape of bricks, or pieces of dry slurry, and would burn it into excellent clinker of a specific gravity as high as the rotary kiln on 14 per cent. of fuel. Of course the rotary kiln had come to stay. If the cement trade was going to move into districts where the cement was to be used, the plant would have to be adapted to the raw materials and fuel most easily obtained on the spot. At present the rotary kiln held the field, and was likely to. With regard to the Standard Specification, he did not quite know on what principles it was framed. It looked very much like a compromise, and not a scientific standard. Some of their friends were a little bit worried about magnesia, as to which he was not quite orthodox. There were cements made out of dolomite which behaved very well for a number of years, even better than Portland cement, so that one got a little bit sceptical about the various theories as to the evil of magnesia. But at any rate he did not know why the Standard Specification Committee drew the line at 3 per cent. In other countries the question had formed the subject of inquiry by Commissions of cement manufacturers and engineers. They drew the line at about 4 per cent. It was an open question, and if it was a hardship pressing on some makers it ought to be proved that cement having above 3 per cent. ought not to be put on the market before adopting a Standard Specification. The question of the use of puzzuolana had been prominent for many years on the Continent, and there were two schools of opinion. Michaelis told them that it would be a very good thing to use trass as an admixture with cement, especially for use in sea-water, but he hoped that before it was done they would carefully consider by whom it was to be done, and in what quantities, and not before they had thoroughly proved that it was in itself desirable. He doubted its advantage, and was afraid it would lead to adulteration.

Mr. H. K. G. Bamber asked the author for his reasons for hoping that the wet process would become obsolete. He knew that, from the manufacturing point of view, with many materials it was much easier to produce a more perfect mixture with the aid of water as a medium than to grind the dry materials together. Speaking with some knowledge of that point, it seemed that the wet process was very effective in that respect, inasmuch as the common practice was to reduce the raw materials to such a fine state of subdivision that 97 or 98 per cent. of the whole material was capable, before leaving the mixing machine, of passing through a sieve of 32,400 holes to the square inch, and that calculated on the dry materials. Of course the difference between the wet and dry process only applied to that part of the process previous to calcination. The author told them something about the action of the fuel ash in the ordinary or chamber kilns, and referred to the sulphur compounds which were present in some form or other, which had the effect, either by becoming mechanically mixed or chemically combined during calcination, of producing a somewhat more slow-setting cement than that manufactured by the rotary process. Could the author tell them whether the presence of sulphur in some form in the cement, probably in the form of sulphates, would be equally effective in slowing the material, if it were present in the clinker derived from the sulphur compounds present in the raw material, as if the same were derived from the fuel used for calcining? An instance had come before him recently in which, by selecting portions of clinker from an ordinary chamber kiln, which had clearly not been contaminated with any fuel, ash, or dust, and by grinding those portions and analysing carefully, he found that clinker taken from four or five different chamber kilns, manufactured at different works, were all practically free from fuel ash, but varied in the content of sulphate (SO_3) from 0·3 up to 1 per cent. All these clinkers, when mixed with water, even to the extent of 35 per cent., had an initial set of about five seconds, and an increase of temperature of about 20° F. in five minutes during the completion of setting, which was about that of a clinker burnt in a rotary kiln, where the ash did not contaminate it. Again, Mr. Blount referred to the great importance of reducing the raw material to an extremely fine state, which was well known to cement manufacturers. A case came before him recently in which a material which contained a very large percentage of sand was mixed with chalk in the right proportion to make a good Portland cement clinker. It was burned in a rotary kiln, and the clinker, which was excellent in appearance, was entirely soluble in acids, the whole of the sand, which was in particles of considerable size, having under these circumstances become combined; but the clinker, or the cement made from it, was quite unstable, and not volume constant. Was it possible that portions of silica on the surface of the particles of sand might by intimate contact with the lime present become tri-calcic silicate, whereas a portion somewhat nearer the interior might only have become di-calcic silicate, and the portion in the interior, mono-calcic silicate? Was that a possibility? Because, if so, the mixture of those three substances, although all soluble in acids, might be the cause of the unstable condition of that particular clinker. Reference had been made to a new apparatus brought forward before this Society at Liverpool, which determined the expansion of cement, which he believed was that of Professor Donnan. He had had an opportunity of trying its accuracy, and it appeared to him that there was a great difficulty in connection with it, inasmuch as the mercury, a material of such high specific gravity, did not appear to penetrate into the cavities of the briquette or block that was being tested, with the result that there was a certain amount of expansion on boiling the block; and if there were cracks, which probably there would be, the mercury did not find its way into them, and therefore an accurate measurement of the expansion of that particular cube was not obtained.

Mr. Gilbert said as regards the automatic handling of the material, with the exception of the rotary kiln, he rather thought the upper diagram had the advantage. In the lower diagram there was a great deal of handling at different stages, the whole of which [illegible] be dispensed with, which would effect a saving of about 1s. a ton. With regard to the saving in the cost of manufacture

from the rotary kiln, as compared with the Schneider kiln, he put it at about 2s. 6d. a ton. As to the mechanical difficulties connected with the rotary kiln, he had been mainly concerned with kilns built by German firms, and one defect was that the cooler was made too small in diameter. In one making about 1¼ tons of clinker per hour, which took 28 per cent. of coal, there should be about 3000 cb. ft. of cold air going through per minute, to cool down the clinker, and support combustion, but in all the experiments he had made, he had never found more than 1000 cb. ft. per minute of cold air enter the clinker cooler. The effect was not so much that the clinker did not get cold, but the end of the cooler got red hot, and its life became very short. Another difficulty was the deposit of a large quantity of coal ash and raw material dust in the flues. The actual length of kilns working on the dry process depended on the amount of moisture in the raw materials, if the waste gases were used for drying in separate drums. He had found 60 ft. satisfactory when the moisture amounted to 16 per cent., but in materials containing only 3 or 4 per cent., he thought the kilns might be 90 to 100 ft. long, and the waste gases would still have sufficient temperature for drying purposes.

Mr. W. F. Reid said he thought the contrast drawn between the practice of 1886 and the present time was a little exaggerated. For instance, the use of hand barrows was not universal in cement manufactories in 1886. He himself in 1870 put up trucks for delivering the stuff at the top of the stone crusher. With regard to the specification quoted, he could only say that any engineer who had such a specification in 1886 was justified in not allowing his name to be published. The specification of Mr. Grant, of the Metropolitan Board of Works, which was the standard specification in the trade, even in the sixties, and certainly before 1870, was far preferable. He mentioned that, so that it might not be supposed that these points in 1886 really were, as they were represented to have been, the general practice in this country. Our great competitors, the Germans, had preceded us in the scientific testing of materials. In 1869, there was no cement manufactory in this country that tested its raw material chemically. He brought over the first carbonic acid apparatus. Dr. Michaëlis at that time fused a piece of cement so highly limed, that it raised his astonishment that it did not "fly." The reason was a very good one. Fused cement did not set at all. They could get cement fused in a kiln if enough fuel were put in; and it ran through the bars; but the custom was to throw it away because it would not set. One might, perhaps, thus produce a setting cement; but the fact that one of the most highly trained scientific men who had tried fused materials since 1870, and had not succeeded, rendered this improbable. He did not himself think that the fusing of materials in that way would produce economically a good Portland cement, or that the process would be one which would be advisable in any way as regarded the material. When the materials were fused, it was by no means certain that they were homogeneous. There was another more hopeful way he thought. The composition of the slag from some of the blast furnaces in the United States was now being accurately proportioned for the purpose of making cement. At the late Congress of Applied Chemistry in Rome, he learnt that what the Americans chiefly worked for now was not the iron but the slag, which they made into cement and carefully proportioned the materials so that they should get slag suitable for cement making. Apparently the iron was now becoming a by-product, and the slag was the chief product. With regard to the puzzuolana, that was a very important product in some countries, but in this country he thought the question of transport was altogether against it, as they had to use a large proportion of it. In the ashes recently ejected from Vesuvius, nature had supplied them with a new material which he had tested and found hydraulic; 60 per cent. was soluble in hydrochloric acid. With regard to the tests at the present day, he thought there was an opening for some modification. The fineness was undoubtedly the one thing the consumer wanted. If he got that, he could utilise the cementitious properties of the product to the highest degree, and the finer the cement the greater the trade would be. Although perhaps the manufacturer might object to greater fineness, yet, if he could only increase the demand and supplant ordinary lime, he would be working to his own interests. He should have liked to have heard something about the very extensive plant put up by Mr. Edison in the States. He had taken the whole cement industry in hand and remodelled it, and started cement works. When he was in the States he endeavoured to see them, but was unable to do so, and if any gentleman present had been there it would be very interesting to hear something about them.

Mr. Friswell said he should like to say a few words on behalf of a man who was long dead. In the year 1887, he wrote an article in the "Engineer"* on the process of burning cement in a cylinder, which had been published in the previous year by Mr. Frederick Ransome. Mr. Ransome had nearly ruined himself in endeavouring to get this process introduced, and in that year he had succeeded in getting a kiln at work at Messrs. Gibbs' Works at Grays. He went down and saw that kiln. It was an iron cylinder 25 ft. long and 5 ft. in diameter, lined with fire brick, fired by means of small Siemens producer, about 3 cwt. per hour, and was supplied with regenerative chambers, so that the waste heat from the kiln was returned to it. Ransome was making cement then at the small rate of something less than 1 ton an hour, but it was quite successful, and good cement was produced. He spent many months after that in endeavouring to get it taken up here, but in vain. It was not until the invention had travelled to the United States, was adopted there, and had then been brought back again, that the matter became interesting to English manufacturers. It was a sad story, but one which ought to be put on record.

Mr. A. O. Trechmann said he agreed with Mr. Bamber that no better method of bringing the raw materials into close combination than the wet method could be devised, and he would like to know the reason of Mr. Blount's preference for the dry process. It could scarcely be on the score of smaller fuel consumption causing less contamination of the purity of the product through coal ash, because in the rotary kiln, as Mr. Blount stated, practically all the coal ash went up the chimney. There was one serious objection to the dry process with rotary kilns. In America, round about the dry-process works, the country was coated with a covering of dust, which was anything but pleasing to the neighbours. With regard to the setting time, Mr. Blount seemed to consider it was very easy to bring rotary burnt clinker to the required setting-time by the addition of water, but he thought in practice it was not so easy. The ash of the fuel used in the fixed kiln acted as a useful retarding agent in the setting process. If clinker were taken quite free from impurities of that kind, the setting time was a difficulty. It was therefore very useful to mix the clinker from a rotary kiln with that from a fixed kiln; the product might not be so pure from the critic's point of view, but it was a very useful article. With regard to the Standard Specification, he did not think it ought to be made much more severe. So far it had been very useful to the manufacturer, because it had been the means of his coming to an understanding with his customers as to their requirements; but he had had to modify his plant more or less in order to bring the whole of his product to that standard, and to make it more severe now would be rather a hardship. He did not agree with Mr. Blount that the manufacture of cement would necessarily for the future be localised in the large consuming centres. It took about 50 cwt. of material to make 1 ton of cement, and therefore cost of transport would prohibit works being put down in districts in which the raw materials were not to be found. As to the use of puzzuolana, he really thought the proportion to be added and the reasons for which it was to be used, should be very carefully stated. It would not do to introduce it for all classes of work. For sea work it might be specified, but the proportions should be accurately stated. He thought the theory of Clifford

* "Engineer," March 4th, 1887. The patent is No. 5442, May 3, 1886.

Richardson that cement clinker was a solid solution was quite obvious, but it did not explain anything serviceable to the manufacturer.

Mr. W. J. A. Butterfield said he recollected the introduction of the rotary kiln by Mr. Ransome, and he understood that one of the chief causes of failure then was the difficulty of getting a sufficiently good basic lining. The principal change, however, was that then it was fired by gaseous fuel; now it appeared to be always fired by coal dust, and he would be glad to hear if the author considered that this change in the mode of firing had been in a large measure responsible for the present success of the rotary kiln.

Dr. Stevens said, with regard to the specification for Portland cement, there was one standard he looked for in vain on the table, and that was the ratio of lime to silica *plus* alumina. In the pamphlet published by the Standard Specification Committee this ratio was given as a sort of footnote. He did not know why it was put as a footnote, because if it was intended to hold good it should have been put in the text, but there appeared to be some difference of opinion about it, and it might want revising. For that reason he should like to hear the author's opinion on the matter.

Mr. Rhodin said he happened to consult Mr. Blount with regard to making white Portland cement; they were bent on the idea of utilising the potash in felspar for agricultural purposes, but they found the difficulty of having about 70 per cent. of residue which they did not know what to do with. Then they thought of utilising it for making Portland cement which should be white. They tried it in Denmark and other places, and eventually came to Mr. Blount and he tried it and actually made cement of exactly the same properties as ordinary Portland cement with practically very little colour. Mr. Blount ascribed the green colour to the 0·02 per cent. of manganese which occurred in felspar. But it appeared to him that if it could be derived from any trace of oxide, even a small trace of iron in these alkalis would cause a remarkable discoloration. There was one point on which he differed from Mr. Blount, and that was that the decrease in the cost of producing power should have made such a difference to chemical manufacturers. He had known of a case where £40,000 or £50,000 was spent on new machinery, and a saving of from 17 to 15½ per cent. resulted; but if they calculated the interest on the money spent he believed it would be the other way about. Last year he saw a 60 h.p. rolling mill driven by one of the old engines made by Mr. Watt himself, and it was quite economical.

Mr. Clayton Beadle asked what was the best length of a rotary kiln, and whether any great increase in the length above those now in use was probable. The Edison kilns were made of cast iron instead of wrought iron or steel, and they very quickly cracked; one of them had to be supported by iron bands. The prevalent idea then seemed to be that kilns 50 ft. long were the best, although some manufacturers were building them about 72 ft. Now, they heard that Edison had them in operation at a length of 150 ft.

Mr. Blount, in reply, drew attention to an old machine for testing the strength of cement which had been lent by Messrs. Cubitt, which was an interesting forerunner of modern testing machines. He said he should prefer to answer the criticisms which had been made on the paper in writing, as he could not go into them at that late hour, and he would only refer to such points as he could dispose of very briefly. As to the length of the kilns he should say a maximum length of 120 ft. was not far out. The ratio of lime to acid oxides was based on Le Chatelier's equation, but the value 2·75 was written in instead of 3, because the consensus of opinion on the Standard Committee was rather against going the full length; he quite agreed that the figure might be revised, and possibly raised a little. With regard to Mr. Butterfield's remarks, it was quite true there was trouble, apart from the basic lining; the producer gas was a cause of difficulty, because with it regeneration was necessary, and regeneration with a cement kiln was not an easy matter on account of the dust, among other things. He thought the rotary kiln in the early days had no great prospect before it until some form of fuel equivalent to oil fuel, which had already proved a success, had been devised. This end was attained when powdered coal was used. With regard to sulphur in the fuel, he did not know why it should be that sulphates should have a greater influence in one case than in another, but he admitted that there were many peculiarities in their action, and that sometimes an advantage was gained by using a mixture. With regard to the silica in the clinker, he thought that Mr. Bamber put the explanation correctly, but perhaps it was clearer to say that it was the surplus lime which made the cement unsound. He should like to join issue with Mr. Reid about the practice in 1886; he had no doubt the works with which Mr. Reid was acquainted pursued a practice better than he (Mr. Blount) had represented, but at the same time the methods which he had described were typical of what prevailed at that time. The engineer to whom he had referred was one of the largest users of cement, and had constructed most important works.

Mr. Blount, replying in writing to the rest of the discussion, agreed that all reasonable suggestions would be most carefully and impartially considered by the Standards Committee. He was much interested in Mr. Spoor's account of a vertical kiln using as little as 14 per cent. of fuel, and should like further details, as this consumption was within sight of the calculated minimum. It was true that there had been much debate concerning the permissible limit for magnesia, and that some magnesian cements behaved well; in view, however, of the want of precision of our knowledge of the chemistry of magnesian cements, caution was obligatory, at least on those responsible for a standard specification. With regard to trass, he did not think there could be two opinions as to its beneficial effect on the strength of concrete; where, when, and by whom it should be mixed, was another matter; on the whole the balance of advantage was with the plan of carrying out the mixture at the place where the cement was being used under the supervision of the engineer.

Mr. Bamber had unintentionally over-emphasised his (Mr. Blount's) views regarding the obsolescence of the use of wet raw materials. He believed that from the technical standpoint it was desirable that the wet process should be abandoned because of the necessity of driving off a large quantity of water, superfluous for any other purpose than aiding admixture. There was really no difficulty in mixing dry raw materials thoroughly; every-day experience was sufficient proof of this. He had touched on the sulphate question in his oral reply. He thought the difficulty of making sound cement from a sandy raw material arose from the fact that many of the particles were not sufficiently fine even after careful grinding to be in such intimate contact with the lime as to ensure their uniform union; thus silicates lower in lime, mixed with lime uncombined with silica, would exist side by side in the cement, the whole of the clinker would be soluble in acids, and nevertheless, because of its unsaturated lime, it would be unsound. Prof. Donnan's apparatus was, as he understood it, designed to measure the dilatation of the test piece as a block, and not to take account of pores or fissures; if that was the correct view, the best measurement was obtained when the mercury did not find its way into the interior of the block.

In reply to Mr. Gilbert, he wished to remark that the diagram given of a modern cement works was chosen as an instance of contemporary practice; every works had its different conditions to be met, and no doubt in some, even cheaper and simpler methods of handling would be possible; the sketch was typical and illustrative, and was not intended as a rigid standard which could not be departed from, whatever the situation and facilities of the works. He agreed that as at present the rotatory process was relatively young, and was being continually applied to raw materials, and in situations that were not quite identical with the materials and places where it had already been used, there was need for each case to be studied on its merits, and the plant modified accordingly.

He would add to what he had already said to

Mr. Reid, that he felt it was not that his description failed to give a true picture of the condition of things in 1886, but that Mr. Reid at that date was a little ahead of his time. The experiments on fused clinker referred to were of much later date than 1869, and proved clearly that fused cement, if of proper composition, was sound and strong. The fused cement which would not set and had to be thrown away was either of the same composition as ordinary clinker, or more probably was even lower in lime; in consequence, when fused, it was little better than a slag, and generally inert. He thought that so far from a blast-furnace process failing to produce a homogeneous cement, it was an apparatus eminently fitted to turn out a product of unfailing uniformity. He was glad to know that Mr. Reid regarded the replacement of ordinary lime by cement as desirable, and not improbable.

He thanked Mr. Friswell for his reference to the good work in early days of Mr. Frederick Ransome; he had himself touched on it some years ago in a paper presented to another institution. In his opinion the substitution of coal dust for gaseous firing had had a most important influence on the development of the rotary kiln.

Mr. Rhodin's remarks were of particular interest as showing how a waste product which was rather an incumbrance might be the raw material of a new industry; white Portland cement would serve many constructional and decorative uses, and its manufacture might well be undertaken. He could hardly believe that Mr. Rhodin, whom he knew to be eminently modern in his ideas, was serious in his contention that it was impolitic on the part of chemical manufacturers to adopt modern power plant. Of course, if the cost of the power was a small part of the whole cost of manufacture, it might not be worth while to replace old engines, but when, as in the case of the cement industry, the cost of power was an important item in the cost of manufacture, the manufacturer simply could not afford to go on using the heat engines of a past generation.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 973.)

English Patent.

Distilling and evaporating liquids in vacuo; Method of and apparatus for ——. O. Unglaub, Salford. Eng. Pat. 18,172, Sept. 8, 1905.

The liquid to be evaporated, or distilled, is first run through a coil arranged within a jacket surrounding a vacuum chamber, and heated by steam traversing the jacket. The bottom end of the coil discharges into the vacuum chamber, wherein the lighter portions of the liquid are vaporised, and the heavier portions are discharged into a receiving chamber. (Reference is directed to Eng. Pats. 17,053 of 1896; 19,262 and 19,957 of 1898; and 6972 of 1902; this J., 1897, 601; 1902, 765.)—C. S.

United States Patents.

Vacuum pan. J. Kostálek, Prague, Austria-Hungary. U.S. Pat. 832,677, Oct. 9, 1906.

The vacuum pan has a "non-scorching" heating system movably mounted within; this consists of a series of superposed heating coils separated by inlet and outlet compartments, and so arranged that the outlet of one coil is connected to the inlet of the next. Valves are placed between the coils, so that the heating can be controlled, and the coils are provided with valved outlets for the escape of condensed liquid.—W. H. C.

[Separating] machine; Centrifugal ——. A. J. Ericsson, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pats. 832,047 and 832,048, Oct. 2, 1906.

See Eng. Pats. 10,862 and 19,109 of 1905; this J., 1905, 958, and 1906, 418.—T. F. B.

Separator bowls; Distributing device for centrifugal ——. N. S. Bök, Stockholm. U.S. Pat. 832,837, Oct. 9, 1906.

See Fr. Pat. 355,062 of 1905; this J., 1905, 1162.—T. F. B.

Filter; Parallel ——. J. Kostálek, Prague, Austria-Hungary. U.S. Pat. 832,678, Oct. 9, 1906.

The claim is for a receptacle for the filtering medium, provided with inlet and outlet pockets arranged alternately, and connected to separate gutters. The pockets comprise a lower, unperforated collecting tube, an upper, perforated inlet tube, and a perforated collecting chamber, connecting and communicating with the tubes. —W. H. C.

Drying apparatus. W. J. McElroy, Assignor to W. W. McElroy, Buffalo, N.Y. U.S. Pat. 832,874, Oct. 9, 1906.

An upright cylindrical casing is divided into chambers by horizontal partitions which have openings alternately at the centre and at the sides, through which the material passes from chamber to chamber. A vertical shaft, driven from above, passes through the centre of the casing, and is provided with an adjustable rotary horizontal shaft in each chamber, supported at its outer end by a wheel which runs in a track situated round the periphery of each chamber. A screw-conveying worm, supported and driven from the horizontal shaft, moves the material towards, and away from, the centre of alternate chambers.—W. H. C.

German Patent.

Steaming and drying apparatus; Movable perforated shelf in ——. H. Meyer. Ger. Pat. 172,451, May 3, 1905.

The patent relates to an apparatus which can be used both as a steaming or extracting apparatus, and as a dryer. When used for the first-mentioned purpose, the material under treatment rests on a perforated shelf in the rotating drum of the apparatus, but when used as a dryer, the shelf, by means of a suitable arrangement of levers, is made to hang loosely from one end, so that as the drum rotates, the material can come in contact with the whole of the heating surface.—A. S.

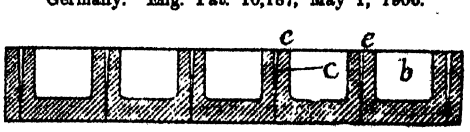
II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 976.)

Sugar cane; Composition and percentage of woody fibre in ——. *Value of bagasse as fuel.* H. Pellet. XVI., page 1059.

English Patents.

Filter-presses [for peat, &c.]. J. Hemmerling, Dresden, Germany. Eng. Pat. 10,187, May 1, 1906.



To avoid the contamination of the expressed liquid by fine particles of solid matter, a hollow chamber, a cross-

section of which is shown in the figure, is placed between each layer of material and the ordinary perforated separating plate. The liquid accumulates in the spaces, *b*, which are made sufficiently large to contain the whole of the liquid expressed from each layer of material, the fine particles of solid matter being kept back by the air pressure in the chambers. The latter are connected by shallow cross channels at *c*, which are provided with fine passages, *c*, through which the air, but not the liquid, can escape.—W. H. C.

Burners or furnaces; Hydrocarbon-fuel-. A. J. Boult, London. From Soc. in Partecipaz. per la Combustione Liquida, Genoa. Eng. Pat. 9121, April 17, 1906.

A HOLLOW metal casing is provided with a compressed-air inlet, and also with two inclined planes (one forming the hearth) down which the liquid fuel flows, these planes being perforated with slots or holes, in such wise that the compressed air escapes through them in different directions, but substantially, at right angles to each other, *i.e.*, the perforations in the one inclined plane are horizontal, whilst those in the other are vertical. A series of refractory bricks may be arranged in a suitable position above the burner, to ensure complete combustion, and, by reflecting heat on to the descending oil fuel, accelerate the vaporisation of the same.—C. S.

Coke ovens. W. Hiby, London. Eng. Pat. 27,001, Dec. 27, 1905.

IN order to protect the workmen from the smoke which is given off during the introduction of the fresh charge, the connection to the hydraulic main being shut off, a pipe is temporarily connected to the soot door of the ascension pipe. This pipe, which projects vertically upwards, has a steam jet so that it acts as an ejector which draws off the gases and smoke, and delivers them at a point well away from the door of the oven. The pipe is slung from a traveller which works on a gantry extending the whole length of the battery of ovens, so that it can be moved from oven to oven as required.—W. H. C.

Power Gas; Generation of ——. H. G. Boyd and W. R. McKay, London. Eng. Pat. 18,930, Sept. 19, 1905.

A MIXTURE of oyster, mussel, or other marine shells (9 parts), with iron, copper, or other metallic filings (say, 1 part), is placed in a vessel fitted with a rotary shaft and stirring blades. Dilute sulphuric acid is fed into the mixture according to requirements, and the gas generated is led off through a moisture trap, and storage vessel, to the motor to be worked by it.—H. B.

Gas generator furnaces. L. Bemelmans, Brussels. Eng. Pat. 19,617, Sept. 28, 1905.

THE generator has a rotary central shaft, and stationary outer wall, the shaft carrying devices which continuously raise the fuel, both at the sides and in the centre, in vertical slices, and let it drop, so as to prevent clinkering, &c. To agitate the main body of fuel in this way, arms carried by the rotary shaft, and provided with scrapers, extend over the stepped grate at a small distance above it, the arms being of such shape that the upper face forms an incline in the direction of rotation; as each arm moves, the fuel is raised by the inclined surface, and then suddenly drops behind the arm. In the centre of the furnace, where rotating arms have but little effect, a cylindrical body, forming a worm or screw-shaped incline, is provided upon the shaft; this likewise raises the fuel gradually, and then allows it to drop abruptly. The rising and falling movements affect the fuel throughout its entire height.—H. B.

Gas producer furnace; Processes of regulating the temperature of combustion in a —— for heating retort ovens or for other uses. H. L. Doherty, Madison, U.S.A. Eng. Pat. 19,716, Sept. 29, 1905. Under Int. Conv., Oct. 25, 1904.

See U.S. Pat. 829,105 of 1906; this J., 1906, 877.—T. F. B.

Gas producers. J. J. Bowmer, Newcastle-on-Tyne. Eng. Pat. 21,406, Oct. 21, 1905.

FOR the purpose of facilitating the removal of clinker from the grate of the producer, the bars of the grate are unconnected at one end, and are free from bearers or other obstructions below, so that an L-shaped pricker, inserted through the bars from below, may be drawn forward the full length of the bars, thus pulling out the clinker. A box-like device, which is open below and the inner side of which reaches down to near the fire-bars, is fixed over their front end; this maintains a clear space at the end of the bars, down through which the extracted clinker may fall into the ash-pit, whilst the inner side of the box holds back the main body of fuel, preventing it from falling forward over the front ends of the fire-bars. —H. B.

Carbonising coals for the production of illuminating and heating gases, and apparatus therefor. W. Young, Peebles, and S. Glover, St. Helens. Eng. Pat. 23,650, Nov. 17, 1905.

THE coal is carbonised in vertical or highly inclined retorts, which are heated externally by means of generator gases so that the coal becomes progressively hotter as it descends. The upper section of each retort, which is above the top level of the coal, and through which the coal-gas has to pass, is heated to a temperature lower than that of the sections below, whereby the gas is subjected to the action of radiant heat sufficient to "crack" the more complex vapours efficiently. The gas, on its way from the top of the retort to the hydraulic main, is led through the charge of raw coal contained in a closed section of the hopper surmounting the retort, whereby tarry and sooty matters are filtered off.—H. B.

Petrol and other oils; Process and apparatus for the vaporisation of —— for the production of carburetted air. W. P. Thompson, London. From Soc. d'Eclair. et de Chauff. par les Procédés A. Guy, Neuilly, France. Eng. Pat. 3892, Feb. 16, 1906.

IN the process of carburetting air, wherein the petrol or heavier hydrocarbon is fed, according to requirements, on to the surface of a body of water within the carburetting chamber, the evaporation of the hydrocarbon is quickened by heating the water by means of an external source of heat, as, for example, an ordinary hot-water circulating device.—H. B.

Gas [Carburetted air] for illuminating and heating purposes from petroleum spirit or other volatile oil or spirit; Apparatus for producing ——. B. K. Green and C. A. Horn, Great Malvern. Eng. Pat. 5222, March 3, 1906.

THE apparatus consists of a carburetting chamber, into which a part of the air supply is blown through pipes immersed in the hydrocarbon, so as to produce a spray, whilst the other portion of the air-supply is projected into the spray; a series of vertical pipes, leading the gas upwards to a drying and condensing chamber, which is charged with calcium chloride or bath-stone; and a back-flash safety valve fixed in the outlet from the condenser to the gas mains. In order that the gas production may vary automatically with the consumption, an air-escape valve, controlled by the internal pressure of the apparatus, is provided on the air-supply pipe of the carburetter: if, owing to fall in the gas consumption, the pressure rises, the relief valve opens more or less and allows more or less of the air to escape into the atmosphere. —H. B.

Carburetted air; Apparatus for the production of ——. Economic Safety Gas Co., Ltd., and C. C. Fowler, London. Eng. Pat. 12,076, May 23, 1906.

THE apparatus comprises a hot-air motor, the burner of which is fed with gas from the apparatus; a blower, driven by the motor, and forcing air through a pipe which is situated near the motor flame so as to be heated; a carburetter, through which the warmed air passes; and a gas-holder. The carburetter consists of a horizontal casing, divided by a partition into two compartments. From the smaller chamber, which is in communication with the petrol and warm-air supplies, three perforated pipes extend into the larger compartment, along the bottom, and the air forces petrol through these pipes, so that it issues upwards as a spray into the larger com-

compartment. The warm air flows from the small into the large compartment through several nozzles which pass through the partition, and mixes with the petrol spray before entering the gas-holder.—H. B.

Gases; Processes and apparatus for purifying ——, *and otherwise treating gases with liquids.* A. Elsenhans, Essen-Rüttenscheid, Germany. Eng. Pat. 25,665, Dec. 6, 1905. Under Int. Conv., Dec. 13, 1904.

See Fr. Pat. 360,341 of 1905; this J., 1906, 466.—T. F. B.

Explosive and other gases; Apparatus for detecting ——. H. E. Hauger and C. P. Pescheux, trading as Soc. H. Hauger and Pescheux, Paris. Eng. Pat. 3371, Feb. 12, 1906. Under Int. Conv., Feb. 22, 1905.

The apparatus consists essentially of a sensitive balance enclosed in a case open to the surrounding air by means of gratings; one arm of this balance carries a hermetically closed receptacle containing air at the usual temperature and pressure, the other arm carries a stirrup-shaped tray (bell-jar) of the same surface as the closed receptacle. The object of balancing in this way is to cause dust to settle equally on the receptacle and its counterpoise. The balance is adjusted so as to be in equilibrium in ordinary air; when, through the presence of foreign gases in the outer air, one side becomes heavier than the other and the balance inclines either way, pointers on the arms slip into mercury cups and close an electric circuit, thereby ringing an electric bell. Difference in temperature of the enclosed and outer air are equalised by a compensator fixed to the end of the arm which carries the counterpoise. This compensator consists of a spiral of soft iron and zinc soldered together, with the zinc on the outside. Expansion or contraction of the spiral through differences in temperature, causes a reel to slide horizontally on a wire attached to the beam in such a way that equilibrium is maintained. (Compare Eng. Pats. 15,694 of 1884; 7846 of 1891; and 11,703 of 1895; this J., 1885, 746.)—A. G. L.

Glow lamps; Process of manufacturing light-emitting bodies for electric ——, *and of connecting them with the supply conductors.* H. Kuzel, Baden, Austria. Eng. Pat. 5129, March 2, 1906.

See Fr. Pat. 366,267 of 1906; following these.—T. F. B.

United States Patents.

Combustible gas from carbonaceous liquids; Process and apparatus for generating a ——. F. Cotton, Hornsby, N.S.W. U.S. Pat. 831,835, Sept. 25, 1906.

See Eng. Pat. 18,291 of 1904; this J., 1904, 1021.—T.F.B.

Solvent and combustible for internal combustion engines; Liquid suitable as —— *and process of making the same.* W. Oppenheimer, Ewell. U.S. Pat. 832,409, Oct. 2, 1906.

See Eng. Pat. 4271 of 1904; this J., 1905, 722.—T. F. B.

Combustibles; Process for determining the heating power of ——. H. Junkers, Aix-la-Chapelle, Germany. U.S. Pat. 832,611. Oct. 9, 1906.

See Eng. Pat. 18,847 of 1904; this J., 1904, 1116.—T.F.B.

Coking apparatus. W. Kennedy, Pittsburg, Pa. U.S. Pat. 831,163, Sept. 18, 1906.

The plant claimed, comprises coking beds on which movable ovens are mounted, the gas-exit pipes of which communicate with a gas-exit flue beneath the coking-bed, when the ovens are in position. When the coking process is complete, the ovens are lifted by means of a kind of travelling crane, moved over a car, and the mass of coke discharged into the latter. Means are provided on the crane for operating a charging-hopper for delivering coal to the ovens.—A. S.

Gas; Apparatus for making ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 833,070, Oct. 9, 1906.

The gas-making apparatus consists of an L-shaped chamber, the upright limb being filled with refractory material, and the horizontal limb forming a coking and combustion chamber. The gases are withdrawn through an outlet some distance up the vertical limb of the chamber, and means are provided for introducing atomised oil into the combustion chamber. Oil and steam are admitted into the chamber at a point on the side of the outlet and opposite to the coking and combustion chamber. Coke is thus burned at one end of the casing, and the products of combustion pass in one direction entirely through the casing, whereby the refractory material next to the point of combustion is more highly heated than the rest of the material; also means are provided for excluding air, and for passing oil and steam through a portion of the refractory material nearest the point of combustion in one direction, and for simultaneously passing oil and steam in the other direction through a portion of the refractory material on the other side of the outlet.—W. C. H.

Gas Producer. A. M. Gow, Edgewood Park, Pa. U.S. Pat. 831,854, Sept. 25, 1906.

The producer consists of an upper (down-draught) chamber and a narrower lower (up-draught) chamber, the two being arranged out of vertical alignment and connected by means of a lateral passage, through which fuel may be discharged from the upper to the lower chamber. A gas off-take is situated adjacent to this passage, in the gasification chamber formed at the top of the lower chamber. Means are provided for feeding fuel to the upper chamber, and for controlling, independently, the supply of air and steam to the upper and lower chambers.—C. S.

Gases; Apparatus for manufacturing and mixing ——. B. Loomis, Hartford, Conn., and H. Pettibone, New Rochelle, N.Y., Assignors to Loomis-Pettibone Gas Machinery Co. U.S. Pat. 833,137, Oct. 9, 1906.

See Eng. Pat. 5911 of 1904; this J., 1904, 929.—T. F. B.

Gas purifying materials; Apparatus for treating ——. J. J. M. Bécigneul, Nantes, France. U.S. Pat. 813,114, Oct. 9, 1906.

See Addition of April 26, 1905, to Fr. Pat. 345,071 of 1904; this J., 1905, 1067.—T. F. B.

French Patents.

Coal; New artificial —— *composed of a mixture of beet-pulp and powdered coal, wood-charcoal, or coke, and an agglomerant.* J. P. Reneaux. Fr. Pat. 366,141, April 28, 1906.

The residual pulp from beet sugar works is ground (after drying if desired), and is then mixed with about 30 per cent. of powdered coal, wood-charcoal, or coke, the whole being rendered coherent by an admixture of about 10 per cent. of pitch, or other suitable adjunct, and pressed into any desired shape.—C. S.

Fuel; Production of —— *by treatment of "vinasse" or the liquid residues of alcohol distillation.* J. T. Connell, F. F. Haldane, and J. Thomson. Fr. Pat. 366,658, May 29, 1906. Under Int. Conv., July 6, 1905.

See Eng. Pat. 13,914 of 1905; this J., 1906, 604.—T. F. B.

Carburetted air; Apparatus for producing ——. Economic Safety Gas Co. Fr. Pat. 366,647, May 28, 1906.

See Eng. Pat. 12,076 of 1906; preceding these.—T.F.B.

Hydrogen gas; Installation for the production of ——. A. Thoms. Fr. Pat. 366,658, May 29, 1906.

A centrifugal pump, which takes gas from a hydrogen-generator and delivers it into a gas-holder, is driven by means of a gas motor, the gas-supply cock of which is so connected to the bell of the gas-holder that the gas is practically shut off when the bell is full, and is turned on as the bell descends. The cock which admits the gas from the pump into the gas-holder is similarly controlled by the movements of the bell. A cord, carrying a weight at one end, and attached to a tripping bar at the other, passes over a pulley on the shaft of the gas motor, and serves to give the latter the initial impulse required on restarting

[illegible] being at rest the [illegible] is connected to the [illegible] and [illegible] while the [illegible] is [illegible] with the [illegible] of the [illegible] gives the initial lift to the valve. The consecutive [illegible] may be sub-driven, instead of motor-driven, in which case the slip-on gear of the driving belt is controlled by the rise and fall of the gas-holder.—L. B.

Condenser for the separation of tar in gas-works. Cie pour l'Eclair. des Villes et la Fabr. des Compteurs et Appareils Divers. Fr. Pat. 366,447, May 21, 1906.

A HORIZONTALLY-ARRANGED casing, the bottom of which is inclined towards an opening at one end, from which the condensed tar flows into an ordinary tar-pot, is provided internally with a series of vertical partitions. The holes in one plate are not opposite to those in the adjacent plates; hence the gas is obliged to pursue a tortuous course in passing through the apparatus, and the tar is retained by impact against the surfaces of the plates. The sum of the areas of the perforations in each partition is equal to the cross-sectional area of the inlet or outlet pipe.—H. B.

Electrodes and filaments of pure graphite for electric lamps. M. Cresta. Fr. Pat. 366,142, May 12, 1906.

GRAPHITE, from which all impurities have been removed, is mixed into a paste with collodion and a small quantity of petroleum. The paste is formed into pencils or filaments, and the solvents are then driven off.—H. B.

Incandescence electric lamps; Process of making conductive connections, of metallic character, between the filaments and current leads of ——. H. Kuzel. Fr. Pat. 366,267, May 16, 1906. Under Int. Conv., Aug. 4, 1905.

FOR making the joints between the filaments (especially carbon filaments) and metallic leads of incandescence lamps, there are employed, as solder, the carbides of refractory metals, such as manganese, tungsten, thorium, &c., the carbides being either pure, or containing excess of carbon, or in solid solution in excess of the metal. For example, the ends of a carbon filament and of a nickel-wire lead are dipped into fused tungsten carbide, and the two ends are then united; or the carbide, finely powdered, may be mixed with an agglutinant, such as gum arabic, and then applied to the ends to be joined, the joint being next dried, and finally raised to a white heat in a suitable atmosphere. The carbide may also be formed in the process of soldering; for example, a mixture of 90 parts of powdered vanadium, 5 parts of graphite, 5 parts of gum arabic, and a little water, may be applied to the joint; on heating, vanadium carbide is produced.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 978.)

Crude petroleum; Determination of water in ——. E. Graefe. Petroleum, 1906, 1, 813—817.

ACCORDING to the author, the methods proposed by Wieleszynski (this J., 1904, 504) and by Nettel (this J., 1904, 952) for the determination of water in crude petroleum do not give concordant results. The method of inferring the proportion of the water by the difference of specific gravities of the crude oil and of the dehydrated oil is shown to be inaccurate. The author proposes a process based on the decomposition of the water by metallic sodium, and collection of the hydrogen evolved. From 5 to 10 c.c. of ether free from water and alcohol are placed in a small distilling flask of 30—40 c.c. capacity, a small quantity of finely-divided metallic sodium is introduced quickly through a funnel with a wide stem, and the latter washed with a further 5 c.c. of ether. A cork carrying a small separating-funnel, the stem of which is drawn out to a point, is now fixed in the neck of the flask, so that the stem dips below the surface of the ether. The delivery tube of the distilling flask [illegible] mercury [illegible] burette, [illegible] bursting of the [illegible] shaken, is now introduced into the separating-funnel well mixed therein with 1 c.c. of ether, the mixture run into the distilling flask, and the funnel washed with further 1 c.c. of ether. From the volume of hydrogen obtained, 2 c.c. are deducted to allow for the [illegible] by the petroleum and other introduced [illegible]. From the number of c.c. of hydrogen the [illegible] in mgrms. can be calculated by means of the [illegible]

$$\frac{a \times 0{\cdot}679 \times b}{273+t}$$

where a represents the volume of hydrogen in c.c., [illegible] barometric pressure, and t, the temperature.—A. S.

ENGLISH PATENT.

Sewage sludge and other waste matters of an organic origin; Destructive distillation of ——, *for the recovery of by-products such as ammonia and oil therefrom, and the utilisation of the residue.* J. C. Buttenshaw, London, and G. Watson, Leeds. Eng. Pat. 19,538, Sept. 27, 1905.

THE precipitated sludge, from which the greater part of the water has been removed by pressing or other means, is introduced into a retort, and subjected to the action of heat and steam. The organic matter is decomposed into gaseous and oily products, which are recovered in the usual manner, whilst the residue is converted into ammonia. The retort is surrounded by flues fitted with dampers, so arranged as to permit of the formation of zones of different temperature, some of which may be so far heated that the carbonaceous residue may be burned by the oxygen resulting from the decomposition of the steam, the retort being heated by the waste gases given off by the material, or by previously treated and heated air with or without the addition of producer or other gas. The retort is preferably vertical, and is fed from the top. Provision is made for the continuous removal of the spent material through the bottom, which material may be employed after suitable treatment as precipitant for fresh sewage.—D. B.

UNITED STATES PATENTS.

Retort [for wood distillation]. P. Jackson, Assignor to J. S. Schofield's Sons Co., Macon, Ga. U.S. Pat. 832,976, Oct. 9, 1906.

A CLOSED cylindrical vessel with a removable cover at one end is mounted by hollow trunnions on a support so that it can be inclined at any angle. Two parallel perforated pipes, connected by a cross pipe at the centre, extend the whole length of the vessel parallel with and close to the interior surface, so that when the vessel is in the horizontal or working position they lie parallel with the bottom. The cross piece is connected by a pipe with one of the hollow trunnions through which steam can be introduced into the perforated pipes. The products of distillation escape through an opening opposite the steam inlet, which is connected to the other hollow trunnion.—W. H. C.

Hydrocarbon oils; Refining and purifying ——. D. T. Day, Washington, D.C. U.S. Pat. 826,089, July 17, 1906.

THE distilled oil is filtered through a porous absorbent material such as palladium black or platinum sponge, charged with hydrogen or absorbable hydrogen-carrying (hydrocarbon) gas or vapour, a supply of such gas or vapour being kept in contact with the absorbent material during the filtering process.—C. S.

"Mastic"; Art of producing ——. H. Paschke, New York. U.S. Pat. 832,697, Oct. 9, 1906.

THE method of producing "mastic" described consists in granulating a cold, soluble, waterproof (bituminous) substance, and subjecting it to the action of a volatile solvent, whereby the evaporation of the solvent is delayed sufficiently to enable it to attack the outer surfaces of the

grains of granulated waterproof material, and soften them so that they adhere to form a stiff plastic mass. Such a mass may be laid in any desired form or position before the action of the solvent extends to the interior of the grains of granulated waterproof material.—W. C. H.

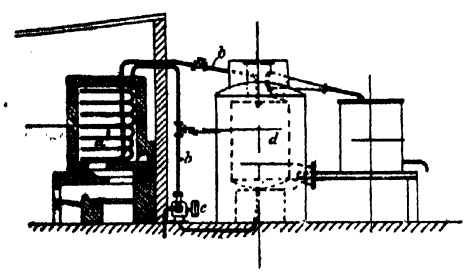
FRENCH PATENT.

Mineral oils furnishing a stable emulsion, and mineral-oil soaps that dissolve to a clear solution; Method of preparing ——. E. Junginger. Fr. Pat. 366,293, March 29, 1906. Under Int. Conv., June 20, 1905.

AN alkali compound of a sulphonated oil (Turkey red oil) is treated with a salt of magnesia or other soluble metallic salt that will furnish a soluble product, and the resulting compound is mixed with an equal quantity of oleic acid and sufficient ammonia (sp. gr. about 0·910) to impart an alkaline reaction and clarify the mixture, whereupon the whole is incorporated with mineral oil and allowed to cool. To produce a fairly clear and stable soap, this product is dissolved in hot water along with about 3 per cent. of calcined potassium or sodium carbonate (calculated on the weight of the oil). This can be concentrated by heat to the consistence of ordinary soft soap.—C. S.

GERMAN PATENTS.

Distilling apparatus for tar and other inflammable liquids and those liable to froth. De Clercq's Patent-Ges. zur Fabrikation der Teer- und Dachpappenmaschinen m. b. H. Ger. Pat. 166,723, Jan. 27, 1904.



THE feature of the type of apparatus, of which the accompanying diagram is an example, is that the tar or other liquid is caused to circulate, by means of the pump, *c*, from the jacketed still proper, *d*, through the coil, *a*, in which it is heated by the gases from the furnace below, and is then pumped back, through *b*, to the still. In this way, it is stated that high temperatures can be attained, without risk of frothing or fire.—T. F. B.

Tar oils for impregnating, preserving, and disinfecting purposes; Process for working up heavy ——. H. Nördlinger. Ger. Pat. 168,611, Jan. 21, 1905. Addition to Ger. Pat. 121,901, May 24, 1899.

THE antiseptic properties of heavy tar oils are said to be considerably increased by the addition of normal or acid (metallic) salts of fatty acids from propionic acid to caprylic acid, or of the corresponding acids of the acrylic acid series; these salts are more readily soluble in the tar oils than are acetates.—T. F. B.

Lubricants; Apparatus for testing ——. J. Walther. Ger. Pat. 171,181, May 29, 1904. XXIII., page 1068.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 978.)

Aromatic amines; New method for the preparation of ——. F. Sachs. Ber., 1906, **39**, 3006—3028.

THE author has investigated the action of sodamide on naphthalene and some of its derivatives, whereby primary amines have been obtained. These are formed in three ways, viz.:—(1) By substitution of the amino for the sulphonic acid group; (2) by replacement of hydrogen in the naphthols and naphthylamines; (3) by replacement of hydrogen in naphthalene itself in presence of substances capable of supplying oxygen. From the 1:5-, 1:8-, and 2:7-naphtholsulphonic acids the corresponding aminonaphthols were prepared in good yield. In the case of the 2:6- and 2:8-naphtholsulphonic acids the entering amino-group did not take the place of the eliminated sulphonic group, but 1:6-aminonaphthol was produced in each case. When β-naphthol (30 grms.) was heated with 1½ parts of sodamide in presence of naphthalene for one to two hours at 205°—220° C., hydrogen was evolved, and 1:6-amino-naphthol (15·5 grms.) obtained. α-Naphthol similarly yielded 1:5-aminonaphthol. Naphthionic acid gave 1:4-naphthylenediamine together with α-naphthylamine. Anthraquinone-β-sulphonic acid gave an aminoanthraquinone, m. pt. 256° C., which did not correspond to the two known aminoanthraquinones. The naphthylamines behaved similarly to the naphthols: thus from α- and β-naphthylamine, 1:5- and 1:6-naphthylenediamine respectively were obtained. Naphthalene itself, when treated with sodamide in presence of phenol, formed substitution products, and α-naphthylamine as well as 1:5-naphthylenediamine resulted.—J. C. C.

Phenylhydrazine; Reduction with ——. *New method for the preparation of the 5-amino-derivative of salicylic acid.* E. Puxeddu. Gaz. Chim. Ital., 1906, **36** [2], 87—89.

THE method described by Oddo and Puxeddu (this J., 1905, 1103) for the reduction of hydroxyazo compounds by means of phenylhydrazine can be used for the preparation of 5-aminosalicylic acid, which has recently become of importance in the dyestuff industry. The benzeneazo-derivative of salicylic acid, $(COOH)(OH)C_6H_3N:NC_6H_5$, (m. pt. 211° C.), was prepared by combining 14 grms. of salicylic acid dissolved in 45 c.c. of 20 per cent. sodium hydroxide solution, and diluted to 200 c.c., with the diazo solution obtained from 9 grms. of aniline, 30 c.c. of 40 per cent. hydrochloric acid, and 50 c.c. of 20 per cent. sodium nitrite solution. Five grms. of the azo compound were heated with excess of phenylhydrazine to 100° C., and the source of heat was then removed; the temperature rises to 185° C., and the reduction is complete in about 10 minutes. The pure aminosalicylic acid, $(COOH)(OH)C_6H_3.NH_2$, is obtained, with a quantitative yield, by washing the product with petroleum spirit. It forms a white crystalline mass, with no definite melting point, which becomes brown when exposed to the air. It is soluble in dilute alkalis and acids.—A. S.

1.4-Anthraquinone. C. Haslinger. Ber., 1906, **39**, 3537—3538.

DIENEL (this J., 1906, 309) gives the melting point of the above compound as 206° C. The author, however, states that at 190° C. blackening takes place, the substance undergoing decomposition. Its conversion into quinizarin has been further investigated, and the progress of the reaction followed quantitatively. From 2 grms. of the anthraquinone, 2·6 grms. of diacetyl-1.4-anthrahydroquinone were obtained. This crystallises from alcohol in almost colourless needles, melting at 169° C., and is converted into diacetylquinizarin when subjected to oxidation with chromic and glacial acetic acids, 2 grms. of the hydroquinone yielding 1·4 grms. of the diacetyl compound. For the production of quinizarin the latter is treated with sulphuric acid, 0·9 grm. of diacetyl derivative giving 0·6 grm. of quinizarin.—D. B.

Hydroxyanthraquinones; Methylation of ——. C. Graebe, C. Thode, and H. Bernhard. Annalen, 1906, **349**, 201—231.

HYDROXYANTHRAQUINONES containing the hydroxyl group in the 1-position either resist methylation wholly or are but imperfectly methylated. Better results are obtained when the corresponding desoxy-derivatives are subjected to methylation. From the resulting ethers the respective methoxyanthraquinones are thereupon obtained by oxidation. Desoxyalizarin dimethyl ether was prepared by treating desoxyalizarin with dimethyl sulphate in

alkaline solution. It crystallises in yellow needles melting at 150° C., and fails to yield an oxime or acetyl derivative. The diethyl ether melts at 128° C. By subjecting the dimethyl ether to oxidation with sodium chromate and glacial acetic acid, alizarin dimethyl ether (this J., 1905, 192) is obtained. Alizarin mono-methyl ether, like alizarin, can only be completely methylated when it is first reduced, then methylated, and eventually re-oxidised. Alizarin dimethyl ether is reduced by zinc dust and ammonia to desoxyalizarin dimethyl ether. The action of diethyl sulphate on alizarin in alkaline solution leads to the formation of a diethyl ether which crystallises in yellow needles melting at 162° C. Flavopurpurin dimethyl ether obtained by treating flavopurpurin in alkaline solution with dimethyl sulphate forms yellow needles, which melt at 239° C. It is also prepared by heating the trimethyl ether with sulphuric acid at 100° C. The latter was produced by methylating desoxyflavopurpurin, and oxidising the resulting ether with sodium chromate and glacial acetic acid. It crystallises from alcohol in needles which melt at 225°—226° C. When hydroxyanthrarufin is subjected to direct methylation, its monomethyl ether is formed. This melts at 202° C., and does not possess tinctorial properties. Reduction with zinc dust and dilute ammonia gives rise to the formation of 1.2.5-trihydroxyanthrone, the desoxy-derivative of hydroxyanthrarufin, which melts at 258° C. and gives on methylation a methyl ether melting at 140° C. Hydroxychrysazin trimethyl ether was prepared by reducing hydroxychrysazin with zinc dust and ammonia, methylating with dimethyl sulphate, and oxidising. It melts at 157° C. and is converted into the dimethyl ether when heated with sulphuric acid for 15—30 minutes at 100° C. The mono-methyl ether is produced by direct methylation, forming orange-yellow needles which melt at 220° C. 2-Methoxyanthraquinone was obtained by methylating 2-hydroxyanthraquinone, whilst the 1-methoxy-derivative was best prepared by heating the sodium salt of erythrohydroxyanthraquinone with potassium methyl sulphate at 200° C. The latter melts at 169·5° C. 2.7-Anthrapurpurin dimethyl ether, melting at 241° C., was produced by methylating anthrapurpurin or heating its trimethyl ether with sulphuric acid at 100° C. The latter was formed by treating desoxyanthrapurpurin with dimethyl sulphate in alkaline solution, and subjecting the resulting ether to oxidation. It crystallises in yellow needles melting at 201° C. The direct methylation of purpurin leads to the formation of an orange-red mono-methyl ether melting at 240° C., whilst the methylation of the reduction products of purpurin gives rise to the production of xanthopurpurin methyl ethers.—D. B.

Phenosafranines; Symmetrical and unsymmetrical —— [*Azine dyestuffs*]. *II.* P. Barbier and P. Sisley. Bull. Soc. Chim., 1906, **35**, 858—868.

When the two phenosafranines (see this J., 1905, 1296) are diazotised under similar conditions, the solution of the symmetrical isomeride rapidly changes to blue, whilst that containing the unsymmetrical base changes very slowly; this difference in rates of diazotisation may be utilised to separate a mixture of the two isomerides, if, after a few minutes, the diazotised solution is extracted with amyl alcohol; the greater portion of the *unsymm*-phenosafranine is extracted, most of the symmetrical isomeride having already been diazotised. Another method of separation consists in extracting the solution of mixed hydrochlorides with pure chloroform; no *symm*-phenosafranine is extracted, but the major part of the unsymmetrical compound is removed; it is stated that 5 per cent. of "azophenosafranine" can be detected in this way. The authors conclude by describing the preparation of the pure anhydrous hydrochlorides, the hydrochlorides containing 1·5 and 5 mols. of water of crystallisation, the sulphates, nitrates, and oxalates; also the hydrochloride of unsymmetrical phenosafranine containing 3 mols. of water, and that of symmetrical phenosafranine containing 4 mols. of water of crystallisation.—T. F. B.

Azomethine compounds; Influence of the carbon double bond on the colour of ——. R. Möhlau and R. Adam. Z. Farben-Ind., 1906, **5**, 377—383.

The authors have investigated the azomethine compounds from the point of view that an increase in the number of chromophores in the molecule leads to an increase in the depth of colour. For this purpose the group—C:C—C:N— was chosen. Compounds possessing this group were obtained by condensing cinnamic aldehydes with primary amines containing an auxochrome group. To determine the influence of the group—C:C—the simple azomethine compounds were compared with the foregoing. The following substances were examined with regard to the increase in colour by the introduction of chromophore and auxochrome groups, and the change of shade due to their position: the condensation products of (1) *p*-aminodimethylaniline, (2) *p*-aminophenol, (3) *o*-aminophenol, (4) 1-amino-4-naphthol, (5) 1-amino-2-naphthol, (6) 1:2:5-aminosalicylic acid with benzaldehyde, the three nitrobenzaldehydes, and *p*-dimethylamino-benzaldehyde on the one hand, and with cinnamic aldehyde, the three nitrocinnamic aldehydes, and *p*-dimethylaminocinnamic aldehyde on the other hand. Thus cinnamylidene-*p*-aminodimethylaniline is yellow, whilst the three isomeric nitro-compounds are orange to dark red; *p*-nitrocinnamylideneaniline is yellow, and *p*-nitrocinnamylidene-*p*-aminodimethylaniline is dark red. The above-mentioned substances do not all react in the same manner; thus, under normal conditions *o*- and *p*-aminophenol form addition products with the three nitrobenzaldehydes, and judging from a number of other similar cases occurring in literature, it would appear that the presence of acid groups prevents the elimination of water in these reactions. A large number of examples from literature bearing on the subject are cited, and further results will be published later.—J. C. C.

Synthetic organic dyestuffs; Action of liquid sulphur dioxide on certain ——. E. Grandmougin. Z. Farben-Ind., 1906, **5**, 383—385.

Liquid sulphur dioxide behaves as a solvent towards organic dyestuffs; it does not act as a reducing agent or as an acid. Benzeneazo-*p*-naphthol and similar dyestuffs were crystallised from solution in the liquid sulphur dioxide, such solution being very similar in colour to those which are obtained with glacial acetic acid.—J. C. C.

English Patents.

Colouring matters [*Dyestuffs*]; *Manufacture of blue and black* [*Azo*] ——. Read Holliday and Sons, J. Turner, and H. Dean, Huddersfield. Eng. Pat. 22,513, Nov. 2, 1905.

By combining diazotised *p*-aminobenzeneazo-*a*-naphthylaminesulphonic acids (1:6 or 1:7) with 1 mol. of aminonaphtholmonosulphonic acid in alkaline solution, intermediate products are obtained, which, when further diazotised and combined with 1 mol. of *m*-phenylenediamine, *m*-toluylenediamine, or chloro-*m*-phenylenediamine (1:2:4), lead to the formation of blue to bluish-black dyestuffs, dyeing cotton directly and possessing great affinity.—D. B.

Colouring matters [*Dyestuffs*]; *Production of* ——. E. Vidal, Huddersfield. Eng. Pat. 23,740, Nov. 17, 1905.

Blue-black dyestuffs which dye cotton direct are produced by heating *p*-aminohydroxy-compounds with sulphur, and then adding caustic soda solution (40° B.) to the melt at below 100° C. The fluid mixture solidifies, and is dried. Example:—A mixture of *p*-aminophenol (100 kilos.) and sulphur (60 kilos.) is melted, and is then heated at 160°—200° C. until the whole is solid. The product is crushed, and mixed with 75 kilos. of caustic soda solution (40° B.). After solidification the mixture is dried below 100° C., and crushed.

A dyestuff producing a blacker shade may be obtained by adding sulphur (13 kilos.) or sodium sulphide (20 kilos.) or both to the melt before the final solidification takes place. The *p*-aminophenol may be replaced by the corresponding amino-ortho- and amino-meta-cresols, 1:2:4-diaminophenol, 1:4-aminonaphthol, or a mixture of two of these; the quantity of sulphur being increased in proportion to the increase of the molecular weight of the amino-compound.—J. C. C.

Dyestuff; Manufacture of a red —— [*Thioindigo Red*]. Kalle und Co. Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 17,162, July 30, 1906. Under Int. Conv., Nov. 13, 1905.

It has been found that the products described in Eng. Pats. 22,736 and 23,316 of 1905 (this J., 1906, 424 and 736) combine readily with isatin resulting in condensation products having the formula:

$$C_6H_4\!<\!\overset{S}{CO}\!>\!C\!:\!C\!<\!\overset{CO}{C_6H_4}\!>\!NH$$

and forming red dyestuffs, which are insoluble in water, but dissolve in alkaline reducing agents.—D. B.

UNITED STATES PATENTS.

Dyestuff; Process of making a red vat-dyeing —— [*from salicylthioacetic acid*]. G. Engi, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 831,844, Sept. 25, 1906.

SEE Eng. Pat. 4687 of 1906; this J., 1906, 470.—T. F. B.

Dyestuff; Black polyazo ——, *and process of making same.* A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. U.S. Pat. 832,393, Oct. 2, 1906.

SEE Eng. Pat. 6189 of 1906; this J., 1906, 750.—T. F. B.

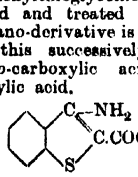
FRENCH PATENTS.

Anthracene compounds; Production of new ——. Badische Anilin und Soda Fabrik. First Addition, dated May 7, 1906, to Fr. Pat. 357,239, Aug. 25, 1905. Under Int. Conv., April 12, 1906.

SEE Eng. Pat. 10,505 of 1906; this J., 1906, 751.—T. F. B.

Thionaphthene; Process for preparing derivatives of ——. Kalle und Co. Fr. Pat. 366,611, May 26, 1906. Under Int. Conv., March 9, 12, and 27, 1906.

CHLORACETIC acid is condensed with o-aminothiophenol, and the product further condensed to form an inner anhydride; this may be saponified by heating with dilute alkali, *o*-aminophenylthioglycollic acid being produced. This is diazotised and treated with cuprous cyanide, whereby the *o*-cyano-derivative is obtained. Saponifying agents convert this successively into the amide of phenylthioglycol-*o*-carboxylic acid, and *a*-aminothionaphthenecarboxylic acid.



Twenty per cent. sodium hydroxide solution may be used for the condensation. The carboxylic acid may be converted into *a*-aminothionaphthene by gently heating with dilute acids, and, by further heating, into *a*-hydroxythionaphthene (thioindoxyl).—T. F. B.

Phenylthioglycol-o-carboxylic acid; Process for preparing ——. Kalle und Co. Fr. Pat. 366,612, May 26, 1906. Under Int. Conv., March 9, 12, and 27, 1906.

A SOLUTION of diazotised anthranilic acid reacts with sodium polysulphides, at low temperatures, with evolution of nitrogen. When this has ceased, the original yellow solution will have become colourless, and acids will precipitate from it a thio-derivative of benzoic acid. If chloracetic acid or one of its salts be added to an alkaline solution of this compound, and the mixture heated to about 80° C. and filtered, phenylthioglycol-*o*-carboxylic acid may be precipitated by addition of acids.—T. F. B.

Thioindigo Red; Process for preparing the leuco-derivative of ——. Kalle und Co. Fr. Pat. 366,613, May 26, 1906.

THIOINDIGO Red (see Fr. Pat. 359,399 of 1905; this J., 1906, 424) may be reduced to a leuco-derivative of acid character by treatment with a reducing agent. If the reduction is effected in alkaline solution, the alkali salts of the leuco-compound are obtained, and the free base is precipitated from these by addition of acids; it is very slightly soluble in water, and only oxidises very slowly in air; it is so stable that it can be used in industry. Five kilos. of the dyestuff, in the form of a 30 per cent. paste, may be reduced by means of a solution containing 300 grms. of anhydrous sodium hyposulphite (hydrosulphite) and 2·5 litres of caustic soda solution, 40° B., heated gradually to 60°—70° C., until reduction is complete; the product is run into dilute acid, in absence of air, and the precipitate filtered and washed with water. Thioindigo Red may also be reduced in alkaline solution by thioindoxyl or thioindoxylcarboxylic acid (see Fr. Pat. 366,611, preceding this).—T. F. B.

Chloroacetanilides; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 366,646, May 28, 1906.

YIELDS of *w*-chloroacetanilide or its homologues, amounting to 70 per cent. and upwards of the theoretical yield, are obtained by heating a suitable salt of aniline or one of its homologues with monochloracetic acid, in presence of a chloride of phosphorus or of sulphur. For example, 260 parts of aniline hydrochloride and 200 parts of monochloracetic acid are heated together to about 100° C., in a vessel provided with a stirring device and a vertical condenser; 100 parts of phosphorus trichloride are gradually added to the mixture, and the heating is carried to 140°—160° C. for a short time, and the product allowed to solidify, when it is introduced into water, and the chloroacetanilide filtered off and re-crystallised if desired.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 982.)

Textile fibres; Chemical functions of ——. L. Vignon. Compt. rend., 1906, **143**, 550—552.

THE author has continued his former researches (this J., 1890, 771 and 855) on the behaviour of wool, silk, and cotton when immersed in solutions of acids, bases, and neutral salts. Known weights, usually about 10 grms., of the scoured fabrics were allowed to remain for one hour at the ordinary temperature in aqueous solutions (1 : 100 and 1 : 1000) of these reagents, and thoroughly washed with distilled water after treatment. In the following table, K is the weight in grammes of the acid, base, or neutral salt in 100 grms. of the solution before contact with the fabric, K_1 the weight of the reagent in 100 grms. of the solution after treatment, K_2 the weight of substance fixed by 100 grms. of the fabric. $\frac{K_2}{K_1}$ is called the coefficient of division of the acid, base, or salt between the fabric and the water.

(1) *Action of acids.* Sulphuric acid:—

Fabric.	H_2SO_4 (1 : 100); 400 grms.				
	Weight of fabric.	K	K_1	K_2	$\frac{K_2}{K_1}$
Silk (raw)	10·0	1·015	0·959	2·169	2·26
Silk (ungummed) ...	8·53	1·015	0·985	1·279	1·40
Cotton	9·12	1·015	1·016	nil	nil
Wool	9·85	1·015	0·902	4·379	4·85

Fabric.	H_2SO_4 (1 : 1000); 400 grms.				
	Weight of fabric.	K	K_1	K_2	$\frac{K_2}{K_1}$
Silk (raw)	9·92	0·093	0·054	1·77	33·77
Silk (ungummed) ...	10·20	0·093	0·079	1·06	14·93
Cotton	9·13	0·093	0·095	nil	nil
Wool	9·70	0·093	0·035	3·90	111·5

(2) *Action of base.* Barium hydroxide:—

Fabric.	$Ba(OH)_2$ (1:100); 350 grms.				
	Weight of fabric.	K	K_1	K_2	$\frac{K_2}{K_1}$
Wool	10·16	1·103	0·853	4·916	5·76
Cotton	9·77	1·103	1·026	2·673	2·60

Fabric.	$Ba(OH)_2$ (1:1000); 350 grms.				
	Weight of fabric.	K	K_1	K_2	$\frac{K_2}{K_1}$
Wool	9·78	0·105	0·037	2·379	64·5
Cotton	9·53	0·105	0·094	0·388	4·127

To avoid carbonation of the baryta, the samples of fabric and the baryta solution were mechanically shaken for one hour in a closed glass vessel.

(3) *Action of neutral salts (sodium chloride).*—Similar experiments were made with cotton and wool using solutions of sodium chloride (1:100 and 1:1000), but no change in the concentration of the solution was observed. Check experiments were made with powdered wood-charcoal and the foregoing reagents, but the results were negative in each case, no absorption taking place. The following conclusions are drawn: (1) Textile fabrics should be regarded as active chemical molecules; (2) animal fibres possess acidic and basic properties; (3) vegetable fibres have no basic properties, but are faintly acidic in character, being comparable with the alcohols; (4) porous substances such as powdered wood-charcoal are chemically inert. The chemical activity, acidic or basic, of fabrics increases with the dilution of the solution. This is shown by the variations of $\frac{K_2}{K_1}$ and is connected with the ionisation of the solution employed. An explanation of the exhaustion of dye-liquors by textile fibres is thus provided.—J. C. C.

Chromate of lead; Suggestions for the amendment of the special rules for factories and workshops in which —— is used, or in which goods dyed with it undergo the processes of bundling and noddling, winding, reeling, weaving, or other treatment. Report to the Home Office by the Medical Inspector of Factories, Oct. 1, 1906.

Recent inspection of dye-works in which lead compounds are employed has shown that a serious percentage of the workers are more or less affected both by the lead and by the chromate solutions used in dyeing yarn with yellow and orange lead chromate. (See this J., 1905, 1282.) The chief danger from lead seems to occur in the operation of "heading" or manipulating the yarn over a bar or post. The existing Special Rules for dye-works in which lead chromate is used have given rise to considerable difficulties in administration, by reason of their very wide application, and amendment of them in certain respects is now desirable. It is therefore proposed that they should be replaced by new regulations, which should be limited to those factories where the danger of lead poisoning has been found to be serious, and a draft of the suggested regulations is submitted for consideration. Many of the clauses are identical with those contained in regulations for factories where lead compounds are used for the manufacture of paints (this J., 1906, 702), such as those for periodical inspection of the workers (every three months), for a record of the results in a Health Register, and for power of suspension from working with lead compounds; also for the provision and use of lavatory accommodation and overalls, suitable places for depositing food, clothing, &c., and of a separate meal room in cases where the factory is not closed during meal times. The employment of efficient exhaust draught is regarded as the most effectual means of ensuring safety, and although it is thought undesirable to specify too closely how the draught should be applied, the opinion is expressed that the air should have a linear velocity of 250 ft. per minute at a distance of 8 ins. behind or under the point where heading is done. The speed of the draught at the ordinary opening is to be determined at least once in every three months and recorded in the Health Register. To protect against the local ulcerating action of chromate solutions where any abrasion of the skin has occurred, adhesive plaster and any other requisites prescribed by the certifying surgeon are to be provided and kept in readiness for the use of persons employed. The Secretary of State invites observations on the suggested regulations.—M. J. S.

Red diazo ground, reserving a black dyestuff printed over it. L. Bloch and E. Zeidler. Bull. Soc. Ind. Mulhouse, 1906, 76, 229—230.

Starting from the fact that the diazo compound of paranitraniline withstands the action of chromic acid, Elbers, Frey, Kurz, and Grosheintz obtained a red discharge on indigo by mixing the diazo solution with alkali chromate, and afterwards passing the material through an acid bath. The authors add chromate to the usual red, which is printed on fabric which has been prepared with β-naphthol, and printed over with a dyestuff which can be developed on β-naphthol, and destroy the dyestuff afterwards by the chromic acid which is formed on taking the goods through an acid bath. Besides Dianisidine Blue and Benzidine Brown, used by the authors, all other dyestuffs known under the names of Diazo Black, Azophor Black, &c., can be used in the same way.—H. Bz.

α-Naphthylamine Claret; Discharge of ——, by means of formaldehyde-sulphoxylate. A. Schaunert and J. Frossard. Sealed communication, 1574, dated Oct. 18, 1905. Bull. Soc. Ind. Mulhouse, 1906, 76, 219—221.

The authors have succeeded in discharging α-Naphthylamine Claret with a neutral discharge, which at the same time completely discharges Paranitraniline Red, Chrysoïdine, &c. On heating formaldehyde-sulphoxylate with a thickening material and aniline, preparations are obtained which completely discharge α-Naphthylamine Claret. The formaldehyde-sulphoxylate is heated to about 60° C., the aniline or xylidine added, and the temperature raised to about 70° C.

In an additional note, dated June 27, 1906, to the preceding communication, it is stated that on working according to the process therein described bad results were frequently obtained with white discharges. It is now found that the discharging power is considerably increased by the addition of certain salts, as, for instance, carbonate, acetate, citrate, or oxalate of ammonium. In presence of xylidine these salts do not decompose formaldehyde-sulphoxylate. The addition of these salts is only required for white discharges and not for coloured ones. A few examples are given. After printing, the goods are taken once or twice through the Mather-Platt, then through a 10 per cent. bichromate solution, and soaped.

White discharge on α-Naphthylamine Claret.—*White T. W. I.:* Rongalite C., 300 grms.; tragacanth solution, 200 grms.; water, 125 grms., and xylidine, 175 grms., the whole being heated to 40° C. *White T. W. O.:* White T. W. I., 800 grms., ammonium oxalate, 50 grms., and tragacanth solution, 150 grms. (this white is the one which is printed on Naphthylamine Claret). *Yellow T. W.:* Thioflavine T., 50 grms.; water, 50 grms.; White T. W. I., 800 grms.; and tannin 50 per cent., 100 grms. *Blue T. W.:* Thiomine Blue, 50 grms.; water 50 grms.; White T. W. I., 800 grms., and tannin 50 per cent., 100 grms. *Blue T. W. T.:* Toluidine Blue, 50 grms. Violet T. W.: Modern Violet, 50 grms.; White T. W. I., 800 grms., and tragacanth solution, 150 grms. *Pink T. W.:* Rhodamine 6 G. conc., 20 grms.; water 30 grms.; White T. W. I., 800 grms.; tannin 50 per cent., 100 grms.; and tragacanth solution, 50 grms. *Olive T. W.:* Mixture of Blue T. W. and Yellow T. W. *Grey T. W.:* Immedial Black extra, 50 grms.; caustic soda 40 per cent., 100 grms., warm water, 50 grms.; White T. W. I., 200 grms., and White T. W. I., 600 grms.—H. Bz.

Dry cleaning. Home Office Memorandum 824, Oct., 1906. E. A. Whitelegge, Inspector of Factories.

To minimise the risk of ignition of the "benzine" by electric sparks generated by friction of the materials, the air should be kept moist, so that the relative humidity does not fall below about 70 per cent. of saturation. An addition of 0·1 per cent. of "antibenzinpyrin," or a soluble oleate, is also a preventive. The working appliances in which inflammable spirit is used should be kept closed by means of balanced covers that will fall back into place if disturbed by an explosion. For such as must be open while in use, easily lowered iron covers should be provided. Used spirit should be conveyed in closed pipes to the settler or still, situated in a special room. No naked lights should be used in benzine rooms; incandescent electric lights should be enclosed in double airtight glass covers, failing which, the rooms should be lit from outside, through airtight windows. Blankets and sand should be kept for extinguishing burning spirit, and water hydrants and hose for preventing extension of flame, steam jets being also useful. Non-inflammable outer garments should be worn by all employees. Outside staircases should be provided, as a means of escape, for all rooms above the ground floor. Ample space and free ventilation will lessen the risk of accidents. No meals should be taken in rooms where inflammable spirit is used. Periodical medical inspection of women and young persons exposed to the fumes is desirable.—C. S.

Silk; Weighted ——. R. Gnehm and W. Dürsteler. XXIII., page 1069.

Serine; Resolution of racemic ——, *into optically active components.* E. Fischer and W. A. Jacobs. XXIV., page 1070.

ENGLISH PATENTS.

Silk-like threads; Manufacture of ——, *and of cellulose solutions therefor.* E. W. Friedrich, Blaton, Belgium. Eng. Pat. 6072, March 13, 1906. Under Int. Conv., March 13, 1905.

SEE Fr. Pat. 364,066 of 1906; this J., 1906, 980.—T. F. B.

Cellulose threads; Method of producing ——. E. Thiele and Soc. Gén. de la Soie Artificielle Linkmeyer, Brussels. Eng. Pat. 15,133, July 3, 1906.

A CONCENTRATED solution of cellulose in ammoniacal copper oxide solution is allowed to pass through comparatively wide apertures (of about 0·5 mm. in diameter) into water or water mixed with a small proportion of acid or alkali. The threads thus formed are, after being stretched in the bath, drawn through an alkaline bath of either cold caustic soda of 39° B. or a boiling solution of less concentration. They are finally treated with acid. —J. C. C.

Dyeing and printing; Preparation of new products for use in ——, *and as pigments, and their applications.* E. Feilmann, London. Eng. Pat. 25,693, Dec. 11, 1905.

THIS invention relates to the manufacture of products for use in dyeing and printing, and as pigments, by forming a dyestuff or the like in an aqueous medium containing casein or paracasein. The dyestuff may be precipitated as a colloidal preparation by suitable treatment. The method of dyeing, by subjecting the material to such a solution as the above, is also claimed.—B. N.

Bronze prints; Manufacture of ——. C. A. R. Ludewig, Hamburg. Eng. Pat. 11,951, May 22, 1906. Under Int. Conv., Aug. 21, 1905.

THIS invention relates to a method of producing bronze printings, and consists in making a mixture of powdered bronze and a suitable filling material, the mixture being applied to a surface previously printed with colour, whilst it is still in a damp state.—B. N.

Discharging of dyed textile fibre; Imps. in, and manufacture of discharging pastes for use in the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7617, March 29, 1906.

SEE Second Addition to Fr. Pat. 355,117 of 1905; following these.—T. F. B.

Washing machines [for textiles]; Rotary ——. H. Stützel, Zürich. Eng. Pat. 26,585, Dec. 20, 1905.

A DOUBLE-DRUM washing machine is claimed in which the inner drum has the walls indented to form troughs, which can be closed on the outside by plates or the like, and which are provided with spraying holes. A great improvement is claimed as compared with washing machines in which perforated sheet metal or perforated tubes form a cylinder, which rotates within the outer drum.—H. BE.

Drying loose wool, yarn, and the like in the form of cops or of strands; Process and apparatus for ——. R. Jahr, Gera, Germany. Eng. Pat. 12,938, June 2, 1906.

SEE Fr. Pat. 366,608 of 1906; following these.—T. F. B.

Dry-cleaning fabrics with the aid of benzene or other volatile fat solvents; Process and cleansing composition for ——. E. Weiss, Weiden, Bavaria. Eng. Pat. 12,080, May 23, 1906.

SEE Fr. Pat. 366,547 of 1906; this J., 1906, 981.—T. F. B.

UNITED STATES PATENTS.

Leaf or fabric; Thin ——, *and method of making the same.* H. R. Gregory, New York, Assignor to W. A. Ker, Brooklyn, N.Y. U.S. Pat. 826,781, July 24, 1906.

ONE-quarter lb. of "soluble cotton" is dissolved in 1 gal. of "amyl oil," and a "colouring matter," such as "bronze," is added in the proportion—one part to four parts of the solution. After thoroughly mixing, the solution is poured on to a liquid, such as water, heavier than the oil. The latter evaporates, leaving a thin leaf on the surface of the water.—B. N.

Textile and paper base. V. A. de Perini, Assignor to C. C. Stockle and T. M. Kentish, Rio de Janeiro, Brazil. U.S. Pat. 831,521, Sept. 18, 1906.

COMMERCIAL fibre, as an article of manufacture, is obtained from the bark of the developed plant *Canhamo brazilensis perini.* Reunited fibres from the plant, and paper-pulp from the core of the plant are also claimed.—B. N.

Silk fabrics; Apparatus for ungumming ——. P. Schmid, Basle, Switzerland. U.S. Pat. 831,097, Sept. 25, 1906.

SEE addition of Jan. 21, 1905, to Fr. Pat. 345,173 of 1904; this J., 1906, 475.—T. F. B.

Dyeing apparatus. G. A. Friedrichs, Assignor to C. A. Proulx, Woonsocket, R.I. U.S. Pat. 832,472, Oct. 2, 1906.

A TUB or vat is provided with an opening in its bottom, and connected to the opening is a conduit, through which a spindle extends into the tub. A "spider," located in the conduit, is fixed on the spindle. The latter, inside the tub, passes through a perforated tube, surrounding which is a basket with an open-work side, the base of the basket resting against and engaging with the "spider" of the spindle. Mounted on the end of the latter is a nut, which also rests against the end of the perforated tube. A movable cover, comprising a tubular portion closed at its outer end and resting over the nut and the foraminated tube, and a flange, surrounding the tubular portion, close the end of the basket.—B. N.

Transfer-printing. J. F. Thorpe, Assignor to Wm. Briggs and Co., Ltd., Manchester. U.S. Pat. 831,582, Sept. 25, 1906.

The required design is applied to a suitable supporting medium by means of a mixture of "indigo salt T" and resin, the latter acting as a carrying medium, and the design is then transferred to the fabric by the action of heat. By the addition of an alkaline solution, the resin is converted into soap and may be readily removed, "the indigo salt T" being converted into indigo, thus leaving it indelibly printed on the fibres of the fabric.

—B. N.

French Patents.

Filaments of artificial silk of relatively great diameter, suitable for use in the unspun condition; Process and differential apparatus for producing ——. V. Krafft. Fr. Pat. 363,922, Feb. 13, 1906.

Fig. 1.

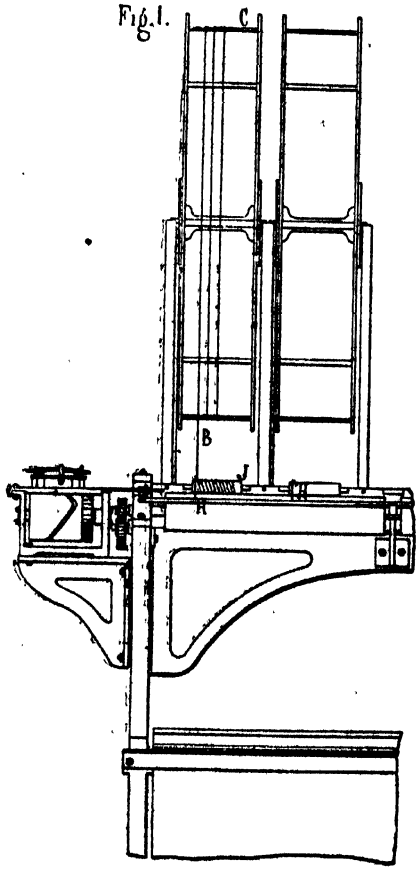
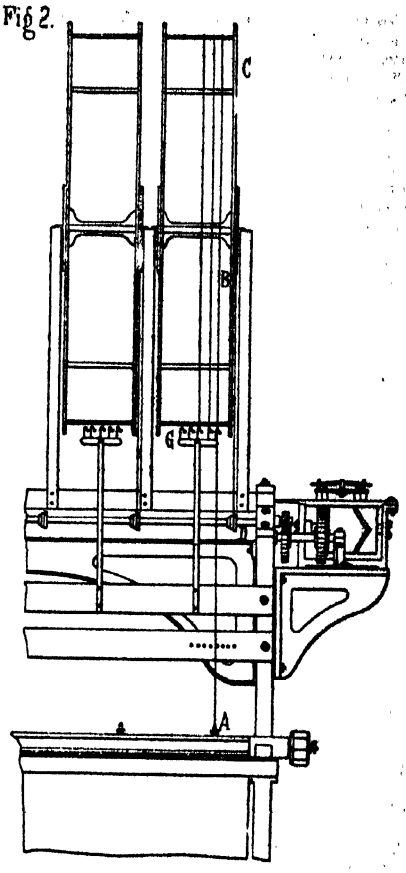


Fig. 2.



Filaments, B (see Figs. 1 and 2), of collodion-silk are drawn by winches, C, from forming nozzles, A, of relatively great, *viz.*, 30—500 "deniers," diameter. After passing spirally several times round the winches, through guide-combs, G, (Fig. 2) they are taken over travelling guides, H, (Fig 1) and wound upon revolving bobbins, J (Fig 1). The circumferential speed of these is made to exceed to any required degree that of the winches, in order to stretch the filaments as they leave the latter in a partially dried state.—E. B.

Glass rollers for use in manufacturing artificial threads. J., W., and H. Röhrens. Fr. Pat. 364,269, March 15, 1906.

The solid glass rollers which are largely employed in the processes of manufacturing artificial threads for the purpose of conducting the latter through baths of ammonia, sulphuric acid, caustic soda, &c., are easily broken, and when broken have to be replaced in their entirety. It is proposed, according to this invention, to construct them in several easily replaceable parts, using for the bodies of the rollers hollow glass cylinders, supported upon rods of metal or other acid-resisting materials enclosed in sleeves or rings of indiarubber. The supporting rods are fixed in the ends of the rollers, by nuts and screws, which, on account of their being the most liable to become damaged, are made of copper or acid-proof bronze or other suitable material.—E. B.

Textile fibres [Artificial silk] from cupro-ammoniacal solutions of cellulose; Process of manufacturing lustrous ——. Soc. anon. "La Soie Nouvelle." Fr. Pat. 365,057, April 10, 1906. Under Int. Conv., April 11 and July 14, 1905.

A cupro-ammoniacal solution of cellulose is forced, under a pressure of 1½—2 atmospheres, through a draw-plate containing holes 0·15—0·12 mm. in diameter, into a precipitating bath of glycerin, rendered acid or alkaline

for this purpose consists of glycerol-monosulphuric acid (37½ parts), glycerol (25 parts), and water (37½ parts). The filaments thus produced may next be passed through a "neutralising" bath of a salt, such as common salt, sodium acetate, &c., capable of reacting with the acid still retained by them. If not decolorised by this treatment, they may be given a further passage through a dilute bath of sodium bisulphate, which readily removes the copper left in them. They are afterwards rinsed in water. The copper may be removed by the action of glycerin alone in the forming and washing baths. The filaments obtained by this method are stated to be more silk-like than any hitherto produced.—E. B.

Cotton tissues; Process of chemically treating [Mercerising] ——, with the object of rendering them stronger and more compact, and capable of being dyed in deeper and faster colours. P. Beresin. Fr. Pat. 364,577, March 20, 1906.

COTTON yarns and tissues are treated for a length of time, which may extend to half an hour, with either: (1) a cold solution of caustic soda-lye at about 40° B.; or (2) a hot solution at about 25° B. of a mixed ammonia-soda-lye, made by adding a solution of ammonia to one of caustic soda prepared by causticising sodium carbonate with lime and allowing the calcium carbonate produced to settle out. Considerable heat is evolved when the alkali solutions are mixed together, and a "double salt" of ammonia and sodium is, it is stated, formed. The cotton materials treated with these solutions, especially those acted upon by the second one, after being washed, &c., can be dyed in more intense shades than the same materials in the untreated state, and the dyeings are more durable and faster to light than those obtained on the latter. The second process is, it is stated, more economical than the first.—E. B.

Cotton and ramie slubbing; Process of mercerising and dyeing ——. E. Steiner. Fr. Pat. 364,965, April 5, 1906.

THE slubbing, sliver, rovings, &c., of cotton or ramie, to be mercerised and dyed, is wound upon metal tubes which are slipped over the winding bobbins. The tubes, which are fluted if they are to be used in dyeing, are then drawn from the bobbins, and placed upon wooden supporting rollers. They are thus put into an apparatus where they are treated under high pressure with the usual scouring agents, or advantageously with compounds, such as sodium sulphide and sodium sulphoricinoleate, which act as efficient scouring agents whilst increasing the strength of the fibres. After being rinsed and drained, the slubbing whilst still in the wet state, is unwound from the tubes, made up in the form of hanks, and thus mercerised and dyed in the same manner as ordinary hanks of yarn. It is next again wound upon the tubes, and dried thereon. It is then ready for spinning into yarns. If the slubbing is to be dyed without being mercerised, the tubes upon which it is carried are placed in an apparatus in which the dye-liquors are circulated through it.—E. B.

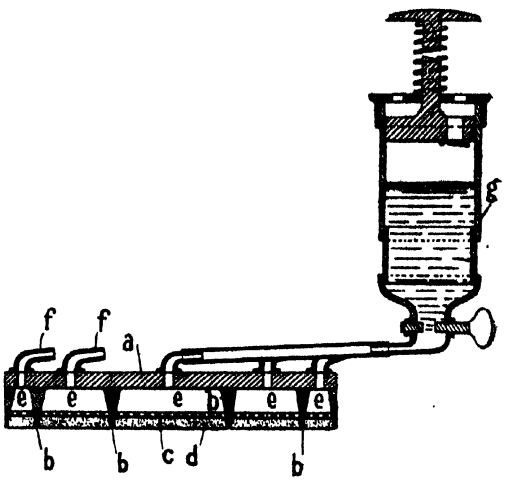
Mercerising and dyeing cotton or ramie slubbing; Process of ——. E. Steiner. First Addition, dated May 1, 1906, to Fr. Pat. 364,965, April 5, 1906 (see preceding abstract).

THE slubbing is opened out with a suitable machine, and the fibres and waste thus obtained are mixed in different proportions with waste silk, and spun in the ordinary manner. Brilliant fibres, consisting of a mixture of waste silk and mercerised cotton, are thus obtained.
—B. N.

Dyeing and binding threads together to form "baste" ribbons, and drying the same, producing several such ribbons simultaneously; Process for ——. C. Jeschke. Fr. Pat. 364,664, March 23, 1906.

SEVERAL "baste" ribbons are simultaneously manufactured by drawing "groups" of threads, each containing a sufficient number of the latter to form a ribbon of the desired width, successively through a separating comb, a bath containing an agglutinant to which a dye-stuff may be added to colour the threads, between rollers to press them together into sheets, over a drying apparatus; then, if desired, between calender rollers to give them a smooth appearance, and finally on to a roller upon which the ribbons thus simultaneously made are wound apart from one another.—E. B.

Block for printing tissues in several colours. E. Gamby. Fr. Pat. 363,977, March 8, 1906.



THE printing-block which forms the subject of this invention is constructed in such a manner as to be capable of printing tissues simultaneously in any required number of colours. It consists of a plate or board, *a* (see figure), to the underside of which are screwed vertical partitions, *b*, corresponding in shape with the outlines of the pattern to be printed, the colour chambers thus made being filled in at the bottom with a perforated sheet, *c*, beneath which is placed a layer of felt, *d*, forming the printing-surface. Each of the chambers communicates by means of an aperture, *e*, in the board, *a*, above it, through a connecting nozzle, *f*, and indiarubber tube, with a vessel, *g*, containing the printing-mixture to be applied from it, as many such vessels, *g*, as there are colours to be printed, being provided. The block, along with the colour vessels, is placed in a supporting frame, suspended by springs from a travelling press. The tissue to be printed is stretched below the block, which is lowered upon and held against it by suitable means. After printing, the block is lifted, and the press is moved forward through a distance equal to its length. Another length of the tissue is printed in the same manner as before, and the press is again moved forward.—E. B.

Discharging on coloured grounds; Method of ——. Badische Anilin und Soda Fabrik. Second Addition, dated May 14, 1906 (under Int. Conv., Feb. 28, 1906), to Fr. Pat. 355,117, June 9, 1905.

SALTS of organic ammonium bases, or the bases themselves, are mixed with the colour-discharging agents, such as formaldehyde-sulphoxylates, either pure or in combination with formaldehyde-bisulphites.—B. N.

Decolorising textile fibres; Process for ——. Badische Anilin und Soda Fabrik. *Fr. Pat. 366,701, May 30, 1906. Under Int. Conv., Feb. 24, 1906.

SEE Eng. Pat. 12,517 of 1906; this J., 1906, 867.—T. F. B.

Drying of textile materials; Process and arrangement for the ——. M. R. Jahr. Fr. Pat. 366,608, May 26, 1906.

THE moist air, leaving the chamber in which the material has been dried, is again brought into contact in another chamber with the dry material, until the latter has attained

its normal degree of humidity, and the air is then withdrawn from the apparatus. Before each compartment receiving the material to be dried, is a chamber divided by a partition into two channels, one of which is heated and the other not, and the air may be passed through either of these by suitably opening or closing the channels. The external air entering through a channel not heated, as well as the moist air entering the dry chamber, serves to cool the dried material.—B. N.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 985.)

Chlorine and hydrogen; Interaction of ——. C. H. Burgess and D. L. Chapman. Chem. Soc. Trans., 1906, **89**, 1399—1434.

The authors have ascertained that the phenomenon, hitherto known as photochemical induction, is not exhibited by a mixture of chlorine and hydrogen in the absence of such impurities as are capable of being destroyed by the insolation of the gases. What has been known as the "decay" of the activity of the gases in the light, caused by leaving them, when active, to stand in the dark over water, has now been traced to the renewed presence of impurities taken up from the water. The inhibiting impurity can be removed from the gases, without the aid of light, by raising the temperature to 100°C. The addition of minute quantities of ammonia, or of a substance yielding ammonia, has been found to cause the gases to exhibit the so-called induction period. The effect of the presence of a minute quantity of suitable impurity in inhibiting the combination of the gases for a time cannot yet be satisfactorily accounted for. The co-efficient of the extinction of light by a mixture of hydrogen and chlorine in equivalent proportions is almost the same as by that of equal volumes of oxygen and chlorine.—A. S.

Nitric oxide and air; Solubility of —— in sulphuric acid. O. F. Tower. Z. anorg. Chem., 1906, **50**, 382—388.

The author has determined the solubility of nitric oxide and of air in pure sulphuric acid of various concentrations, at different temperatures. The determinations were made in an absorption apparatus fashioned after the style of a Bunsen eudiometer. With 98 per cent. acid no constant results could be obtained in the case of nitric oxide, mercury being dissolved by the sulphuric acid in presence of this gas. Concentrated sulphuric acid, therefore, should never be used in the Lunge nitrometer. Constant results were, however, obtained with sulphuric acid of concentrations between 50 and 90 per cent., the volume of nitric oxide absorbed per c.c. of acid at 18°±1° C. and 760 mm. being as follows: 90 per cent. acid, 0·0193 c.c.; 80 per cent., 0·0117; 70 per cent., 0·0113; 60 per cent., 0·0118, and 50 per cent. acid, 0·0120 c.c. The corresponding results for the solubility of air in sulphuric acid were: 98 per cent. acid, 0·0173 c.c.; 90 per cent., 0·0107; 80 per cent., 0·0069; 70 per cent., 0·0055; 60 per cent., 0·0059, and 50 per cent. acid, 0·0076 c.c.; in this case, constant results were obtained even with the 98 per cent. sulphuric acid. The results obtained show that, in the determination of nitrates, nitrites, or oxides of nitrogen by means of Lunge's nitrometer, the solubility of nitric oxide in sulphuric acid of a concentration below 90 per cent. is so small that it can be neglected, provided not more than 10 c.c. of acid are used. The solubility of air in sulphuric acid is also so small as to be negligible. The best results will be obtained with sulphuric acid of 70 per cent. strength, in which both nitric oxide and air show a minimum solubility.—A. S.

Calcium sulphate; Solution of —— in salt solution. G. Arth and Crétien. Bull. Soc. Chim., 1906, **35**, 778—782.

Five grms. of pure sodium chloride and 5 grms. of precipitated calcium sulphate were heated in a thermostat with 200 c.c. of a solution of sodium chloride saturated at the ordinary temperature, for 15 hours (which is sufficient to produce equilibrium), at temperatures ranging from 0° to 99° C., and the calcium, sulphuric acid and chlorine were determined in the resulting solution; the chlorine content of the solution increased fairly regularly from 15·253 grms. per cent. at 0° to 17·128 grms. at 99°. The calcium content increased regularly from 0·1838 grm. per cent. at 0°, to 0·2309 grm. at 71°, and then decreased to 0·2068 grm. at 99°. The sulphuric anhydride attained its maximum, 0·2993 grm. per cent., at 62·5°, and then fell sharply to 0·2204 grm. at 65°, whence it dropped gradually to 0·2007 grm. at 99°. It is thus impossible to deduce the solubility of calcium sulphate in salt solution by determining one of the constituents. The results were similar when no excess of sodium chloride was present.—T. F. B.

Salts of iron, chromium, tin, cobalt, nickel, and zinc; Hydrolysis of —— in presence of iodides and iodates. S. E. Moody. Amer. J. Science, Silliman, 1906 [4], **22**, 176—184. Chem. Centr., 1906, **2**, 1106—1107.

The action of potassium iodide and iodate on aluminium chloride or sulphate can be utilised for the iodometric determination of aluminium (this J., 1905, 1033). Ferrous and ferric salts are also hydrolysed by the iodide-iodate mixture, the former being also oxidised. $Fe_2(SO_4)_3 + 5KI + KIO_3 + 3H_2O = 2Fe(OH)_3 + 3K_2SO_4 + 6I$. The hydrolysis is complete after boiling the solution for 30 minutes. Sulphates of chromium, tin, cobalt, and nickel are acted upon in a similar manner. In the case of stannic salts, complete hydrolysis can be effected at the ordinary temperature if the iodine be removed as it is liberated. Cobaltous hydroxide is oxidised to cobaltic hydroxide by excess of iodate; a corresponding reaction does not take place with nickelous hydroxide. Zinc sulphate is hydrolysed only to the extent of 80·13 per cent., a basic sulphate, $Zn_3(OH)_6SO_4$, being formed.—A. S.

Silicates; Chemistry of ——. E. Jordis. Z. angew. Chem., 1906, **19**, 1697—1701.

The author has investigated the properties of silicates formed in the wet way. Silicic acid being so weak an acid, is but slightly dissociated in solution; but its salts are highly dissociated, and the more so the less soluble they are, so that it is only possible to obtain them in the presence of other salts of the same metals, added to check the dissociation. Pure colloidal silicic acid does not exist alone—only in presence of traces of other substances (called by the author "Sol-formers"). Gelatinous silica, and hence also the dry silica prepared from it by evaporation, is never pure, but retain chlorine, alkali, iron, or organic substances. Pure silica is obtainable by decomposing silicon tetrachloride, and expelling traces of chlorine from the product by Meyer's method of long ignition at 1000° C. Orthosilicates of the alkalis or alkaline-earths could not be obtained in the wet way—only metasilicates; but fusion processes yielded orthosilicates. Bisilicates of the alkaline-earths appear to exist, more soluble than the monosilicates. Alkaline-earth hydroxides react with alkali silicates, precipitating alkali-free silicates of the alkaline-earths. Possibly this reaction occurs during the hardening of cements. When solutions of alkali silicates and of salts of the heavy metals (iron, copper) react, the results are very complex, and are no doubt rendered so through the varying degrees of hydrolysis of reagents and products. On mixing equivalent quantities, not only is precipitation incomplete, but acid and base are not equivalent to one another, either in precipitate or filtrate. If to the acid filtrate alkali be gradually added, a further precipitate falls, which when neutrality is reached contains all the iron, but only part of the silica present; and this precipitate will absorb a considerable quantity of additional alkali before the solution becomes alkaline to test-papers. The colours of the precipitated iron and copper silicates vary with the content of water, and still more with the temperature. Some of the copper silicates are very bright, but they have only slight covering power and are not likely to become of any industrial importance.—J. T. D.

Sulphur; A hydrate of ——. W. Spring. Rec. trav. chim. Pays-Bas, **25**, 253—259. Bull. Acad. roy. Belg., 1906, 452—459. Chem. Centr., 1906, 2, 1036.

The author finds that Debus's sulphur δ, formed, together with ordinary sulphur and the polythionic acids, by the action of hydrogen sulphide on sulphurous acid in aqueous solution, is not a new allotropic form of sulphur, as stated by Debus (J. Chem. Soc., 1888, **53**, 282—6), but hydrate of sulphur. The precipitated sulphur from the reaction was washed by dialysis, and dried *in vacuo* until the weight was constant, a yellowish, partly transparent substance showing a conchoidal fracture being obtained. This contained about 51·6 per cent. of sulphur soluble in carbon bisulphide. The portion insoluble in carbon bisulphide begins to lose water when heated to 80° C., and the total quantity of water evolved at the melting point of sulphur corresponds to the formula, S_8,H_2O. The hydrate when pressed into the form of a rod has the sp. gr. 1·9385 at 19°/4° C., and loses 1·33 per cent. of water when left standing over sulphuric acid for seven months; the powdered hydrate under similar conditions loses 2·41 per cent. of water. As the hydrate loses water, its specific gravity increases. If the dehydrated product be left in contact with water, its specific gravity becomes lower, indicating that there is a form of sulphur capable of uniting directly with water. After partial dehydration in an exsiccator, the pulverulent hydrate contained 3·1 per cent. soluble in carbon bisulphide, and the compressed hydrate 5·8 per cent.—A. S.

Phosphorus; Investigations on ——. A. Siemens. Arbb. Kais. Ges.-A., **24**, 264—304. Chem. Centr., 1906, 2, 1084—1085.

The author points out that there is no chemical reaction of yellow phosphorus which is not also given by red phosphorus. The differences in the behaviour of the two modifications are due to the fact that the red phosphorus reacts at a much slower rate than the yellow modification. With regard to the cause of phosphorescence, the author confirms the statement of Jungfleisch (this J., 1905, 252) that this is due to the formation of a volatile lower oxide of phosphorus. (Compare Thorpe and Tutton, J. Chem. Soc., 1890, **57**, 569.)

Detection of yellow phosphorus in commercial red phosphorus.—The following process was found to give satisfactory results. Five grms. of the sample are boiled for half an hour with 150 c.c. of benzene under a reflux condenser. After cooling, the solution is filtered from the undissolved red phosphorus, and 1 c.c. is shaken vigorously in a test-tube with 1 c.c. of ammoniacal silver solution (1·7 grms. of silver nitrate in 100 c.c. of ammonia solution of sp. gr. 0·992). If the sample contained no yellow phosphorus, the solution will give only a faint yellow coloration, but if yellow phosphorus be present, a reddish or dark brown coloration or a precipitate is produced. Regard must be paid only to the coloration produced during the first half-hour. Of the 5 grms. of red phosphorus taken for the test, 1·5 mgrms. are dissolved by the 150 c.c. of benzene, and the author suggests that this should be the highest permissible limit for the amount of soluble matter in commercial red phosphorus.

The author states that the work of Roozeboom on the phases of phosphorus shows that the view frequently put forward that red phosphorus is transformed into yellow by friction is incorrect. On striking or rubbing, red phosphorus is merely brought into a finer state of division, and this finely divided phosphorus is more soluble and chemically active than the ordinary red variety. This explanation is confirmed by the fact that the production of the more soluble phosphorus is not influenced by the weight of the grinding agent (large earthenware balls), but is favoured by the use of grinding stones (granite) with sharp edges. Scarlet phosphorus (this J., 1903, 494, 1225, and 1256; 1904, 17), also, is stated to be merely red phosphorus in a very fine state of division. Various points of difference between yellow phosphorus and the finely-divided red phosphorus are mentioned.—A. S.

Hydrofluosilicic acid; Note on the titration of ——. N. Sahlbom and F. W. Hinrichsen. XXIII., page 1068.

Permanganate solution; Titration with alkaline ——. [*Determination of formic and nitrous acids.*] E. Rupp. XXIII., page 1070.

Oxygen; A test for ——. A. C. Christomanos. XXIII., page 1068.

English Patents

Chromic acid; Electrolytic production of ——. J. Y. Johnson. From Badische Anilin und Soda Fabrik. Eng. Pat. 27,009, Dec. 27, 1905. XIA., page 1052.

Lime; Kilns for burning ——. W. E. Benton, Acton. Eng. Pat. 11,820, May 26, 1906.

The lime-kiln described is of the continuous type, and comprises a number of chambers that can be successively charged, fired, cooled, and emptied. Over the fire-bars of each chamber is an arch or flue of perforated fire-blocks, from which the hot gases pass either into a flue arranged lengthwise, between the rows of chambers and above the level of the kiln-floor, through openings controlled by suitable dampers, or else into outer longitudinal flues below the level of the kiln floor, being directed downwards thereto by sheet iron plates fitted into the doorways of the firing holes. Footplates are provided to close the openings from the firing hole into the outer flue. Both the upper and lower flues communicate with the chimney. Forced draught is supplied by suitable apparatus through a flue which runs the length of the kiln below the level of the kiln floor, and is provided with side flues controlled by doors, opening into the ash-pits.—W. C. H.

Lithium carbonate; Extraction of lithium as —— *from its ores.* C. Poulenc, Paris. Eng. Pat. 9971, April 28, 1906.

See Fr. Pat. 361,517 of 1905; this J., 1906, 884.—T. F. B.

Nitrate of soda; Manufacture of ——, *and the recovery of by-products in connection therewith.* C. Stuart-Bailey, London. Eng. Pat. 19,189, Sept. 22, 1905.

By the process described, carbonaceous matter containing nitrogen is subjected to destructive distillation, to yield ammonia and other by-products. The combustible gases and waste heat derived from the distillation process are employed as the source of power for generating electricity with which to obtain caustic soda solution, hydrogen, and chlorine from brine. The hydrogen is passed through the incandescent carbonaceous matter to recover any residual nitrogen in it. The ammonia produced by the distillation process is passed with air or oxygen over a heated contact substance, preferably platinum, in successive steps, the nitric acid and ammonium nitrate thus produced being removed by the caustic soda solution obtained from the electrolysis of the brine, between each step and the succeeding one. The whole may be worked as a composite or continuous process, in apparatus suitably arranged for it.—W. C. H.

Hypochlorite solutions; [Electrolytic] Manufacture of ——. W. P. Digby and A. W. M. Marshall. Eng. Pat. 915, Jan. 12, 1906. XIA., page 1052.

Oxygen generators. G. F. Jaubert, Paris. Eng. Pat. 12,834, June 1, 1906. Under Int. Conv., June 5, 1905.

See Fr. Pat. 361,537 of 1905; this J., 1906, 928.—T. F. B.

United States Patents.

Lime; Process of making ——. J. C. Jones, Carthage, N.Y. U.S. Pat. 832,485, Oct. 2, 1906.

Calcination is effected in an inclined rotating cylinder. —E. S.

Ferrocyanides; Production of —— *from gas.* W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 832,466, Oct. 2, 1906.

See Fr. Pat. 365,410 of 1906; this J., 1906, 928.—T. F. B

FRENCH PATENTS.

Salts of the oxyhalogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.-G. Second Addition, dated April 20, 1906, to Fr. Pat. 362,737, Jan. 10, 1906. XI*A*., page 1053.

Electrolysis of solutions of alkali chlorides, with mercury cathode; Apparatus for the ——. J. J. Rink. Fr. Pat. 365,838, May 2, 1906. XI*A*., page 1053.

Calcium hydride; Manufacture of ——. Elektrochem. Werke, G.m.b.H. Fr. Pat. 366,242, May 15, 1906.

SEE Eng. Pat. 11,767 of 1906; this J., 1906, 759.—E. S.

Nitrogen peroxide; Method of working combustion motors [explosion engines] in order to obtain —— as a by-product. F. Häusser. Fr. Pat. 366,604, May 26, 1906. Under Int. Conv., May 31, 1905.

THE combustible mixture of gases with air, or with air and oxygen, after compression is ignited in an explosion engine. When the mixture has attained its maximum temperature, it is cooled suddenly by a jet of water to just below the decomposing point of nitrogen peroxide. At this temperature however the gaseous mixture still has considerable pressure, and it is allowed to expand and perform mechanical work in the usual way.—E. S.

Flowers of sulphur; Process and apparatus for the manufacture of ——. E. Rasse-Courbet. Fr. Pat. 366,280, May 16, 1906.

THE mineral containing sulphur or "orpiment (arsenic sulphide)" is melted in receptacles in the upper part of a furnace, from each of which the melt is run into a closed muffle immediately beneath. From the heated muffles, the vapours are drawn into chambers, having conical bottoms, in which condensation is principally effected, and thence into and through other chambers in which further condensation takes place, whence the gases pass into a coke tower to be washed, and have exit finally into a pipe for combustion. The ore receptacles, the muffles, and the communicating channels are all heated by circulation of gases of combustion from a single fire-place.—E. S.

Oxygen; Apparatus for generating ——. The Roessler and Hasslacher Chem. Co. Fr. Pat. 366,524, May 23, 1906. Under Int. Conv., Feb. 8, 1906.

THE apparatus consists of a cylinder having double sides, inclosing some such non-heat conducting substance as asbestos, charged with a certain quantity of water, and having suspended within it another, considerably smaller cylinder, open at the bottom, containing cartridges of, for instance, compact sodium peroxide, or other substance that will yield oxygen on coming into contact with water. The cartridges are supported by a permanent spring resting on the bottom of the outer cylinder, and the cover of the inner cylinder is formed with a central tube, attached to the cover of the casing. This tube is continued upwards by a valve piece screwed into it, to which valve a flexible delivery tube for the oxygen given off may be attached. There is another valve in the cover communicating with the interior of the casing and the outer atmosphere. When both valves are closed, the water contained in the enclosing cylinder does not gain access to the charge in the inner cylinder; but on opening the valves, pressure in the latter cylinder is released, whereby water has access to the peroxide, and oxygen continues to be evolved as long as the valves remain open. The rate of evolution of the oxygen is under easy control, and it is stated that the apparatus may be put out of action for weeks by closing the valves. The cover to the casing is secured by two screws; but it is so constructed that it can, on partial rotation, be removed without removing the screws.—E. S.

Oxygen; Composition disengaging —— on contact with a liquid. The Roessler and Hasslacher Chem. Co. Fr. Pat. 366,526, May 23, 1906. Under Int. Conv., April 14, 1906.

IT is stated that when an alkali peroxide is decomposed by water in presence of a metallic oxide as catalyst, the production of a hydrate of the peroxide or of hydrogen peroxide is lessened, with increase of the amount of oxygen set free. Amorphous sodium peroxide, mixed with 5 per cent. of a metallic oxide, such as cupric, manganic, nickel, or ferric oxide, yields oxygen, and a small proportion of hydrogen peroxide on treatment with water, and the result is not materially affected by altering the proportion of the metallic oxide. But if sodium peroxide be melted with 5 per cent. of such a metallic oxide, the product yields, on treatment with water, oxygen with almost explosive violence, and no hydrogen peroxide is found in the caustic solution. If less than 5 per cent. of metallic oxide be melted with sodium peroxide, the subsequent reaction with water is proportionally less active. Thus, it is possible to prepare sodium peroxide with a catalytic body under such conditions as to give any desired activity in oxygen production on treatment with water. (See also U.S. Pat. 788,256 of 1905; this J., 1905, 546.)—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 985.)

Silicates; Chemistry of ——. E. Jordis. VII., page 1043.

ENGLISH PATENTS.

Glass; Manufacture of ——. J. A. Chambers, Allegheny, Pa., U.S.A. Eng. Pat. 15,293, July 5, 1906.

THIS patent refers to modifications of the apparatus described in Eng. Pat. 2879 of 1906 (this J., 1906, 427). In the present invention the pot furnace is divided into two chambers by a depending wall or mantle, which extends from the roof to a distance above the rotating table sufficient to allow of the passage of the pots beneath the mantle. One of these chambers, containing pots filled with glass ready for working, is provided with a door, through which full pots can be withdrawn, or empty pots replaced upon the table. The replaced empty pots pass, by the next rotation of the table, into the second or pot-heating chamber, where the chilled glass adhering to the pots is re-melted, before the pots again arrive, by a further rotation of the table, below the trough that supplies molten glass from the tank. Means are provided for heating this pot-heating chamber. By modifying the construction of the depending walls or mantles, the pot furnace can be divided into three portions; in the first the pots are filled with glass from the tank, and carried by the table into the second portion, which is open to form a drawing chamber, from which the empty pots are carried by the table into the third, or pot-heating chamber. To ensure better and more uniform heating of the pots at all stages of the process, heating flues may be arranged below the rotating table, and instead of pots placed on the table, depressions or cups may be made in it to hold the glass, and the cups connected by openings, to maintain a constant level.—W. C. H.

Furnaces; Smelting, crucible, heating, annealing, and like ——, *and kilns for burning and glazing pottery, and for other like purposes.* The Incandescent Heat Co., Ltd., and A. Smallwood. Eng. Pat. 18,877, Sept. 12, 1905. X., page 1049.

Kilns employed for burning or fixing the colours or glaze upon glass or earthenware, and other materials, applicable also for other purposes. H. Thornton, R. N. Sharp, and J. H. Ingle, Leeds, and L. W. Stanley, Bromley, Kent. Eng. Pat. 25,639, Dec. 9, 1905.

THIS patent describes a modification of the apparatus described in Eng. Pat. 28,078 of 1904 (this J., 1906, 122), in which the furnace chamber is heated by the combustion of gases issuing from jets arranged on each side of the hearth. In the present modification it is proposed to use a combustible mixture of air and gas or hydrocarbon vapour, in which the air is in excess of the amount required for complete combustion of the gas or vapour. This mixture is supplied to the jets or burners at a speed greater than the speed of propagation of the flame, ignition occurring by impact of the mixture on a refractory

hood or cap placed over the nozzle of the burner. The firing compartment is provided with an arched top, and with guides for supporting the tray, on which the articles to be fired are placed. The burners pass through holes in the floor of the compartment, and each is provided with a perforated hood or cap, which causes ignition of the combustible mixture at or near the point of impact, and is stated to produce a flameless combustion. Between the underside of the tray and the surface of the floor is a space to allow for the hoods over the burners, which may be filled and made level with asbestos or other refractory material, which also prevents the flame escaping too rapidly from the perforations of the caps.—W. C. H.

UNITED STATES PATENTS.

Glass sheets; Manufacture of ——. W. L. Clause, Sewickley, and H. K. Hitchcock, Tarentum, Pa. U.S. Pat. 832,842, Oct. 9, 1906.

THE process described consists in causing glass to flow through a slot or orifice, and dividing the exuding stream into two or more streams by the application of tension in two or more directions at an angle to each other. The outer portions of the exuding stream are drawn in directions at an angle to, and out of the line of flow, whilst the core or inner portions of the stream are drawn approximately in the direction of flow of the glass, more glass being exuded from the orifice than is sufficient to form the articles required.—W. C. H.

Glass; Apparatus for the manufacture of sheet ——. H. K. Hitchcock, Tarentum, Assignor to C. W. Brown, Pittsburg, Pa. U.S. Pat. 832,860, Oct. 9, 1906.

THE apparatus described comprises a receptacle for glass, provided with a discharge slot, with outwardly flaring walls, which slot can be adjusted relatively to the height of the glass in the receptacle. A spout or channel extends from the glass-containing receptacle, and means are provided for regulating the temperature of and flow of glass in the channel. The glass is drawn away from the slot at the same rate as it passes through it. The mean axis of the sheet is maintained in approximately the same plane, regardless of the variations in thickness, and the sheet passes between pairs of driven rollers constructed to yield in planes at right angles to their axes, without distorting their peripheries, and without shifting their axes of rotation. The connections from the driving mechanism to the rollers are arranged to have a torsional strength less than the frictional bite of the rollers on the sheet. A cutter is provided to move either transversely to, or in the same direction as the sheet, and at the same rate, and means are also provided for receiving and carrying away the severed sections of the sheet.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 987.)

Silicates; Chemistry of ——. E. Jordis. VII., page 1043.

ENGLISH PATENTS.

Wood; Apparatus for impregnating or colouring ——. F. Pärr and J. Kopetz, Vienna. Eng. Pat. 21,902, Oct. 27, 1905.

THE apparatus described is of the class in which discs, into which liquid under pressure can be introduced, are forced against the ends of the logs. Between the packing rings of the pressure discs and the end surfaces of the log, intermediate rings can be inserted, which hold the packing for the end surfaces securely in position in annular grooves, and also, if desired, by rims on the interior edges of the intermediate rings. To purify the impregnating liquid, filters can be arranged in front of the end surfaces of the log, and within the intermediate rings. The pressing discs are connected with their supports by means of ball and socket joints to enable the discs to be forced tightly against the intermediate rings, when the end surfaces of the logs are not parallel.—W. C. H.

Cement. J. T. South and G. Payne, Brighton, and E. G. Payne, London. Eng. Pat. 13,232, June 8, 1906.

FOR the improved cement, chalk, albo-carbon or naphthalene, sodium sulphate or other suitable alkali salt, zinc sulphate, alum, and coke-breeze or coal ashes, are mixed together in a powdered condition, either dry or with water, and the sediment dried and powdered. This mixture is afterwards mixed with Portland cement and sand, and the whole mixture is then ready for use as cement.—W. C. H.

UNITED STATES PATENTS.

Stone, artificial; Manufacture of ——. J. Purvis and T. Rouse, London. H. C. J. Purvis, executrix of J. Purvis, deceased, and T. Rouse, Assignors to W. W. Tait, Philadelphia. U.S. Pat. 831,296, Sept. 18, 1906.

SEE Eng. Pat. 3294 of 1903; this J., 1903, 629.—T. F. B.

Wood; Process of preserving ——. J. T. Logan, Texarkana, Texas. U.S. Pat. 831,793, Sept. 25, 1906.

WOOD poles are treated in a closed vessel with live steam until the sap has evaporated. The vessel is then exhausted and simultaneously heated with dry heat, after which zinc chloride is injected and forced into the wood by pressure. The poles are then kiln-dried, and the ends treated in quick succession with a bath of hot creosote, followed by a bath of cold creosote.—A. G. L.

Pulp, wood, &c.; Method of treating ——, *and the resulting material.* C. F. Mabery, Cleveland, Ohio. U.S. Pat. 832,799, Oct. 9, 1906.

PULP, wood, and analogous substances are waterproofed and rendered tough and impervious by treating them first with rosin oil, and then with a solution composed of a vegetable gum, *e.g.*, copal gum, a drying-oil or other binder, and a solvent.—A. G. L.

X.—METALLURGY.

(*Continued from page* 991.)

Steel; Manufacture of —— *in the basic Siemens-Martin furnace.* W. Schmidhammer. Stahl und Eisen, 1906, **26**, 1247—1249.

THE article is based on one by A. Mignot in the "Comptes Rendus mensuels de la Société de l'Industrie minérale" (May, 1906), which deals with the basic process in France. The basic process is continually replacing the acid process, on account of its elasticity in permitting different ways of working, and allowing of the use of all sorts of raw materials. It is usual to decarburise completely and then to carburise again by suitable additions. But since 1891 one large works has stopped decarburisation when the required carbon content has been reached. This method is used in making medium hard steels with 0·35 per cent. of carbon from a mixture of 70 per cent. of scrap and 30 to 40 per cent. of pig-iron containing, on the average: phosphorus, 0·58; sulphur, 0·17; carbon, 3·4; silicon, 1·9; and manganese, 1·6 per cent. In making hard steel with 0·65 to 0·70 of carbon for cable wire, decarburisation is carried to the 0·35 point, and the steel then re-carburised by adding ferromanganese or ferrosilicon. The slags are rendered liquid by the addition of fluorspar. In another case soft steel was made from ore and pig-iron containing: carbon, 2·4; silicon, 0·7; manganese, 0·2; phosphorus, 1·4; and sulphur, 0·3 per cent. The hearth was lined with powdered limestone, and covered with limestone in pieces (6 to 7 per cent. of the pig-iron); on this was placed hæmatite ore (10 per cent.), and the whole covered with the pig-iron. After melting down, the slag was removed, another 8 to 10 per cent. of ore was added, as well as burnt limestone and 0·1 to 0·2 per cent. of 80 per cent. ferromanganese, and the whole cast after adding another 1 to 1·25 per cent. of ferromanganese. The steel obtained

contained: carbon, 0·11 per cent.; manganese, 0·40; phosphorus, 0·028; sulphur, 0·052; and a trace of silicon. The basic furnace may also be used to purify pig-iron for the acid process. In this case the hearth is charged with layers of pig-iron, hæmatite ore in large lumps (7 to 8 per cent. of the pig-iron), powdered limestone (10 to 15 times the weight of the silica produced) mixed with fluorspar (2 per cent. of the pig-iron), and more pig-iron on top. Just before casting 4 per cent. of ferromanganese is added. By adding 20 to 30 per cent. of scrap to the charge, ore and flux may be saved. In this way a pig-iron with carbon, 4 per cent.; silicon, 0·5; manganese, 4·5; phosphorus, 0·05; and sulphur, 0·02 per cent., gave a product with carbon, 2·1; silicon, trace; manganese, 2·4; phosphorus, 0·02; and a trace of sulphur. Pig-iron with 1·5 per cent. and more of phosphorus and 0·5 per cent. of sulphur is successfully treated by the Bonnand-Verdié method. In this the working is divided into two distinct phases: In the first a slag is produced very rich in lime, and containing 10 to 12 per cent. of silica, 3 to 4 of ferrous oxide, and 8 to 10 or less of total metallic oxides, together with most of the sulphur and a considerable part of the phosphorus. It is rendered sufficiently liquid by adding fluorspar. In the second phase the phosphorus is completely removed by a slag similar in basicity to the first but with more of the lime replaced by ferrous oxide, of which 15 per cent. may be present. This process has been further developed by working it in three stages. In the first most of the silicon is eliminated by forming a very silicious slag, which renders it easier to obtain the two very basic slags required in the two later stages in which sulphur and phosphorus are removed. In the basic process part or the whole of the pig-iron may also be replaced by ground coke in quantity corresponding to 1½ to 2 times the carbon in the pig-iron it replaces. To guard against its too early combustion, the coke is wrapped up in five times its weight of planings. For a charge of 20 tons about 500 kilos. of coke and 3000 kilos. of planings are used.—A. G. L.

Precipitate [Silver and gold]; Treatment of the ——, and manipulation of the tilting furnaces at the Redjang Lebong mines, Sumatra. S. J. Truscott. Inst. Min. and Metall., Oct. 18, 1906. [Advance proof.]

THE zinc-boxes are cleaned up twice a month; the precipitate and the "short zinc" are collected in separate tanks, and subjected to acid treatment, followed by washing with hot water, the consumption of acid being 0·117 lb. per lb. of precipitate treated and 0·514 lb. per lb. of short zinc. The washed precipitate is pressed and then calcined in quantities of about 500 lb. upon an iron tray over a wood fire; a good sample after calcination contained: gold, 8·19 per cent.; silver, 58·10; zinc, 5·90; lead, 3·80; selenium, 3·56; silica, 3·96; together with smaller proportions of iron, copper, and manganese, and 14·76 per cent. of undetermined matter. One hundred parts of clean precipitate require 16 parts of borax for fluxing; less clean precipitate requires 17·8 parts of borax, 9·0 parts of sodium bicarbonate, and 0·7 part of sand; the precipitate from the short zinc requires 22·7 parts of borax, 9·8 of sodium bicarbonate, and 4·8 parts of sand. The mixing is effected in a large enamelled drum, scrap iron being added when it is expected that matte will form, as is always the case when the short zinc precipitate is under treatment. The matte consists principally of silver selenide, which is readily reduced with sodium bicarbonate in presence of scrap iron. The furnaces are built in pairs, and consist of box-shaped castings lined with fire-bricks, two of the sides having trunnions carried in bearings on iron standards; the furnaces are tilted around these by means of worm and wheel gearing. The retort rests at an angle of about 30° from the horizontal upon an arch of fire-brick placed some inches above the level of the fire-bars. The furnace inside the fire-brick lining is 22 ins. square by 36 ins. high; the retort is 30 ins. long, 9½ ins. diameter at the back, 13¾ ins. at the middle, and 6½ ins. at the mouth, and the neck protrudes slightly through the front casting. The charge is from 150 to 200 lb., and when this is reduced, more is added until a total charge of 250 to 300 lb. is reached; after complete reduction, the slag is run off into slag pots and the metal into moulds of about 640 oz. capacity. The fire is started at 5 a.m. with charcoal; afterwards a mixture of charcoal and coke is used; with ordinary precipitate eight bars can be reduced and poured from each furnace in a day. From July to December, 1905, the amount of slag made was equivalent to 1·82 oz. per ounce of bullion, the average assay being gold, 9·5 oz.; silver, 299·3 oz.; the bullion contained 126·86 parts of gold to 818·54 parts of silver, together with selenium up to 3 per cent. and small amounts of copper, lead, and iron. The costs of smelting 2076 lb. of calcined precipitate during December, 1905, which yielded 3336·8 oz. of gold and 19,510·4 oz. of silver, amounted to £84 15*s.* 7*d.*, of which £12 10*s.* represented Europeans' wages, £8 6*s.* 8*d.* native labour, £22 0*s.* 8*d.* fuel, £10 16*s.* acid, £14 12*s.* 6*d.* borax, £1 9*s.* 9*d.* sodium bicarbonate, £13 retorts (three), and £2 general supplies; the total being equivalent to 0·098 pence per oz. of fine gold or 0·89*d.* per oz. of fine metal. The pot smelting previously employed cost less in pots and fuel, but much more in manipulation.—J. H. C.

Copper and phosphorus. E. Heyn and O. Bauer. Mitt. Königl. Materialprüfungsamt zu Gross-Lichterfelde West, 1906, **24**, 93—108.

THE authors have studied the influence of varying amounts of phosphorus on copper, and have prepared a number of micro-photographs. The structure is found to be perfectly homogeneous in the case of alloys containing not more than 0·175 per cent. of phosphorus. From this point onwards dark crystals are visible, surrounded in the first place by a lighter zone richer in phosphorus and then by eutectic veinings, which become visible with about 0·5 per cent. of phosphorus, and very marked with 0·75 per cent. The eutectic contains 8·27 per cent. of phosphorus, and has a melting point of 707° C. This point is well marked in all the mixtures of up to 14·1 per cent. of phosphorus, the melting point of which decreases at first from 1084° (that of pure copper) to 707° (that of the eutectic), and then rises again up to 1020°. This point is the melting point of the compound, Cu_3P, the existence of which is conclusively proved by measurements of the density and of electric potential. The phosphides of copper are found to be electronegative towards copper itself. In mixtures with from 0·5 to 14·1 per cent. of phosphorus the eutectic point at 707° disappears entirely, these bodies being mixtures of Cu_3P and (probably) Cu_2P_2. It is, however, impossible to prepare homogeneous bodies with more than 15 per cent. of phosphorus by melting, since for every temperature there exists a distinct maximum of phosphorus, beyond which that element is given off at that temperature, and for 1020° this maximum is 14·1 per cent. Bodies with a higher phosphorus content would have higher melting points, and hence no body with more than about 15 per cent. of phosphorus can be prepared by melting, as during the time required for the melting, any excess of phosphorus is volatilised. By heating mixtures of amorphous phosphorus with copper turnings at about 300° to 400°, friable masses with over 20 per cent. of phosphorus can be obtained. It is suggested that this heating be carried out in a series of crucibles filled with the mixtures, each one connected with the next by a tube reaching some way down, so as to minimise the loss due to escaping phosphorus vapour. Phosphorus hardens copper more than does tin, the compound, Cu_3P, being much harder than the corresponding tin compound, Cu_3Sn.—A. G. L.

Manganese-molybdenum alloys. G. Arrivaut. Compt. rend., 1906, **143**, 464—465.

THE author has extended his work (this J., 1906, 849) on this subject, and has made, by the aluminothermic method, alloys containing up to 75 per cent. of molybdenum. They are all silver-white, homogeneous, non-magnetic alloys, very hard, and more brittle as the content of manganese is higher. They are unaffected by air, are completely soluble in nitric acid, hot concentrated sulphuric acid, or fused alkali bisulphates. Acetic acid attacks those containing less than 63 per cent. of molybdenum, and hydrochloric acid attacks all, though it does not dissolve all completely. By the regulated

attack of alcoholic acetic acid or of hydrochloric acid the author has separated respectively from the alloys containing 35—45, 47—59, and 65—72 per cent. of molybdenum, the compounds, Mn_2Mo, MnMo, and $MnMo_2$. These are all steel-grey, non-magnetic, crystalline powders, stable in air at ordinary temperatures, attacked by chlorine, by water vapour at 250° C., and by oxygen or sulphur at a red heat. The alloys appear all to consist of one or other of these compounds in association with metallic manganese.
—J. T. D.

Lead smelting; Formation of fume in ——. F. O. Doeltz and C. A. Graumann. Metallurgie, **3**, 442. Eng. and Min. J., 1906, **82**, 584.

THE authors state that galena is far more volatile than lead oxide. At 860° C. it suffers a loss of weight of 18 per cent. in one hour. The formation of scaffolds of lead sulphide in lead blast-furnaces, and the fine needles of sulphide in the masonry of reverberatory furnaces are due to the sublimation and condensation of galena.

Lead sulphate is only slightly volatile, but is decomposed at about 1000° C. The lead sulphate found in flue-dust chambers is formed chiefly by the action of sulphur trioxide on lead oxide, or by oxidation of lead sulphide.
—A. S.

Sulphide ores; Roasting of —— to sulphates. R. Vondráček. Oesterr. Z. Berg.-Hütt., 1906, **54**, 437—441. Chem. Centr., 1906, **2**, 1089.

THE author has investigated the process of roasting sulphide ores, especially lead sulphide, to sulphates, and concludes from his results that for the formation of good yields of sulphates three conditions are necessary, viz., excess of air; the presence of contact-substances (catalysers), and a favourable temperature for the contact-process; and the presence of metal oxides and a suitable temperature for the formation of sulphates. These three conditions should be attained in succession. The gases formed on roasting must remain in contact for a certain time with the roasted material which acts as a catalyser, and during this period the temperature should not be raised above a certain point. In certain cases, where very stable sulphates are formed, the second and third phases may proceed conjointly, the sulphur trioxide formed being immediately absorbed by the metal oxide acting as contact-substance. All conditions tending to prevent rapid rise of temperature accelerate the formation of sulphates. The presence of inert gangue, of hygroscopic and combined water, and of carbonates thus all exert a favourable effect, as also does the presence of moisture in the air.

If it be desired to avoid the formation of sulphates in the roasting of sulphide ores, excess of air must not be used over that required for the combustion of the fuel gases and the oxidation of the ores, and the ore should be given a preliminary heating.—A. S.

Mineral production of India. Bd. of Trade J., Oct. 18, 1906. [T.R.]

THE quantity of minerals raised in British India in 1905 in mines regulated by the Indian Mines Act was as follows:—

	1904.	1905.
	Statute tons.	Statute tons.
Coal	7,561,338	7,762,779
Manganese ore	138,733	204,194
Mica	21,320	25,548
Limestone	50,847	93,170
Salt	107,413	94,078

The above table does not include the mineral production of Hyderabad and other great native states. The favourable geographical position of the Bengal coal fields, the excellent quality of the coal, and the easy mining conditions, give Bengal a great advantage over other provinces and the development of the coal industry has been remarkable. In 1898 the output was only 3,622,090 tons; in 1905 it amounted to 7,234,103 tons. The Mining Inspector traces a coke output to the extent of 258,958 tons, as carried by the railways, the coke being all produced in crude ovens, which do not average more than 40 tons of hard coke per 100 tons of coal. The East Indian Railway Company are installing a battery of modern retort ovens, with by-product recovery plant, at Giridih. Copper appears for the first time in the list of minerals raised from mines classed under the Indian Mines Act. Only 40 cwts. were raised, but a serious effort is being made to develop copper mining on a considerable scale. The export of manganese ore, in which India now takes a leading position, totalled 281,734 tons.

Australian mineral production and export. Mining World, Oct. 6, 1906. [T.R.]

THE production of gold in the various Australian States is as follows:—

	1904. Fine ozs.	1905. Fine ozs.
New South Wales	269,817	274,267
Queensland	639,151	592,620
South Australia	29,100	20,447
Tasmania	65,921	73,541
Victoria	765,600	747,166
Western Australia	1,983,230	1,955,316
Total	3,752,829	3,663,357

It is anticipated that the production will reach its former level during the present year. The exports of minerals during 1904 and 1905 from Australia were as under:—

	1904. £	1905. £
Alunite	925	6,750
Brass	512	796
Copper:		
Bars, &c.	220	4,973
Ingots	1,550,281	978,384
In matte	—	1,100,139
Ore	100,567	19,517
Bullion	3,693	—
Gold:		
Bullion, &c.	5,563,865	5,259,669
Ore, &c.	9,637	10,174
Specie	10,128,408	4,255,703
Iron and Steel:		
Bar, &c.	2,414	2,140
Girders, &c.	172	117
Lead:		
Pig	872,000	783,823
In matte	—	15,308
Sheet, &c.	16,116	29,643
Mercury	22	—
Ores:		
Antimony	503	5,260
Bismuth	17,910	24,009
Chromium	1,268	—
Cobalt	76	350
Iron	—	98
Molybdenite	5,432	8,372
Scheelite	1,980	10,409
Tungsten	128,179	123,042
Zinc blende	8,375	—
Platinum	—	825
Plumbago	165	188
Silver:		
Bullion, &c.	847,727	699,241
In matte	—	117,899
Silver-lead ore	564,025	236,461
Bullion	793,596	770,623
Spelter, concentrates, &c.	47,231	780,003
Tin:		
Ingots	611,820	765,221
Ore	132,042	202,508
Zinc, all kinds	1,484	1,989

Coal production, although confined principally to New South Wales, is steadily expanding, despite frequent

labour disputes and other difficulties. The value of the exports, other than interstate, in 1905, was £861,692 against £786,490 in 1904. The exports of coke represented a value of £3,105, New Zealand being almost the only customer. Shale production is likely to become a leading industry within the next few years, by reason of the large amount of capital invested in working the enormous deposits in the western portion of New South Wales. In 1904 the value of the exports was £18,897, which became increased to £28,304 in 1905, the Netherlands taking nearly the whole quantity.

Antimony production in 1905. Mining World, Oct. 6, 1906. [T.R]

The supply of ore marketed continues to be exceedingly small. China for the last five or six years has produced the greatest quantity of ore, but since June, 1904, there has been a heavy falling off in these shipments. The production of antimony as a by-product and from imported ores in the United States in 1905 amounted to 3240 short tons, valued at $705,787, as against 3057 tons, valued at $505,524, in 1904. The production of metallic antimony from domestic and foreign ores in the United States is about 500 short tons per annum, whilst that contained in hard lead has amounted to somewhat over 2500 short tons for the last four years. The total consumption of antimony in the United States in 1905 was 5712 short tons, compared with 4759 tons in 1904. Accurate figures showing the output of China, the source of largest supply, are not obtainable, as the empire does not collect mineral and metal statistics. From the most authoritative source—the importers of Chinese antimony—it is learned that the exports from China in the first six months of 1905 amounted to 2014 long tons, while the last half showed a material decrease. In 1904 the exports from China were 12,037 long tons, as against 7341 tons in 1903, 10,087 tons in 1902, and 3633 tons in 1901.

English Patents.

Furnaces; Smelting, crucible, heating, annealing, and like ——, and kilns for burning and glazing pottery and for other like purposes The Incandescent Heat Co., Ltd., and A. Smallwood, Loudon. Eng. Pat. 18,877, Sept. 19, 1905.

The invention consists essentially in arranging above a horizontal combustion chamber a heating chamber for a number of crucibles, an annealing chamber, and a chamber for reheating, &c., all these chambers being so connected to the combustion chamber or to one another by heat-distributing passages, that heat may be easily supplied to or shut off from any part of any of these chambers. A jacketing chamber is placed so as to extend above all three chambers, the burnt gases passing from this into the chimney.—A. G. L.

Alloys; Manufacture of metallic ——. A. Jacobsen, Hamburg, Germany. Eng. Pats. 19,198 and 19,198A, Sept. 22, 1905.

See Fr. Pat. 353,999 of 1905; this J., 1905, 1071.—T. F. B.

Metallic alloys; Manufacture of ——. A. Jacobsen, Hamburg, Germany. Eng. Pat. 19,198B, Sept. 22, 1905.

To 50 per cent. of the alloy described in Eng. Pat. 6945 of 1904 (this J., 1904, 1220), which consists of two atomic weights each of copper and iron, and one atomic weight each of nickel and aluminium, there is added 50 per cent. of copper. The new alloy is of the same strength as the former one, but is considerably softer, and more ductile. Useful results are also obtained if the proportion of copper be varied from 20 to 80 per cent.—A. G. L.

Aluminium alloys; Process for improving —— by heating and chilling. C. Claessen, Berlin. Eng. Pat. 19,282, Sept. 23, 1905.

See Fr. Pat. 358,028 of 1905 and Addition thereto; this J., 1906, 185 and 482.—T. F. B.

Metals; Refining ——, and apparatus therefor. W. S. Simpson, London. Eng. Pat. 19,781, Sept. 30, 1905.

See Fr. Pat. 360,408 of 1905; this J., 1906, 542.—T. F. B.

Crucibles or vessels for the mixing and alloyage of metals. W. S. Simpson, London. Eng. Pat. 19,781A, Sept. 30, 1905.

See Fr. Pat. 360,408 of 1905; this J., 1906, 542.—T. F. B.

Metals; Method of manufacturing —— according to the aluminothermic process. H. Goldschmidt and O. Weil, Essen on Ruhr, Germany. Eng. Pat. 20,004, Oct. 3, 1905.

See Fr. Pat. 358,071 of 1905; this J., 1906, 185.—T. F. B.

Ores and their by-products; Process for the sulphatisation of ——. E. Enke, Kattowitz, Germany. Eng. Pat. 22,900, Nov. 8, 1905.

See Ger. Pat. 163,410 of 1904; this J., 1906, 221.—T. F. B.

Ore concentration. H. L. Sulman, H. F. Kirkpatrick-Picard, and J. Ballot, London. Eng. Pat. 26,712, Dec. 21, 1905.

See Fr. Pat. 363,418 of 1906; this J., 1906, 890.—T. F. B.

Screen for washing ores, combustible minerals, and the like. C. J. A. Marty, Limoges, France. Eng. Pat. 11,764, May 19, 1906.

The screen consists essentially of two superimposed, perforated metal plates, between which solid or hollow balls act like valves above each hole in the lower plate. The lower plate is also provided with one or more additional openings corresponding to the same number of collectors below them, in which the small quantity of sand, &c., collects which might impede the action of the balls.—A. G. L.

Metals; Process and apparatus for obtaining —— from their sulphides. T. J. Heskett, Brunswick, Australia. Eng. Pat. 26,980, Dec. 27, 1905.

Impure sulphide ores are first smelted in a blast-furnace with sufficient fuel and fluxes to produce a pure sulphide, which flows in a continuous stream into an oxidising chamber. Pure sulphides may be directly charged into and melted in the latter through a hopper at the top. In the oxidising chamber, rapid oxidation is effected by an air-blast supplied through tuyères below the level of the molten sulphide. The volatilised metallic oxides, together with sulphur dioxide, pass into a reducing chamber supplied with solid or gaseous reducing agents, in which the metals are reduced, the less volatile metals collecting in the molten condition at the bottom of the reducing chamber. The more volatile metals are also reduced, but pass on to a condensing chamber, where they deposit in the order of their condensation. The sulphur dioxide passes on, and can be utilised as usual.—A. G. L.

Steel; Manufacture of —— in Martin furnaces. V. Defays, Brussels. Eng. Pat. 9996, April 28, 1906. Under Int. Conv., April 29, 1905.

See Fr. Pat. 365,671 of 1906; this J., 1906, 991.—T. F. B.

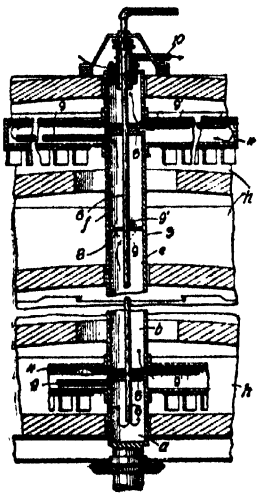
United States Patents.

Blast furnace. L. Heckscher, Radnor, Pa. U.S. Pat. 828,310, Aug. 14, 1906.

The object of the invention is to secure even cooling of the walls of a blast furnace. For this purpose the masonry of the upper part of the furnace is supported not on the main mantle itself, but on a false mantle placed at about the point where the walls of the furnace begin to slope inwards. The false mantle is supported on the main mantle by a number of radial vertical plates, each of which has an opening in its lower part to allow water to pass through it. The main mantle is placed in the usual position, a little above the bosh, and is supported in the usual way on columns; its outer edge is turned upward so that it forms an annular trough. A mantle-jacket surrounds the walls of the blast furnace between

the two mantles, and below the main mantle, ending just above the tuyères is an annular trough leading to the waste pipe. Below the main mantle is placed an annular flange, tapering downwards and surrounding the bosh, but leaving an opening between it and the mantle-jacket. This flange prevents the water leaving the mantle-jacket. Water is projected against the mantle-jacket between and below the mantles by means of two circular pipes. —A. G. L.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 831,165, Sept. 18, 1906.



The furnace comprises a number of superposed hearths, *h*, a hollow shaft, 3, passing through the hearths, and hollow arms, 4, radiating from the shaft and extending into the hearths. The shaft is divided into compartments, *a*, *b*, *c*, *f*, by partitions, 8; from each compartment, on one side of the partition, a tube, 9, leads into the corresponding hollow arm, and on the other side of the partition a complementary tube, 9¹, leads from this arm into the opposite one. A limited quantity of a cooling medium is introduced into the lowest compartment through the tube, 6; this is vaporised by the heat of the furnace charge, and the vapour circulates through each compartment in the shaft in succession, following the path indicated by the arrows, and finally escaping at 10.—A. S.

Furnace; Roasting ——. F. Klepetko, New York. U.S. Pat. 831,166, Sept. 18, 1906.

The furnace comprises a number of superposed hearths, with a vertical hollow shaft passing up through them. Hollow arms radiate from the shaft, and extend into the hearths. A cooling medium enters through a feed-pipe passing longitudinally through and discharging into the lower end of the shaft. An outlet pipe for the cooling medium also extends through the shaft, and discharges at the top, and branch pipes lead from the interiors of the hollow arms to the outlet pipe.—A. S.

Furnace; Ore-roasting ——. W. A. Maddern, Boulder City, Western Australia. U.S. Pat. 831,232, Sept. 18, 1906.

See Eng. Pat. 24,124 of 1902; this J., 1904, 22.—T. F. B.

Furnace; Ore-roasting ——. T. Edwards, Ballarat, Victoria. U.S. Pat. 832,248, Oct. 2, 1906.

See Eng. Pat. 28,464 of 1903; this J., 1904, 1150.—T. F. B.

Furnace for calcining or burning briquettes of ore. F. J. Bergendal, Herräng, Sweden. U.S. Pat. 832,358, Oct. 2, 1906.

See Eng. Pat. 9206 of 1905; this J., 1905, 958.—T. F. B.

Metal-bearing materials; Method of reducing ——. A. H. Helander, Pueblo, Colo. U.S. Pat. 831,067, Sept. 18, 1906.

To reduce metal-bearing materials, they are formed with fuel-bearing and fluxing materials into a viscous mixture, which is injected into a blast-furnace at the zone of fusion.—E. S.

Detinning [tin-plate]; Process of ——. K. Goldschmidt and J. Weber, Assignors to Th. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 831,223, Sept. 18, 1906.

See Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

Ore separator and classifier. E. J. Swyny, Balmain, and S. G. Plucknett, Newtown, N.S.W. U.S. Pat. 831,252, Sept. 18, 1906.

See Eng. Pat. 19,140 of 1904; this J., 1904, 1150.—T. F.B.

Vanadium ores; Treating ——. J. O. Handy, Pittsburg, Pa. U.S. Pat. 831,280, Sept. 18, 1906.

The ore is mixed with a quantity of sodium salt (sodium chloride), sufficient to form sodium pyrovanadate with the vanadium present, and heated to distil off sulphur. Residual sulphur is removed by roasting, the product is extracted with hot water, and the solution evaporated to dryness. The residue is purified by washing it with cold water, dissolving in hot water, acidulating, and evaporating to dryness, and again washing with cold water. —A. G. L.

Alloy for bearings. H. Kreusler, Wilmersdorf, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 831,357, Sept. 18, 1906.

See Eng. Pat. 10,513 of 1906; this J., 1906, 816.—T. F. B.

Ferrophosphorus; Manufacture of ——. J. J. Gray, jun., Rochdale, Tenn. U.S. Pat. 831,427, Sept. 18, 1906.

A mixture containing iron ore, phosphate rock, and a silicious material in such proportions as may be required to liberate the amount of phosphorus it is desired to combine with the iron, is charged into a blast furnace and smelted.—E. S.

Armour plates; Manufacture of ——. R. A. Hadfield, Sheffield. U.S. Pat. 831,858, Sept. 25, 1906.

See Eng. Pat. 15,220 of 1904; this J., 1905, 736.—T. F. B.

Steel; Art of hardening and toughening ——. J. Churchward, New York. U.S. Pat. 832,770, Oct. 9, 1906.

The process is the same as that described in Eng. Pat. 15,423 of 1905 (this J., 1906, 889), except that tungsten is added to the steel as well as chromium, nickel, and manganese.—A. S.

Metals; Art of hardening and toughening ——. J. Churchward, New York. U.S. Pat. 832,772, Oct. 9, 1906.

Vanadium is added to the steel in addition to the metals mentioned in U.S. Pat. 832,770 (see preceding abstract). —A. S.

Alloy of iron and steel; Self-hardening ——. J. Churchward, New York. U.S. Pat. 832,773, Oct. 9, 1906.

Claim is made for a steel containing: carbon, about 0·20 to 0·60 per cent; nickel, 4 to 6 per cent.; tungsten, 0·5 to 1·5 per cent.; chromium, 2·5 to 3 per cent.; manganese, 0·5 to 1 per cent., and vanadium, 0·25 to 0·5 per cent.—A. S.

Iron and steel; Method of recovering —— from slags. R. Baggaley, Pittsburg, Pa. U.S. Pat. 832,948, Oct. 9, 1906.

Iron is obtained from the ferruginous slag of a copper furnace by mixing the slag with carbonaceous fuel and a flux, and subjecting it to a temperature higher than that ordinarily used in an iron blast-furnace. The iron produced is then bessemerised.—A. G. L.

[*Copper*] *Slimes; Process of treating* ——. H. N. Thomson and F. Laist, Anaconda, Mont. U.S. Pat. 832,176, Oct. 2, 1906.

Slimes from metallic (copper) ores are dried and disintegrated, and then roasted at a dull red heat. The roasted product is then treated with a mixture of sulphuric acid, iron sulphate, and sodium chloride, gases from a roasting-furnace containing air and sulphur dioxide being at the same time passed through the mass. The solution obtained is filtered, the tailings are washed, and hydrogen sulphide is passed through the combined filtrate and washings. The metallic (copper) sulphide is finally smelted to metal (copper) as usual.—A. G. L.

Converting mattes and speisses and other metallic compounds; Apparatus for ——. H. Haas, San Francisco, Cal. U.S. Pat. 832,665, Oct. 9, 1906.

In the lining of the converter a series of conduits is arranged about a central axis, these conduits all having an upward, outward, and forward inclination, whereby the blasts of air which are forced through them tend to rotate the mass in the converter in the same direction.—A. S.

Copper matte; Process of smelting ——. W. Kemp, Tucson, Arizona, Assignor to the Kemp Hydro-Carbon Furnace Co., New York. U.S. Pat. 832,738, Oct. 9, 1906.

Copper matte, mixed with silica or other flux, or alone, is charged into a furnace in the solid state, and reduced to metallic copper by subjecting it to the action of a burning mixture of oil-vapour, steam, and air, containing an excess of oxygen, the lower zones of the charge being successively reduced.—A. G. L.

Ore roasting and oxidising apparatus. F. C. Butterfield, Oakland, Cal. U.S. Pat. 832,292, Oct. 2, 1906.

The furnace consists of a horizontally rotating shell having heads with openings aligned around the circumferences of the heads, for the admission of ore at one end and the discharge of solid residue at the other. The openings are controlled by sliding gates. Reduced tubular ends project centrally from the heads. A combustion chamber is provided, movable to and fro from the inlet of the shell, and abutting endwise against the inlet, for the liquid-fuel supply. The tubular extension at the opposite end of the furnace is connected to settling and condensing chambers for the delivery of the separated gases and vapours.—A. G. L.

Ores; Process of treating complex sulphide ——. W. G. Rumbald and G. Patchin, London. U.S. Pat. 832,341, Oct. 2, 1906.

See Eng. Pat. 2532 of 1905; this J., 1906, 325.—T. F. B.

Metals; Process of separating —— *from their ores.* G. H. Waterbury., Assignor to J. J. Huddart, Denver, Colo. U.S. Pat. 832,563, Oct. 2, 1906.

The powdered ore is treated with a solution in water of salt, alkali nitrate, and sulphur dioxide, the whole being agitated and heated by the simultaneous introduction of air and steam. The solution obtained is drawn off, and the metals in it are precipitated by hydrogen sulphide, forced into the liquid by air under pressure.—A. G. L.

Metal values; Method of extracting —— *from ores.* R. Baggaley, Pittsburg, Pa. U.S. Pat. 832,833, Oct. 9, 1906.

Ores are "liquated" without the use of carbonaceous fuel by feeding preheated silicious ores into a bath of low-grade matte at one end in a converting furnace, the bath being kept hot, and its contents well mixed by blowing air through it. The silicious ore fed in is in excess of the amount that can be melted through the formation of selective slags. Molten slag, matte, and "silicious liquated matter" overflow continuously into a forehearth at a lower level for separation by gravity.—A. G. L.

[*Gold, silver, and copper*]. *Metals; Art of precipitating* —— *from cyanide solutions.* W. J. Sharwood, Berkeley, Cal., Assignor to C. W. Merrill, Lead, S.D. U.S. Pat. 832,860, Oct. 9, 1906.

Copper and the precious metals are precipitated from alkaline cyanide solutions by neutralising the solutions with the proper quantity of acid material, and then bringing them into contact with metallic zinc or an alloy of zinc in a finely-divided state.—A. G. L.

Briquettes of ore, &c.; Process of manufacturing ——. H. Schulte-Steinberg, Düren, Germany. U.S. Pat. 833,005, Oct. 9, 1906.

See Eng. Pat. 3235 of 1904; this J., 1904, 444.—T. F. B.

French Patents.

Cementation of objects of iron or steel; Process and apparatus for the ——. A. W. Machlet. Fr. Pat. 366,245, May 15, 1906.

The invention is especially applicable to the cementation of a number of small objects at the same time. The objects are heated in a large crucible to a temperature exceeding a red heat, but below their fusing point, the temperature being kept very even and uniform. An atmosphere of carbonaceous gas is kept in the crucible during the heating, and the articles are moved about by rotating the crucible. The articles are also surrounded by a reducing atmosphere during the cooling. After several heatings and coolings, the articles are tempered as usual by quenching. The apparatus used in carrying out the above process is also claimed.—A. G. L.

Retort, muffle, crucible, &c., for the reduction of zinc ores and other purposes. D. Delville and Comp. des Métaux et Prod. Chim. D'Overpelt. Fr. Pat. 366,380, May 18, 1906.

The retort, &c., is provided on the outside with a number of horizontal channels for the better utilisation and transmission of the heat supplied. The channels are of such form that a section of the retort appears much like a cog wheel.—A. G. L.

Bismuth; Process for the extraction of ——. H. Becker, Fr. Pat. 366,439, May 21, 1906.

The bismuth is extracted from its ores and compounds by a solution of an alkali hyposulphite or an alkaline-earth hyposulphite, and then precipitated as bismuth sulphide by the addition of an alkali (or alkaline-earth) sulphide, the solution being at the same time regenerated. Or, the bismuth is extracted by a solution of a "per-salt," preferably ferric chloride or sulphate, to which also other salts may be added, and is precipitated from the solution, either as basic salt by heating or diluting the solution, or as metal, by the action of another metal, such as zinc, or by electrolysis preferably with the aid of a diaphragm, the electrolysis also regenerating the solution which, in the other cases, must be regenerated by blowing air or chlorine through it. If other metals, *e.g.*, copper, which would render the bismuth obtained impure, are present in the ore, they may be removed by a preliminary treatment; *e.g.*, in the case of copper, the ore might be extracted with ammonia or dilute hydrochloric acid.—A. G. L.

Armour plates; Process of making ——. Marrel Frères. Fr. Pat. 366,532, May 23, 1906.

The armour plates are made from a crucible steel containing 0·160 to 0·300 per cent. of carbon, 0·4 to 0·8 per cent. of chromium, and 3 to 4 per cent. of nickel; the chromium may be wholly or partly replaced by titanium, tungsten, molybdenum, or vanadium. The steel, after rolling once, is, if desired, subjected to the cementation process; it is then heated to a determined temperature, and cooled in such a manner as to give the desired structure, the operations being repeated until this is attained. Both the faces are then tempered at the same time, by heating the whole plate very gently and evenly, and quenching on both sides. The structure of the steel obtained should show an amorphous grain, and be porcelain-like in the cemented portions.—A. G. L.

Ores; Process for the dry concentration of ——. Minerals Separation Ltd. Fr. Pat. 366,685, May 29, 1906.

The process for the dry concentration of ores comprises the use of a concentrating table provided with longitudinal ribs or corrugations between which are passages for a current of air. The ribs or corrugations are of truncated conical form in cross-section. The top or cover of the table, on to which the ore is fed, is of cloth or other material permeable to air. The table is inclined, both longitudinally and transversely, and a longitudinal reciprocating motion is imparted to it. The ore is fed on to the upper end of the table, and by the motion of the table and the action of the air, which is introduced below and rises through the passages between the corrugations, is separated into layers of different density, as it travels towards the lower end of the table.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 994.)

(*A.*)—ELECTRO-CHEMISTRY.

Nickel salts; Periodic phenomena during the electrolysis of ——. A. Thiel and A. Windelschmidt. Z. Elektrochem., 1906, 12, 737.

The formation of nickel peroxide at the anode, which is noted in the electrolysis of nickel salts in ammoniacal or oxalic acid solutions is followed by a re-dissolving of the deposit. The formation and disappearance of the peroxide occur periodically. This is clearly observed by the deflections of the ammeter and voltmeter. The potential difference between the electrodes increases with the formation of the deposit, and falls with its re-dissolving. In ammoniacal solutions the periodic deflections are first observed when almost all the nickel has been deposited; they cease so soon as the metal is completely removed from the electrolyte. In oxalate solutions the phenomena are still more marked, and commence at an earlier stage.
—R. S. H.

English Patents.

Batteries; Primary ——. C. Ruzicka, London. Eng. Pat. 18,931, Sept. 19, 1905.

The battery comprises a hermetically-sealed vessel containing electrodes consisting of frames, perforated plates, or gauze sheets, composed of two different metals, or of a metal and a metallic carbide, or of a metallic carbide and carbon, wholly or partially coated, or charged, with like substances of an electro-conductive character, or capable of being rendered electro-conductive. The electrolyte may consist of chlorine, fluorine, oxygen, nitrogen, or hydrogen, under sufficient pressure to maintain it, or a portion of it, in the liquid state, or it may consist of water, or other suitable liquid, having in solution salts of metals, the oxides of which are strongly caustic, the liquid being charged with chlorine, or other suitable gas, under a pressure above that of the atmosphere.—B. N.

Wood; Treatment of —— to be used in electro-chemical apparatus. D. H. Whitehead and Q. Marino, London. Eng. Pat. 20,143, Oct. 5, 1905.

Wood, to be used for the construction of the diaphragms or cells of electric batteries or accumulators, in the form of plates, tubes, or the like, is submitted to the influence of an "ammoniacal-cupreous" liquor, and afterwards to a bath of "liquid ammonia" (sp. gr. 0·88). The wood is then withdrawn, well washed in water, and immersed in nitric acid, after which it is submitted to the action of sulphurous acid. Finally it is immersed in a solution composed of alcohol, caustic potash, and ethyl acetate in various proportions. The wood is thus rendered porous and permeable to the electric current, whilst remaining neutral to the electro-chemical reactions. A modification is described in which, at the end of the above processes, a bath of ammonia solution is employed, in order to render neutral the wood impregnated with the "sulpho-nitric" liquid.—B. N.

Mercury electrolytes for electrolytic cells. H. S. Hatfield and The Reason Manufacturing Co., Ltd., Brighton. Eng. Pat. 20,500, Oct. 10, 1905.

The electrolyte, for use in electrolytic electricity meters, consists of a solution of a double salt, or two or more salts such as mercuric iodide and potassium iodide.
—B. N.

Furnaces; Electric —— for treating gases. H. Pauling, Gelsenkirchen IV., Westphalia. Eng. Pat. 8452, April 9, 1906.

The gas is subjected to the action of electrical discharges between a pair of diverging electrodes, the gas being separated into two currents of different velocities which are passed between the opposite ends of the electrodes. One current of gas serves to convey the electric discharges from the place where they are formed, thus preventing short-circuiting, whilst the other current causes the discharges, thus conveyed, to continue their propagation along the electrodes, so as to form arcs of the desired great lengths.
—B. N.

Emulsions of mercury or other conducting substances; Process and apparatus for making ——. E. Lederer, Vienna. Eng. Pat. 18,513, Sept. 13, 1905.

For obtaining very fine emulsions of metals for making salves, &c., a continuous electrical sparking is brought about between two electrodes, whereby the cathode metal in thrown off in a fine state of division. The disintegration is brought about in media such as vaseline, tallow, or lanolin, which during the process are in the molten condition but subsequently become hard or set. The electrodes are caused to come together and are separated by the action of the electric current, which traverses a solenoid, within which is an iron core attached to one of the electrodes. Several forms of construction are described.—R. S. H.

Chromic acid; Electrolytic production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 27,009, Dec. 27, 1905.

This invention relates to a process of manufacturing chromic acid by electrolytically oxidising a chromium compound of a lower degree of oxidation in an acid solution. A cell is employed in which the cathode and anode are separated from each other by a wall, which does not reach to the bottom of the cell, the solution to be electrolysed being supplied in such a manner that the inner or cathode compartment always contains a sufficient quantity of the acid to allow the electrolysis to proceed properly. The solution is preferably introduced, either continuously or intermittently, as a layer near to the bottom of the cell, so that it approaches the anode at the points of greatest current density, and afterwards passes to the points of lower current density. Two examples of results are given, with the proportions of substances used, in one of which 83 per cent. of the chromium was oxidised, 87·5 per cent. of the current supplied being utilised, and in the other, 84 to 90 per cent. of the chromium was oxidised, 78 per cent. of the current being utilised.—B. N.

Hypochlorite solutions; [Electrolytic] Manufacture of ——. W. P. Digby and A. W. M. Marshall, London. Eng. Pat. 915, Jan. 12, 1906.

In the production of hypochlorites by the electrolysis of saline solutions, a diaphragm of ebonite, slate, or other suitable non-porous material is interposed between the anode and cathode. The diaphragm is provided with a number of small perforations in the portion below the liquid level. By having a higher level of liquid in the cathode chamber or by other means, the electrolyte is caused to pass through the perforations, and impinge upon the anode surface.—R. S. H.

Alkaline chloride solutions; Apparatus for the electrolytic decomposition of —— by means of mercury cathodes. J. J. Rink, Copenhagen. Eng. Pat. 10,219, May 1, 1906.

See Fr. Pat. 365,838 of 1906; following these.—T. F. B.

UNITED STATES PATENTS.

Insulating material and process of manufacturing same. J. Billwiller, Goldach, Switzerland. U.S. Pat. 831,321, Sept. 18, 1906.

See Fr. Pat. 349,850 of 1904; this J., 1905, 739.—T. F. B.

Furnace; Electric ——. E. A. Storey, Newark, N.J. U.S. Pat. 832,511, Oct. 2, 1906.

This invention relates to an electric or dielectric furnace, and comprises a furnace proper, with conductors arranged horizontally and extending through opposite walls of the furnace, and a "resistor" supported by the inner ends of the conductors. Other conductors, supported by the furnace and movable vertically, are arranged to make contact with the "resistor," all the conductors being freely movable into and out of operative position. Tracks are supported within the furnace, and a wagon moves on these, means being provided for moving the wagon lengthwise of the furnace.—B. N.

Air or other gases; Electrically treating ——. J. H. Bridge, Philadelphia, Pa. U.S. Pat. 832,767, Oct. 9, 1906.

This invention relates to a method of electrically treating air or other gas by the silent discharge, a number of annular electric discharges, surrounding a corresponding number of air spaces, being formed on the surface of a perforated electrode. Air is passed, from the under side of the electrode, through the perforations, in minute streams into the interior of the air spaces. Each stream of air, emerging from the perforations, is continued in the form of an outward jet from the surface of the electrode, whilst simultaneously the electric discharge is caused to assume an elongated shape in the same plane as the air current, and substantially surrounding it. The jet of air is then caused to break through the luminous walls of the discharge, thus securing actual contact with it. The streams of air are finally re-united, and led in bulk away from the action of the electric discharges.—B. N.

Electrifier for treating air or other gas. J. H. Bridge, Philadelphia, Pa. U.S. Pat. 832,768, Oct. 9, 1906.

The electrifier comprises solid and perforated tubular electrodes concentrically arranged with respect to each other, with an insulating means adapted to close the electrodes at one end, and form in conjunction with the electrodes an inlet and outlet for the air to be treated. Each electrode is provided with a conductor; a fuse and disc forming part of the conductor for the positive electrode. The disc is so arranged that, when the fuse is destroyed by an excessive electric current passing through, it closes the inlet for air leading to the electrodes.—B. N.

Electrode for use in the manufacture of bleaching liquor. R. Kother, Cunewalde, Germany, Assignor to C.E. Waithman, Gaddum, Cheshire. U.S. Pat. 832,983, Oct. 9, 1906.

See Eng. Pat. 21,437 of 1905; this J., 1906, 379.—T. F. B.

FRENCH PATENTS.

Voltaic arcs of great size; Production of ——. Badische Anilin und Soda Fabrik. Second Addition, dated April 26, 1906 (under Int. Conv., Feb. 26 and 27, 1906), to Fr. Pat. 357,358, Aug. 30, 1905.

By using several reaction tubes and polyphase currents, the arcs may be directly connected without the use of a counter-electrode. Several insulated electrodes may be mounted in the interior of each tube.—B. N.

Electrodes and filaments of pure graphite for electric lamps. M. Cresta. Fr. Pat. 366,142, May 12, 1906. II., page 1035.

Incandescence electric lamps; Process of making conductive connections, of metallic character, between the filaments and current leads of ——. H. Kusel. Fr. Pat. 366,267, May 16, 1906. II., page 1035.

Salts of the oxyhalogen acids; Electrolytic production of ——. Deutsche Solvay-Werke A.-G. Second Addition, dated April 20, 1906, to Fr. Pat. 362,737, Jan. 10, 1906. (See also this J., 1906, 766 and 891.)

In the electrolysis of the halogen salts of the alkali and alkaline-earth metals in cells without diaphragms with a view to producing salts of the oxyhalogen acids, soluble compounds of lead, copper, antimony, or selenium are added to the electrolyte. These additions limit considerably the wasteful cathodic reduction.—R. S. H.

Electrolysis of solutions of alkali chlorides, with mercury cathode; Apparatus for the ——. J. J. Rink. Fr. Pat. 365,838, May 2, 1906.

A diaphragm of asbestos or other suitable material separates the cell into two chambers, each of which is provided with a circulation system for the solution of the alkali chloride. In this manner the salt solution in proximity to the mercury cathode is exempt from dissolved chlorine. The amalgam is decomposed in a separate chamber, where it falls in a thin stream over suspended sheets of metal.—R. S. H.

Fertiliser; Highly nitrogenous product specially suitable as a ——, and process of making the same. Soc. d'Electro-Chimie. Fr. Pat. 366,376, May 18, 1906. XV., page 1059.

[*Electrical*] *Fusion of corrosive or non-corrosive substances* [*Sodium peroxide*]. The Roessler and Hasslacher Chemical Co. Fr. Pat. 366,523, May 23, 1906.

The material to be fused is contained in a vessel the walls of which are cooled by water, and thus remain coated with a protective layer of unfused material. Electrodes of sheet copper or other metal are supported inside the vessel at some distance from the walls, and are connected to a source of alternating current, which can be regulated to the desired intensity. For the commencement of the operation the two electrodes are short-circuited by a resistance; but so soon as a mass of the fused material fills the space between the electrodes, the process can be carried on continuously, fresh quantities of the substance being fed in at the surface, and the fused product being allowed to flow out of the vessel in corresponding amount. The operation is described in its application to the fusion of sodium peroxide. The current density in this case should range between 235 and 390 amperes per sq. dm. of the submerged electrodes. Provided the current is not interrupted, and the water cooling of the vessel is maintained, the sodium peroxide is undecomposed, and the vessel and electrodes are not attacked.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

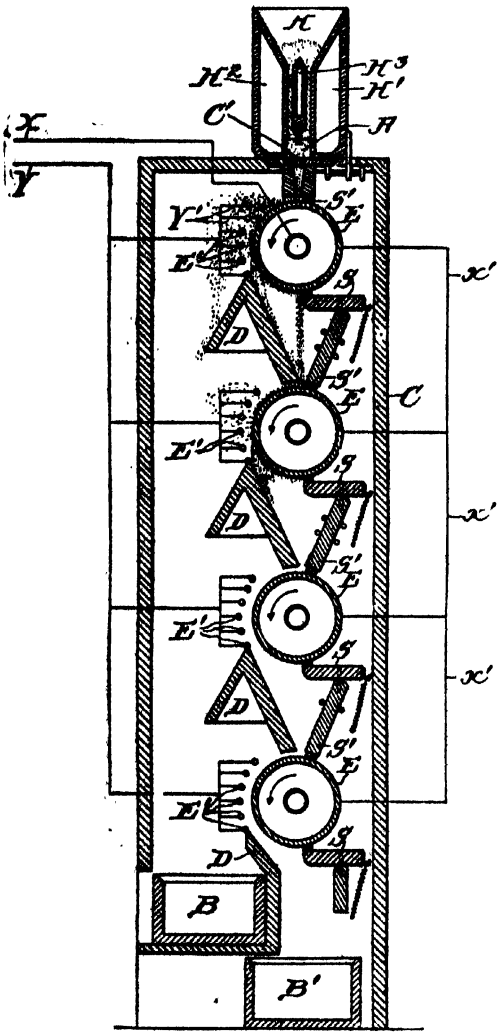
Fused electrolytes; Factory scale experiments with —— Part III. E. A. Ashcroft. Electrochem. and Met. Ind., 1906, 4, 357—358. (See also this J., 1906, 594.)

The author describes several possible applications of his electrolytic apparatus with two chambers, and magnetic stirring and circulation of the intermediate electrode. In the treatment of mixed ores, it is proposed to electrolyse the sulphide ore directly, all the metals being deposited on to the fluid lead cathode by the aid of a high current density, the sulphur distilling off and being collected. In the second compartment, the metals are dissolved at the anode, and are received fractionally upon a suitable cathode. A special form of magnetically rotating disc is described, which would be applicable as a cathode for such purposes. The molten metals separating on these discs are collected after being thrown off from the periphery or by the centrifugal action are forced inwards along spiral grooves towards the centre. In the case of solid metals, the condition of the deposit is improved by the friction with the molten electrolyte resulting from the rotation of the disc.—R. S. H.

UNITED STATES PATENTS.

Electrostatic separation; Method of and apparatus for ——. C. W. Pickard, Amesbury, Mass., Assignor to Huff Electrostatic Separator Co., Maine. U.S. Pats. 827,115 and 827,116, July 31, 1906.

THE patents relate to a process and apparatus for electrostatically separating or concentrating mixed comminuted materials. The apparatus consists of a casing, C, in which hollow, cylindrical, metallic electrodes, E, are mounted one above the other on hollow trunnions. These electrodes rotate in the direction indicated by the arrows, and are connected by the wires, X, x^1, to one pole of a source of, electricity (preferably that described in U.S. Pat. 796,011 of 1905), of which the other pole is connected by the wires, Y, Y^1, to the electrodes, E^1, of fine metal wires enclosed in relatively thick glass tubes. The feed-hopper, H, is provided with heating chambers, H^1, H^2, and H^3, into which hot gases are passed. Hot gases are also passed through the electrodes, E. The ore is fed from the hopper, by means of an agitator disposed at A, through the slot, C^1, on to the upper electrode, E, and then falls in succession on to the other electrodes. The attracted particles collect in the bin, B^1, and the repelled particles in B, the two streams of falling material being separated by the dividing plates, D. Any material adhering to the rotating electrodes is removed by the scrapers, S, S^1.—A. S.



Zinc; Process for the electrolytic production of ——. V. Engelhardt, Vienna, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 831,843, Sept. 25, 1906.

SEE Eng. Pat. 16,396 of 1904; this J., 1904, 1098.—T. F. B.

FRENCH PATENTS.

Electric induction furnace for high frequency currents. Schneider et Cie. Fr. Pat. 361,627, July 13, 1905.

THE furnace consists of a chamber or crucible of refractory material, which contains the metal to be treated. The outer wall of the furnace is bound and supported by a solenoid of copper or other metal through which a high frequency alternating current is passed. The solenoid may consist of a number of separate, broken, and insulated coils, which are connected electrically in series.—R. S. H.

Induction furnace for continuous fusion. A. Hiorth. Fr. Pat. 365,655, April 23, 1906. Under Int. Conv., Jan. 4, 1906.

IN electric furnaces of the induction type, a common primary coil is employed for two or more furnaces. The iron core is constructed so as to be detachable in sections, and it is arranged so that it can serve alternatively or simultaneously for two or more furnaces. The chief object of the invention is to ensure the continuity of the production, and avoid delays caused by the relining of the furnaces which require a slow and lengthy drying.—R. S. H.

Electric [Induction] furnace. Röchling'sche Eisen und Stahlwerke G. m. b. H. and W. Rodenhauser. Fr. Pat. 366,440, May 21, 1906.

THE furnace, which is intended for the production of steel by the refining of pig-iron, or for other metallurgical purposes, is characterised by the fact that the primary coils serve for inducing current in two or more separate secondary circuits. In the first place, a secondary is formed by the charge of metal contained in an annular channel surrounding the primary. This annular channel is widened out at the sides of the furnace so as to form chambers containing a considerable mass of the charge. An auxiliary secondary circuit is formed of copper coils, wound over or between the primary windings, these coils being connected to conducting blocks or electrodes placed at the sides of the furnace and in contact with the charge. The currents in the two secondary circuits thus superimpose their effects in heating the charge in the furnace. It is proposed to construct the secondary coils of copper tubes through which a water circulation is kept up, and thus utilise them for protecting the walls of the furnace and the primary coils from excessive heating.—R. S. H.

Electro-deposition of metal upon metal plates. Hille und Müller. Fr. Pat. 365,456, April 20, 1906. Under Int. Conv., April 22, 1905.

THE metal plates or sheets, upon which it is desired to deposit a film of metal electrolytically, are joined together to form a continuous band, which is transported through the various vats in a similar manner to an ordinary straight band of metal.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 996.)

Castor oil; Caucasian ——. O. Liebreich. Therap. Monats., 1906, 20, 444.

A SPECIMEN of expressed castor oil, from the Caucasus, which had been kept by the author for eight years gave the usual characteristic numbers. When 8 c.c. were shaken with 3 c.c. of carbon bisulphide and 1 c.c. of strong

sulphuric acid, a brown-orange colour was produced. Under similar conditions the best Italian castor oil gave a yellow-red colour-reaction. The latter had a higher free acid value, 7·3; the acid value of fresh oil, extracted from Caucasian seeds with ether, was only 2·6.—J. O. B.

Oleic acid; Constitution of ——, *and action of ozone on oils and fats.* E. Molinari and E. Soncini. Ber., 1906, **39**, 2735—2744.

Ozone value of oils.—The saturated fatty acids of linseed oil were found to absorb no ozone, whilst the unsaturated fatty acids took it up quantitatively. A good solvent to prevent the substance becoming viscid under the action of the gas was found in hexane, which could be easily expelled, after the reaction, by means of a current of ozone. The authors determined the ozone values of various oils (maize, castor, rape, &c.), and found that the increase of weight corresponded with the amount calculated from the iodine value. Thus, linseed oil with an iodine value of 171 absorbed 30 per cent. of ozone, as against the theoretical 32·3 per cent.

New method of determining ozone.—Ordinary olein was used as the absorbing agent, and it was found that the increase in weight corresponded with the amount of ozone absorbed.

Action of ozone on oleic acid.—Oleic acid prepared by the authors was purified, and gave a product with the correct elementary composition, and an iodine value of 90·03. On treating a solution of 10 grms. of this acid in glacial acetic acid with ozone, the increase in weight was 1·70 grms., showing that 1 mol. of oleic acid had absorbed 1 mol. of ozone (O_3). The oleic acid ozonide produced was a viscous, almost colourless, transparent liquid, heavier than water, and absorbing no iodine. It was stable up to 80° or 90° C., but decomposed on raising the temperature. Its elementary composition and molecular weight corresponded with the formula $C_{18}H_{34}O_5$. It had only a slight reducing action on Fehling's solution. No salts could be prepared owing to the readiness with which it decomposed by water in the presence of alkalis. When decomposed by dry or moist heat, it yielded five products—a mobile liquid (b.pt. about 190° C.) with a pungent pleasant odour, and four fatty acids, *viz.*, azelaic acid, normal nonylic acid, and two others separable by distillation *in vacuo*. From a study of these decomposition products, and the mode of their formation, the authors came to the conclusion that the double bond of oleic acid must be in the middle of the normal chain between C_9 and C_{10}, and that the following equation represented the formation of the ozonide:—

$$CH_3(CH_2)_7.CH:CH.(CH_2)_7.COOH + O_3 = CH_3(CH_2)_7.CH.CH.(CH_2)_7COOH$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad O.O.O.$$

The authors consider that their results prove conclusively that oleic acid absorbs three atoms of oxygen and not four as found by Harries (Ber., 1905, 1630).—C. A. M.

Oleic acid; Ozonides of ——. C. Harries and C. Thieme. Ber., 1906, **39**, 2844—2846.

In a previous communication (Annalen, 1906, **343**, 318), the authors showed that on treating a solution of oleic acid in chloroform with ozone, a thick syrup was produced, and the addition compound was found to have absorbed 4 atoms of oxygen. They now find that if this substance be washed with water containing sodium bicarbonate, dried, and extracted with ether, the new product is a liquid containing only 3 atoms of absorbed oxygen. Hence they term their former product oleic acid perozonide, and the new one normal oleic acid ozonide. The perozonide obtained quantitatively by their former method can be purified by being dissolved in ethyl acetate and precipitated by petroleum spirit. It is a colourless, almost glass-like product, which gradually breaks up on contact with water, yielding a deposit of azelaic acid. The normal ozonide is a colourless viscous oil, which is also slowly decomposed by water yielding varying amounts of azelaic acid. The two ozonides differ mainly in regard to their behaviour with water, the perozonide giving a far more pronounced reaction for hydrogen peroxide than does the normal ozonide. The decomposition products of both with water are qualitatively identical, *viz.*, azelaic and nonylic acids or their aldehydes. The constitutional formula given for the normal ozonide is the same as that given by Molinari and Soncini (see preceding abstract).—C. A. M.

Butter; Detection of cocoanut oil and margarine in ——. L. Robin. Compt. rend., 1906, **143**, 512—514.

The fatty acids obtained from cocoanut oil are almost entirely soluble in 60 per cent.. alcohol, at a temperature of 15° C., whilst the fatty acids of pure butter are only partially soluble, and those of margarine very slightly soluble. It is well known that the proportion of the fatty acids which are soluble in water, is greater in the case of butter than in the case of cocoanut oil and margarine, and that cocoanut oil yields a far larger quantity of fatty acids soluble in 60 per cent. alcohol, but insoluble in water, than do butter and margarine. On these facts the author bases a method for the detection of cocoanut oil or margarine, or mixtures of the same, in butter. The details of the process are as follows:—Five grms. of the sample are placed in a graduated 150 c.c. flask, 25 c.c. of alcoholic potassium hydroxide solution are added, the flask is attached to a reflux condenser, and the contents gently boiled for five minutes, to saponify the fat. After the solution has cooled a little, water is added to bring the percentage of alcohol in the mixture to about 56·5. Sufficient N/2 alcoholic hydrochloric acid is now added to neutralise the excess of potassium hydroxide exactly, and liberate the fatty acids from the soap. The hydrochloric acid is prepared by mixing the requisite amount of acid with alcohol, diluting with water until the solution contains 56·5 per cent. of alcohol, and then adding 56·5 per cent. alcohol to make the solution half normal. The quantity of acid to be added to the soap solution is ascertained by titrating a separate quantity of 25 c.c. of the potassium hydroxide solution with the acid. The contents of the flask are now cooled to 15° C., made up to 150 c.c. with 56·5 per cent. alcohol, mixed, and filtered. Fifty c.c. of the filtrate are titrated with N/10 alkali, using phenolphthalein as indicator. The result, expressed in c.c. of N/10 alkali per 1 grm. of fat, represents *the fatty acids soluble in 56·5 per cent. alcohol.* Another 50 c.c. of the filtrate are evaporated to a volume of 15 c.c., the separated fatty acids are collected on a wet filter, washed four times with cold water, then dissolved in alcohol, and the solution titrated. The result expresses *the fatty acids insoluble in water, but soluble in 56·5 per cent. alcohol.* The difference between the above two results gives *the fatty acids soluble in water.* The following figures were obtained as the results of a large number of experiments:—

	Soluble in alcohol.	Insoluble in water. (a).	Soluble in water. (b)	Ratio: $\frac{(a)}{(b)} \times 10$
Pure butter, maximum	14·82	2·31	6·66	12·7
Do. do. minimum	11·67	5·51	5·92	9·3
Margarine	2·67	2·56	0·11	232·7
Cocoanut oil	46·69	44·71	1·98	225·9

Analyses of mixtures containing from 5 to 14 per cent. of cocoanut oil or margarine, gave results which show that the method is capable of detecting this kind of adulteration. The figures given above do not represent the exact measure of the quantities of the various fatty acids in the fractions, as no account was taken of the fatty acids which were insoluble in 56·5 per cent. alcohol, their volume being ignored in making up the total volume to 150 c.c. This is, however, of no importance if the conditions as above laid down, be followed.—W. P. S.

Arachis oil-cake; Poisonous action of ——. E. Krüger. XVIIIA., page 1062.

Cholesterol and phytosterol; Method for the separation of ——. A. Windaus. XXIII., page 1069.

ENGLISH PATENT.

Filtering apparatus more particularly adapted for the extraction of stearine from fatty acids in sulpho-oleic acid solution. M. Lanza, Turin, Italy. Eng. Pat. 11,877, May 21, 1906.

SEE Fr. Pat. 366,457 of 1906; following these.—T. F. B.

UNITED STATES PATENT.

Soap-drying machine. F. H. Merrill, Los Angeles, Cal. U.S. Pat. 831,884, Sept. 25, 1906.

THE soap is discharged by means of an elevator into a bin provided with a series of deflectors, sloping downwards, and having an air space between each. Or there may be a combination of two such bins, with the deflectors on their inner and outer walls. A deflector at the top directs the soap into either bin, and there is an air chamber below the partition between the bins, and a deflector for directing the air upwards from this chamber to either side of the partition. The soap is divided in a machine before reaching the elevator, and is distributed by means of spreaders before entering the bins.—C. A. M.

FRENCH PATENTS.

Filter particularly suitable for the separation of solid fatty acids from sulpholeic acid. M. Lanza. Fr. Pat. 366,457, May 21, 1906.

CLAIM is made for a filter specially suitable for the separation of solid particles in an emulsion. The lower part of the filtering material is in communication with an air-pump which produces alternate aspiration and compression, with the result that the fine particles which tend to clog the interstices are detached, clearing a passage for the liquid. For the separation of sulphonated fatty acids, the filter cloth is first covered with a fine layer of fatty acids which are washed several times at 25° C. with water acidified with sulphuric acid and containing a little sulpholeic acid.—C. A. M.

Oils and fats; Process of bleaching ——. H. A. Metz and P. S. Clarkson. Fr. Pat. 366,630, May 28, 1906.

TWO hundred parts of oil, such as maize oil, are agitated in a closed vessel for 10 hours with 600 parts of water and 15 parts of sodium hyposulphite (hydrosulphite). The mixture is then allowed to stand for about 32 hours, and the oil layer separated. Formaldehyde-sodium hyposulphite, $NaHSO_2.CH_2O$, may also be used; 10 parts of the compound are employed for the above-mentioned quantities of oil and water, the mixture is heated in a closed vessel to a temperature of 70° C., and then allowed to stand until bleaching has been effected. —W. P. S.

Waxes, varnish, rubber solutions, and analogous substances; Process of rendering —— *uninflammable.* V. A. Boucheron. Fr. Pat. 366,564, May 25, 1906.

THE claim is for the use of carbon tetrachloride as a substitute for the whole or part of the solvents usually employed in the preparation of solutions of waxes, resins, india-rubber, &c.—A. S.

Soap; Method of preparing a light and porous lime ——. C. Ferrier. Fr. Pat. 366,460, May 22, 1906.

CLAIM is made for the creation of a partial vacuum in the saponification of fats by means of lime in an "autoclave." This enables the steam to be maintained at a temperature below 100° C., with the result that the calcium soap produced is only slightly hydrated, very porous, and more suitable for further treatment than that obtained in the usual way.—C. A. M.

GERMAN PATENT.

Lubricants; Apparatus for testing ——. J. Walther. Ger. Pat. 171,181, May 29 1904. XXIII., page 1068.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 997.)

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Pigments; Manufacture of printing ink ——. P. Fireman, Braddock Heights, Va., U.S.A. Eng. Pat. 19,190, Sept. 22, 1905. Under Int. Conv., Jan. 19, 1905.

SEE U.S. Pat. 802,928 of 1905; this J., 1905, 1180.—T.F.B.

[*Zinc*] *Ores or zinc waste; Treatment of mixed or composite* ——, *and the manufacture of zinc white and other products therefrom.* J. W. Worsey, St. Helens, Lancs., and E. Hoal, Liverpool. Eng. Pat. 19,839, Oct. 2, 1905

THE treatment is especially applicable to poor zinc ore or dross, containing zinc (and other metals) in the form of oxide, carbonate, or sulphide. In the last case, the ore &c., is first desulphurised as usual in a kiln. The roasted ore is ground so as to pass through a 10 by 10-mesh sieve, and is then heated with its own weight of sulphuric acid, of 90° T., to which is added about 1 per cent. of nitric acid, sodium nitrate, or an equivalent salt; or else, if the ore contains silver, the nitrate is replaced by sodium chloride. The ore and acid are heated in a pan to about 300° F. until the mixture becomes pasty, the fumes given off being collected, and, together with the sulphur dioxide obtained in the roasting of the ore, utilised for making sulphuric acid. The pasty mixture is next heated at a dull red heat in a muffle furnace, air and steam being passed over it at the same time. When no more fumes are evolved, about 2 per cent. of ground quicklime or dolomite are spread over the charge, and worked into it to render the iron insoluble. The charge is then lixiviated in vats with boiling water, to which, or to the charge, sodium chloride has been added if the ore carries silver or lead, in order to convert these metals into insoluble chlorides. The solution of sulphates obtained, chiefly of zinc and copper, is freed from the latter metal by electrically depositing it on zinc plates. If iron is present, chlorine is added until the solution smells strongly of the gas, and the whole is agitated by blowers. The liquid is then neutralised by adding waste zinc oxide or calcium carbonate until a dark precipitate appears, when air is led in, and the liquid finally boiled, in order to remove any manganese, nickel, or other "subtle" metals present. The purified solution is allowed to settle, and filtered, after which an alkali sulphide or carbonate solution is added, and the whole boiled. The precipitated zinc pigment is filtered off, washed, dried, and ground as usual. (See also Eng. Pat. 3668 of 1900; this J., 1901, 367.)—A. G. L.

Dyeing and printing; Preparation of new products for use in ——, *and as pigments, and their applications.* E. Feilmann. Eng. Pat. 25,693, Dec. 11, 1905. V., page 1040.

FRENCH PATENTS.

Zinc white oil paint. Hentschel et Cie Commandit-Ges. Fr. Pat. 366,465, May 22, 1906.

ZINC white is mixed with an equal quantity (or more) of finely ground silica, and with some calcium carbonate, and then incorporated with a vehicle consisting of linseed oil, Japanese wood oil, and resin. Other preparations containing resin may be used in place of the Japanese wood oil.—A. S.

Silicon monoxide [*Pigment*]; *Method of transforming brown* —— *into white bioxide.* H. N. Potter. Fr. Pat. 366,644, May 28, 1906. Under Int. Conv., June 14, 1905.

SILICON monoxide, in the state of an impalpable light brown powder, is blown through a flame, whereby it is oxidised and whitened, whilst remaining pulverulent Fr. Pat. 360,375 of 1905 (this J., 1906, 546) is referred to. —E. S.

(B.)—RESINS, VARNISHES.

Colophony; Composition of American ——. P. Levy. Ber., 1906, **39**, 3042—3046.

In a former communication the author asserted that the main constituent of American colophony (yielding abietic acid) had the composition, $C_{20}H_{30}O_2$, and he here replies to certain objections of Klason and Köhler based on their examination of the crystallisable acid fraction of the resin of *Pinus abies*. He states that the acid prepared by him differs from that of other investigators chiefly in its greater power of crystallisation and in its considerably higher melting point. The form of the crystals has been proved to be identical with that already described for abietic acid. Fractional distillation *in vacuo* of American colophony has yielded a viscous substance, which, after being purified by treatment with ether and sodium hydroxide solution, is a colourless oil with slight refractive power, having the composition, $C_{19}H_{30}$, and boiling at 210°—211° C. under a pressure of 26·5 mm. It is fairly soluble in ether and benzene, but dissolves with difficulty in alcohol. Its specific gravity at 20° C. is 0·977. It appears to be formed from abietic acid thus—

$$C_{19}H_{29}COOH = C_{19}H_{30} + CO_2.$$

Decomposition of colophony on these lines has already been described by Easterfield and Bagley (this J., 1904, 989), and by Schwalbe on heating colophony under ordinary pressure. In the author's opinion the hydrocarbon, $C_{19}H_{30}$, is probably identical with Deville's "colophene" ($C_{40}H_{64}$) and with the "abietene" of Easterfield and Bagley ($C_{18}H_{28}$). He considers that both these formulæ should be rejected in the light of the formation of the hydrocarbon from abietic acid. The former assumption that abietic acid was derived from colophene is negatived by these facts. The action of phosphorus pentachloride or thionyl chloride on the acid yields the corresponding acid chloride, which, however, cannot be purified sufficiently for analysis, since it is decomposed even on distillation *in vacuo*. By repeated fractionation of the decomposition products the author has isolated a colourless oily body with an intense blue fluorescence. It boils at 200°—202° C. under a pressure of 17 mm., and has the composition, $C_{19}H_{28}$. This substance, which the author terms "abietin," behaves exactly like "abietene" with organic solvents. It appears to be one of the numerous products formed in the dry distillation of colophony, and the author represents its formation from abietic acid by the equation—

$$C_{19}H_{29}COOH = C_{19}H_{28} + CO + H_2O.$$

(See also this J., 1903, 1250.)—C. A. M.

United States Patents.

Varnishing composition and process of making same. A. E. Nienstadt, Newark, N.J. U.S. Pat. 831,736, Sept. 25, 1906.

Clear colourless preparations are obtained by deodorising gum-pontianac, freeing it from acid by treatment with alkali (*e.g.*, ammonia), washing it in cold water to remove the alkali, drying it, and dissolving it in a suitable solvent such as a liquid hydrocarbon. The gum-pontianac may be shredded into thin, irregularly perforated strips before deodorisation.—C. A. M.

Turpentine still. F. M. Gideon, Ballston, Va. U.S. Pat. 832,311, Oct. 2, 1906.

Claim is made for a still containing a basket of wire or like material suspended from the top, and having a perforated bottom kept in position by means of a catch upon a support below. The still has a movable head and a steam pipe beneath the basket, and means are provided for withdrawing the latter.—C. A. M.

Terpenes and rosin; Apparatus for extracting ——. G. A. Kerr, Lynchburg, Va. U.S. Pat. 832,863, Oct. 9, 1906.

The wood to be treated is fed continuously into one end of a still or digester, and discharged at the other end. It is conveyed through and agitated in the still by a conveyor, provided with a hollow shaft with openings through which steam is introduced into the still. At a number of points along the still, the steam, laden with terpenes, can escape. The wood passes by a conduit from the still to an extractor, within which is a similar conveyer having a hollow shaft and openings for the introduction of steam. The extractor is constructed to contain a rosin-extracting bath in it, provided with an outlet.—W. C. H.

Wood oil; Process for treating —— with oxidising agents. A. Kronstein, Karlsruhe, Germany. U.S. Pat. 833,063, Oct. 9, 1906.

See Eng. Pat. 1386 of 1901; this J., 1901, 485.—T. F. B.

French Patents.

Varnish and paint; Manufacture of ——. E. A. Ruch. Fr. Pat. 361,664, Aug. 2, 1905.

Claim is made for the use of aluminium resinate in the preparation of varnishes and paints by incorporating it with oil of turpentine or the like, with or without the addition of colouring matters.—A. S.

Waxes, varnish, rubber solutions, and analogous substances; Process of rendering —— uninflammable. V. A. Boucheron. Fr. Pat. 366,564, May 25, 1906. XII., page 1056.

(C.)—INDIA-RUBBER, &c.

Mollendo biscuit rubber; Analysis of ——, *and the valuation of raw rubber.* D. Spence. Quarter. J. Inst. of Comm. Research in the Tropics, Liverpool Univ., 1906, **1**, 183—184.

The author points out the uselessness of judging raw rubbers from their appearance and physical characters. A specimen of raw Mollendo biscuit rubber, which, from outward appearance, seemed to be of inferior quality, proved to contain less proteid and resinous impurities than are frequently found in the finest Para rubber. Its elasticity was good, and it withstood fairly high temperatures without showing signs of "tackiness." The following are the results of the chemical analysis:—Caoutchouc, 79·05; resin, 1·80; insoluble matter, 2·35 (proteids, 1·6); moisture, 16·6, and ash, 0·50 per cent. The rubber was thus of first-grade quality, but very imperfectly freed from moisture. It was valued at 4*s.* 10*d.* per lb. as compared with 5*s.* 2*d.* per lb. for fine Para rubber.—A. S.

United States Patent.

Gum chicle or other adhesive; Process for purifying ——. S. A. Davis and F. V. Canning, New York. U.S. Pat. 831,041, Sept. 18, 1906.

The material is heated until it "flows"; it is then placed in a screening bag, or sack, and passed between steam-heated compression rollers or rods.—W. P. S.

French Patents.

Rubber substitute; Process for the manufacture of a ——. E. Luserna di Rora. Fr. Pat. 366,191, Jan. 31, 1906.

Forty-eight grms. of glue are dissolved in 352 grms. of hot water, and a solution of 28 grms. of tannic acid in 372 grms. of hot water is added. The precipitate is separated, dissolved in castor oil, and the solution mixed with an equal volume of ether. The mixture is treated with one-tenth of its weight of guncotton, and when this is dissolved, the mass is subjected to the action of "CO_2, CO_2 and C_2H_2" for 10—15 minutes in a closed vessel, after which it is evaporated until it acquires the consistence of rubber. The product can, it is stated, be vulcanised in the same way as natural rubber.—A. S.

Caoutchouc; Manufacture of ——. M. Wildermann. Fr. Pat. 366,704, May 30, 1906.

If from 2 to 4 grms. of raw rubber be treated for some

time in a flask with 30 c.c. of chloroform, and then agitated with a further 270 c.c. of chloroform, and heated on the water-bath, the whole of the rubber dissolves with the exception of mechanical impurities. If, then, alcohol be added drop by drop, without agitation, until a permanent turbidity is produced, and the whole allowed to stand, a considerable quantity of a flocculent precipitate ("caoutchouc α") is obtained. After this is removed, a second quality of caoutchouc ("caoutchouc β") can be separated from the solution by the addition of a further 500 c.c. of alcohol. The evaporation residue of the filtrate from this product contains the remainder of the caoutchouc and the resin. If it be extracted with boiling absolute alcohol, the resin is dissolved, and a third quality of caoutchouc ("caoutchouc γ") is left. The present patent relates to a method of treating raw caoutchouc on an industrial scale, and by an economical process, so as to separate it into caoutchouc α on the one hand, and caoutchouc β and γ and resin on the other, or into caoutchouc α and β and caoutchouc γ and resin. The apparatus for carrying out the process comprises a dissolving vessel, a drainage vessel, condensers, and receptacles for the solvents, together with circulating and exhaust pumps, and the necessary connections. Heating coils are provided in the dissolving and drainage vessels. The crude rubber is placed in pans which are disposed between the turns of the heating coil in the dissolving chamber. A mixture of suitable solvents, of which one (chloroform, benzene, carbon tetrachloride, solvent naphtha) will dissolve the whole of the rubber, whilst the other (ethyl or methyl alcohol) will only dissolve the resins or other constituents which it is desired to remove, is forced by the circulating pump into the dissolving tank, and after a certain time (about 12 hours) the solution containing the resin, &c., is allowed to pass into the drainage vessel, leaving behind either caoutchouc α or caoutchouc α and β, according to the composition of the solvent used. The solvent is next evaporated from the residual caoutchouc and from the solution of resin, &c., the apparatus during this part of the process being connected to the exhaust pump; the vapours pass to the condensers, and the condensed solvent is returned to its receptacle.—A. S.

Waxes, varnish, rubber solutions, and analogous substances; Process of rendering —— uninflammable. V. A. Boucheron. Fr. Pat. 366,564, May 25, 1906. XII., page 1056.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 997.)

Gelatin rendered insoluble by formaldehyde. A. L. Lumière and A. Seyewetz. Bull. Soc. Chim., 1906, **35**, 872—879.

THE maximum amount of formaldehyde which is permanently absorbed by gelatin is between 4·0 and 4·8 grms. per 100 grms. of dry gelatin; this absorption takes place when a 10 per cent. formaldehyde solution acts on dry gelatin; any increase of this concentration results in smaller absorption of formaldehyde; variations of temperature have little effect on the absorption. When gaseous formaldehyde is brought into contact with gelatin, the absorption is much slower, but the maximum is the same as when absorption takes place in aqueous solution. Hot water slowly decomposes formolised gelatin, repeated treatment rendering the gelatin completely soluble. When heated alone at 110° C., formolised gelatin evolves formaldehyde, whilst treatment with 15 per cent. hydrochloric acid resolves it, in the cold, into gelatin and formaldehyde. The aldehydic group could not be detected in formolised gelatin, which is regarded rather as an addition product than a true compound.—T. F. B.

Chromed hide powder question; The ——. F. Kopecky. Collegium, 1906, 97—100, 101—108, 110—116, 117—124, 125—128.

A CONTINUATION of work published in Collegium, 1904, Nos. 116, 117 (this J., 1904, 830). For the manufacture of a good chromed hide-powder, the inferior parts of a hide, such as shoulders and flanks, are quite suitable, and the fibrous part is more so than the compact grain surface. The very serious mechanical difficulties of grinding raw hide are almost entirely overcome by chroming the material before grinding. It is important, however, that the material should be uniformly chromed throughout its substance, as an insufficiently chromed streak in the centre yields an irregular and too soluble powder. Chromed powder absorbs slightly more of the bodies present in tanning materials than unchromed, but excessive chroming causes unsatisfactory action by preventing sufficient absorption of water. Chrome oxide itself has practically no absorptive power for tannin. A good neutral powder is made by chroming hide-bellies previously delimed by a sour bran drench, with 10 per cent. of chrome alum and 3½ per cent. of washing soda on the wet weight of hide. The materials are dissolved separately in the cold, and the mixed solution is added gradually to the hide, revolving with water in a drum. The tannage must be slow, lasting about 18 hours. The leather is neutralised with 3 per cent. of borax, partially dried, and shaved thin in the shaving machine, the grains being finished as leather, and the shavings thoroughly washed, dried, and ground. Good analyses can be made with the shavings of commercial box-calf simply washed and used moist. The use of the chromed powder in detanning by the filter bell, by maceration, and by shaking with the tannin solution was studied, and by experiments with known mixtures of tannin with dextrin and gallic acid, it was shown that a smaller proportion of non-tanning matters was absorbed by the two latter methods, which were therefore to be preferred. The method recommended for the determination of non-tannins is as follows, all manipulations, except detannisation, being carried out according to the rules of the International Association: The dry chromed powder is soaked for at least six hours, and is then squeezed in cheese-cloth until the excess of water is removed. Thirty grms. of this wet powder, still containing about 70 per cent. of moisture as determined by drying a weighed portion, are added to 150 c.c. of the tannin solution, and left for one hour, stirring about three times during this period. The mixture is now poured on to a filter paper and allowed to run through, returning the filtrate twice to the funnel. Fifty c.c. of the filtrate are evaporated, the residue dried and weighed, a correction being made for the water introduced by the wet powder. In the filter bell the absorption of the tannin takes place in a comparatively limited quantity of powder, and the author believes that acids are given up by the portion of powder in which absorption takes place, which are again absorbed in the upper part of the filter bell, where the powder is not acted on by tannin. The tendency of chrome powder to give higher figures for non-tannins in the maceration and shaking methods, as compared to the filter process, is due to lessened absorption of the non-tannin substances, and not to soluble hide substance; the powder even after boiling for half an hour, gives practically the same results as powder soaked in cold water overnight. It was found that, whilst gallotannic acid was readily and completely absorbed by neutral, chromed hide-powder, this was not the case with neutral liquors of mangrove and some other tanning materials unless acid was added. An exhaustive study of the effect of addition of various acids to the chrome powder was made, and it was found that formic or acetic acid were more suitable than either sulphuric or lactic acid, but were too volatile, and that it was more satisfactory to acidify the tanning solution than to use acidulated chrome powder. The author extends his work to the analysis of spent and fermented tan-liquors, which naturally contain organic acids, which are more or less absorbed by the hide-powder. The amount of non-volatile acid absorbed by the hide-powder, and therefore estimated as tannin, can be determined by titration of the residues of tannins and non-tannins respectively, if the nature of the acid can be assumed. Titration by Procter's method with lime-water of residues of a liquor to which known quantities of lactic acid had been added, gave very satisfactory results.—H. Bn.

UNITED STATES PATENTS.

Leather and process of manufacturing same. B. Trenckmann, Assignor to Zephyrlederfabrik Ges. m. b. H., Schöneberg, Germany. U.S. Pat. 831,491, Sept. 18, 1906.

SEE Fr. Pat. 340,486 of 1904; this J., 1904, 830.—T. F. B.

Glue and gelatin from bones; Method of manufacturing ——. H. Hilbert, Heufeld, Germany. U.S. Pat. 833,053, Oct. 9, 1906.

SEE Fr. Pat. 348,045 of 1904; this J., 1905, 628.—T. F. B.

FRENCH PATENTS.

Waterproofing solution [Coal-tar dissolved in petroleum, for leather, paper, &c.]. G. Mongauzi. Fr. Pat. 365,374, March 26, 1906.

PETROLEUM (1 litre) is added to coal-tar (1 kilo.), heated to a temperature of 60° C. The two are mixed together, and the mixture allowed to stand for a few minutes. The clear solution is then decanted or withdrawn from the residue, which is again heated and treated with petroleum. The solution is applied to leather, *e.g.*, shoes, &c., paper, or other materials, to render them water-resistant.—E. B.

XV.—MANURES, &c.

(*Continued from page 997.*)

FRENCH PATENT.

Fertiliser; Highly-nitrogenous product specially suitable as a ——, *and process of making the same.* Soc. d'Electro-Chimie. Fr. Pat. 366,376, May 18, 1906.

THE process is intended specially for works in which electrical power is used. Part of the electrical energy is used for the production of nitric acid from atmospheric nitrogen, and part for the manufacture of calcium carbide, from which calcium cyanamide is obtained by the action of nitrogen. The more or less concentrated nitric acid is then neutralised with the calcium cyanamide, the resulting product forming a mixture of calcium nitrate, cyanamide nitrate, and secondary products, such as nitrate of urea, ammonium nitrate, &c. The dried mass contains 20—25 per cent. of nitrogen.—C. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page 998.*)

Sugar cane; Composition and percentage of woody fibre in ——. *Value of bagasse as fuel.* H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, 24, 277—284.

THE author has made a critical examination of a paper by Prinsen-Geerligs (Archief voor de Java Suikerindustrie, 1906, No. 7), in which results of analytical and calorimetric estimations of various samples of bagasse are given. Fifty-eight samples of woody fibre, from various kinds of sugar cane, gave the following results: Sugar, 2·92—8·46 per cent.; water, 39·25—52·51; ash, 1·04—4·91; silica, 0·75—3·88; and cellulose, 43·43—61·08. The amount of woody fibre in the canes varied between 8·24 and 19·1 per cent. The calorific power of several of the samples of bagasse was also estimated; the results did not differ much, and not nearly enough to explain the great variations observed in the fuel values of different bagasses. The differences also in the amounts of cellulose were insufficient to account for the variations of the fuel value, although canes which give a bagasse suitable as fuel generally contain a high proportion of cellulose. Inferior bagasse has a comparatively low density; the density of the woody fibre is greater the higher the percentage of the fibre in the cane. Prinsen-Geerligs considers that the calorific power of the woody fibre of sugar cane is comparable to that of the woody fibre of young trees, but is of the opinion that the value of the former as a fuel cannot be determined by analysis. He considers also that the great variations in the fuel values of bagasses are due (1) to the volume of bagasse on the furnace bars; (2) to the amount of air which reaches the bars; (3) to the draught. The author agrees with Prinsen-Geerligs's conclusions, and adds that the amount of water vaporised per kilo. of dry bagasse varies with the arrangement of the furnace, the air supply and method of introducing it, the rate of combustion, the draught, the amount of water in the bagasse and condition of the latter, and the method and regularity of charging the furnace. The author considers that the bagasse (free from sugar, water, and ash) from 1000 kilos. of canes containing 10 per cent. of woody fibre, is roughly equivalent to 38—45 kilos. of anthracite. —L. E.

Sucrose; Solubility of —— *in water in presence of invert sugar.* H. Pellet and C. Fribourg. Bull. Assoc. Chim. Sucr. et Dist., 1906, 24, 304—315.

INVERT sugar solutions were prepared by dissolving the requisite quantities of pure sucrose in water, adding 0·5 c.c. of pure concentrated hydrochloric acid, making up to 500 c.c., and then heating in a boiling water-bath until the rotation was constant. The cane sugar solutions inverted in this way varied in concentration from 20 per cent. up to saturation. After the inverted solutions had cooled, they were neutralised, and then saturated with sucrose at about 27° C. The saturated solutions were then analysed, the degrees Brix (apparent and real), the sucrose, reducing sugars, and ash being determined. The authors have drawn the following conclusions from their results: (1) A saturated solution of sucrose can still dissolve invert sugar. (2) If a saturated solution of sucrose be inverted, the solution of invert sugar thus obtained can dissolve a further quantity of sucrose. (3) In an invert sugar solution saturated with sucrose at 29° C., and containing approximately as much sucrose as invert sugar, 1 part of water contains 3·5 parts of solid matter, whereas in the case of a sucrose solution, saturated at the same temperature, 1 part of water contains 2·16—2·20 parts of solid matter. In an invert sugar solution saturated with sucrose at 29° C., and containing 68 parts of sucrose per 100 parts of invert sugar, 1 part of water contains 3·90 parts of solid matter. (4) Hence it follows from (3) that the solubility coefficient of pure sucrose is inapplicable in the case of after-products of cane sugar manufacture when these contain considerable quantities of invert sugar. (5) In the case of solutions containing invert sugar and sucrose, it may be admitted that by successive crystallisations, a solution of invert sugar saturated with sucrose will be obtained, in which the proportion of sucrose to invert sugar is 0·69:1. Hence the molassagenic coefficient of invert sugar under such conditions is 0·69. This figure, however, is not applicable to solutions such as cane molasses, which contain organic non-sugar and salts; these substances modify the molassagenic action of invert sugar. From the composition of a sample of average final molasses, the authors have calculated a mean molassagenic coefficient—1·05—applicable to the total non-sugar present in any sample of sugar. The authors have also determined the viscosities of the saturated solutions, and have found that the viscosity increases rapidly with the percentage of invert sugar. —L. E.

"Glucose"; Report on the determination of —— *by the volumetric method.* A. Watt. XXIII., page 1069.

UNITED STATES PATENT.

Bone-black; Process of treating [purifying] ——. J. E. Siebel, Chicago, Ill. U.S. Pat. 831,805, Sept. 25, 1906.

THE bone-black is treated first with an alkali acid sulphate solution, and then with an alkali carbonate solution. —W. P. S.

FRENCH PATENT.

Coal; New artificial ——, *composed of a mixture of beet-pulp and powdered coal, wood charcoal, or coke, and an agglomerant.* J. P. Remaury. Fr. Pat. 366,141, April 28, 1906. II., page 1054.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 1000.)

Barley; Nature of the phosphoric acid compounds in ——, and the changes which they undergo in the malting processes. W. Windisch and W. Vogelsang. Woch. f. Brau., 1906, 23, 516—519 and 556—558.

The authors have taken advantage of the observation of Schulze and Castoro, that freshly precipitated calcium phosphates are soluble in a perfectly neutral solution of ammonium citrate, as a basis for an analytical separation of inorganic phosphates from phosphoric acid in organic combination. For this purpose, 100 c.c. of barley or malt extract were treated with 10 c.c. of a 10 per cent. solution of calcium chloride, and made alkaline with ammonia. The calcium phosphate was filtered off and washed, and the precipitate and filter were digested with 50 c.c. of a 10 per cent. solution of ammonium citrate for 24 hours, the phosphoric acid in the solution being then precipitated with magnesia mixture. For the determination of the total phosphoric acid, the organic compounds in the infusion were hydrolysed by boiling with sulphuric acid, and the phosphoric acid was precipitated by molybdate. In this way it was found that a cold-water infusion of barley contained a considerable quantity of total phosphoric acid, a large portion of which was in the inorganic state. But when the infusion was made under conditions which precluded the activity of enzymes, *e.g.*, in the presence of 1 per cent. of hydrochloric acid or after treatment of the barley with boiling alcohol, the whole of the phosphoric acid was in the organic state. Raw barley, therefore, contains no inorganic phosphates; these are only produced when the organic compounds are exposed to the hydrolytic action of the enzymes as in the steeping and malting processes. This conversion of the phosphoric acid compounds, already far advanced in the case of malt, may sometimes be completed during the process of the saccharification of the mash, especially if germination has been conducted in the dark. The hydrolysis of the organic phosphates during germination appears to be retarded by sunlight, as is indicated in the table below under the heading of "malts." This table shows the results obtained with two samples of barley, germinated in the laboratory, and with the malts obtained from them. Sample A was exposed during germination to direct sunlight, whereas Sample B was treated only in diffused daylight. The values for phosphoric acid (as P_2O_5) are expressed in terms of the dry substance in each case.

Barleys.

	A. Per cent.	B. Per cent.
Moisture	12·97	9·21
Albumin	10·37	19·25
Total phosphoric acid	0·940	1·126
Cold water infusion—		
Total phosphoric acid	0·545	0·694
Inorganic phosphoric acid	0·477	0·569
Cold water infusion in presence of hydrochloric acid—		
Total phosphoric acid	0·443	0·437
Inorganic phosphoric acid	*nil.*	*nil.*
Green malt (four days)—		
Total phosphoric acid	—	0·293
Inorganic phosphoric acid	—	*nil.*†
Green malt (six days)—		
Total phosphoric acid	0·550	0·413
Inorganic phosphoric acid	0·483*	trace.†
Green malt (eight days)—		
Total phosphoric acid	—	0·550
Inorganic phosphoric acid	—	0·254†.
Green malt (nine days)—		
Total phosphoric acid	0·726	—
Inorganic phosphoric acid	0·663*	—

* Infusion prepared without addition of acid.
† Infusion in presence of 1 per cent. hydrochloric acid.

Malts.

	A. Per cent.	B. Per cent
Moisture	5·88	5·75
Total phosphoric acid	0·899	1·145
Cold water infusion—		
Total phosphoric acid	0·557	0·800
Inorganic phosphoric acid	0·422	0·751
Cold water infusion in presence of hydrochloric acid—		
Total phosphoric acid	0·424	0·603
Inorganic phosphoric acid	0·100	0·297
Wort mashed in laboratory—		
Total phosphoric acid	0·547	0·738
Inorganic phosphoric acid	0·383	0·637

—J. F. B.

Yeasts and fungi; Assimilation of the auto-digestion products of beer yeast by various races of ——. II. P. Lindner and F. Stockhausen. Woch. f. Brau., 1906, 23, 519—523.

The authors have repeated and extended the observations of Lindner, Rülke, and Hoffmann (see this J., 1905, 1120) on the availability of the nitrogenous products of the auto-digestion of beer yeast as nutrients for the growth of various yeasts and fungi. The different products isolated were incorporated separately in agar media containing dextrose and salts, but no other nitrogenous nutrient. A difficulty presented itself in the fact that many of the yeasts showed a distinct development on the control plates to which no nitrogenous substance had been added. This was due to the presence of residues of nitrogenous matter in the agar-agar employed. These matters were ultimately eliminated by exposing the agar to a spontaneous fermentation which took place with the development of butyric acid; the product was then thoroughly washed with water. The results of the present extended series of experiments are summed up in several tables. They indicate that as a rule the top-fermentation yeasts are most particular in the selection of their nitrogenous nutrition, and that the bottom-fermentation yeasts come next. The only digestion product generally available for all the yeasts is leucine. Other substances, more or less available for several of the species, are tyrosine, adenine, asparagine, aspartic acid, and ammonium sulphate. Certain species of top-fermentation distillery yeasts, and the English top-fermentation beer yeasts in general, are capable of assimilating arginine in addition to the other substances mentioned above. The bottom-fermentation beer yeasts are generally distinguished from most of the top-fermentation varieties by their stronger development on tyrosine, adenine, and ammonium sulphate. The wild yeasts, *S. pastorianus III., and ellipsoideus I.* and *II.*, behave like the bottom yeasts, only more vigorously. *S. turbidans* [*ellipsoideus II.*] occurs in both top and bottom fermentation forms of constant type; these two forms behaved alike in these experiments, except that the growths of the top-fermentation forms were more vigorous. In strong contrast with the highly selective behaviour of the above culture and "wild" yeasts is the almost omnivorous behaviour of the mycoderma and anomalous yeasts, which are capable of assimilating nearly all the digestion products of beer yeast to a full extent, and many of which even assimilate potassium nitrate.—J. F. B.

Micrococcus (M. esterificans) which forms "fruit-esters." Beck. Arbb. Kais. Ges.-A., 24, 256—263. Chem. Centr., 1906, 2, 1078.

Micrococcus esterificans was discovered by the author ten years ago in a sample of butter. In the arrangement of its colonies it resembles *Staphyloc. pyogenes aureus*. On ordinary nutrient media it develops an aroma of "fruit-esters," changing after some days to one resembling that of freshly-baked bread. A characteristic property of the organism is the formation of an orange colouring matter on gelatin and agar. It grows on milk, with formation of "fruit-esters," but without curdling the milk, or causing it to turn sour. It does not produce indole, phenol, or nitrite; in saccharine media no carbon dioxide

rmed, nor is hydrogen sulphide produced in nutrient ions of peptones. The constituent to which the ant aroma is due, is soluble in ether, chloroform, and on bisulphide; it appears to be present in the cell-tance, and to be combined with a fatty compound. —A. S.

r; *Rapid fermentation of* ——. L. Meunier. Bull. soc. Chim. Sucr. et Dist., 1906, **24**, 320—321.

means of utilising the excess supply of apples in in seasons, over that required for cider manu-re, the author recommends the conversion of apple into brandy. Under ordinary conditions however, must ferments very slowly. To remedy this, it d be treated with 10—15 grms. of ammonium phate per hectolitre, and should be fermented with orous yeast at 20°—25° C. Under such conditions, days are sufficient for the complete fermentation must of average gravity. The brandy obtained the fermented wort is of satisfactory quality.—L. E.

s; *Algerian red and white —— of the Mascara trict.* E. Jalade. Bullet. Féd. Pharm. du Sud-ouest du Centre. 1906, **30**, 233—241.

red wines of the Mascara district are eminently suit-to replace Spanish wines for blending, as "*vins de ge.*" They possess sufficient colour, extractive er and alcohol, to allow them to be used advan-usly to improve certain poorer French vintages. natural bouquet is agreeable, so that they may be at once, whilst when properly matured they acquire few years characters approaching those of the best ls of Burgundy. The white wines, in addition to value for ordinary use, are suitable for employment edicinal or pharmaceutical purposes. The charac-f these wines are shown in the following table of the s obtained with 15 samples of red wine and 11 of white.

	Red Wines.		White Wines.	
	Maximum.	Minimum.	Maximum.	Minimum.
ic gravity..	1·0035	0·994	1·017	0·9869
ol, per cent. volume ...	14·7 Grms. per litre.	12·8 Grms. per litre.	16·2 Grms. per litre.	12·5 Grms. per litre.
acidity as huric acid	6·96	3·234	4·704	2·548
le acid as lic acid ...	1·296	0·360	1·8	0·432
extract at C.	54·7	28·80	57·94	17·20
ing bodies as trose	24·73	1·40	36·15	0·854
ium sulphate	1·307	0·299	1·238	0·359
ium acid rate :.....	3·948	1·342	3·440	1·223
.....	4·900	2·150	4·250	2·400

—J. O. B.

English Patents.

; *Treatment* [*roasting*] *of* ——. E. M. Cowell, Saxmundham, Suffolk. g. Pat. 26,041, Dec. 14, 1905.

invention relates to the preparation e amber, crystal, or black malt used olouring and flavouring beer, &c., and sts in roasting malt or green (raw) in rotating cylinders, a current of ir being passed through the cylinders g the operation. The quantity of air ulated according to the object for the material under treatment is ded.—W. P. S.

asic malt extracts; Process for con-ting —— into solid form for rendering same durable. I. Pollak, Vienna. g. Pat. 9866, April 27, 1906.

n concentrated malt extracts are mixed into a stiff a with 30 to 40 per cent. of fine flour of germinated cereals, rich in diastase. Simultaneously with the absorption of water, the hydrolysis of the starch by diastase begins, two molecules of starch taking up one of water, forming dextrins and finally maltose. The dough, on standing *in vacuo*, becomes quite hard, and can be moulded into any required form, or powdered. The product contains a greater proportion of diastase than ordinary malt extract, is more convenient and cleanly to use, and can be kept as long as desired.—S. R. T.

Fermenting vats. J. House, London. Eng. Pat. 18,836, Sept. 18, 1905.

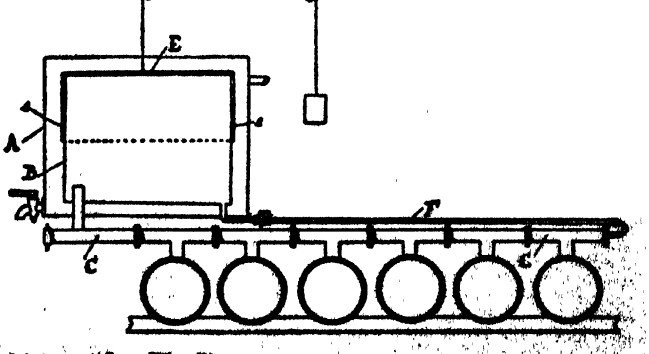
The invention relates to apparatus of the type described in Eng. Pat. 22,484 of 1899 (this J., 1900, 165). Claim is made for providing both the fermenting vat and the gas and yeast tank with water jackets, so that they can be kept at any desired temperature.—S. R. T.

Mash tuns and infusion decoction and digester vessels and the like. J. House, London. Eng. Pat. 18,837, Sept. 18, 1905.

The lower part of the mash tun, with sides and perforated false bottom, rests on ribs within an annular containing chamber. Immediately below, and opening centrally into the vat, is a wort-receiver, or underback, having a vertical circular grating or screen, and two lateral openings, the one to admit air, the other connecting with a pump. The mash tun is provided with a central hollow shaft, opening into radial loops or tubes, or concentric spiral tubular coils, for the circulation of steam or hot water. Where radial loops are fitted, the shaft is partitioned in such manner as to insure perfect circulation through them. In addition, the shaft carries arms or vanes, provided with inclined or helical faces, for the stirring or convection of the contents of the tun.—S. R. T.

Fermentation [*in casks*]; *Process of* ——. E. J. Vloeberghs, Norderwijck, Belgium. Eng. Pat. 5135, March 2, 1906.

An arrangement is described by which the system of fermentation in casks can be carried out without exposing the froth expelled from the bung-holes to contamination air. The bung-holes of the fermentation casks are connected with a horizontal main, C, which is constructed in sections that can be readily dismounted. The main, C, conducts the froth, expelled from the casks, into a tank, B, which is jacketed by water of any desired temperature contained in an outer tank, A. The tank, B, is covered by a hood, E, closed by a water-seal after the manner of a gasometer. The hood is so counterbalanced as to rise and expose holes, *e*, in its sides, by which the gas can escape, as soon as the pressure reaches a predetermined limit. The liquid which condenses from the froth collects in the bottom of the tank, B, and can be returned to the fermentation casks by opening a cock in the small pipe, *F*.



When barm is required, it can be collected from the main, C, at a certain stage of the fermentation.—J. O. B.

Waste, juices, syrups, and scented extracts; Process for the preparation of concentrated ——. E. Monti, Turin, Italy. Eng. Pat. 9205, April 18, 1906.

See Fr. Pat. 366,338 of 1906; this J., 1906, 947.—T. F. B.

Wine and the like; Method of and apparatus for improving the quality of ——. F. O. Nilsson and J. A. Jonsson, Stockholm, Sweden. Eng. Pat. 13,563, June 13, 1906. Under Int. Conv., June 16, 1905.

The invention relates to an apparatus for subjecting wine and other liquors to strong preliminary agitation, and then to simple centrifugal rotation and filtration. A bowl, of the type of an ordinary milk separator, contains a central cylindrical chamber surrounded by two concentric cylinders, the space between which is packed with a filtering material. The central cylinder is fitted with radial perforated wings, and the wine falling upon these is violently agitated. Passing on, the liquor is forced through the filter and out of the bowl again.—S. R. T.

United States Patent.

Wort; Proces of fermenting ——. H. A. Schalk, New York. U.S. Pat. 831,748, Sept. 25, 1906.

The process provides for the continuous fermentation of wort in a series, or battery, of vats. After fermenting the wort in the first vat, a portion is discharged into the next vat, and so on, the partly-filled vats being supplied with fresh quantities of unfermented wort. The contents of the vats are subjected successively to aeration and to the action of air which is forced over the surface of the liquid.—W. P. S.

French Patents.

Antiseptics and yeasts acclimatised thereto for grain distillery purposes. G. Jacquemin and G. Fritsche. Fr. Pat. 361,643, July 22, 1905.

A mixture of formaldehyde and milk or other nitrogenous vegetable or animal substance is added to the wort, which is then fermented by means of yeast or saccharifying mould fungi, which organisms have been previously acclimatised to formaldehyde by successive cultivations in media containing progressively increasing additions of that substance.—C. S.

Yeast; Method of cultivating ——. K. Kruis and F. Ringhoffer. Fr. Pat. 366,533, May 23, 1906.

The wort or culture medium is prepared by mixing beet juice with potato juice freed from starch, the two being acidified, sterilised, and filtered either before or after mixing. Alternatively, the pulp of beet and potatoes in the fresh or dried state can be employed, the former being lixiviated and the latter saccharified, whilst the liquids resulting from these treatments are converted into a nutritive wort by adding the substances in which they are deficient, and by sterilisation and filtration.—C. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 1001.)

(*A.*)—FOODS.

Arachis oil-cake; Poisonous action of ——. E. Krüger. Chem.-Zeit., 1906, 30, 999.

In November, 1904, several cows died with symptoms of acute poisoning after eating fodder containing arachis meal. Examination of the meal showed the presence of a certain proportion of castor seeds in addition to other foreign substances, but feeding experiments on sheep and rabbits gave negative results, all the animals remaining healthy. It is suggested as a possible explanation that the poisoning may have been due to products of the reaction between certain constituents in the arachis meal and in the fodder given with it.—C. A. M.

Butter; Detection of cocoanut oil and margarine in ——. L. Bodin. XXIII., page 1069.

"Crude fibre"; Determination of cellulose, lignin, and cutin in ——. J. König. XXIII., page 1069.

United States Patents.

Pasteurising process. H. E. Weber, Canton, Ohio. U.S. Pat. 831,812, Sept. 25, 1906.

The liquid is caused to flow by gravity, opposed by centrifugal force, in a thin film of gradually increasing thickness over the treating surface.—W. P. S.

Animal tissues [Meat]; Preserving ——. C. E. Calm, Chicago, Ill. U.S. Pat. 832,180, Oct. 2, 1906.

Meat or other animal tissue is treated with ferric nitrate in the proportion of 4 oz. of the salt to 100 lb. of meat, &c., whereby the growth of bacteria and other micro-organisms is arrested.—A. G. L.

(*B.*)—SANITATION; WATER PURIFICATION.

Industrial Diseases Committee.

Times, Nov. 1, 1906.

The departmental committee which was recently appointed "to inquire and report what diseases and injuries, other than injuries by accident, are due to industrial occupations, are distinguishable as such, and can properly be added to the diseases enumerated in the Third Schedule of the Workmen's Compensation Bill, 1906," has now begun its inquiry. The committee proposes to investigate the following diseases and injuries which have been suggested for its consideration—*viz.*, gradual poisoning from the vapour of carbon bisulphide, dinitrobenzene, dinitrotoluene, and aniline; gradual poisoning from carbonic oxide gas, sulphuretted hydrogen gas, and chlorine gas; alkaloidal poisoning from African boxwood in shuttlemaking; illness set up by nitrous fumes, hydrochloric acid fumes, ammonium chloride fumes, and sulphur fumes; compressed air illness (caisson disease); chrome ulceration of the skin; various trade eczemas; fibrosis of the lungs from inhalation of silicious or metallic particles (potter's asthma and grinder's phthisis); pneumonia from inhalation of basic slag dust; miner's nystagmus and miner's "beat knee" and "beat hand"; neurosis due to vibration; cardiac dilatation in slate quarries; and glanders. Correspondence relating to the inquiry should be addressed to Frank Elliott, Esq., secretary to the committee, at the Home Office, Whitehall, S.W. Anthrax, ankylostomiasis, and poisoning by lead, mercury, phosphorus, and arsenic are already included in the Third Schedule of the Workmen's Compensation Bill, and are not, therefore, within the committee's terms of reference.

English Patents.

Air; Purification of vitiated ——. A. H. Atteridge and the British Submarine Boat Co., Ltd., London. Eng. Pat. 19,012, Sept. 20, 1905.

The air is forced, by means of a fan, through a cylinder containing granular soda-lime, and then through water acidulated with an organic acid. A filter containing "carbolised tow" is placed at each end of the soda-lime cylinder, and a small proportion of oxygen is mixed with the air before, or after, its passage through the acidulated water.—W. P. S.

Sewage sludge and other waste matters of an organic origin; Destructive distillation of ——, *for the recovery of by-products such as ammonia and oil therefrom, and the utilisation of the residue.* J. C. Butterfield and G. Watson. Eng. Pat. 19,502, Sept. 27, 1905. III., page 1035.

Furnace for consuming rubbish and other matter not easily consumed. H. Self, Düsseldorf, Germany. Eng. Pat. 22,847, Nov. 7, 1905.

The firegrate of the furnace is pivoted so that the hot clinker may be discharged into a truck running on rails in a closed space below the furnace. The truck is provided with a false perforated bottom, and a blast of air is driven

into the space below the false bottom, and, passing up through the hot clinker, enters the furnace through the firegrate. An alternative method of obtaining a hot-blast for the furnace is to draw air through the clinker in the truck, and to introduce the heated air into a space below the grate of the furnace.—W. P. S.

Water and other liquids; Sterilising, softening, and heating ——, *and apparatus therefor.* G. W. Westrope and E. E. Cooper, London. Eng. Pat. 26,527, Dec. 20, 1905.

THE water to be treated is passed from a small reservoir into a vessel provided with a number of baffle-plates arranged horizontally. The height of the water in the vessel is so regulated by the position of the small reservoir and the level of the water in the latter, that, when cold, the surface of the water is below the overflow of the vessel, but when the temperature is raised to boiling point, the water overflows continuously from the top of the vessel. Any suitable means of heating may be employed; the overflow may consist of an inclined pipe or be formed by a conical top to the vessel ending in a pipe, and the vessel may be open or closed. If desired, the hot water leaving the vessel can be used for partially heating the incoming water. The heating arrangement may be regulated automatically, and a waste pipe is provided in the small reservoir to take up any leakage from the ball-tap admitting the water to the said reservoir.—W. P. S.

Incrustation in water receptacles; Composition for removing and preventing ——. S. Rubert and P. Rubert, Barcelona, Spain. Eng. Pat. 6806, March 21, 1906. Under Int. Conv., Dec. 9, 1905.

THE composition consists of a mixture of acid sulphates, neutral phosphates, "potassium and sodium oxides," and a colouring matter. Varying proportions of these constituents are used, and the composition is prepared in the form of a paste, liquid, or powder, or it may be compressed into cakes.—W. P. S.

UNITED STATES PATENT.

Incrustation; Preventing ——. S. Rubert and P.R. Laporta, Barcelona, Spain. U.S. Pat. 831,107, Sept. 18, 1906.

SEE Eng. Pat. 6806 of 1906; preceding these.—T. F. B.

FRENCH PATENTS.

Water; Process for the purification of ——. G. Lambert. First Addition, dated July 19, 1905, to Fr. Pat. 361,435, May 3, 1905 (this J., 1906, 862).

CALCIUM carbonate is used instead of the sodium carbonate mentioned in the original specification, and the water, after treatment, is drawn off from the settling tank through a floating filter. In cases where large quantities of water are to be treated, the reagents are mixed with the water in a tank provided with a stirring device; each tankful of treated water is then led into the settling tank, and filtered.—W. P. S.

Water; Sterilisation and clarification of ——. C. F. J. Hy. Fr. Pat. 361,642, July 22, 1905.

THE water is treated with a mixture consisting of calcium permanganate, four parts, and anhydrous sodium carbonate, 26 parts; the mixture is added, with constant stirring, in quantities of 0·1 grm. per litre, until the water has a persistent red coloration. A mixture, consisting of anhydrous ferrous sulphate, 10 parts, and anhydrous aluminium sulphate, 20 parts, is then added in quantity equal to the amount of the permanganate mixture used, and the precipitate formed allowed to settle. Finally, the water may be filtered.—W. P. S.

Water; Process for the purification of —— by means of suspended filter-beds. L. Girerd and J. Drapier. Fr. Pat. 368,614, May 28, 1906.

THE water is led into the bottom of a small settling tank placed at the top of a tall cylindrical vessel, the latter is divided into compartments by a number of horizontal plates, the lower plates being perforated whilst the upper plate is non-perforated, and forms the bottom of the upper compartment of which the settling tank forms a part. The water rises in the settling tank, overflows through a sieve, and gradually fills the upper compartment. A siphon, contained in a box, intermittently discharges small quantities of the water from the upper compartment on to a layer of filtering material placed on the perforated bottom of the next lower compartment; from the latter, the water drips on to two more layers of filtering material contained in the lower compartments of the vessel, and is finally collected in a channel at the bottom. The size of the settling tank and of the upper compartment, and the rate of the flow of the water, are so regulated that the water takes about one hour to pass through the tank, and five hours through the upper compartment. The layers of filtering material in the two upper filter compartments consist of a calcined mixture of iron oxide, manganese dioxide, and barium oxide, whilst the lowest layer of filtering material consists of sifted volcanic cinders.—W. P. S.

Water; Process and apparatus for sterilising —— by means of ozone. M. Otto. Fr. Pat. 366,728, May 31, 1906.

THE apparatus consists of a large metal cylinder mounted horizontally on bearings at either end, supporting rollers being also provided along its length. The interior of the cylinder is filled with inert, granular substances, such as flint stones. Pipes passing through stuffing-boxes enter both ends of the cylinder, and serve as the inlet and outlet for the water to be treated; smaller pipes are also provided for the introduction of the ozone, and for the discharge of the exhausted gas. The water supply is so regulated that the cylinder is kept about two-thirds full, and by rotating the cylinder, the ozone is thoroughly mixed with the water. The action of the ozone is increased if pressure be allowed to form in the cylinder. A fixed cylinder may be employed, but in this case the ozone must be led by bent pipes to the lower part of the cylinder.—W. P. S.

Air; Process for the regeneration and purification of ——. The Roessler and Hasslacher Chemical Co. Fr. Pat. 366,525, May 23, 1906. Under Int. Conv., March 9, 1906.

THE air is forced through a cylinder, where it is brought into contact with an alkali peroxide, preferably sodium peroxide; the carbon dioxide is thus removed, and the air enriched by oxygen liberated as the result of the action of the moisture contained in the air on the peroxides. The sodium peroxide is contained in a rotating wire-gauze cylinder mounted in the main cylinder; the rotation causes the coating of carbonate, &c., to be rubbed off the surface of the lumps of peroxide, and exposes a fresh surface of the latter to contact with the air.—W. P. S.

(C.)—DISINFECTANTS.

FRENCH PATENTS.

Formaldehyde disinfectant; Process of preparing a ——. Chem. Fabr. Flick in Ichendorf, G.m.b. H. Fr. Pat. 366,307, May 16, 1906.

ONE hundred parts of 40 per cent. formaldehyde solution and 20 parts of 96 per cent. alcohol are added to a mixture of 70 parts of glycerol with 30 parts of oleic acid. Potassium hydroxide solution is then added until a clear solution is obtained; about 6 c.c. of 33 per cent. potassium hydroxide solution are required. Sodium hydroxide or ammonia may be used in place of potassium hydroxide, and the oleic acid may be replaced, wholly or in part, by resin.—W. P. S.

Formaldehyde; Production of gaseous ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 366,604, May 25, 1906. Under Int. Conv., July 19 and Aug. 3, 1905.

THE process consists in treating with water mixtures of polymerised formaldehyde (paraformaldehyde, trioxymethylene) with metal peroxides having an alkaline reaction, or with salts of peracids derived from these

peroxides. For example, a vigorous evolution of gaseous formaldehyde is obtained by adding 15—20 c.c. of water to 25 grms. of a mixture of 1 part of paraformaldehyde and 2½ parts of barium dioxide.—A. S.

GERMAN PATENT.

Tar oils for impregnating, preserving, and disinfecting purposes; Process for working up heavy ——. H. Nördlinger. Ger. Pat. 168,611, Jan. 21, 1905. III., page 1036.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 1002.)

"Crude fibre"; Determination of cellulose, lignin, and cutin in ——. J. König. XXIII., page 1069.

ENGLISH PATENTS.

Paper; Substance for rendering —— *impervious to oil and grease.* W. H. Pearson, York. Eng. Pat. 24,563, Nov. 28, 1905.

MILK from which the cream has been separated is treated warm with a small proportion of sulphuric acid. The precipitated curd is washed and pressed, then diluted with water, and dissolved by the addition of ammonia. The paper is saturated with this solution by immersion, and when dried it is impervious to oil and grease.—J. F. B.

Celluloid; Manufacture of substances resembling ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,228A, May 1, 1906.

SEE Fr. Pat. 366,106 of 1906; this J., 1906, 1001.—T. F. B.

Cellulose threads; Method of producing ——. E. Thiele and La Soc. Gén. de la Soie Artif. Linkmeyer. Eng. Pat. 15,133, July 3, 1906. V., page 1040.

UNITED STATES PATENTS.

Textile and paper base. V. A. de Perini, Assignor to C. C. Stookle and T. M. Kentish. U.S. Pat. 831,521, Sept. 18, 1906. V., page 1040.

Asbestos [Vulcanised composition]; Method for treating ——. A. H. Hipple, Omaha, Neb. U.S. Pat. 828,114, Aug. 7, 1906.

THE process described in U.S. Pat. 694,859 (this J., 1902, 474) is improved by thoroughly incorporating fibrous asbestos and powdered sulphur into a pulp with water, and forming the pulp into paper or millboard or other convenient article. The water is then removed, and the dried product is saturated with a suitable oil. The material is subsequently subjected to a vulcanising process by the carefully regulated action of heat, a temperature of about 300° F. being maintained for a definite time. —J. F. B.

Celluloid; Manufacture of ——. A. Béhal, Paris, Assignor to Special Products Co. U.S. Pat. 831,028, Sept. 18, 1906.

SEE Eng. Pat. 11,512 of 1905; this J., 1905, 855.—T. F. B.

Celluloid-like substances; Method for producing ——. O. B. Thieme, Potsdam, Germany. U.S. Pat. 831,488, Sept. 18, 1906.

THE whole or a part of the camphor usually employed in the manufacture of celluloid is replaced by urea in which the hydrogen associated with the nitrogen is replaced by organic radicals. (Compare Claessen; Fr. Pat. 364,604; this J., 1906, 368.)—J. F. B.

FRENCH PATENTS.

Paper pulp; Use of a mixture of gypsum and plaster of Paris as a loading for ——. A. Monin. Fr. Pat. 366,112, May 12, 1906.

CRUDE natural calcium sulphate (gypsum) when used as a loading for paper pulp does not form a pasty mass with water, and is consequently not easily retained by the pulp. On the other hand, the dehydrated sulphate (plaster of Paris) forms hard lumps. According to this invention a mixture consisting of three parts of gypsum and one part of plaster of Paris, or other suitable proportions, forms a thick pasty mass with water equal to china clay and talc, and far superior to either of the two constituents used separately.—J. F. B.

Waterproofing solution [coal-tar dissolved in petroleum, for leather, paper, &c.]. G. Mongauzi. Fr. Pat. 365,374, March 26, 1906. XIV., page 1059.

Celluloid; Production of products resembling ——. Badische Anilin und Soda Fabrik. First Addition, dated May 16, 1906, to Fr. Pat. 363,846, March 5, 1906. Under Int. Conv., Aug. 8, 1905. (See Eng. Pat. 8077 of 1906; this J., 1906, 608.)

SYMMETRICAL methylbenzoyltrichloranilide can replace the acetyl derivatives of tri- or polychlor-alkylanilines in the production of celluloid, as substitutes for camphor. The other benzoyl derivatives of halogenated alkylanilines are not sufficiently soluble for the purpose, and do not cause the nitrocellulose to swell sufficiently (see Eng. Pat. 10,228 of 1906; this J., 1906, 866).—T. F. B.

Textile fibres [Artificial silk] from cupro-ammoniacal solutions of cellulose; Process of manufacturing lustrous threads of ——. Soc. anon. "La Soie Nouvelle." Fr. Pat. 365,057, April 10, 1906. V., page 1041.

Cork; Manufacture of artificial ——. H. Coale. Fr. Pat. 366,586, May 26, 1906.

CUTTINGS of cork and other cork waste are reduced to a granular condition. The granulated material is then packed into a vessel having the shape of an inverted truncated cone with a base of wire gauze and a hinged cover at the smaller end. This vessel containing the granulated cork is immersed in a bath of dilute sulphuric acid, which dissolves some of the impurities; the hinged cover is then raised, and the particles of good cork float out to the surface whilst the heavy inferior particles remain in the vessel. The floating cork is removed, bleached, and packed into moulds together with an agglutinating agent, preferably albumin. The moulded masses are then subjected to moist heat in the form of steam in order to coagulate the albumin, and are finally dried. If necessary, the finished product may be softened by glycerol.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 1003.)

Morphine; Separation of —— *from solution in glycerol.* H. M. Gordin and W. H. Harrison. Amer. J. Pharm., 1906, 78, 464.

THE glycerol solution of morphine sulphate is treated with excess of *N*/1 iodine solution, and the mixture is diluted with water to about three times its volume. On standing overnight, about 80 per cent. of the morphine present crystallises out as morphine triodide hydriodide. The crystals are collected, washed with water containing a little Wagner's reagent, and dissolved in a few c.c. of 10 per cent. sulphurous acid solution. On adding a slight excess of potassium carbonate to this, and heating to 60° C. for about a minute, the alkaloid commences to crystallise out within half an hour from the cold liquid.

Brucine; Erlenmeyer jun.'s cinnamic acid salts of ——. W. Marckwald und R. Meth. Ber., 1906, 39, 2596—2600.

ERLENMEYER, jun., has described two isomeric brucine salts of cinnamic acid, melting at 107°—113° C. and 135° C. respectively, and further has based important theoretical speculations on their existence. The authors now show that the salt melting at 113° C. crystallises with a molecule of alcohol, and has the composition $C_{23}H_{26}O_4N_2.C_9H_8O_2+C_2H_6O$. The other salt, which they obtain by mixing cinnamic acid with brucine in the proportion of 2 mols. to 1 mol., has a rotation $[\alpha]=-4{\cdot}2°$, melts at 135°, and has the composition $C_{23}H_{26}O_4N_2$ $(C_9H_8O_2)_2$, in which the second molecule of acid acts as a molecule of acid of crystallisation. Erlenmeyer jun.'s salts are thus not isomerides.—E. F. A.

Eriodictyon californicum leaves; Chemistry of ——. F. B. Power and F. Tutin. Proc. Amer. Pharm. Assoc., 1906. Pharm. J., 1906, 77, 381.

THE leaves yielded 29·2 per cent. of a complex mixture of crude resinous substances, about 75 per cent. of the mixture being soluble in ether. Three new substances of phenolic nature were isolated from the leaves:—*Eriodictyol*, $C_{15}H_{12}O_6$ (m. pt., 267° C.), about 0·23 per cent.; *homo-eriodictyol*, $C_{16}H_{14}O_6$ (m. pt., 223° C.), about 3 per cent.; and about 0·014 per cent. of a yellow substance, $C_{16}H_{12}O_6$, at present unnamed. Other constituents of the leaves are about 0·7 per cent. of triacontane (m. pt., 65·2° C.), and pentatriacontane (m. pt., 74·5° to 75° C.); about 0·5 per cent. of free and combined acids, including formic, acetic, cerotic, and other acids in the free state, and the glycerides of formic, butyric, cerotic, and other acids; a very small amount of a phytosterol (m. pt., 136° to 137° C.); a considerable amount of dextrose; and about 0·1 per cent. of a yellow volatile oil possessing the characteristic odour of the drug. Eriodictyol was obtained in small fawn-coloured plates, which darkened and melted to a red liquid at 267° C. It is moderately soluble in hot alcohol and in acetic acid, very sparingly soluble in boiling water, and insoluble or very sparingly soluble in other organic solvents than those named, but it dissolves readily in solutions of the fixed alkalis and alkali carbonates, forming almost colourless solutions, which rapidly absorb oxygen and assume a deep brown colour. Homo-eriodictyol was obtained in lemon-yellow plates, which are more sparingly soluble in water than eriodictyol, but more readily soluble in alcohol or acetic acid. A drop of ferric chloride solution added to dilute alcoholic solutions produces an intense red-brown colour with homo-eriodictyol, and a deep greenish-brown, changing rapidly to pure brown, with eriodictyol. Basic lead acetate affords a bulky yellow precipitate with eriodictyol in saturated aqueous solution, but homo-eriodictyol is not appreciably precipitated by the same reagent. The existence of the "ericolin" of Thal was not confirmed, and "ericinol," the assumed hydrolytic product of that body, appears to be furfural, the chief volatile body resulting from the action of a dilute mineral acid on a purified extract of the leaves. The "eriodictyonic acid" of Quirini appears to have consisted of impure homo-eriodictyol.—A. S.

Rheum rhaponticum; Constituents of the root of ——. A. Tschirch and Christofoletti. Schweiz. Woch. Chem. Pharm., 1906, 44, 361—370.

THE crushed root was extracted with 70 per cent. alcohol, then with 95 per cent. alcohol, and finally with 5 per cent. aqueous ammonia. The latter extract was red in colour, but contained only traces of oxymethylanthraquinones.

Rhaponticin, $C_{28}H_{24}O_9$, was obtained in colourless, tasteless prisms, m. pt. 231° C. (after becoming coloured at 210°), by evaporating the 70 per cent. alcoholic extract to a syrupy consistence, and treating it with ether. On standing, rhapontiicin separated out and was purified by re-solution in 70 per cent. alcohol, precipitation with water, and recrystallisation from 70 per cent. alcohol, after treatment with animal charcoal. It is insoluble in ether, benzene, and chloroform; soluble in hot water, acetone, alcohol, and acetic acid; readily dissolved, especially on warming, by acetone or alcohol diluted with water. It contains one methoxyl group, and yields a diacetyl compound, m. pt. 138° C. Rhapontiicin only slightly reduces Fehling's solution when boiled.

Rhapontigenin, $C_{17}H_{22}O_9$, m. pt. 180°—181° C., is obtained by the cautious hydrolysis of rhapontiicin with dilute sulphuric acid, and shaking out with ether. The crude rhapontigenin obtained on distilling off the ether is purified by recrystallisation from alcohol; it then forms well-defined colourless needles, readily soluble in acetone, ether, alcohol, ethyl acetate, acetic acid, and pyridine; sparingly soluble in cold water and only slightly more so on heating; insoluble in benzene and in light petroleum spirit. It contains a methoxyl group, and yields dibenzoyl (m. pt., 145°—146° C.) and diacetyl compounds (m. pt., 108°—110° C.).

Oxymethylanthraquinones.—The ethereal liquids, after the precipitation of the rhapontiicin, when evaporated to dryness and treated with 10 per cent. sodium carbonate solution, leave chrysophanic acid undissolved. After partial purification, this has the m. pt. 181°—182° C., but it still contains 1·48 per cent. of methoxyl. Pure chrysophanic acid has the m. pt. 196° C. It is suggested that this should be named chrysophanol, to distinguish it from the chrysophanic acids, containing variable quantities of methoxyl, obtained from different drugs.

Tetrahydromethoxychrysophanol.—The sodium carbonate solution from the above contained neither rhein nor emodin, but gave a new body, tetrahydromethoxychrysophanol, $C_{16}H_{16}O_5$, in golden yellow scales, m. pt. 216° C., on shaking out with toluene and precipitating the toluene solution with light petroleum spirit.

Anthraglucosides.—The mother liquors, after the separation of the free oxymethylanthraquinones, gave, after hydrolysis with alcoholic potash, a further yield of oxymethylanthraquinone, rhubarb-red, and rheogimin, thus indicating the presence of an anthraglucoside.

Tetrahydromethylchrysophanol, $C_{16}H_{16}O_4$, crystallising in orange-red, glittering scales, m. pt. 195°—196°, was isolated by shaking out with ether the alkaline liquid after the above hydrolysis. It is soluble in chloroform, ether, benzene, and acetone, and is precipitated from benzene solution by light petroleum spirit. It is insoluble in sodium carbonate solution, and very slightly soluble, with a red colour, in ammonia. It gives a diacetyl compound, m. pt. 205° C.—J. O. B.

Juniperus phœnicea (L.); Essential oil of ——. J. Bodin. Bull. Soc. Chim., 1906, 35, 922—925.

THE fact that oil from *Juniperus phœnicea* has been supplied in place of that from *Juniperus sabina* is due to the close resemblance between the two shrubs. In examining the oil of *J. phœnicea* the author gives some data in addition to those found by Umney and Bennett (see this J., 1906, 88). The oil was distilled from the twigs of young plants cut at the beginning of the winter. The constants for five samples were:—

	I.	II.	III.	IV.	V.
Sp. gr. at 15° C.	0·868	0·867	0·868	0·868	0·867
Optical rotation in 100 mm. tube	+3°28′	+2°54′	+3°12′	+4°12′	+3°36′

The samples were soluble in 4—5 parts of 90 per cent. alcohol. The smell, which is characteristic, resembles that of true savin oil. The yield from the plants was 0·4—0·5 per cent. Of the oil prepared by the author 70 per cent. distilled between 150° and 180° C. The sp. gr. at 19° C. was 0·858, and optical rotation in a 100 mm. tube, +2° 56′. The oil consisted of pinene, with traces of camphene and phellandrene.—F. SEDN.

Myrrh; Essential oil of ——. K. Lewinsohn. Pharm. Zeit., 1906, 51, 782.

ESSENTIAL oil of myrrh contains 1 per cent. of eugenol; meta-cresol; free acetic and palmitic acids;

pinene; dipentene; limonene; and two sesquiterpenes of the formula $C_{15}H_{24}$, one of which is probably identical with cadinene.—J. O. B.

Elaterin. J. Pollak. Ber., 1906, **39**, 3380—3382.

The elaterin used had been prepared from *Elaterium album*, so-called, the dried sap of the fruit of *Ecballium* (*Monordica*) *Elaterium*. It forms handsome colourless crystals, which melt at 222°—223° C. after several crystallisations from alcohol. Analyses point to the formula $C_{20}H_{28}O_5$ or $C_{20}H_{26}O_7$. No methoxyl groups are present. It dissolves slowly in alcoholic potash. On diluting with water and extracting with ether, an amorphous product results. If acidified and extracted with ether, the residue gives water and acetic acid on distilling in a vacuum. Acetic acid is given off when elaterin is treated with cold sulphuric acid. If the resulting liquid be neutralised, there is a precipitate. The filtrate, when distilled in a vacuum, yields acetic acid. Determinations indicate the presence of only one acetyl group.—F. Shdn.

Novocaine; Characters and tests for ——. P. Lemaire. Répert. Pharm., 1906, **18**, 433—436.

Novocaine, *p*-aminobenzoyldiethylaminoethanol hydrochloride, occurs in fine white needles, m. pt. 156° C., very soluble in water; the 4 per cent. aqueous solution is optically inactive, thus differing from cocaine. A few particles of novocaine, added to 1 or 2 drops of strong cobalt nitrate solution and gently warmed, give a fine blue colour; cocaine, alypine, and stovaine react similarly. Nine c.c. of 10 per cent. zinc chloride solution give with 1 c.c. of a 5 per cent. solution of novocaine hydrochloride a precipitate of fine acicular crystals. Under similar conditions no reaction is obtained with cocaine, stovaine, or eucaine hydrochlorides; holocaine forms only droplets on the side of the tube. 0·5 c.c. of a 1 per cent. solution of novocaine, added to 1 c.c. of sodium hypobromite reagent, gives in the cold, an orange precipitate, becoming red on heating. Alypine, cocaine, stovaine, and tropacocaine give no coloration. Two or 3 drops of 2 per cent. solution of ammonium iron alum added to 2 or 3 c.c. of 1 per cent. novocaine solution, give no violet colour as with subuctine and nirvanine, nor a red brown as with orthoform. Gold chloride solution (1 per cent.) gives an immediate brown precipitate with novocaine; with cocaine and tropacocaine hydrochlorides, and with alypine and stovaine, the precipitate is whitish. Like cocaine and its allied bases, novocaine gives a precipitate, in the cold, with potassium permanganate.—J. O. B.

Nandina domestica; Hydrocyanic acid from the leaves of four varieties of ——. J. Dekker. Apoth.-Zeit., 1906, **21**, 843.

The aqueous distillate from the fresh leaves of *Nandina domestica*, var. *fructu albo*, contained hydrocyanic acid equivalent to 0·12 per cent. of the material. *Nandina domestica*, var. *fructu rubro*, gave 0·147 per cent.; the var. *major*, 0·070 per cent.; and var. *angustifolia*, 0·070 per cent. Acetone was also present in the distillates. Eijkman has previously recorded the presence of berberine and of the amorphous alkaloid nandinêne, $C_{19}H_{19}NO_4$, in the root-bark.—J. O. B.

Carbon bisulphide; Spontaneous ignition of —— *on pouring.* Pape. Rev. Scientif.; through Rev. Pharm., 1906, **24**, 213.

A case of spontaneous ignition of carbon bisulphide is recorded, when the liquid was being transferred from a container to a glass carboy, by means of a metal funnel. The operation was being conducted in the open air, and about 100 metres from any naked flame. The ignition is attributed to an electric discharge, excited by the friction of the falling liquid on the iron funnel, which, resting on the glass mouth of the carboy, was completely insulated. The weather at the time was very hot and dry. Similar cases of spontaneous ignition have occurred when carbon bisulphide has been filled into iron drums, for transport. This has usually also been attributed to electrical discharge, but T. Trapl points out that this may not be the only cause. The oxidation of ferrous sulphide may cause sufficient rise of temperature to ignite the bisulphide. This has been shown to be the cause of an explosion of distillation products from heavy tar oils. The danger may be avoided by filling the drums with carbon dioxide, or other inert gas, before introducing the inflammable liquid.—J. O. B.

Sodium chloride; Organo-sols and -gels of ——. C. Paal and G. Kühn. Ber., 1906, **39**, 2859—2862.

By the interaction of sodium ethyl malonate and ethyl chloroacetate in benzene solution, sodium chloride and the organic condensation product are formed, but the former remains dissolved as organosol, giving rise to an opalescent orange-coloured solution. Petroleum ether precipitates this and the absorbed organic compound in an amorphous state, the fresh precipitate being entirely soluble in benzene, though containing 58 per cent. of sodium chloride. Similar results are obtained on carrying out the reaction in ligroïn or xylene; in the latter case the solution on standing deposits the organogel of sodium chloride as an orange transparent jelly. On adding acetyl chloride diluted with benzene to sodium ethylmalonate, a similar orange opalescent solution is at first produced, following which a voluminous deep orange jelly of organogel is obtained; this, in the dry state, contains as much as 87 per cent. of sodium chloride.—E. F. A.

Sodium bromide; Organo-sols and -gels of ——. C. Paal and G. Kühn. Ber., 1906, **39**, 2863—2866. (See preceding abstract.)

Sodium ethylmalonate and ethyl bromoacetate react in benzene to form the soluble organosol which is precipitated by petroleum ether and then dissolves completely in benzene; this contains 80 per cent. of sodium bromide. The gel is obtained as a voluminous orange-yellow jelly. On condensing with acetyl bromide a rose-coloured amorphous gel is precipitated. The organosol of sodium bromide is less stable than that of the chloride and therefore more easily converted into the corresponding gel; traces of water rapidly cause the partial conversion into crystalline salt. The authors were unsuccessful in obtaining the corresponding sodium iodide sol or gel; crystalline compounds always resulted from the interaction of sodium ethylmalonate with iodine, ethyl iodide, or *p*-iodoethylpropionate, either in benzene or xylene solution.—E. F. A.

Permanganate solution; Titration with alkaline ——. [*Determination of formic and nitrous acids.*] E. Rupp. XXIII., page 1070.

Ether; Exemption from duty of sulphuric —— *in Holland.* Bd. of Trade J., Oct. 18, 1906. [T.R.]

The *Nederlandsche Staatscourant* for October 2, contains the text of a decree, dated September 18, authorising the importation, duty free, of sulphuric ether for use in the manufacture of incandescent mantles.

English Patents.

Emulsions of mercury or other conducting substances; Process and apparatus for making ——. E. Lederer. Eng. Pat. 18,513, Sept. 13, 1905. XI*A*., page 1052.

Saturated compounds; Conversion of unsaturated into ——. C. Dreymann, Turin, Italy. Eng. Pat. 19,988, Oct. 3, 1905.

See Fr. Pat. 358,212 of 1905; this J., 1906, 224.—T. F. B.

Aldehydes; Manufacture of ——. E. Spurge, Witham. From E. C. Spurge, Niagara Falls, U.S.A. Eng. Pat. 21,814, Oct. 26, 1905.

The process described in U.S. Pat. 829,360 of 1906 (this J., 1906, 909) for producing vanillin from isoeugenol is applied also to the oxidation of other aromatic compounds with the side chain, $-CH{:}CH.CH_3$ (*e.g.*, isosafrol and anethol), to aldehydes; more water should be present in these latter cases than in the oxidation of isoeugenol, since the bisulphite derivatives of heliotropin and anisaldin are much less soluble than that of vanillin, and the condensation product is therefore liable to become an effect.—T. F. B.

Therapeutical preparations containing formic aldehyde. P. Rosenberg, Berlin. Eng. Pat. 2662, Feb. 3, 1906.

This therapeutical preparation is composed of a chemical combination of 5 mols. of formaldehyde with one of milk sugar. The product is a solid soluble in water, acetone, or alcohol. It has no corrosive action on the mucous membranes. It is broken up into formaldehyde and milk sugar by decomposing agents, including those present in the human body. It is prepared by mixing a solution of formaldehyde, or trioxymethylene, with the amount of milk sugar indicated by the above composition. The mixture is heated in a vacuum at a temperature of 60°—70° C., and then evaporated to dryness in the open at a temperature not exceeding 70° C.—F. Shdn.

United States Patents.

Acetylene and chlorine; Process of making compounds of ——. J. H. Lidholm, Alby, Sweden. U.S. Pat. 831,725, Sept. 25, 1906.

See Fr. Pat. 358,146 of 1905; this J., 1906, 197.—T. F. B.

Pinene; Derivative of ——, *and process of making same.* N. Thurlow, Niagara Falls, N.Y., Assignor to the Portchester Chemical Co., Port Chester, N.Y. U.S. Pat. 833,095, Oct. 9, 1906.

Pinyl oxalate, b. pt. 157°—160° C. at 680 mm. vacuum, is prepared by heating turpentine with oxalic acid at a temperature below 120° C., distilling the reaction product at 78°—82° C. under a vacuum of half an atmosphere, and afterwards distilling the residue with steam until 85—90 per cent. have come over. The distillate is an oily mass (sp. gr., 0·930—0·935 at 20° C.) containing pinyl oxalate, having a harsh, unpleasant odour, and becoming brown on exposure to the air. On heating, it decomposes into camphor, carbon monoxide, and water; when heated with water, it yields oxalic acid and hydrocarbons.—A. S.

German Patents.

Camphor; Process for the purification of ——. A. Hesse. Ger. Pat. 164,507, May 19, 1904.

The patentee has discovered that camphor is soluble in dilute sulphuric acid. The solution of the crude camphor is warmed to decompose impurities, and the latter or their decomposition products are removed by decanting, filtering, &c. The camphor is afterwards precipitated from the solution by dilution with water, or by extraction with suitable solvents. The process is stated to be specially useful for the purification of artificially prepared camphor, as the mixture of camphor with borneol or isoborneol containing small quantities of manganese and chromium compounds can be treated directly. The camphor is obtained from the sulphuric acid solution, by diluting with water, as a white pulverulent precipitate. —A. S.

Salts of organic acids; Process for preparing alkali —— from the corresponding acid nitriles and amides. Deutsche Gold- und Silber-Scheide Anstalt, vorm. Rössler. Ger. Pat. 169,186, July 9, 1903.

Acid amides or nitriles are converted into the alkali salts of the corresponding acids by treatment with calcium hydroxide, and an alkali salt of an acid, the calcium salt of which is with difficulty soluble in neutral or alkaline solutions. By thus avoiding the use of free alkali hydroxide, the process becomes cheaper, whilst, at the same time, the products are said to be of greater purity, the calcium salt carrying down the impurities with it. —T. F. B.

Alcohols; Process for preparing symmetrical dihalogen derivatives of tertiary ——, *of the formula* $R.C(OH)(CH_2.halogen)_2$. Farbenfabr. vorm. F. Bayer and Co. Ger. Pat. 168,941, Jan. 27, 1905.

By the action of alkyl- or aryl-magnesium halides on symmetrical dihalogenated acetone derivatives, double compounds are obtained, which are readily decomposed by water or acids, producing the corresponding dihalogenated tertiary alcohols, $R.C(OH)(CH_2X)_2$, R representing an aromatic radical, and X, halogen. β-Naphtyldichlorhydrin, β-phenyldichlorhydrin, β-ethyldiiodohydrin and similar compounds can be prepared by this process. —T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 1003.)

Sodium sulphite solutions; Stable ——. W. Weissenberger. Eder's Jahrbuch. Brit. J. Phot., 1906, 53, 829—830.

Two samples of a 5 per cent. sodium sulphite solution, one of which also contained 2 per cent. of mannitol, were kept for 14 days, at the end of which time each was utilised for development with amidol; the one containing mannitol possessed strong developing properties, whilst the other was useless. A similar solution (containing mannitol), after keeping for three months in a corked bottle, contained 1·2 per cent. of sulphite; increasing the quantity of mannitol to 4 per cent. gave no increase of stability. Solutions prepared with anhydrous sulphite were more stable, a solution of 25 grms. per litre, containing 4 per cent. of mannitol, still containing 1·59 per cent. after three months and 0·65 per cent. after six months. Glycerol and isobutyl alcohol possess similar preservative properties for sulphite solutions, but not quite so marked as those of mannitol. Finally, it was found that a concentrated solution of sodium sulphite (anhydrous sulphite, 25 grms.; mannitol, 2 grms.; water, 100 c.c.) was very stable, only losing 1 per cent. of sulphite in three months.—T. F. B.

English Patents.

Photographs on silver chloride paper; Printing and developing ——. H. J. Mallabar, Liverpool. Eng. Pat. 13,032, June 23, 1905.

See Fr. Pat. 355,790 of 1905; this J., 1905, 1255.—T. F. B.

Photographs; Process for producing colour ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 22,725, Nov. 9, 1905.

See Fr. Pat. 365,314 of 1906; this J., 1906, 953.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 1006.)

Explosion; Circumstances attending an ——, *in the Press House and Incorporating Mills, which occurred at the factory of the Sedgwick Gunpowder Co., Ltd., at Sedgwick near Kendal, Westmorland, on June 23, 1906.* By Major A. Cooper-Key, H.M. Inspector of Explosives.

During a severe thunderstorm, which passed over the factory in question, the cake press house and four incorporating mills exploded. The explosions were undoubtedly due to lightning, and they all took place at the same instant, and there would appear to have been at least three separate strokes from the same flash. Of these three strokes, *viz.*, those which struck a poplar tree in front of one of the mills and the copings of another mill respectively, could not have been due to surging, side-flash, or other inductive effect, as the material struck was in each case non-conducting, but it is not improbable that the presshouse was blown up by an induced current or flash in the interior of the building. There is, therefore, evidence of the somewhat rare phenomenon of a divided flash striking simultaneously two unprotected objects nearly 100 yards apart, whilst at the same moment, a third object, the press house, 40 yards from the nearer of the other two, and protected by conductors, was separately exploded either directly or indirectly by a portion of the same flash. A description is given of the [illegible]

of lightning conductors recommended by Major Cardew for explosives factories in South Africa, where thunderstorms are so frequent and severe. The following modification of that system is recommended as securing a reasonable degree of safety, in the case of explosives factories in Great Britain. Two or more well-earthed conductors should be raised as high as practicable on poles standing a yard or two away from the actual building. These should be connected near their upper terminals by means of barbed-wire cables. The "finials" should consist of as many points as possible, and all joints should be made thoroughly good mechanically, and soldered in addition. If the conductors are actually in contact with the building, there is an increased risk of a portion of the flash seeking an alternative path through some metal inside the building, with disastrous results, many, if not most, building materials being better conductors than dry air, and, moreover, sharp bends are not so easily avoided as when separate poles are used. Internal masses of metal should be thoroughly well connected to each other and to earth, and should be situated at as great a distance as practicable from the conductors. All external metal, such as rain gutters, lead flashing, iron door plates, &c., should be connected to the conductors or otherwise thoroughly earthed. The press house under consideration in the report, was protected by two conductors of copper tape of the usual weight, one at each end of the building, connected along the ridge and well earthed in wet soil. Neither the metal inside the building nor the pressure feed pipe leading into it from the pump were connected to earth, and the conductors had not been tested for nearly three years. Moreover, the copper tapes were attached to the building instead of being raised on poles some little distance away. The building was, therefore, exposed to danger from all the sources mentioned above.

—G. W. McD.

Phosphorus; Investigations on ——. A. Siemens. VII., page 1044.

ENGLISH PATENT.

Gunpowder; Manufacture of smokeless ——. R. F. G. Robrecht, Berlin. Eng. Pat. 8604, April 10, 1906.

SEE Fr. Pat. 364,973 of 1906; this J., 1906, 953.—T. F. B.

UNITED STATES PATENT.

Explosives; Manufacture of ——. G. W. Gentieu, Peoria, Ill. U.S. Pat. 832,605, Oct. 9, 1906.

NITROCELLULOSE is mixed with alcohol, and then subjected to the action of ether vapour, which combines with the alcohol, and forms a solvent for the nitrocellulose.—A. G. L.

FRENCH PATENTS.

Nitroglycerin; Manufacture of ——. F. L. Nathan, J. M. Thomson, W. Rintoul, and A. Scott. Fr. Pat. 366,393, May 26, 1906.

THE glycerin is nitrated with a mixture of Nordhausen sulphuric acid and nitric acid with the object of obtaining a larger yield of nitroglycerin without increasing the size of the plant. Special claim is made for the treatment of 10 parts of glycerin with a mixture of 28 parts of nitric acid of about 21·5 per cent. strength, and of 34 parts of Nordhausen sulphuric acid containing about 20 per cent. of sulphur trioxide.—C. A. M.

Explosives; Process for preparing safety ——. B. G. Reschke. Fr. Pat. 366,729, May 31, 1906.

SEE Eng. Pat. 12,716 of 1906; this J., 1906, 953.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 1010.)

APPARATUS, &c.

GERMAN PATENT.

Lubricants; Apparatus for testing ——. J. Walther. Ger. Pat. 171,181, May 29, 1904.

THIS patent relates to apparatus of the type in which a vertical, loosely mounted disc is pressed against a rotating disc with the interposition of a film of the lubricant. The weight or power necessary to prevent the rotation of the loose disc is a measure of the friction. In order to allow of changing the material of the friction-discs, and of working at higher temperatures than that of the atmosphere, the apparatus is enclosed in an open double-walled cylinder, and the friction-discs are so mounted that they can be exchanged for others when desired.—A. S.

INORGANIC—QUALITATIVE.

Oxygen; A test for ——. A. C. Christomanos. Verh. Ges. Deutsch. Ntf. u. Aerzte, 1905, II. Teil., I. Hälfte, 76—77. Chem. Centr., 1906, 2, 1139—1140.

IF phosphorus tribromide be allowed to act upon copper salts, especially upon copper nitrate, solid or in solution, and, after cooling, the mixture be shaken with ether, a liquid is obtained, which forms an extremely sensitive reagent for the detection of oxygen, either gaseous or dissolved in alcohol, ether, &c., or the oxygen of hydrogen peroxide. With the colourless reagent prepared with copper nitrate solution, the presence of a trace of oxygen causes the upper ethereal layer to become green, and the lower layer purple-red; the colorations soon disappear, but are formed again on exposure to fresh oxygen. The reagent prepared with solid copper nitrate has a yellowish-green tint; it becomes coloured an intense green in presence of oxygen, the coloration being deeper and more persistent than that obtained when copper nitrate solution is used. The reagent contains cuprous bromide and phosphorous acid, which are oxidised in presence of oxygen.

The reagent can also be used for the detection of acetylene.—A. S.

Phosphorus; Investigations on ——. A. Siemens. VII., page 1044.

INORGANIC—QUANTITATIVE.

Potassium; Quantitative determination of ——. R. Pajetta. GAZ. Chim. Ital., 1906, 36 [2], 150—156.

THE author has examined the method for the determination of potassium proposed by Tarugi (this J., 1904, 882), and finds that potassium persulphate is more soluble in water and in solutions of potassium or sodium sulphate than stated by that author. The solubility of potassium and sodium persulphates in water is increased by the presence of sodium sulphate, and diminished by the presence of potassium sulphate. Since even in the simplest case, namely, the determination of potassium in potassium sulphate, by Tarugi's method, sodium sulphate is formed as a reaction product, accurate results cannot be obtained.—A. S.

Hydrofluosilicic acid; Note on the titration of ——. N. Sahlbom and F. W. Hinrichsen. Ber., 1906, 39, 2609—2611.

THERE is a difference of opinion in the literature whether hydrofluosilicic acid can be titrated as a monobasic acid requiring 6 mols. of potassium hydroxide (Offermann's method), or as a dibasic acid requiring 2 mols. (Weiss's method). Treadwell advises titration in presence of alcohol in the latter case, whilst Penfield makes use of an indirect method by treating the silicon fluoride with a 50 per cent. alcoholic solution of potassium chloride. The authors find that, inasmuch as hydrofluosilicic acid is a strong acid, the nature of the indicator used is of minor importance, but that, in presence of alkaline solutions, i.e., of hydroxyl ions, the hydrofluosilicic acid is hydrolysed easily into silicic acid and hydrogen fluoride. It can, thus, only be titrated as a dibasic acid when removed from the further action of the hydroxyl ions, e.g., by precipitation with alcohol as insoluble potassium or barium salt. On heating, the hydrolysis is much accelerated, and the acid can then be directly titrated with sodium hydroxide as a monobasic acid according to the equation:—

$$H_2SiF_6 + 6NaOH = 6NaF + Si(OH)_4 + 2H_2O.$$

The thermal springs of the Kaiserbad, in Aachen were found to contain 0·0008 grm. of fluorine per litre.

—F. F. A.

Permanganate solution; Titration with alkaline ——. [*Determination of formic and nitrous acids*]. E. Rupp. XXIII., page 1070.

Nitric oxide and air; Solubility of —— *in sulphuric acid.* O. F. Tower. VII., page 1043.

ORGANIC—QUALITATIVE.

Cholesterol and phytosterol; Method for the separation of ——. A. Windaus. Chem.-Zeit., 1906, 30, 1011.

The author is of opinion that a process for separating cholesterol and phytosterol can be based on the great difference in solubility of the dibromides of these alcohols in mixtures of ether and glacial acetic acid. A mixture of 40 c.c. of ether and 66 c.c. of glacial acetic acid dissolves only 0·25 grm. of cholesteryl dibromide, and this slight solubility is further reduced by very small additions of water. Phytosteryl dibromide is much more soluble in the ether-acetic acid solution, and separates only after the addition of considerable quantities of water. The dibromides are easily prepared from the alcohols by dissolving the latter in 10 times their volume of ether, and treating the ethereal solution with an equal volume of a 5 per cent. solution of bromine in glacial acetic acid, allowing the mixture to stand for an hour in ice-cold water. In the case of cholesterol, a certain quantity of dibromide separates out, and this can be increased by the addition of a few drops of water. The phytosteryl dibromide does not separate unless a considerable volume of water be added. The dibromides thus obtained are easily converted into the alcohols by treatment with zinc dust or sodium amalgam; the author prefers the former method. Experiments are quoted in which a qualitative separation of the mixed alcohols was obtained.—J. A.

Butter; Detection of cocoanut oil and margarine in ——. L. Robin. XII., page 1055.

ORGANIC—QUANTITATIVE.

Silk; Weighted ——. R. Gnehm and W. Dürsteler. Färber-Zeit., 1906, 14, 218—220, 233—237, 249—253, 269—272, 286—288, 299—305.

The method most generally applicable for determining the amount of weighting in silk is the nitrogen method. The authors prefer the Kjeldahl method, the first operation consisting in digesting the silk with a mixture of sulphuric and phosphoric acids in presence of mercury. This method can, however, be replaced in many cases by the extraction process, which, in addition to being more rapid, enables the nature of the charge to be examined to a large extent.

Examination of weighted silk dyed with colours other than black.—The method proposed by Gnehm (this J., 1903, 968) of extracting with cold hydrofluoric acid gives low results generally, whilst Zell's method, involving treatment with hot 5 per cent. hydrochloric acid (this J., 1903, 825), is also unreliable, the results being too high. The best method is found to be to extract the silk twice, for 15 minutes, with 1 to 2 per cent. hydrofluoric acid at 50°—60° C., using a platinum thimble. Extraction with hydrofluosilicic acid appears to be always incomplete, and was therefore rejected. Silk weighted with tin phosphate-silicate may be advantageously treated for half an hour with hydrogen sulphide in presence of dilute hydrochloric acid, at 70°—80° C., then for five minutes with 4 per cent. sodium sulphydrate solution at 40°—50° C., and finally for 15 minutes with 2 per cent. sodium carbonate solution, at 60°—70° C.; a pure silk fibroin remains after this extraction. If the silk has also been weighted with an aluminium compound, the above extractions must be repeated, since the first extraction will only remove about three-fourths of the charge. Ordinary mineral weightings can also be satisfactorily determined by treatment with oxalic acid solution at 70° C., followed by treatment with dilute sodium carbonate solution.

Examination of weighted black silks.—Black silks in which the weighting consists entirely of tin phosphate, can be completely extracted by heating with 1—2 per cent. hydrofluoric acid (or 3—5 per cent. oxalic acid), and then with 2 per cent. sodium carbonate solution; both these methods are useless when iron is present. By successive extractions with hydrogen sulphide in 1 per cent. hydrochloric acid solution, 4 per cent. sodium sulphydrate, and 2 per cent. sodium carbonate solution, the charge can be practically completely extracted from all black silks, without material deterioration of the fibre; the results are usually somewhat low, but are sufficiently accurate for practical purposes. (See also this J., 1903, 622.)

Determination of constituents of mineral weightings.—It is recommended that the charge be extracted from the silk with hydrofluoric acid, or, preferably, oxalic acid, and the acid extract and ash remaining after ignition of the residue, examined. The hydrogen sulphide extraction method is of little value for this purpose. Silica is determined in the ash after extraction with oxalic acid in the usual manner. Tin can best be determined by electrolytic precipitation from the oxalic acid extract. Hydrofluoric acid extraction is not suitable for determining the silica in the charge, but can be used for determining all other mineral weighting materials.—T. F. B.

Chromed hide powder question; The ——. F. Kopecky. XIV., page 1058.

"Glucose"; Report on the determination of —— *by the volumetric method.* A. Watt. Internat. Sugar Jour., 1906, 8, 502—506.

The author is inclined to attribute the wide differences between the estimations of "glucose" in beetroot sugar by British and Continental chemists respectively to differences of method, the volumetric process (which, as usually worked, is liable to many sources of error) being used by the former, whereas the gravimetric process is used on the Continent. In the volumetric process, variations in the conditions of working, cause serious errors; the greatest error thus introduced (which may amount to 20—150 per cent. of the "glucose") is due to the presence of sucrose. The author recommends the compilation of tables of correction similar to those used for the gravimetric process, and, in the meantime, he suggests that the volumetric results should be corrected by standardising the Fehling solution with solutions containing sucrose and invert sugar, in the proportions present in the samples under investigation. —L. E.

"Crude fibre"; Determination of cellulose, lignin and cutin in ——. J. König. Z. Unters. Nahr. u. Genussm., 1906, 12, 385—395.

"Crude fibre," whether obtained by the well-known process of Henneberg and Strohmann or by the modified process of the author [hydrolysis of the hemicelluloses by sulphuric acid in presence of glycerol] is a mixed product containing, in addition to the more resistant celluloses, lignin, and the complex esters known under the general names of cutin and suberin. In order to determine these constituents of the complex, the "crude fibre" is digested in the cold with hydrogen peroxide in presence of aqueous ammonia. The treatment is continued for a long time, with successive additions of hydrogen peroxide until the residue is colourless. The lignin is oxidised by this treatment, and is converted into soluble products. The residue, cellulose *plus* cutin, is then treated with the cuprammonium solvent, whereby the cellulose is dissolved whilst the cutin remains unattacked. The liquid is filtered in a Gooch crucible, and the residue of cutin is weighed; the cellulose is determined in the filtrate after precipitation by alcohol, and the difference between the sum of these two values and the weight of crude fibre taken, is expressed as lignin. These determinations are supplemented by combustion analyses of the respective products, from the results of which, in the case of meadow-hay, clover-hay, and various brans, the author concludes that the lignin contains 55·3—59·0 per cent. of carbon, and the cutin 60·0—75·4 per cent. of carbon. In many of the specimens examined, the cellulose separated from solution in cuprammonium was found to contain a higher percentage of carbon than the normal. This was found

to be due to the presence of methoxyl groups, the proportion of which ranged between 0·4 and 2·62 per cent., the latter number being found in the cellulose of wheat bran. This is in accordance with the observations of Cross, Bevan, and Beadle, who called attention to the presence of methoxyl groups in the cellulose from jute. The lignin portion of the "crude fibre" contains, in addition to methoxyl groups, ethoxyl and acetyl residues. The percentage of lignin in the plant increases as the vegetation develops, and this increase is more pronounced than that of the cellulose. The higher the percentage of lignin and cutin, the lower is the digestibility of the "crude fibre" or cellulose, and *vice-versa*.—J. F. B.

Crude petroleum; Determination of water in ——. E. Graefe. III., page 1035.

Permanganate solution; Titration with alkaline ——. [*Determination of formic and nitrous acids*]. E. Rupp. Z. anal. Chem., 1906, **45**, 687—692.

In certain cases oxidation by means of permanganate takes place more rapidly in alkaline than in acid solution, and the following methods are given for the determination of formic acid and nitrous acid:—

Formic acid.—A measured volume of formic acid (or formate) solution, containing not more than 1 per cent. of the acid, is placed in a stoppered flask, an excess of *N*/10 permanganate solution and 0·5 grm. of anhydrous sodium carbonate are added, and the mixture is heated in a water-bath for 30 minutes. After cooling, 75 c.c. of water, 25 c.c. of dilute sulphuric acid, and 2 grms. of potassium iodide are added, and the liberated iodine is titrated with thiosulphate solution. Each c.c. of *N*/10 thiosulphate solution corresponds with 0·0023 grm. of formic acid. The heating in the water-bath is necessary, as at the ordinary temperature the oxidation requires from six to ten hours for completion. In acid solution, the oxidation of formic acid by permanganate is not nearly completed after the lapse of ten hours.

Nitrous acid.—The oxidation of nitrous acid proceeds equally rapidly in acid and alkaline solutions but in the former there is a danger of loss of nitrous acid. The determination is carried out as in the case of formic acid except that no heating is required, the oxidation being completed in 10 minutes at the ordinary temperature. One c.c. of *N*/10 thiosulphate solution is equivalent to 0·0023 grm. of NO'_2. (See also this J., 1906, 41.)—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 1010.)

Autoxidation and oxidation by means of nitric oxide. W. Manchot. Ber., 1906, **39**, 3510—3511.

It has already been shown by the author and Herzog, that by the autoxidation of organic compounds of the type RH_2, such as oxanthranol, indigo white, hydrazobenzene, and the like, the oxygen taking part in the reaction leads to the formation of hydrogen peroxide according to the equation $RH_2 + O_2 = R + H_2O_2$. It has been found by further experiment that oxidation also takes place smoothly and with the same rapidity by the action of nitric oxide on the above compounds, and this without the production of hydrogen peroxide, the reaction being represented by the equation—

$$RH_2 + 2NO = R + H_2O + N_2O.$$

The formation of hydrogen peroxide is, in the author's opinion, due to the fact that the chain of two atoms of oxygen contained in the oxygen molecule is not split up by the reaction.—D. B.

Thiocarbamide as a solvent for gold. J. Moir. Chem. Soc. Trans., 1906, **89**, 1345—1359.

The author has previously shown (this J., 1906, 481) that gold is dissolved by acid solutions of thiocarbamide, especially in presence of suitable oxidising agents. From the solutions of gold containing hydrochloric acid and sulphuric acid respectively, two new complex salts have since been isolated, for which the author proposes the formulæ

$$2[C_2H_6N_4S_2AuCl],2CH_4N_2S \text{ and}$$
$$(C_2H_6N_4S_2Au)_2SO_4,2CH_4N_2S.$$

The complex chloride can also be obtained by the action of thiocarbamide on gold-potassium chloride solution. *s*-Diphenyl- and diacetyl-thiocarbamide have no solvent action on gold; hence it would appear that the activity of thiocarbamide itself depends upon its isomerisation to the compound, $NH{:}C(NH_2).SH$, the hydrogen of the SH group being replaceable by gold. The author is of opinion that most of the so-called addition compounds of thiocarbamide and salts of the heavy metals (compare Emerson Reynolds, Annalen, 1869, **150**, 255) are constituted similarly to the compounds described above, and thus contain less hydrogen than is indicated by the accepted formulæ.—A. S.

Serine; Resolution of racemic —— *into optically active components.* E. Fischer and W. A. Jacobs. Ber., 1906, **39**, 2942—2950.

Serine, the simplest hydroxyamino acid occurring among the decomposition products of proteids, has been known hitherto only in the racemic form. The *p*-nitrobenzoyl derivative has been completely resolved by means of the quinine salt into the isomeric optically active nitrobenzoyl-serines which, when heated with hydrogen bromide, are converted into the corresponding active serines. These have the rotation $[\alpha]_D = +6{\cdot}87$, and $[\alpha]_D = -6{\cdot}83$ respectively in water, and are otherwise very similar in properties. *d*-Serine tastes distinctly sweet, *l*-serine is less so though still appreciably sweet and has a peculiar after-taste. *l*-Serine is probably the naturally occurring form, as its methyl ester yields an anhydride identical with a substance isolated from the decomposition products of silk fibroin. The authors have also resolved *iso*-serine and diaminopropionic acid.—E. F. A.

Exhibitions; Committee on International ——. Times Oct. 25, 1906.

The president of the Board of Trade has appointed the following gentlemen to be a committee to make inquiries and to report with reference to the participation of this country in great international exhibitions:—Sir A. E. Bateman, K.C.M.G., chairman; Mr. A. Wilson Fox, C.B.; Mr. C. A. Harris, C.B., C.M.G.; Mr. Algernon Law; Sir James Kitson, Bart., M.P.; Mr. Malcolm Ramsay, C.B.; Sir Swire Smith; Mr. S. J. Waring. Mr. J. F. Wintour, of the Board of Trade, will act as secretary to the committee. The terms of reference to the committee are:—"To inquire and report as to the nature and extent of the benefit accruing to British arts, industries, and trade from the participation of this country in great international exhibitions; whether the results have been such as to warrant His Majesty's Government in giving financial support to similar exhibitions in future; and, if so, what steps, if any, are desirable in order to secure the *maximum* advantage from any public money expended on this object."

New Book.

Ammonia and its Compounds. By J. Grossmann, M.A., Ph.D. Harper & Brothers, 45, Albemarle Street, London, W.; and New York. 1906. Price 2s. 6d. net.

Small 8vo volume, containing 127 pages of subject matter with seven illustrations, 16 additional pages devoted to tables of specific gravity, comparative table of hydrometer degrees (Baumé and Twaddell), with corresponding specific gravities. Finally, the alphabetical index. The subject matter is subdivided as follows: I. Ammonia. II. Concentrated gas liquor. III. Liquor ammonia. IV. Liquid ammonia. V. Ammonium carbonates. VI. Ammonium sulphate. VII. Waste gases and liquors from the sulphate manufacture. VIII. Ammonium chloride. IX. Ammonium nitrate. X. Ammonium phosphate. XI. Ammonium sulphides. XII. Ammonium fluorides. XIII. Ammonium sulphocyanide and ferrocyanide. XIV. Ammonia recovery from spent oxide.

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Official Notices.

DECENNIAL INDEX, 1896—1905.

IMPORTANT NOTICE.

The Hon. Treasurer is prepared to receive subscriptions for the Decennial Index (1896—1905). The Authors' Names portion is now in the press and will be issued early in the new year; and the subject-matter portion will follow as soon as possible afterwards. The price is 10*s.* for the whole Index, or 11*s.* ($2.75) post free.

Copies of the Collective Index (1881—1895) may be had at the same price.

Cheques on members' own bankers, or money orders, payable at the G.P.O., London, should be made payable to Samuel Hall, and sent to the Hon. Treasurer, East London Soap Works, Bow, E., with the signed fly-leaf of a notice which will be sent out with the ordinary subscription notice, and to any others who make application for it.

SUBSCRIPTIONS OF MEMBERS ABROAD.

IMPORTANT NOTICE.

Members are reminded that the subscription of 25*s.* ($6.16) for 1907 should be sent to us to reach the Hon. Treasurer early in the New Year, so as to ensure continuity in the receipt of the Society's Journal.

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"INDUSTRIAL DISEASES COMMITTEE."

With reference to a notice which appeared in the November 15th issue of the JOURNAL (p. 1035), announcing the appointment of a Departmental Committee "to inquire and report what diseases and injuries, other than injuries by accident, are due to industrial occupations, are distinguishable as such, and can properly be added to the diseases enumerated in the Third Schedule of the Workmen's Compensation Bill, 1906," members who desire to assist the Committee by tendering evidence are requested to communicate with the Society.

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Gandil, Lewis C., Chemical Laboratory, [illegible]

[illegible]

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Death.

Miller, Dr. Edmund H., School of Mines, Columbia University, New York City, U.S.A.

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,, 26,020. Shepherd and Shepherd. Incandescence gas mantles. Nov. 17.
,, 26,039. Glover and Glover. *See under* VII.
[C.S.] 22,046 (1905). Clelands Graving Dock and Slipway Co., and Roxburgh. Gas producers. Nov. 7.
,, 22,229 (1905). Weber. Combustion apparatus for producing gases under pressure for power purposes. Nov. 7.
,, 22,677 (1905). Internat. Patent Fuel Synd., and Shedlock. Artificial fuel and the manufacture thereof. Nov. 14.
,, 22,919 (1905). Cambridge Scientific Instrument Co., and Burton. *See under* XXIII.
[C.S.] 23,484 (1905). Timmis and Jones. Fireclay and other retorts for making gas. Nov. 21.
,, 24,443 (1905). Hutchins and Wilkie. Gas producer apparatus. Nov. 7.
,, 20 (1906). Bayer. *See under* XXIII.
,, 12,153 (1906). Kuzel. Connecting filaments of electric glow lamps with thin supply wires. Nov. 21.
,, 13,682 (1906). Wheatley (Frowein und Wiescher). Incandescence mantles. Nov. 7.
,, 13,701 (1906). Saurer. Carburetting apparatus. Nov. 21.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 24,192. Kridlo. Treatment of petroleum residues.* Oct. 30.
,, 24,344. Wirth. Rendering heavy coal-tar oils odourless.* Oct. 31.
,, 24,687. Bowing. Destructive distillation of coal and other substances and apparatus therefor. Nov. 3.
,, 24,961. Robinson and Edwards. Distilling and carbonising certain materials to obtain by-products therefrom.* Nov. 6.
,, 25,039. Crutch. Manufacture of halogen compounds of benzene and other halogen carbon and hydrogen carbon compounds. Nov. 13.
[C.S.] 21,941. (1905). Walter. Transformation of organic substances by partial combustion. Nov. 7.
,, 6601 (1906). Blass. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 24,008. Hirschberger, Mason, and Levinstein, Ltd. Safraninones and reddish sulphurised dyestuffs therefrom. Oct. 29.
,, 24,091. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-nitrodiphenylamine or homologues or derivatives thereof. Oct. 29.
,, 24,092. Ges. f. Chem. Ind. in Basel. Manufactur of a red, vat-dyeing dyestuff from salicylthio acetic acid. [Ger. Appl., Nov. 4, 1905.]* Oct. 29.
,, 24,429. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Nov. 1.
,, 24,518. Bloxam (Act.-Ges. f. Anilinfabr.). *See under* XX.
,, 24,553. Thorpe. Manufacture of diamidonaphthalene and derivatives thereof. Nov. 2.
,, 24,826. Uhlmann. Manufacture of sodium salts of aromatic sulphonic acids. [Ger. Appl., Nov. 5, 1905.]* Nov. 5.
,, 25,193. Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of yellow monoazo dyestuffs.* Nov. 8.
,, 25,493. Imray (Soc. Chem. Ind. in Basle). Manufacture of monoazo dyestuffs which can be chromed. Nov. 12.
,, 25,639 Crutch. *See under* III.
,, 25,847. Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of black mordant azo dyestuffs.* Nov. 15.
,, 25,889. Wells. Production of aniline dyes. Nov. 15.
,, 25,977. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new diphenylamine compounds and colouring matters therefrom.* Nov. 16.
[C.S.] 7273 (1906). Ransford (Cassella und Co.). Preparations of sulphine colours. Nov. 7.
,, 9700 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of phenylglycine or its homologues. Nov. 21.
,, 10,506 (1906). Schrottky. Manufacture of substances suitable for use in the manufacture of indigo. Nov. 7.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 24,303. Pering. *See under* XIX.
„ 24,677. Gaydet. Apparatus for treating with liquids yarns in the form of cops, bobbins, and the like.* Nov. 3.
„ 24,708. Mainprice. Treating silk waste preparatory to spinning. Nov. 5.
„ 24,724 and 24,725. Pickles and Pickles. Bowls or rollers used in apparatus for schreinering, calendering, embossing, and the like. Nov. 5.
„ 24,791. Kenyon. Bleaching and dyeing cotton sliver. Nov. 5.
„ 25,248. Ainley. Machines for washing and scouring fabrics. Nov. 9.
„ 25,445. Pickles and Pickles. Dyeing and mercerising fabrics. Nov. 12.
„ 25,781. D'Izoro. Cops and bobbins, dyeing and bleaching machines. Nov. 15.
„ 25,942. Heaton. Preparation for use in sizing yarn. Nov. 16.
„ 25,971. Ransford (Cassella und Co.). Manufacture of multi-coloured fabrics. Nov. 16.
[C.S.] 16,159 (1905). Quackenbos. Cleaning wool and recovering the grease and the solvent used. Nov. 21.
„ 23,050 (1905). Klug. Dyeing apparatus. Nov. 21.
„ 23,345 (1905). Ickringill. Sterilisation of wool, cotton, rag, hair, &c. Nov. 21.
„ 1939 (1906). Abel (Act.-Ges. f. Anilinfabr.). Dyeing acetylated cellulose or artificial silk made therefrom. Nov. 21.
„ 9710 (1906). De Caudemberg. Manufacture of fibrous agglomerates. Nov. 7.
„ 13,005 (1906). Ker. Thin leaf or fabric, and method of making same. Nov. 14.
„ 19,182 (1906). Richter. Apparatus for the wet treatment of fabrics. Nov. 21.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

[C.S.] 4486 (1906). Salomon. *See under* IX.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 24,101. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of a dry chlorinated compound of lime. Oct. 29.
„ 24,134. Sisson. Hydrated carbonate of magnesium and its production. Oct. 30.
„ 24,144. Crossley and Rigby. *See under* II.
„ 24,447. British Thomson-Houston Co. (Allgem. Elektricitäts Ges.). *See under* XI.
„ 25,404. McTear. Manufacture of salt. Nov. 10.
„ 25,435. Trobridge. *See under* I.
„ 25,547. Williams and Fenner. Saturators for use in the manufacture of ammonium sulphate. Nov. 13.
„ 25,605. Cunnington. Manufacture of nitrogen compounds from atmospheric nitrogen. Nov. 13.
„ 25,813. Radcliffe. Treatment of spent liquor. Nov. 15.
„ 25,864. Kuzel. Production of colloidal elements. [Ger. Appl., Dec. 12, 1905.]* Nov. 15.
„ 25,928. Grossmann. Treatment of ammonia liquors. Nov. 16.
„ 25,976. Tyers, Hedley, and The United Alkali Co., Ltd. Treatment of sulphuretted hydrogen or gases containing sulphuretted hydrogen for the obtainment of sulphur therefrom. Nov. 16.
„ 25,978. British Thomson-Houston Co. (General, Electric Co.). Production of boron. Nov. 16.
„ 26,039 Glover and Glover. Revivifying oxide of iron. Nov. 17.
[C.S.] 1650 (1906). Wetter (Wülfing). Manufacture of black oxide of iron. Nov. 14.
[C.S.] 3980 (1906). Det Norske Aktieselskab f. Elektrokem. Ind., and Halvorsen. Production of concentrated nitric and sulphuric acids from nitrosulphonic acid and nitrous sulphuric acid. Nov. 7.
„ 7478 (1906). Fairweather (Beaver and de Nordenflycht). Dissolving plant for the recovery of sodium nitrate from caliche. Nov. 14.
„ 9621 (1906). Soc. Franç. La Norgine. Extraction of iodine from liquids containing iodine compounds. Nov. 14.
„ 11,979 (1906). Von Foregger. Means for generating oxygen. Nov. 7.
„ 11,981 (1906). Brindley. Composition for use in generating oxygen. Nov. 21.
„ 12,246 (1906). Jaubert. Preparation of oxygen by decomposition of oxygenated salts. Nov. 7.
„ 19,718 (1906). Toelle. Production of basic sulphate of lead. Nov. 21.
„ 19,732 (1906). Kronen. Production of basic lead salts insoluble in water. Nov. 7.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 24,272. Murray. Kilns for firing pottery, porcelain, bricks, &c. Oct. 31.
„ 24,589. Moir. Separating solids from water in china clay and similar materials by electrolysis. Nov. 3.
[C.S.] 12,554 (1906). Atkinson and Smith. Enamelling or glazing metallic or other surfaces. Nov. 7.
„ 18,663 (1906). Marks (Colburn). Production of sheet glass. Nov. 14.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 24,256. Kochmann and Kaufmann. Manufacture of substances capable of resisting water and chemical influences. Oct. 31.
„ 24,272. Murray. *See under* VIII.
„ 24,537. British Thomson-Houston Co. (Gen. Electric Co.). Cement. Nov. 2.
„ 24,583. Haskin. Maturing and preserving wood. Nov. 3.
„ 24,701. Meadowcroft, Holgate, and Huncoat Brick and Terra Cotta Co. Manufacture of brick and tiles. Nov. 5.
„ 24,823. Assoc. Portland Cement Manufacturers, Ltd., and Gibbs. Burning lime and other substances.* Nov. 5.
„ 25,043. Hennings. Manufacture of artificial slate.* Nov. 7.
„ 25,157. Trenkler. Accelerating the hydraulic hardening of cement, &c., made from blast-furnace slag.* Nov. 8.
„ 25,416. Evans (Graaff und Co.). Freezing-proof fire-extinguishing agent.* Nov. 10.
„ 25,417. Boult (Cöln- Müsener Bergwerks Akt.-Ver.). Hardening articles made from ground slag. Nov. 10.
„ 25,621. Woerdehoff. Manufacture of facing stone.* Nov. 13.
„ 25,857. Brooks. Hydrating and cooling cement. Nov. 15.
[C.S.] 1129 (1906). Smith. Material for making red bricks, tiles, and other articles. Nov. 21.
„ 3240 (1906). Stoddart. Manufacture of filtering media from slag. Nov. 21.
„ 4486 (1906). Salomon. Production of weather-proof and non-inflammable timber, and dyeing the same. Nov. 14.
„ 4503 (1906). Johnson (Koepp und Co.). Manufacture of stucco. Nov. 7.

X.—METALLURGY.

[A.] 24,072. Vuigner. Treatment of sulphide ores of lead and zinc. Oct. 29.
„ 24,074. Vuigner. Extraction of zinc from sulphide zinc ores, more especially from ores also containing

[A.] 24,096. Rheinische-Nassauische Bergwerks- und Hütten-A.-G., Borchers, and Graumann. Direct production of zinc from zinc sulphide and utilisation of the sulphur. [Ger. Appl., Nov. 3, 1905.]* Oct. 29.
,, 24,098. Bousfield and Bousfield. Plant for steel manufacture. Oct. 29.
,, 24,234. British Thomson-Houston Co. (Allgem. Elektricitäts Ges.). Purification of tantalum. Oct. 30.
,, 24,352. Viel. Obtaining metals and alloys, particularly aluminium and silicon, from their oxides. [Fr. Appl., Oct. 31, 1905.]* Oct. 31.
,, 24,526. Moyano. Extraction of zinc in the form of oxide from inferior calamines. [Span. Appl., June 12, 1906.]* Nov. 2.
,, 24,616. Keith and Machonochie. Utilisation of waste ferruginous materials. Nov. 3.
,, 24,905. Fernan. Extraction of metals from ores.* Nov. 6.
,, 25,112. Harbord. Pig-iron manufacture. Nov. 8.
,, 25,304. Rauch. Alloy of iron. Nov. 9.
,, 25,336. Harbord. Pig-iron manufacture. Nov. 9.
,, 25,372. Angel. Burning off zinc from oxidised ores and other materials containing zinc. Nov. 10.
,, 25,489. Perreur-Lloyd and Gardner. *See under* XI.
,, 25,530. Stanley. Crushing and treating ores for the extraction of precious metal. Nov. 12.
,, 25,553. Dawes. Blast furnaces. Nov. 13.
,, 25,574. Holdsworth. Treatment of poor sulphide ores. Nov. 13.
,, 25,966. Cowper-Coles. Rendering silver non-tarnishable. Nov. 16.
[C.S.] 23,319 (1905). Beaumont. Apparatus for recovering gold from disintegrated ores. Nov. 14.
,, 23,783 (1905). Davies. Flux for treating cast iron and other metals. Nov. 7.
,, 23,977 (1905). MacIvor, Fradd, and Metals Extraction Corporation. Treatment of sulphide ores containing zinc. Nov. 21.
,, 26,813A (1905). Ashcroft. *See under* XI.
,, 1660 (1906). Rayner, and Hardy Patent Pick Co. Machine for washing coal, minerals, &c. Nov. 14.
,, 3900 (1906). Brinton. Cast manganese steel rail. Nov. 7.
,, 4107 (1906). Hadfield. Manufacture or treatment of steel. Nov. 7.
,, 16,283 (1906). Bates and Peard. Annealing metals. Nov. 7.
,, 18,134 (1906). Stolzenwald. Realising the value of material containing zinc. Nov. 14.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 24,296. Mahlke and Brion. Electric apparatus for subjecting gases to the action of arc flames. [Ger. Appl., Nov. 3, 1905.]* Oct. 31.
,, 24,447. British Thomson-Houston Co. (Allgem. Elektricitäts Ges.). Preparation of nitrogen-oxygen compounds from mixtures of nitrogen and oxygen by means of an electric discharge. Nov. 1.
,, 24,589. Moir. *See under* VIII.
,, 24,806. Ferchland. Electrodes for electrolytic purposes. [Ger. Appl., Nov. 9, 1905.]* Nov. 5.
,, 24,820. Reynolds. Electric furnaces. Nov. 5.
,, 24,985 and 24,986. Cowper-Coles. Electrolytic deposition of metals. Nov. 6.
,, 25,489. Perreur-Lloyd and Gardner. Electrolytically extracting metals from ores.* Nov. 12.
,, 25,599. Reynolds. Electric furnaces. Nov. 13.
,, 25,991 and 25,992. Maschinenfabr. Oerlikon, Wüthrich, and Stirnimann. Electric furnaces. Nov. 16.
[C.S.] 26,813A (1905). Ashcroft. Electrolysis of metallic compounds or ores. Nov. 14.
,, 2465 (1906). Hermite. Electrolytic apparatus. Nov. 7.
[C.S.] 11,675 (1906). Brindley. Fusing materials by electricity. Nov. 7.
,, 12,329 (1906). Röchling and Rodenhauser. Electric furnaces. Nov. 14.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 24,135. Ermen. Preparation of emulsions. Oct. 30.
,, 24,822. Karsam Soap Co., Ltd., Samuel, and Lockwood. Manufacture of soap or mixtures containing soap.* Nov. 5.
,, 25,882. Pearson. *See under* XV.
,, 26,077. Johnson (Kalle und Co.). Production of a fatty substance from micro-organisms. Nov. 17.
[C.S.] 23,546 (1905). Macpherson and Heys. Detergent for use with hard or salt waters. Nov. 21.
,, 1719 (1906). Wörner. Preparation of emulsifiable matter. Nov. 21.
,, 6601 (1906). Blass. Solidifying fluid greases, tar, &c., and increasing the consistency of solid fats, resins, soaps, or the like. Nov. 21.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

[A.] 25,700. Meeze. Method of rust-proofing iron. Nov. 14.
,, 25,959. Griffiths. Pigments. Nov. 16.
[C.S.] 22,252 (1905). Colignon. Manufacture of paint. Nov. 7.

(*B.*)—RESINS, VARNISHES.

[C.S.] 6601 (1906). Blass. *See under* XII.
,, 11,090 (1906). Elkeles and Klie. Manufacture of polishes and varnishes from resins and the like. Nov. 21.

(*C.*)—INDIA-RUBBER.

[A.] 24,787. Lesage. Elastic material and apparatus for making it. [Fr. Appl., Nov. 6, 1905.]* Nov. 5.
,, 24,969. Gentzsch. Utilisation of waste rubber. [Ger. Appl., Nov. 16, 1905.]* Nov. 6.
,, 24,970. Gentzsch. Utilisation of waste rubber. [Ger. Appl., Feb. 2, 1906.]* Nov. 6.
,, 25,735. Alexander. Manufacture of aqueous solutions of caoutchouc and the application thereof to regenerating caoutchouc. Nov. 14.
,, 25,970. Kingzett, Kingzett, and Kingzett. Preparation of substitutes for gutta-percha and india-rubber.* Nov. 16.
[C.S.] 13,493 (1906). Hopkinson and Midgley. Vulcanisation of rubber goods. Nov. 21.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 24,189. Thompson (Kelk). Tanning, tawing, or curing hides or skins. Oct. 30.
,, 24,267. Bailey. Treatment of isinglass. Oct. 31.
,, 25,647. Eschalier. *See under* XIX.
[C.S.] 4561 (1906). Jensen. Composition for preserving leather. Nov. 14.
,, 18,004 (1906). Osborne and Schupp. *See under* XX.

XV.—MANURES, &c.

[A.] 24,492. Lehmann. Manufacture of fertilisers from animal refuse. Nov. 2.
,, 24,647. Macdonald. Manufacture of manure.* Nov. 3.

[A.] 24,901. Catto. Condensing and deodorising gases arising from fish manure drying plant. Nov. 6.
,, 25,882. Pearson. Apparatus for extracting oil from fish, fish oil, &c., for producing fertilisers. Nov. 15.
[C.S.] 17,029 (1906). Wenzel. Composition for applying to the soil to render it porous. Nov. 14.

XVI.—SUGAR, STARCH, GUM, &c.

[A.] 24,035. Steffen. Treatment of potatoes for obtaining starch and a food-stuff.* Oct. 29.
,, 25,340. Eastick. Process for making and purifying invert sugar. Nov. 10.
,, 25,860. Ost. Sugar purification. Nov. 15.
[C.S.] 13,217 (1906). Barbet. Desulphurising saccharine fruit juices. Nov. 21.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 24,093. Fritsche. Fermenting distillery mashes. Oct. 29.
,, 24,229. Carroll. Distillery and treating of spirits.* Oct. 30.
,, 25,595. Braunbeck. Saccharification of starch in the distilling industry, and in the production of yeast.* Nov. 13.
,, 25,691. Davis. Apparatus for use in brewing. [U.S. Appl., Nov. 15, 1905].* Nov. 14.
[C.S.] 18,351 (1905). House. Process of brewing. Nov. 21.
,, 2242 (1906). Wagner. Brewing material derived from starch and analogous farinaceous materials. Nov. 14.
,, 5619 (1906). Nathan. Vessels for use particularly in the manufacture of pasteurised beer. Nov. 21.
,, 21,567 (1906). Elektrochemische Werke Ges. Process for depriving alcohols, especially ethyl alcohol, of water. Nov. 7.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

[A.] 24,035. Steffen. *See under* XVI.
,, 24,082. Linzel and Bischoff. Manufacture of non-alcoholic drinks from fermented liquors. Oct. 29.
,, 24,435. Schwarz. Preservation of grape must and other fruit juices. Nov. 1.
,, 25,019. Liversedge. Manufacture of butter and butter substitutes. Nov. 7.
,, 25,750. Rasmussen. Evaporating the watery parts of milk, dissolved casein, and other liquids and semi-liquids. Nov. 14.
[C.S.] 12,424 (1906). Von Tury. Egg substitute. Nov. 2.
,, 13,217 (1906). Barbet. *See under* XVI.

(*B.*)—Sanitation; Water Purification.

[A.] 24,172. Girerd and Drapier. Purifying waste water. Oct. 30.
,, 24,945. McLean. Preparation of valuable products from sewage sludge. Nov. 6.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 24,067. Newton (Bayer und Co.). Manufacture of cellulose derivatives. Oct. 29
,, 24,281. Terrell. Manufacture of collodion for incandescent mantles. Oct. 31.
,, 24,308. Pering. Manufacture of water- and fat-proof paper, cardboard, weaving-stuff, &c.* Oct. 31.
,, 25,647. Escalier. Process for strengthening cellulose and albuminoid bodies. Nov. 13.
[C.S.] 10,486 (1906). Soc. Anon. Mirabet. Sizing composition for use in the manufacture of paper. Nov. 21.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 24,222. Reitz. Production of radio-active crystals.* Oct. 30.
,, 24,518. Bloxam (Act. Ges. f. Anilinfabr.). Manufacture of 3-aminophenyl-5-oxy-1.2-naphthimidazoledisulphonic acid. Nov. 2.
,, 24,826. Uhlmann. *See under* IV.
,, 24,830. Chem. Fabr. von Heyden, A.-G. Manufacture of isobornyl esters. [Ger. Appl., Feb. 16, 1906.]* Nov. 5.
,, 25,494. Meister, Lucius, und Brüning. Manufacture of dialkylbarbituric acids. [Ger. Appl., Nov. 28, 1905.]* Nov. 12.
,, 25,693. Crutch. *See under* III.
,, 25,718. Newton (Bayer und Co.). Manufacture of aminoacetopyrocatechin or derivatives thereof. Nov. 14.
,, 25,747. Twitchell. Process for effecting a combination between selected alcohols and fatty acids.* Nov. 14.
[C.S.] 21,757 (1905). Zimmermann (Chem. Fabr. auf actien, vorm. E. Schering). Manufacture of organic magnesium compounds. Nov. 7.
,, 239 (1906). Ellis (Merck). Manufacture of a substance from ergot. Nov. 21.
,, 18,004 (1906). Osborne and Schupp. Converting catechine into catechutannic acid. Nov. 21.
,, 21,567 (1906). Elektrochemische Werke. *See under* XVII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 24,046. Birnbaum. Photographic films. Oct. 29.
,, 24,667. Bolas. Production of photographs. Nov. 3.
,, 25,188. Stevens and Stevens. Photographic films.* Nov. 8.
,, 25,728. Husson and Bornot. Manufacture of photographic dry plates.* Nov. 14.
,, 25,869. Bloxam (Act. Ges. f. Anilinfabr.). Agent for fixing photographic images. Nov. 15.
,, 25,906. Pfenninger. Emulsion for photographic and like purposes.* Nov. 16.
[C.S.] 23,109 (1905). Rieder. Production of photographic prints. Nov. 21.
,, 5109 (1906). Beaumont. Production of coloured photographs. Nov. 21.
,, 14,435 (1906). Bloxam (Neue Photographische Ges.) Photographic pigment paper. Nov. 7.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 24,240. Claessen. Explosives.* Oct. 30.
,, 25,291. Haffner. Manufacture of matches. [Belg. Appl., Nov. 10, 1905.]* Nov. 9.
[C.S.] 25,081 (1905). Cooking, and Kynoch, Ltd. Solvents for nitrocellulose in the preparation of explosives. Nov. 7.
,, 6705 (1906). Venier. Explosives. Nov. 21.
,, 20,889 (1906). Luis and Williamson. Explosives. Nov. 14.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 24,405. South Staffordshire Mond Gas Co., and Pinnock. Portable gas analysis apparatus. Nov. 1.
[C.S.] 22,919 (1905). Cambridge Scientific Instrument Co., and Burton. Method and apparatus for estimating and recording the quality of gases. Nov. 14.
,, 20 (1906). Bayer. Apparatus for analysing gases. Nov. 7.

Death.

Miller, Dr. Edmund H., School of Mines, Columbia University, New York City, U.S.A.

Birmingham and Midland Sections.

Meeting held at the University, Birmingham, on Thursday, November 1, 1906.

MR. ALEX. E. TUCKER IN THE CHAIR.

THE INFLUENCE OF SMALL QUANTITIES OF ELEMENTS IN COPPER UPON ITS REACTIONS WITH NITRIC ACID.

J. H. STANSBIE, B.SC., F.I.C.

The investigation now to be described is a continuation of that contained in a paper (this J., 1906, 45—50) in which attention was directed to the gases liberated by the action of nitric acid on copper containing varying small proportions of arsenic, antimony, and bismuth.

In this paper some of the changes brought about in the solution during the dissolution of the metals and alloys and the escape of the gaseous products are described.

The nitric acid.—The ordinary pure acid used in the laboratory, which was found to contain traces of sulphate and chloride, and to leave a small residue on evaporation, was slowly distilled from a Wurtz flask. The distillate was then heated on a water-bath to 60° C., and a current of pure dry air aspirated through it until it became perfectly colourless, the aspiration being continued during the cooling of the acid.

The sp. gr. of the acid thus prepared was found to be 1·437, and it was diluted to give a solution of sp. gr. 1·2 the water used being redistilled in the same way as the acid itself. The 1·2 acid was found by titration to contain 396·27 grms. of nitric acid per litre. The 1·2 acid was then tested for impurities. No indication of chlorine in 50 c.c. of the solution was given by silver nitrate, even after standing for several days. A very faint indication of sulphuric acid in the same volume after neutralisation with pure sodium carbonate was given by barium chloride. 50 c.c. of the acid was evaporated in a weighed platinum dish, which increased in weight 0·2 mgrm., and showed a small stain in the centre. A careful examination for nitrous acid made by Griess's test with standard solutions of metaphenylenediamine and sodium nitrite, showed 1·5 mgrm. of nitrous acid in 1000 c.c. of the acid.

The acid obtained as described above was used for the experiments, and sufficient was prepared at once to carry out the complete series. The apparatus, which is described in the paper referred to above, was modified by passing a siphon tube through the bung to the bottom of the beaker in which solution of the metal was effected; this was used to transfer the solution from the beaker to the flask without bringing it into contact with the air. Preliminary experiments showed that it was necessary to measure accurately the volume of the acid solution used, so that instead of simply bringing the end of the nozzle of the burette on to the top of the tube delivering the acid into the beaker, it was ground into the bore of the tube; it could be thus brought into exactly the same position, and the accurate delivery of the same volume of acid for each experiment was ensured.

The principal aim of the investigation was to determine the amount of nitrous acid formed in the solution during the dissolution of the metal or alloy. It was, therefore, necessary to keep the solution out of contact with the air until the free acids had been neutralised. After a number of trials, it was decided to neutralise the solution with excess of pure sodium carbonate, and to determine the amount of nitrous acid in it by titration with standard solutions of potassium permanganate and ferrous ammonium sulphate. The excess of sodium carbonate in the solution was determined by standard acid solution, with methyl orange as indicator. Copper is not always completely precipitated from its solution in nitric acid by excess of sodium carbonate at the atmospheric temperature until it has stood for 48 hours. Precipitation is completed on boiling, but it was thought that an operation would be avoided by allowing the precipitation to become complete in the cold, although boiling does not affect the sodium nitrite in alkaline solution. In fact the stability of the nitrite in the presence of excess of sodium carbonate was very marked. Boiling the solution, or allowing it to stand for several days, did not alter the amount of nitrite as determined by permanganate solution. Even air or oxygen may be aspirated through the solution without affecting the nitrite. So that when the nitrous acid is once neutralised, no difficulty is experienced in its accurate determination.

The experiments were conducted as follows: The metal or alloy is reduced to fine filings, sifted through brass gauze with 64 meshes to the linear inch, and magneted; 1 grm. of the filings is transferred to the dry beaker in which the dissolution is to be effected. The acid is run into the burette, levelled, and raised to 65° C. by hot water in the water jacket. The beaker is placed in position, connected with the gas cylinder, and the water lute run round. The water-bath is brought into position, and the acid allowed to run in drop by drop. When solution is complete, previously boiled water is run into the beaker from the burette to displace the gas, the gas cylinder is disconnected, and the delivery tube of a wash bottle containing boiled water connected with the gas-delivery tube leading to the beaker. The siphon tube is then opened, and a 500 c.c. flask about half full of a solution containing 6·0 grms. of pure sodium carbonate, brought into position with the siphon tube reaching nearly to the bottom. The solution in the beaker is then siphoned over by blowing into the wash-bottle to commence the action. When sufficient liquid has siphoned over the connection is broken, the parts of the apparatus which have been in contact with the solution well washed, and the washings added to the flask. The flask, after being well shaken, is made up nearly to the mark, well stirred, and set aside till the next day; it is then filled up to the mark, the contents well mixed, and allowed to stand another day for the complete precipitation of the basic copper carbonate.

The solution is filtered into a dry flask, the filter having been previously washed with a portion of the same solution, and 50 c.c. withdrawn by a pipette for determining the nitrous acid, and the excess of sodium carbonate. The permanganate solution is made so that 1 c.c. = 0·001 grm. of nitrous acid. It was standardised by ferrous ammonium sulphate, and checked by titrating a solution of pure silver nitrite with it. The ferrous ammonium sulphate solution used for the reduction of the excess of permanganate added to ensure the complete oxidation of the nitrite, was made so that 10 c.c. = 5 c.c. of the permanganate solution.

The determination of the nitrous acid is carried out as follows: 50 c.c. of the solution is run from a pipette into a conical flask, excess of permanganate is then added from a burette, and dilute sulphuric acid added. When the oxidation of the nitrous acid is complete, 10 c.c. of the ferrous solution is run in, and the excess oxidised by further addition of permanganate. After the necessary corrections have been made, the volume of the permanganate divided by 100 gives the weight of nitrous acid in mgrms. in 500 c.c. of the solution. Always two, and sometimes three titrations were made with each solution.

The excess of sodium carbonate is determined by titration with standard nitric acid solution, of which 1 c.c. =0·01 grm. of sodium carbonate. The volume of acid solution, divided by 10, gives the weight of free sodium carbonate in 500 c.c. of the solution.

The arrangemen of the results is based upon the following considerations:—

The weight of nitrous acid formed in an experiment

being known, the weight of sodium carbonate required to neutralise it can readily be calculated. The excess of sodium carbonate is known, so that the total weight used for neutralisation is obtained by difference. This consists of the part used to neutralise the excess of nitric acid, to precipitate the copper from the copper nitrate, and to neutralise the nitrous acid. By subtracting the weight of the latter, the weight of carbonate used up by the free nitric acid and the nitrate together is found. The copper nitrate is equivalent to free nitric acid, so that the weight of the free and combined nitric acid can be calculated. The weight of nitric acid used in the oxidation of nitric oxide to nitrous acid is given by :—

$$2NO + H_2O + HNO_3 = 3HNO_2$$
$$44{,}640 \text{ c.c.} \qquad 63 \text{ grms.} \quad 141 \text{ grms.}$$

And the volume of nitric oxide so oxidised can be calculated. Also, since the volume of nitric oxide liberated from the solution is known, the total volume of nitric oxide produced during the dissolution of the metal is also known, the solubility of the gas in water being neglected.

The weight of nitric acid used in an experiment was determined by running the required volume of the acid solution from the burette into a 500 c.c. flask containing 6 grms. of sodium carbonate in solution, making up to 500 c.c., and then titrating with the standard acid solution for excess of the sodium carbonate. This was checked by running through a blank experiment, in which all the conditions of an ordinary experiment were observed, except the addition of the metal.

Excess of sodium carbonate when the acid was run in = 1·014 grm.

Excess of sodium carbonate with the blank experiment = 1·018 grm.

Then $4{\cdot}984 \times \frac{126}{106} = 5{\cdot}926$ grms. of nitric acid.

Pure copper.—The following results, which are the mean of five experiments, were obtained with the pure metal :—

One grm. of copper, 5·926 grms. of nitric acid, and 6 grms. of sodium carbonate were used for each experiment.

Titration with permanganate.

Volume of permanganate required for 50 c.c. of solution	= 12·85 c.c.
Weight of nitrous acid in 500 c.c. of solution	= 0·1285 grm.
Weight of sodium carbonate to neutralise 0·1285 grm. of nitrous acid	= 0·1442 „
Weight of nitric acid to oxidise dissolved nitric oxide	= 0·0574 „

Titration with standard acid.

Volume of acid required for 50 c.c. of solution	= 15·10 c.c.
Weight of sodium carbonate in excess in 500 c.c. of solution	= 1·510 grm.
Weight of sodium carbonate used in neutralising nitrous acid	= 0·1442 „
	1·6542 grm.

Then $4{\cdot}3458 \times 126 \div 106 = 5{\cdot}166$ grms. of nitric acid as free and combined acid. The volume of nitric oxide which would be produced by the decomposition of the nitrous acid in the solution is given $0{\cdot}1285 \times 44640 \div 141 = 40{\cdot}7$ c.c. So that the total volume of nitric oxide produced by the secondary reaction is $176 + 40{\cdot}7 = 216{\cdot}7$ c.c., when 1 grm. of copper is dissolved.

According to the ordinary equation, 1 grm. of copper would liberate 236 c.c. of nitric oxide by the decomposition of 0·6667 grm. of nitric acid, and convert 2 grms. of acid into nitrate; and 216·7 c.c. of nitric oxide would result from the decomposition of 0·612 grm. of acid.

Therefore the results show that 90 mgrms. of the acid disappear, and as little or no gas other than nitric oxide collects in the cylinder, it is probable that the complete reactions are somewhat more complicated than those shown by the ordinary equations.

Variations in temperature.—A number of experiments were made to determine the effects of varying the temperature at which the reaction takes place. 1 grm. of copper and 5·926 grms. of nitric acid were used in each experiment, and the other conditions were kept as constant as possible, the temperature of the reaction being the only variable. The results are given in the following table, in which the weights are expressed in mgrms. The total volume of liberated and dissolved nitric oxide is also given.

Temperature °C.	Total weight of nitric acid used.	Weight of free and combined nitric acid as nitrate.	Weight of nitric acid decomposed in production of nitric oxide.	Weight of nitric acid used in oxidising nitric oxide.	Weight of nitric acid used in other reactions.	Weight of nitrous acid in solution.	Total volume of nitric oxide in c.c.
15	5,926	5,164	556	120	86	268	198
25	5,926	5,156	585	122	63	274	207
35	5,926	5,162	608	108	47	241	215
45	5,926	5,172	616	82	56	184	218
55	5,926	5,176	611	74	66	165	216
65	5,926	5,166	612	57	90	129	217
75	5,926	5,169	613	50	94	112	217
85	5,926	5,177	598	38	113	84	212

An examination of the table shows that variations in the temperature at which the reaction takes place have practically no effect upon the secondary change by which nitric oxide is produced, although the rate at which the changes take place increases with increase in temperature. It has already been noticed that the volume of gas other than nitric oxide liberated during the reaction is small, and decreases as the temperature of the reaction increases; and the table shows that the weight of acid used up in changes not indicated under the conditions of the experiment varies somewhat with the temperature, but is by no means negligible. It would seem from this that either a soluble gas is liberated, or that some of the acid is neutralised by ammonia formed during the reactions.

The alkaline solution was examined for ammonia by Nessler's test. The solution from the reaction at 25° C. gave 0·9 mgrm. of ammonia, and that from the reaction at 65° C. gave 0·6 mgrm. in 500 c.c. These quantities would neutralise 3·33 and 2·2 mgrms. of nitric acid respectively, but these are small compared with the quantities shown in the table, and when the nitric acid from which the ammonia is formed is added it would not increase the quantities to more than 5 and 3 mgrms. respectively. So that, though ammonia is undoubtedly formed during the reaction of the copper and acid, it is not in sufficient quantity to account for the disappearance of the quantities of acid indicated. A blank experiment without the metal was carried through, and the alkaline solutions examined for ammonia, which was indicated by the Nessler test; but the difference was sufficiently marked to show the influence of the dissolving metal. The distilled water used for the experiments was found to contain a trace of ammonia, but it was not thought necessary to use ammonia-free water for the whole series. What becomes of the "lost" acid is worthy of investigation, but it requires more extensive apparatus than has been used so far. The curve A (Fig. 1) shows the decrease in the amount of nitrous acid in the solution as the temperature increases, and the curve B shows the practically constant volume of nitric oxide formed during the reactions at varying temperatures. This bears out the suggestion made by Dr. Frankland that the difference in the volume of the collected gas at different temperatures might be accounted for by the nitric oxide being less soluble in the hot acid.

The instability of nitrous acid in the nitric acid solution containing copper nitrate was demonstrated by aspirating a current of pure air through such a solution containing 1 grm. of copper. The solution, instead of being neutralised directly with sodium carbonate, as in the other experiments, was collected in a flask, which was then connected with the apparatus used for purifying the nitric acid, and a moderate current of air aspirated through it while its temperature was kept at 65° C. by

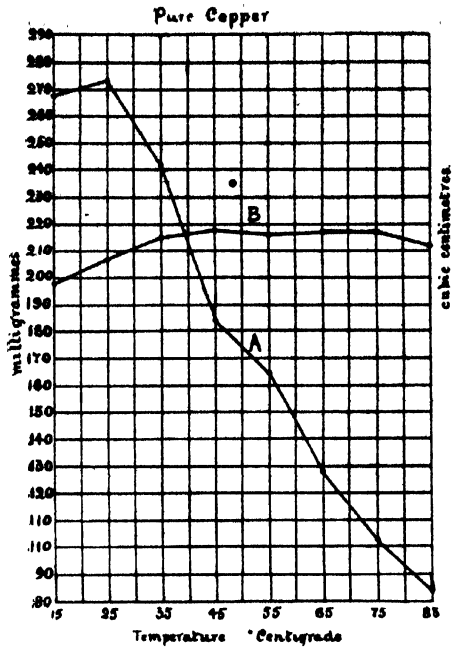


FIG. 1.

the aid of a water-bath. A long bulbed tube was interposed between the flask and the flexible tube leading to the pump. The further end of this tube showed no trace of condensation of liquid, and the tube itself was washed at the conclusion of the aspiration, the washings being added to the flask. In this way it was hoped to prevent any free acid from being carried off by the moist air leaving the flask. The solution was then added to a 500 c.c. flask containing 6 grms. of sodium carbonate in solution, and the experiment finished as described above.

The solution was found to contain 3·5 mgrms. of nitrous acid, as compared with 129 mgrms. found in the solution which had not been aspirated. This shows that the nitrous acid is either oxidised by the oxygen of the air passing through the solution, or that it is decomposed, and nitric oxide escapes with the issuing air. If oxidation takes place, the quantity of free nitric acid should increase in proportion to the weight of nitrous acid oxidised; but if nitric oxide escapes, the increase in the quantity of free acid would only be one-third of that weight.

The free nitric acid and nitrate in the solution required 4·455 grms. of sodium carbonate for neutralisation, which is equal to 5·297 grms. of nitric acid. Now from the table given above it is seen that, in the normal experiment, 5·166 grms. of nitric acid is indicated, so that there is an increase of 0·131 grm. in the free acid when the solution is treated with air at 65° C. If the whole of the nitrous acid which is shown to have disappeared during the aspiration were converted into nitric acid the increase would be 0·167 grm., but if it had been decomposed into nitric oxide and free nitric acid the increase would have been 0·056 grm. Therefore, the evidence is strongly in favour of the statement that the current of air passing through the solution oxidises the nitrous acid, and that only a comparatively small proportion is decomposed with evolution of nitric oxide in a moderately dilute solution. If, however, the solution is concentrated, and exposed to the air, nitric oxide escapes even after the whole of the metal has disappeared.

Bismuth and Arsenic.—As these metals, together with antimony, were dealt with alone as well as in the alloyed state in the previous paper, the experiments were continued with the bismuth and arsenic, but not with the antimony, on account of the practical impossibility of completely oxidising it in the 1·2 acid at 65° C.

Bismuth.—The results obtained with the bismuth are very interesting, as they show that the reactions taking place when the metal dissolves in the 1·2 acid at 65° C. are expressed by the equation:—

$$2Bi + 8HNO_3 = 2Bi(NO_3)_3 + 4H_2O + 2NO$$
415 grms. 44640 c.c.

This is proved by following statement of results:—1 grm. of the metal dissolved in 15 c.c. of the acid solution containing 5·926 grms. of nitric acid gave 0·0856 grms. of nitrous acid = 27·1 c.c. of absorbed nitric oxide and 79·5 c.c. of the evolved gas = 106·6 c.c. = total volume of nitric oxide liberated by the reaction of the acid with the metal; the volume calculated from the equation = 107·5 c.c.

The weight of free and combined nitric acid left in the solution = 5·598 grms. The weight of acid used for oxidation of nitric oxide in the solution = 0·038 grm. The weight of acid which disappears in the production of the nitrous oxide = 0·294 grm., as compared with 0·301 grm. as calculated from the equation. The total weight of acid thus accounted for = 5·930 grms. It is clear, therefore, that bismuth has little or no tendency to set up reactions other than the simple ones by which the production of nitric oxide can be explained.

Arsenic.—The experiments with arsenic furnished another interesting investigation. In the original experiments as described in the first paper, the so-called pure acid for use in the laboratory, which was found to contain traces of sulphate, chloride, and solid matter, diluted to 1·2 sp. gr., was used, and the arsenic dissolved rapidly in it at 65° C. But when the pure acid, prepared as already described, was substituted, the metal dissolved with difficulty, and much more slowly, although the result was the same. It evidently furnished an example of the influence of traces of impurity in the acid solution. Traces of sodium sulphate, sulphuric acid, sodium chloride, and hydrochloric acid were introduced separately into the pure acid, and it was found that the hydrochloric acid was the only one that accelerated the reaction between the arsenic and the acid. Since sodium chloride itself produces no effect, it would appear that the acceleration is due to the presence of a trace of free chlorine, which probably exerts a catalytic action, and thus promotes the general reaction between the arsenic and the nitric acid. The difference is very marked, for with the impure acid 0·5 grm. of arsenic dissolved completely in 15 c.c. of the impure acid at 65° C. in five minutes, whereas the same weight of metal under the same conditions required 55 minutes for complete solution when the pure acid was used. It was thought that the presence of nitrous acid in the acid solution might, as suggested by Dr. Price in his remarks on the first paper, exert some influence, and on that account the pure and impure acid were examined for the presence of the lower acid. The results were 2·1 mgrms. of nitrous acid per litre for the pure acid, and 3·2 mgrms. per litre for the impure acid. The difference is not sufficiently marked to account for the increase in the rate of action; and, further, it may be remarked that nitrous acid is formed in the solution as soon as the action commences, so that the presence of more or less nitrous acid in the original solution would not account for the difference in the rate of action. The presence of a trace of free chlorine gives the best explanation of the facts. It may be remarked that the arsenic furnished the only experiment in which any difference in the use of the ordinary pure acid and the specially purified acid was noticed. Even in the case of the arsenic itself small differences in the quantitative results could be accounted for by the difference in the rate of action. The following results for nitrous acid formed in the solution were obtained by the dissolution of 0·5 grm. of arsenic in 15 c.c. of the acid solution at 65° C. The solutions were neutralised with the sodium carbonate, and titrated with the standard permanganate in the usual way:—

(1) Ordinary acid gave 226 mgrms. nitrous acid.
(2) Purified acid gave 231 mgrms. nitrous acid.

(3) Purified acid with trace of chlorine gave 227 mgrms. nitrous acid.

For (1) the absorbed and the evolved nitric oxide = 238 c.c., and if it is assumed that the whole of the arsenic is oxidised to the pentoxide with liberation of nitric oxide and the formation of water the calculated volume is nitric oxide = 248 c.c., which is a close approximation to the observed result. Also it was found that 4·549 grms. of sodium carbonate was required to neutralise the free acid and the arsenic anhydride. Now if 0·5 grm. of arsenic is converted into 0·767 grm. of pentoxide it requires 0·7 grm. of nitric acid, so that there would be 5·784 – 0·7 = 5·084 grms. of free acid; but 0·1076 grm. of nitric acid is required for the oxidation of the absorbed nitric oxide, and the actual weight of free acid would be 5·084 – 0·1076 = 4·9764 grms.

This weight of acid would require 4·187 grms. of sodium carbonate to neutralise it, so that leaves 4·549 – 4·187 = 0·362 grm. for the neutralisation of the arsenic acid. By calculation 0·767 grm. of arsenic pentoxide is neutralised by 0·354 of the carbonate with formation of sodium dihydrogen arseniate (NaH_2AsO_4).

The facts stated above may be put into the form of an equation, thus:—

$$6As + 10HNO_3 = 3As_2O_5 + 5H_2O + 10NO$$

and show that the reactions between arsenic and nitric acid under the conditions stated are simple in character.

It should be noted that the weight of nitric acid in 15 c.c. of the ordinary acid is smaller than in the same volume of the purified acid, which is no doubt due to different methods being used for the determination of the specific gravity. The hydrometer method was used for the ordinary, and the weighing method for the purified acid.

Alloys of copper and arsenic.—The alloys used for the experiments, the details of which are given below, are the same as those used for the experiments described in the first paper. The experiments were carried through as already described for the pure metals, so that 1 grm of the finely-divided alloy, 5·926 grms. of acid in 15 c.c. of the solution, and 6 grms. of sodium carbonate were used for each experiment. The general results are arranged in the form of tables for easy reference, and the important quantities are traced on curves to render the relations more obvious. All weights are expressed in milligrams and to the nearest milligram, as this enables whole numbers to be used, and thus brings out the general relations more readily.

Alloys of copper and arsenic.

Arsenic per cent.	Total weight of nitric acid used.	Total weight of nitric acid free and combined as nitrate and oxide.	Weight of nitric acid decomposed in production of nitric oxide.	Weight of nitric acid used in oxidising dissolved nitric oxide.	Weight of nitric acid used in other reactions.	Weight of nitrous acid in solution.	Total volume of nitric oxide in c.c.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0·00	5,926	5,166	612	57	90	129	217
0·05	5,926	5,297	468	45	121	100	164
0·10	5,926	5,369	427	37	153	82	152
0·25	5,926	5,260	432	44	190	96	153
0·50	5,926	5,278	449	46	153	102	159
0·75	5,926	5,299	477	48	102	107	169
1·00	5,926	5,288	505	49	83	111	179
1·50	5,926	5,259	539	54	74	120	190
2·00	5,926	5,248	563	52	63	122	196
2·50	5,926	5,208	570	53	94	119	202
3·00	5,926	5,190	601	57	78	129	213

Note.—All weights are given in mgrms.

It will be noticed that the decrease and increase in the nitrous acid in solution follows the same general law as the decrease and increase of the liberated nitric oxide as the percentage of arsenic increases. See columns (1) and (7) in the table, and curve B, Fig. 2. Column (8), and curve A, Fig. 2, also show that the total volume of liberated and dissolved nitric oxide decreases and increases in the same general way, giving a minimum volume below

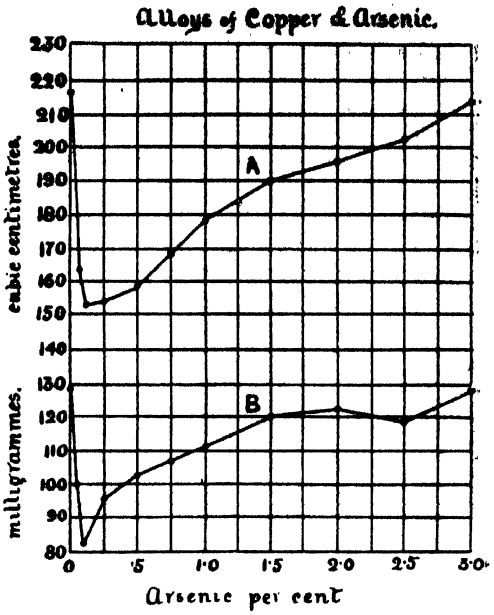


FIG. 2.

0·25 per cent. of arsenic. The weight of the "lost" acid also increases and decreases, but in this case the increase is accounted for in the liberation of the other gas, most probably nitrogen from its insolubility, which follows the same law.

Alloys of copper and antimony.—The remarks made in connection with the alloys of copper and arsenic also apply generally to the copper-antimony series, but the influence of the antimony is less marked than that of arsenic. This is seen by reference to columns (1), (7), and (8) of the table given below, and is emphasised by the curves A and B in Fig. 3.

Alloys of copper and antimony.

Antimony per cent.	Total weight of nitric acid used.	Weight of nitric acid free and combined as nitrate and oxide.	Weight of nitric acid decomposed in production of nitric oxide.	Weight of nitric acid used in oxidising dissolved nitric oxide.	Weight of nitric acid used in other reactions.	Weight of nitrous acid in solution.	Total volume of nitric oxide in c.c.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0·00	5,926	5,166	612	57	90	129	217
0·05	5,926	5,182	593	58	95	130	210
0·10	5,926	5,218	580	57	71	129	205
0·25	5,926	5,217	561	54	94	120	197
0·50	5,926	5,193	552	56	105	126	194
0·75	5,926	5,210	559	57	100	127	197
1·00	5,926	5,202	564	59	101	132	200
1·50	5,926	5,217	568	60	81	134	202
2·00	5,926	5,181	586	61	98	136	208
2·50	5,926	5,181	584	59	102	134	207
3·00	5,926	5,168	589	60	110	135	208

Note.—All weights are given in mgrms.

Alloys of copper and bismuth.—In this series of alloys the characteristic action of antimony and arsenic disappears entirely. In fact, the numbers obtained seem to point rather to a reverse action in the case of the alloys up to about 0·25 per cent. of bismuth. It has been noticed already that pure bismuth seems to give a comparatively simple set of reactions with nitric acid, and this is borne out by the alloys up to 0·25 per cent.

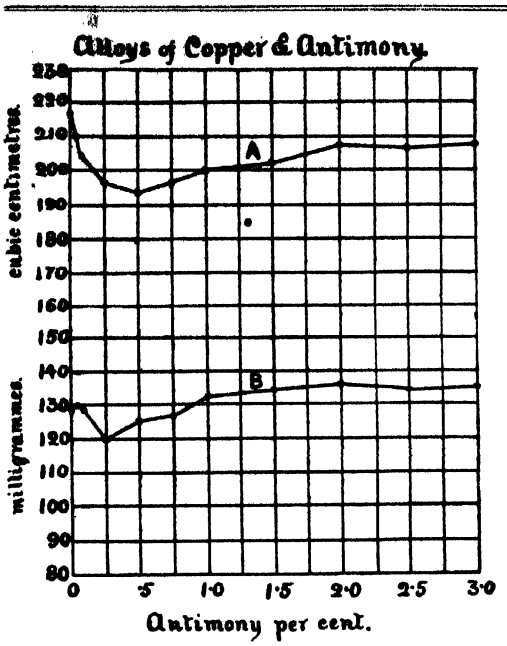


FIG. 3.

The general relations are given in the table, and shown in the curves A and B, Fig. 4.

Alloys of copper and bismuth.

Bismuth per cent.	Total weight of acid used.	Weight of free and combined nitric acid as nitrate.	Weight of nitric acid decomposed in production of nitric oxide.	Weight of nitric acid used in oxidising dissolved nitric oxide.	Weight of nitric acid used in other reactions.	Weight of nitrous acid in solution.	Total volume of nitric oxide in c.c.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0·00	5,926	5,166	612	57	90	129	217
0·05	5,926	5,246	624	63	—7	141	221
0·10	5,926	5,225	629	66	6	147	221
0·24	5,926	5,248	623	65	—10	146	219
0·48	5,926	5,231	611	60	14	135	215
0·72	5,926	5,242	589	57	38	128	207
0·83	5,926	5,246	579	56	45	127	204
1·10	5,926	5,254	561	56	46	126	202
1·57	5,926	5,246	569	58	53	129	200
2·15	5,926	5,232	549	51	89	121	193
2·61	5,926	5,226	540	54	100	118	190

Note.—All weights are given in mgrms.

Several conclusions can be drawn from the results given in this and in the first paper. The chief experiments are those which prove that the introduction of small quantities of foreign elements into pure copper has a marked influence on the character of the reactions between the metal and nitric acid. This is so decided in the case of arsenic and antimony as to leave no room for doubt as to its existence. Why this is so, still requires explanation, and nothing further can be added to the suggestion, already put forward, that the percentage of impurity which gives the most marked effect is that which, when in combination with copper, forms the most perfect solid solution of the compound in the excess of copper. Some colour is given to this by the fact that bismuth, which does not appear to form any compound with copper stable at ordinary temperatures, seems to exert an

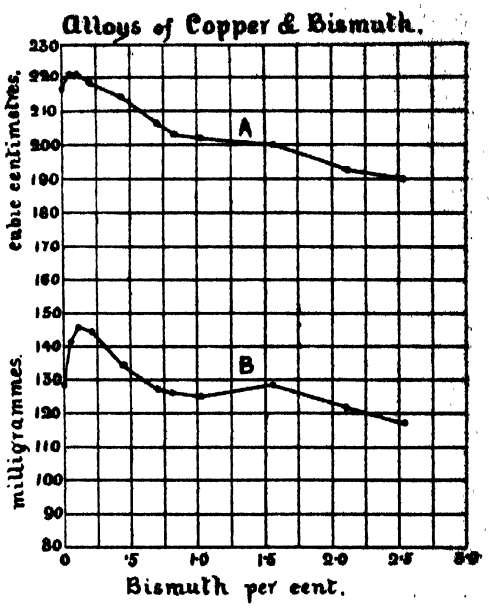


FIG. 4.

influence proportional to the quantity present in the alloy, for there is no marked minimum such as occurs with the arsenic and antimony alloys. There is no doubt that the presence of small portions of these elements in the alloys have a maximum disturbing effect upon the energy relations of their masses with the acid solution into which they dissolve. Whether this is due entirely to purely chemical relations is an open question, but it is worthy of note that as the atomic volume of the impurity increases its effect decreases.

The two variables which exert the greatest influence on the rate of action, and in the distribution of the products of the action, are concentration of acid, and temperature. This is brought out clearly in dealing with pure copper. There is no doubt that the main reactions by which nitric oxide is formed are influenced very little by variations in the temperature at which they take place, but the distribution of the gas between the solution and the atmosphere above it is clearly a function of the temperature. This is very marked over a wide range of temperature, and there is no difficulty even in detecting the effect of a variation of 2° or 3° in two experiments.

The formation of ammonia is also apparently a function of the temperature, but it may be that the effect of an increase in temperature is to cause the decomposition of ammonium nitrate with liberation of nitrous oxide almost as fast as it is formed. This would account for the smaller quantity of ammonia at the higher temperature.

The "lost" acid presents a problem which must be solved before the reactions can be fully explained, but it may be noticed that the formation of ammonium nitrate and its decomposition into nitrous oxide would account for some of it, as the solubility of the nitrous oxide would cause its disappearance from the main bulk of gas remaining for measurement. The simple character of the reactions for bismuth and arsenic, which leave very little "lost" acid to be accounted for, should be noted.

DISCUSSION.

Dr. T. S. PRICE asked whether the speaker considered that nitrous acid was produced by a secondary reaction, viz., the oxidation of nitric oxide by nitric acid, or did he assume that it might also be produced primarily by a

reduction of nitric acid during the reaction? What evidence was there in support of the supposition that all the nitrous acid was produced by oxidation of the nitric oxide? With respect to the effect of hydrochloric acid on the reaction between nitric acid and arsenic, it seemed to him curious that certain chlorides did not act in a similar way, since on adding a chloride to the nitric acid, hydrochloric acid was certain to be produced.

Mr. H. L. HEATHCOTE said the fact that arsenic dissolved so slowly in pure nitric acid called to mind the behaviour of iron in nitric acid that was pure. Iron was passive towards most grades of nitric acid, particularly when pure. It was quite possible that they had to do with the passive state, or the partially passive state, of arsenic. Bismuth, as discovered by Andrews, showed a passive condition in nitric acid. Copper also exhibited this condition. Arsenic, so far as he was aware, had not been observed in a passive condition. This might be the first observation of that. If that were the case, then the electrolytic processes which went on when the metal was dissolving might have something to do with the "lost" acid. He suggested that the becoming passive of a metal was caused by the little local currents which were produced at the surface; since such local currents were produced in the case of copper, they might give an explanation of the "lost" acid. That hypothesis, he thought, was borne out by the becoming passive of the arsenic, in which condition there would be no local currents.

Mr. LEWIS asked what would be the effect if preparations of powdered bismuth, arsenic, and antimony were mixed with powdered copper in the same proportion as the alloyed metals. Did lead also produce the same effect as bismuth?

Mr. J. E. STACEY JONES said he found it exceedingly difficult to get nitric acid absolutely free from sulphur for the determination of sulphur in rubber as well as in steel. He was recently in want of some acid in a hurry, and could not wait to get it in the ordinary way of commerce; he, therefore, had to attempt to make it. He tried to distil it as the author described, and found there was practically as much sulphuric acid in the distillate as previously. Afterwards he distilled it over barium nitrate, and removed 80 to 90 per cent. of the sulphate But there was some sulphate there even after taking all precautions. He also asked whether the author could enlighten him on a good process of purification of fuming acid.

Mr. STANSBIE, in reply, with regard to Dr. Price's question about the reduction of nitric acid to nitrous acid direct, said that was a matter which he had not considered at present. In the experiments he had been carrying out, it had proved rather difficult to get results on account of the many variations which might take place. He was modifying the apparatus which he had used so far, and he hoped to have more to say about the question, later on, as to whether the nitric oxide was simply liberated, and then oxidised to nitrous acid by nitric acid—that was a perfectly possible reaction—or whether nitrous acid was simply the result of partial reduction, or more than partial reduction, of the nitric acid. With regard to the action of hydrochloric acid and common salt when added to pure nitric acid, he could only say that he got a result with the acid that he did not get with the salt. He was now investigating whether nitric peroxide was one of the products of the decomposition of nitric acid by pure copper. He thought later he would be able to prove that it was. The subject required a lot of work to obtain anything like accurate information about it. As to what Mr. Heathcote said of bismuth, he agreed that a passive condition was usually induced when the acid was strong. The stronger the acid, the greater tendency for the passive condition to be induced in the case of a metal, whether iron or bismuth or what not. But in all his experiments with bismuth, the metal dissolved rapidly in the 1·2 acid. As stated in the paper, the arsenic was the only metal he had dealt with in which he had noticed any difference whatever in the action when the impure acid was used, and when the purified acid was used. He was still making investigations as to "lost" acid. It was completely lost to sodium carbonate, and therefore he had called it by the name "lost" acid. The only objection he had to the use of oxalic acid for titrations was that it was rather slower than ferrous ammonium sulphate. The sulphate worked consistently, and was stable in dilute solutions. He would try oxalic acid again, and if it were safer he would be glad to use it. In reply to Mr. Alcock, he could not say whether the coloration produced in nitric acid after dilution was due to the presence of iron in the acid; that was a matter for investigation. Experiments with simple mixtures of copper, bismuth, antimony, and arsenic were fully described in the first paper. For every alloy used the corresponding mixture was prepared—the effect of the added element was found to be simply that of an added constituent of the mixture; he meant by that that one could calculate from the composition of the mixture the volume of nitric oxide which had been liberated, showing that the simple act of mixture had no effect upon the reaction between the metals and the acid. He had not done any experiments with lead in copper at present. A considerable percentage of lead (as compared with bismuth) might be added to copper without its liquating. Bismuth sweated out in small globules over the surface of the alloy. Those globules, on analysis, were found to be pure bismuth. The only copper he got in the solution was that probably scraped off in removing the globules. He had taken much trouble on the subject of the purification of nitric acid, and found that any sulphate present was concentrated in the residue from the distillation. With the first experiments his object was to show that with alloys of arsenic and copper and so on there would be a differential action. He took the nitric oxide as a sort of indicator, without any thought particularly of the acid. The same acid was used in the whole series of experiments, and the differential action obtained was due to impurity in the metal.

Sydney Section.

Meeting held at Sydney on Tuesday, August 21, 1906.

DR. R. GREIG-SMITH IN THE CHAIR.

A POSSIBLE NEW COMMERCIAL SOURCE OF ALCOHOL.

BY E. A. MANN.

Investigations have been proceeding for some months in the Government Laboratory, Perth, W.A., on the *Xanthorrhœa preissii*, a plant confined to Western Australia, and which, in common with other species of the same genus occurring throughout Australia, is known as the "grass tree."

From its peculiar character and appearance, which forms a striking feature of our bush scenery, this plant naturally excites curiosity and interest; apparently useless, it nevertheless occupies large tracts of country, in the clearing of which it has, in the past, been ruthlessly destroyed, and it is hardly surprising, therefore, that attempts have been made from time to time to ascertain whether it could not be turned to some practical use. It is said to have been used as a source of picric acid; and being of a very resinous nature, its exudations have been tried in the manufacture of varnish, samples of the resin having been sent to England to ascertain their value in this respect, but it is reported to lack "body," and to be of no value, except for the cheaper and inferior classes

of varnish. On the other hand, it is said to have been successfully used in Queensland.

A more interesting attempt to turn it to practical account is that which has been made locally, by Mr. Charles Harper, of Guildford, in this State, and which led largely to my own investigation. Mr. Harper, in endeavouring to produce from the grass tree a fodder for cattle, prepared from the interior core of the stem of the plant a meal, which, I believe, has been used on stock with encouraging results. On submitting a sample of this fodder to analysis, the following results were obtained:—

Moisture, 9·19 per cent.; fat, 0·78 per cent.; albuminoids (N × 6·33) 2·83 per cent.; fibre, 35·93 per cent.; ash, 0·40 per cent.; carbohydrates (by difference), 50·87 per cent.

The carbohydrates were found to consist of:—

Reducing sugars (calculated as dextrose), 10·25 per cent.; non-reducing sugars (calculated as cane sugar), 15·86 per cent.; and other carbohydrates (by difference), 24·76 per cent.

Attempts were made to isolate the sugars in a pure form by crystallisation, but this was found to be impossible, owing to the large amount of interfering substances present; it occurred to me, however, that if they could be fermented, they might possibly be made a commercial source of alcohol. 350 grms. of the meal were extracted with boiling water, and the solution thus obtained was fermented with yeast. Fermentation proceeded vigorously. It was found that the sugars had been practically all fermented, as judged by the action on Pavy's solution, and the resulting alcohol was separated by distillation, yielding 300 c.c. of an alcoholic solution containing 8·34 per cent. of absolute alcohol by weight, or equivalent to 18·3 per cent. of sugar in the original meal. This return was equivalent to 1·24 galls. proof spirit per bushel (60 lb.) of the meal, whereas by the copper reduction method 25 per cent. of sugar had been found; the difference between the original amount of sugar present and that represented by the alcohol formed might be due either to variation in composition of successive samples of meal, or to the presence of other substances which reduced the copper solution.

Further, theoretically, pure sugar should yield 51 per cent. of alcohol, but only about 1 proof gallon is usually obtained from 10 lb. of sugar. Recalculated on this basis, the sugars amounted to 20·6 per cent.

A second extraction with 6 lb. of core, and a third with 2½ cwt., gave smaller proportionate yields, possibly due to variations of moisture in the meal, and to the specimens being gathered at different seasons of the year.

The various results obtained were:—

Month.	Weight of sliced core.	Proof galls. spirit per bushel (60 lbs.).	Equivalent sugar per 100 core.	Per cent. sugar by analysis.
September	350 grms.	1·24	20·6	26·1
February	6 lb.	0·8	13·3	not determined.
June	2½ cwt.	0·5	10·0	10·5

The yield of alcohol from various materials may be stated as follows:—

	Yield in proof galls. per bushel. (60 lb.).
Pure starch	4·68
Wheat, rye, barley, oats, buckwheat, maize, average	2·08
Malt	2·00
Potatoes (containing 21 per cent. starch)	1·26
Sugar cane (containing 12 per cent. sugar)	0·72
Beet (containing 10 per cent. sugar)	0·60
Grass-tree core	0·5 to 1·24

There are certain side issues which might be worth pursuing at the same time, if the manufacture of spirit from the grass tree were taken up on a large scale, viz.:—

1. The resin present in the outer shell or covering of the trunk could probably be utilised for making cheap varnishes as already indicated, grass-tree spirit itself being used as a solvent.

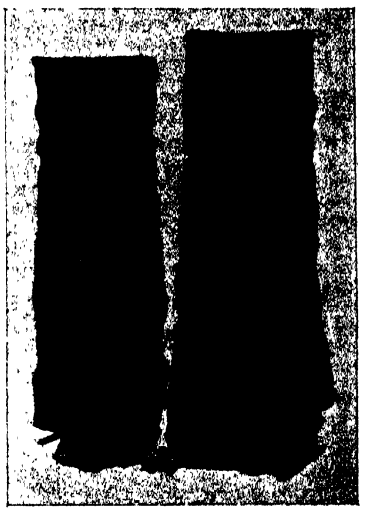
2. The outer strippings of the trunks could be used as an excellent fuel for raising heat in connection with the extraction and distillation.

3. The whole core contains a large percentage of fibre, which is short, and already in a suitable condition for use, and it has been suggested that this could be used to advantage in the manufacture of strawboard and rough paper.

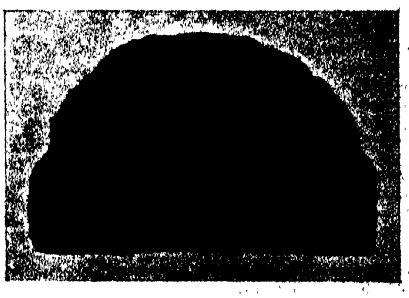
4. The green leaves of the plant have a certain value as fodder for stock.

The plants are readily knocked over, and the outer scaly protective covering or shell is easily removed.

In the accompanying photographs are shown longitudinal and transverse sections of the trunk of the grass tree, in which the very curious and interesting arrangement of the fibres in the core can be distinguished. From



LONGITUDINAL SECTION OF TRUNK, showing outer shell and core. The latter exhibits a layer of longitudinal fibres next to the outer shell. Average diameter of core, 6½ ins.



TRANSVERSE SECTION OF TRUNK showing radial character of core, and outer layer of longitudinal fibres next to the shell.

the centre, fibres radiate to the circumference, and are interlaced by longitudinal fibres passing down through it

core; the latter are specially accumulated in an outer layer next the surrounding outer shell composed of dead leaf bases. Between these interlacing fibres is contained the "meal" which contains the sugar.

I have to acknowledge valuable assistance given by Dr. W. H. Ince and Mr. T. J. Wallas, in connection with the laboratory work arising out of this inquiry.

Discussion.

Mr. T. U. Walton said that as nothing had been done in the way of identifying the sugars, one could only speculate as to their nature; but the fact of the non-reducing sugar being completely inverted by boiling for a short time was sufficient to show that it was not cane sugar. Possibly a glucoside was present, which yielded the additional proportion of glucose on boiling.

Mr. T. Steel said that the resin of the grass tree was an article of commerce, being collected and shipped to Europe and America. He agreed that cane sugar would not be inverted as described, but doubted if a glucoside could be present in quantity sufficient to yield 15 per cent. of glucose. He suggested that there might be a readily hydrolysable gum. As long ago as 1866 (Trans. Roy. Soc. Victoria), Ligar suggested the Xanthorrhoea as a source of alcohol, and in 1876 a patent was applied for in Melbourne for the manufacture of sugar from it. As a source of alcohol he did not think the plants could be profitably used, for they would soon be cut out and were slow growers. Besides, in Australia there was molasses as a waste product containing 50 per cent. sugar.

Mr. W. A. Dixon said that the resin from the grass tree was unsuitable for varnish making, because it contained the soluble benzoic and cinnamic acids, which made the varnish show stains with water.

Yorkshire Section.

Meeting held at the Queen's Hotel, Leeds, on Monday, October 29, 1906.

Mr. F. W. Branson in the Chair.

CHAIRMAN'S ADDRESS.

The Canal System and the Means of Internal Transport.

By F. W. Branson.

Abstract.

I propose this evening to briefly introduce for the consideration of the members of the Yorkshire Section of the Society of Chemical Industry, an important national question, *viz.*, the improvement of the canals and inland navigations of the United Kingdom.

One of my predecessors, Mr. James E. Bedford, suggested, in 1903, important extensions of the waterways of Yorkshire, and urged that the entire canal systems of the country should be improved. Since that time progress has been made, and a Royal Commission has been appointed. Careful consideration has been given to the project by the Council of this Society, an Internal Transport Committee having been appointed to co-operate with any similarly-constituted authorities with a view to secure much-needed reform. Various Chambers of Commerce, &c., have also given much attention to the entire question. Fortunately the problem to be solved is not a political one, but it is difficult and complicated owing to the extent and variety of the vested interests concerned (*e.g.*, two-seventhe of the existing canals are controlled by various railway companies). Other difficulties are the variation in size of the existing canals, which prevent satisfactory through routes being arranged, the deficiency of water supplies, and many other causes. The proper development of the canal systems of this country will not, I feel sure, affect adversely the interests of the railway companies as a whole, but benefit them. Mr. Rowland H. Barran, M.P., has again introduced a "Canals Bill," which is supported by several leading manufacturers and members of the Society of Chemical Industry. The careful attention of all traders should be given to the consideration of so important a measure. The Bill contains the following memorandum: "This Bill proposes to constitute a strong Central Canals Board for the purposes of obtaining Provisional Orders authorising the Board to take over, improve, and manage, in the first instance, certain canals which form a chain of navigation between the principal ports of England. Powers are also taken for subsequently acquiring by Provisional Orders other canals (with the exception of the Manchester Ship Canal), and for their improvement and management. The object of the Bill is by such a consolidation of interests and management to improve the facilities for water-carriage, and to establish a complete system of intercommunication." The Bill also provides: "That no chairman, director, manager, or other official of a railway company shall be eligible for the office of a member of the Board." It is proposed that the Canals Board shall consist of 23 members, of whom 15 shall be appointed and 8 elected. A carefully considered scheme has been put forward by Mr. J. A. Saner, whose proposition is that a system of intercommunicating canals shall be constructed for vessels of 300 tons to connect, in one system, the ports of London, Liverpool, Hull, and Bristol with Birmingham in the Midlands, and that two transverse systems in connection with the foregoing shall be constructed to connect Liverpool to Hull, and London to Bristol respectively. It is obvious that without legislation little can be achieved, and this will be difficult unless public opinion vigorously supports the action taken by the Mansion House Association on Railway and Canal Traffic, and other allied organisations. As to the cost of such a gigantic scheme, Mr. Saner has estimated that the Hull to Liverpool Section would cost £1,300,000; Hull to Birmingham, £2,700,000; Birmingham to London, £2,300,000; Birmingham to Bristol, £1,600,000; Birmingham to Liverpool, £2,200,000. To purchase existing canals on the basis of 20 years' purchase, assuming an annual net profit of £500,000, and allowing £1,000,000 for contingencies, would mean, in addition to the above sums, about £11,000,000, making a total of about £21,000,000. Assessing the present annual income of canals at £1,500,000, the traffic would, in his opinion, require to be practically doubled in order to make the scheme a financial success. On such a system as Mr. Saner is anxious to see carried out it is calculated that it will be possible for the mileage ton rate to cost for fuel, labour, and depreciation as little as ½d. per ton per mile for barges of 100 tons, and the rate would be considerably less for cargoes carried in steamers of, say, 300 tons. It is perfectly obvious, therefore, that there is great scope, especially in Lancashire and Yorkshire, for water carriage for certain classes of traffic, such as heavy and risky chemicals, coals, minerals, breakable goods, &c., &c.

The address was illustrated by lantern slides showing the present canal system, and differentiating the canals owned by the railway companies; also a map showing the new system as proposed by Mr. Saner.

Discussion.

Mr. Wardle (Vice-President, Leeds Chamber of Commerce) said that the cheapest water communication was carried on by private boats, and half the tonnage between Hull and Leeds was of this description. The Leeds Co-operative Society had a large number of private boats. He thought he was correct in saying that the rate from Hull to Leeds was a good deal more than 1d. per ton per mile, whilst according to Mr. Saner's estimate the cost would only be ½d. per ton per mile if the suggested

extensions of the canal system were carried out. As an example of an industry which had suffered on account of high rates of carriage, he mentioned that oil-crushing, which had been in this country first started in Leeds, had now been taken to Hull. It was, therefore, very important that Leeds and the West Riding should have cheaper communication with the sea. The most ardent advocates of improvement were the people of Birmingham and Bristol, where the canal trade suffered on account of the small guage of some of the connecting canals and the want of a uniform depth and width for boats of a fairly large size. The former city would benefit enormously by the introduction of such an improvement. The opposition of the railway companies was the most formidable obstacle, and their power was great, especially in Parliament. The improvement of waterways would, however, be an advantage even to them by the resultant expansion of the trade of the country. On the Continent the action of the French and German Governments had brought down the inland freight in some cases below 25 per cent. of that in this country. The success of German industries as shown by such works as those of the Badische Analin und Soda Fabrik on the Rhine was in no small degree due to cheap freights and adequate internal water communication.

Mr. W. P. BOWMAN thought it was necessary in the interests of the trading community to reduce the rates. The system of classification adopted by the railway companies made it more and more difficult in sending parcels of mixed goods. They would not now allow mixed consignments, but insisted on separate parcels for each different class of goods. Their inspectors were authorised to unpack goods in the yards or stop them in transit for the purposes of examination, often at the risk of damage or delay. It was, therefore, advisable to further the extension of waterways, especially since railways and most of the present canal companies acted together to such an extent that there was only a slight difference in rates, and practically no competition between them.

Mr. W. McD. MACKEY drew attention to the fact that under the railway bills as originally drawn the public had a right to use the railroads in common with the railway companies, and in law the right still existed. That is, one might run a private carriage or wagon on the railroad. Unfortunately, though, for the public the railway company was under no obligation to work the points for it. In the case of coal, water carriage had the great advantage over the railway, in freedom from breakage. Breakage occurred mainly in the shunting, and was a serious and recognised source of loss in the coal trade. This subject, though not strictly chemical, fell well within the scope of the Society; and he thought that some of the time that was annually spent in discussing Continental methods of technical education might with advantage be devoted to other subjects such as this, in which we really had much to learn from the Continent, where, especially in France, water carriage was being rapidly developed, whereas with us it was actually declining. He was struck when in Staffordshire with the usefulness of the canal system there. It seemed to fulfil for certain districts, as far as the carriage of heavy material was concerned, all the duties of a railway.

Mr. FAIRLEY gave an instance of the effect of heavy local carrying rates on industries. He mentioned a case in which it was cheaper to send goods by rail from Manchester to London and thence to Macclesfield, than direct. This showed the advantage cheap water accommodation would give.

Prof. GARDNER asked if figures were available to prove that water carriage under average conditions was actually cheaper than that by land.

Mr. R. K. CALVERT thought that railways could not altogether be blamed for taking up canals, since in many cases in the early days of railways they had been forced to this. One reason why canals had not developed in this country as on the Continent was that there were too many companies for such a small mileage. If the canals had been in fewer hands they might have agreed to adopt a uniform gauge. The question would have to be solved either by nationalisation of the canals or by a trust. Difficulties in the way of this were that prosperous companies might object to absorption of non-prosperous concerns, and that County Councils and other public bodies not gaining direct benefit by the system might decline to contribute. The easiest and most feasible plan of action appeared to be for the Government to take up the matter rather than for it to be left to private enterprise. It was impossible to estimate the cost, but it would no doubt be a good thing if the State were able, as had been suggested, to buy up the waterways on the basis of a twenty years' purchase of the nett profits of the canal system. It was advantageous to have canals made like the Bridgewater Canal, without locks. Leeds owed much of its prosperity to the waterways of the Aire and Calder Navigation, and the Leeds and Liverpool Canal.

Mr. F. W. BRANSON, in reply, said that canals should be used for what suited them. Some classes of material could not be conveyed by rail. Figures showed that there was no comparison between the rates by rail and water. Although Leeds was indebted to the Aire and Calder, it was advisable that the rates should be still further reduced. Many interests, such as agriculture, would benefit enormously by development of water communication.

The Chairman exhibited the following:—A new device enabling the operator in micro-photography to see and adjust the polished and etched metallic surface immediately before taking the photograph. Also apparatus for preparing metals for photo-micrography; apparatus for photographing metallic surfaces with high powers; various kinds of pyrometers, &c.; sections of the Madder plant used by Sir W. H. Perkin, F.R.S., in his early researches on alizarine.

Prof. W. M. Gardner showed a sample of mauve dye made by Sir William Perkin at the time of his first discovery, and samples of silk dyed with the same.

LIVERPOOL UNIVERSITY. MUSPRATT LABORATORY.

A NEW building, which is to be ready for occupation before the end of the year, has been presented to the University of Liverpool by Mr. E. K. Muspratt. Under the title of "The Muspratt Laboratory," it is to be used wholly in the study of physical chemistry, and especially electro-chemistry, and will afford accommodation for at least 40 workers. It is one of the best equipped laboratories for that purpose, and, together with its electrical machinery, apparatus, and furnaces, will have cost its donor little less than £16,000. The building is one of four storeys, with its exterior faced with pressed red brick and stone, in harmony with the surrounding buildings of the University. It stands behind the existing Chemical Institute building of the University, and communicates with this on the basement level. The basement contains a dynamo room, a battery room, a store, a large electric furnace room, and a research room for four students. The generating machinery will comprise an 80 kw. alternator, with two windings, to give 1000 ampères at 80 volts, or 500 ampères at 150 volts; a 30 kw. direct current generator supplying current at 80—100 volts.; and a 10 kw. charging set for the batteries. The generating machinery is to be driven by current taken from the town mains at 400 volts pressure, each dynamo having a direct coupled motor on the same bed-plate. The battery room is to receive a battery of 36 Tudor cells, arranged in six sets of six cells each. The current from these will be employed for electrochemical work demanding low voltage. An 80 kw. electric furnace is to be installed in the large furnace

room in the basement. The first floor of the building contains a lecture theatre, with accommodation for between 80 and 90 students, a library, a photographic room, a workshop, and a preparation room for the lecture experiments. The students' large laboratory, with accommodation for 21 students, is located on the second floor, and, in addition, the research rooms for advanced students and for members of the staff, and the balance and instrument store rooms will also be found on this floor of the building. The third floor of the building contains a laboratory for the senior students and five rooms which will be chiefly devoted to research work, whilst the flat roof of the building is also planned to give additional accommodation for students, when required, for certain classes of experimental work. The working benches for the students in the two main laboratories and in the research rooms will be provided with gas, water, and electricity supply. The draught cupboards and general ventilating shafts throughout the building are served by gas burners, it being considered unnecessary to arrange for mechanical ventilation by exhaust fans. The main lighting of the buildings is by brackets or pendants carrying incandescence gas burners; but the fume chambers and certain of the rooms will be lighted by tantalum lamps. Prof. F. G. Donnan is in charge of the new laboratory.

On Oct. 13, the laboratory was formally presented to the University by Mr. Muspratt, and then declared open by Sir William Ramsay. The gift was acknowledged by the Vice-Chancellor of the University, and an address was given by Sir William Ramsay on the value and importance of research work in scientific training. He pointed out that the highest purpose of a University must be to make young men and women acquire the habit of conscious thought, and that the occupant of a chair of physical chemistry finds much difficulty in getting students to think for themselves—a task which could be best achieved through the medium of research work. The study of organic and inorganic chemistry elsewhere in the University should, of course, not be neglected by those who would work in the new laboratory. Prof. Ostwald, of Leipzig, gave a lecture later in the day on the "Relation of New Facts to the Older Theories of Chemistry," in which he showed how much better it would seem to be to introduce the study of chemistry by means of simple examples of Willard Gibbs's phase rule, than through, as at present, the ill-defined and difficult notions of molecules and atoms. In isolating any substance, the chemist had to work upon bodies, apparently homogeneous, such as solutions, and endeavour to resolve them, more and more nearly, but never completely, into so-called pure substances, which are unattainable limits. Thus, for example, he can resolve aqueous alcohol more and more accurately into pure alcohol and pure water as limiting substances, without ever actually obtaining either of these unchemical entities. On the following evening, the Liverpool Section of the Society of Chemical Industry received as guests at dinner in the University Club House the English and foreign visitors. Dr. Conroy, Chairman of the Section, presided, and the President of the Society, Mr. Eustace Carey, was also present. It is not without interest that both Mr. Muspratt, the donor of the laboratory, and Sir William Ramsay, who opened it, are Past Presidents of the Society of Chemical Industry.

EXAMINATIONS IN CHEMICAL TECHNOLOGY.

The Institute of Chemistry of Great Britain and Ireland has adopted a scheme for periodical examinations of its Fellows and Associates in the principles and practice of chemical technology, with the object of encouraging them to acquire a fuller, a wider and more thorough knowledge of the subject. Knowledge of such matters as the following is required of the candidate:—

The application of well-known chemical and physical laws to industrial operations; the development, control, and transmission of power and heat; a working knowledge of operations and plant in general industrial use, also of treatment and handling of materials; the properties of materials affecting their application to the construction of plant and apparatus in chemical works; some ability in interpreting drawings and in making dimensioned, rough sketches; the calculation of working costs, and a general knowledge of the clerical work connected with manufacturing operations. Questions which might involve the disclosure of unpublished processes and details of plant in particular works are not put. The present Board of Examiners consists of Ludwig Mond (Chairman), David Howard (Deputy Chairman), George Beilby, Bertram Blount, Charles C. Carpenter, R. Forbes Carpenter, Edward Divers, Percy F. Frankland (President of the Institute), Oscar Guttmann, Julius Lewkowitsch, Raphael Meldola, Edmund J. Mills, H. R. Procter, A. Gordon Salamon, and J. Millar Thomson. The first examination was held in October, and lasted three days. One candidate out of three passed the examiners. In addition to the Board of Examiners, Dr. Harold G. Colman specially examined candidates in gas manufacture, and Messrs. F. W. Harbord and John E. Stead in steel manufacture; Dr. Lewkowitsch, a member of the Board, specially examined in the oils and fats industry.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 1032.)

English Patents.

Heat interchanging or temperature equalising apparatus. A. E. A. Birk, Copenhagen. Eng. Pat. 18,321, Sept. 11, 1905.

The apparatus consists of a coil of tubes, the convolutions of which touch one another throughout their entire length. The liquid or gas to be heated or cooled flows through or over the coil in one direction, and the heating or cooling medium flows over or through the coil in the contrary direction, so that the counter-current principle is fully made use of. The liquid which flows over the coil is fed from a distributor on to a corrugated cooling plate, from which it flows on to the coil, and the other gas or liquid is forced through the coil under pressure, so that the whole of it has to traverse the entire length of the coil in order to obtain a maximum of efficiency. Two or more of these coolers may be combined into a series, and the pressures in the coils may be kept different to allow of a progressive effect. In this case, the connection between the separate coils is made by a suitable pressure-regulating valve. (Reference is directed to Eng. Pats. 3169 of 1887, 17,570 of 1891, 17,735 of 1895, 17,694 of 1902, and 3917 of 1904.)—W. H. C.

Cooling and drying moist air; Processes for continuously—— in large quantities, and plant for use in the same. C. Lean, London. From Maschinenbau Anstalt Humboldt, Kalk, Germany. Eng. Pat. 24,309, Nov. 24, 1905.

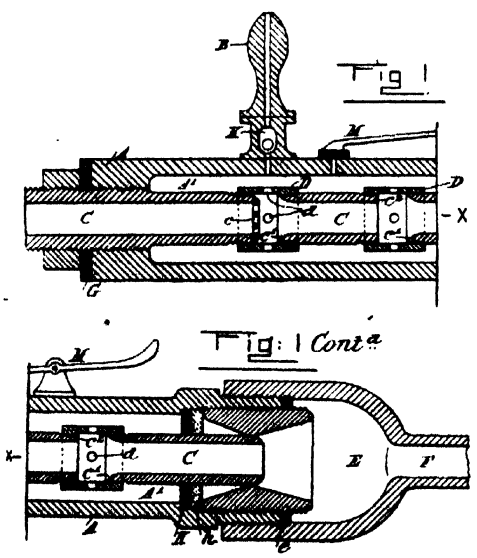
See Fr. Pat. 358,513 of 1905; this J., 1906, 270.—T. F. B.

Agitating apparatus for use in evaporating, distilling, emulsifying, gas-washing, pulping, and all similar industrial purposes. A. Z. Clark, Melbourne, Victoria. Eng. Pat. 3062, March 13, 1906.

An agitator furnished with propeller blades is rotated

in a horizontal plane partly within the lower end of an open-ended vertical cylinder, adjustably suspended in a tank or still, and a deflecting plate is arranged in the space in the tank around the cylinder to prevent circular motion of the contents. If the apparatus is to be used for gas-washing, the vessel is covered, and is provided with a bent inlet-pipe which passes centrally through the cover, and terminates just below the latter, within the suspended cylinder, which is in this case made of gauze or perforated plate. The annular space in the vessel is divided by a horizontal perforated plate which extends from the inlet-pipe at a point slightly above its lower end to the sides of the vessel, the cover of which is also furnished with an exit pipe.—W. H. C.

Vacuum; Apparatus for creating and maintaining a ——. A. J. Boult, London. From A. Manvers and H. Phillips, Sydney, N.S.W. Eng. Pat. 11,724, May 19, 1906.



The claim is for a small portable appliance which may be connected to any apparatus in which it is desired to produce a vacuum. It consists of an outer casing, A, which can be attached to the apparatus to be evacuated, by a nozzle, B, provided with a non-return ball-valve, K. Water under a pressure of at least 35 lb. to the square inch enters the compound inner tube, C, and is broken up into jets by the perforated cap, *c*. The tube, C, is made up of several parts connected by perforated sleeves, D, through the perforations, *d*, of which air is drawn from the annular space, A^1, by the jets of water. The mixture of air and water finally enters the expanded portion, E, which is screwed on to the end of the casing, A, and serves as a seal to prevent back-pressure of air from the escape pipe, F. The joints of the apparatus are made tight by the rubber washers, G, H, *e*, and the metal washer, *h*. The inlet ends, c^1, of the segments of the tube, C, have a trumpet shape and the outlet ends, c^2, a square shape as shown. Should water be drawn into the annular space, A^1, in consequence of any accident, the vacuum in A^1 can be destroyed by opening the valve, M.—W. H. C.

Centrifugal machines; Continuously operative ——. R. Haddan, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 16,000, July 14, 1906.

The claim is for a continuously operating centrifugal machine for separating solids from liquids. The drum is formed of a number of superposed, conical, perforated plates with solid plates interposed between them to guide the liquid. Modifications are claimed, in which the out flow openings are formed by parts engaging with and movable in relation to each other, or the solid and perforated plates may be in one piece with channels formed in the plate-body to allow the material to pass from the out-flow openings to the periphery of the drum.—W. H. C.

Centrifugal machines for drying or other purposes ——. R. Haddan, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 16,001, July 14, 1906.

The improvement consists in introducing supplementary discs between the usual ones. The material to be treated is introduced into the drum through the spaces between one side of the supplementary disc and the adjacent ordinary disc, and through the corresponding space on the other side any desired gaseous or liquid agents may be introduced to act on the material in the drum.—W. H. C.

United States Patents.

Muffle or furnace for annealing. A. Smallwood, Assignor to The Incandescent Heat Co., Ltd., London. U.S. Pats. 833,640 and 833,641, Oct. 16, 1906.

See Eng. Pat. 18,877 of 1905; this J., 1906, 1049.—T. F.B.

Separator; Centrifugal ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 834,043, Oct. 23, 1906.

The material to be separated is introduced through an axially-mounted feed tube, fitted with a worm conveyor, and discharging through a lateral opening rotating with the horizontal rotary separating vessel. The outlet for the separated liquid portion is arranged between the circumferential wall and the axis of the vessel, whilst the solid portion, deposited in the vessel, is removed to a discharge opening by means of a spiral conveyor mounted on a cage which surrounds the feed tube inside the vessel, and is rotated at a rate of speed different from that of the vessel itself.—C. S.

Pyrometer; Electrical-resistance ——. E. F. Northrup, Philadelphia, Pa. U.S. Pat. 834,162, Oct. 23, 1906.

The pyrometer comprises a porcelain tube, a low-resistance temperature-measuring conductor mounted inside and near one end of this tube, supports for the conductor, separate insulating tubes, inside and nearly as long as the porcelain tube, and enclosing current leads and potential leads connected with the resistance conductor; a head receiving one end of the porcelain tube, and fitted with terminals for the potential and current leads, and an outer metal tube, surrounding the porcelain tube near the head, and fitting into a metal cap secured to the face of the head.—C. S.

French Patents.

Crucibles of sand and lime; Process for the manufacture of ——. S. W. Berglund. Fr. Pat. 366,830, April 27, 1906.

The mixture of sand and lime, to which other materials, such as cement, may be added, is brought into the moulds in a state of suspension in water, and submitted to pressure without removing the water. The pressure may be applied at temperatures above 100° C.—A. G. L.

Filter; Recuperative ——. M. Lamort. Fr. Pat. 366,807, June 2, 1906.

The liquid to be filtered is placed in a vessel, through the perforated bottom of which it descends on to a movable endless belt of wire gauze, which is caused to oscillate continuously. The solids separated from the liquid are discharged into a suitable receptacle. The liquid adhering to the under side of the gauze is removed by contact with blades of wood arranged below the belt.—C. S.

Vacua; Process and apparatus for obtaining high ——. F. Soddy. Fr. Pat. 367,587, June 30, 1906.

See Eng. Pats. 17,923 of 1905, and 5348 and 5349 of 1906; this J., 1906, 992 and 853.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 1035.)

Coals; Determination of calorific value of —— *by the Parr calorimeter.* E. J. Constam and R. Rougeot. Z. angew. Chem., 1906, **19**, 1796—1806.

The authors have measured the calorific values of a large number and variety of coals by Parr's method, and have investigated the effect of a number of details in the working, comparing the results with those obtained from the same coals with the Mahler bomb. The chief conclusions are as follows:—(1) The factor to be used (no. of calories corresponding to 1° C. observed rise of temperature in the instrument) is, with the same coal, variable with the quality (content of sodium peroxide and of water) and with the coarseness of grain of the sodium peroxide used, and also according as correction for loss of heat by radiation is or is not made. The variation from these causes may amount to 3 per cent. of the total value. (2) The magnitude of other errors renders it superfluous to correct for loss of heat by radiation. (3) The difference between the Parr result and the Mahler result is not greater when ordinary high-grade commercial peroxide is used than when the peroxide is finely powdered; the closest agreement is obtained by using excess of finely-ground peroxide, together with potassium persulphate. In no circumstances, however, have the authors ever obtained complete combustion of a sample of coal in the Parr calorimeter, and they do not regard its results as sufficiently trustworthy to serve as basis for a decision as to the calorific value of a coal.—J. T. D.

Naphthalene from coal gas; Removal of ——. A. H. White and J. M. Barnes. J. Gas Lighting, 1906, **96**, 181—183; 244—245; 324—326.

In continuation of the investigation of White and Clary on this subject (this J., 1906, 59) the authors have further investigated the effect on the naphthalene content of the gas, of the removal of the suspended tar from the crude gas. The experiments were carried out at different works by analysing the gas at the inlet and outlet of the Pelouze-Audouin tar separator, placed in all cases between the primary and secondary condensers, *i.e.*, before the gas had been completely cooled, and at the same time a sample of the gas from the inlet was treated for the complete removal of the tar by means of a specially-constructed centrifugal separator, the gas passing from this apparatus being also analysed. The results obtained show that the separation of the suspended tar, whether by the Pelouze or the centrifugal separator, simultaneously effects the removal of a considerable proportion of the naphthalene vapour from the gas, although no material reduction of temperature occurs during the separation. The authors believe that this reduction is due to the fact that in the process of separation the gas is brought into intimate contact with the tar, thus enabling the latter to effect its full solvent action on the naphthalene still present as vapour in the gas. The amount of naphthalene left in the gas, however, becomes greater as the temperature at which the gas passes through the separator increases. Whilst in most cases it is found that the complete or nearly complete removal of the suspended tar is advantageous, experience at one works examined, has shown that, under the particular conditions prevailing there, such complete removal is undesirable, as, if carried out, stoppages from deposited naphthalene quickly occur in the secondary condenser and scrubbers, which are obviated by working the Pelouze-Audouin separator in such a manner as only to remove a portion of the suspended tar. The exact causes of the abnormal results at this works have not yet been elucidated. The authors find that it is impossible to obtain from large mains a true average sample of crude gas containing suspended tar, the amount of the latter being about three times as great near the edge as at the centre of the main. Further tests have been made with regard to the absorption of naphthalene by solvents at high temperatures, and it is shown that under suitable conditions heavy tar, pitch, and even the so-called "free carbon" of coal-tar all absorb considerable quantities of naphthalene, the amount absorbed under the conditions of the experiment increasing with rise of temperature. The authors also reply to some of the criticisms made upon their previous paper (this J., 1906, 60).—H. G. C.

Steam; Dissociation of ——. I. H. v. Wartenberg. II. W. Nernst and H. v. Wartenberg. VII., pages 1093 and 1094.

Carbon dioxide; Dissociation of ——. W. Nernst and H. v. Wartenberg. VII., page 1094.

Water vapour and carbon dioxide; Dissociation of —— *at high temperatures.* I. Langmuir. VII., page 1094.

English Patents.

Fuel; Combustible gaseous —— *for the generation of motive power.* G. M. S. Tait, New York. Eng. Pat. 9501, April 23, 1906.

Air, substantially free from moisture, is passed without the admixture of steam through a deep bed of fuel (say 3 ft. to 5 ft.), so as to produce a gas consisting substantially of carbon monoxide and nitrogen, with less than 5 per cent. each of carbon dioxide and hydrogen. The cooled and purified gas is mixed with air in predetermined proportion in the cylinder of a gas engine, compressed to between 11 and 16 atmospheres, and then ignited. It is claimed that the elimination of hydrogen from the gas, leads to increased efficiency, owing to the high compression thereby rendered permissible. If the fuel used be coal, or other clinkering material, a mixture of air and carbon dioxide or gaseous products of combustion, may be used instead of pure air; the endothermic reaction of the carbon dioxide upon the carbon thus reduces the temperature and prevents clinkering.—H. B.

Coke ovens. W. Klönne, Magdeburg, Germany. Eng. Pat. 21,135, Oct. 18, 1905.

See Fr. Pat. 358,624 of 1905; this J., 1906, 309.—T. F. B.

Carburetted air apparatus. T. H. Glasscoe, Wanstead, Essex. Eng. Pat. 14,226, July 10, 1905.

The carburetter is constructed in sections, each provided with its own air-inlet and gas-outlet valves, these being so connected to the bell of the gas-holder that the number of sections in operation is controlled by the movements of the bell. Each section is fitted with a jacket through which hot water or other heating fluid can be passed, the admission valves being likewise controlled by the movements of the gas-holder bell, so that only the sections in operation are heated. Thermostatic devices are also used in connection with the air valves, so as to counteract the influence of changes of temperature upon the richness of the carburetted air produced.—H. B.

Furnaces used in connection with gas retorts. J. H. Brown, Nottingham. Eng. Pat. 18,723, Sept. 16, 1905.

In a generator for heating gas retorts, having a series of overlapping flat bars under its charging inlet, the level grate at the foot of the said step-like arrangement of bars, and the door at the front of the same, are dispensed with.—H. B.

Gas generators; Suction ——. J. G. L. Bormann, Charlottenburg, Germany. Eng. Pat. 7499, March 28, 1906.

See U.S. Pat. 817,035 of 1906; this J., 1906, 421.—T. F. B.

Ferrocyanides; Manufacture of —— *from gas-purifying masses or other ferrocyaniferous masses.* T. Bollowitsch. Eng. Pat. 8362, April 6, 1906. VII., page 1095.

Gases; Process for removing sulphide of hydrogen from ——. E. Burschell, Landau, Bavaria. Eng. Pat. 11,133, May 12, 1906.

See Fr. Pat. 366,047 of 1906; this J., 1906, 976.—T. F. B.

Metals; Increasing the electrical resistance of —— *[for use in electric incandescence lamps].* H. Kuzel, Baden, Austria. Eng. Pat. 7655, March 30, 1906. Under Int. Conv., July 26, 1905.

SEE Fr. Pat. 364,613 of 1906; this J., 1906, 920.—T. F. B.

Electrical incandescence bodies; Method of producing metallic [tungsten] ——. Deutsche Gasglühlicht A.-G. (Auerges.), Berlin. Eng. Pat. 14,901, June 30, 1906. Under Int. Conv., Oct. 28, 1905.

IN order to obviate the distortion which occurs when metallic electrical glow-bodies, during their manufacture, are heated white hot in suitable gases by the electric current, the process is so conducted that, when an alternating current is used, its periodicity is increased to, say, 100, or the form of curve of the current is selected so as to make the periodic fluctuations of temperature less than in the case of the usual, approximately sinus-formed, alternating current having a periodicity of 60 or less. When a continuous current is used, the influence of the magnetic field permeating the workroom is eliminated or corrected, as, for instance, by enclosing the room in an iron casing, by compensating the magnetic field by a suitable additional field, by setting the loops of filament perpendicular to the horizontal components of the magnetic field, or by changing the position of the filament during the operation, so that the terrestrial magnetism exerts a twist in the opposite direction to what it did before.—H. B.

UNITED STATES PATENTS.

Furnace gases; Apparatus for purifying and re-heating ——. D. Lamond, Pittsburg, and D. D. Lamond, Allegheny, Pa. U.S. Pat. 833,467, Oct. 16, 1906.

THE apparatus consists of a series of communicating settling chambers arranged within a series of communicating hollow walls; means for admitting impure gas to the first chamber of the series; a gas washer communicating with the last chamber of the series; a connection for passing the washed gas through the series of hollow walls (beginning with the last of the series), in order to reheat the gas; and an outlet for the purified and heated gas from the hollow wall of the first chamber of the series. —C. S.

Coke and gas; Process of producing ——. F. Logan, Phœnixville, Pa. U.S. Pat. 833,471, Oct. 16, 1906.

THE oven (see U.S. Pat. 833,611; following abstract) is charged with coal, and when the charge is hot enough for coking off, steam is admitted below. The resulting water-gas is mixed, in the oven, with gas distilled from coal in another, and with oil-gas generated simultaneously in the first oven, the mixed gas being then drawn off to the gasometer.—C. S.

Coke and gas; Apparatus for making ——. F. Logan, Phœnixville, Pa. U.S. Pat. 833,611, Oct. 16, 1906.

A NUMBER of coke ovens, each with a perforated bottom or grate, and a steam inlet below, and an oil inlet above the same, are connected together by means of a pipe extending through their upper walls, and fitted with valves between the ovens. A valved pipe leads from the ovens to a suction fan for withdrawing the gas.—C. S.

Retort; Vertical —— for the destructive distillation of coal. H. W. Woodall, Wimborne, Assignor to A. M. Duckham, Parkstone. U.S. Pat. 833,861, Oct. 23, 1906.

SEE Eng. Pat. 21,447 of 1905; this J., 1906, 306.—T. F. B.

Gas; Method of producing ——. J. S. Smith, Chicago, Ill. U.S. Pat. 833,182, Oct. 16, 1906.

THE gas is passed from a generator up through a carburetter, and from the top of this to a second carburetter, down which it also passes. At or near the bottom of the second carburetter a portion of the descending gas is returned through a passage at the bottom of the carburetters to the first carburetter, whilst the remainder of the gas passes on to its destination. The returned portion of the gas passes up through the first carburetter together with gases coming from the generator, and on its way is mixed with steam or oil or both. (See following abstract.)—W. C. H.

Gas-producing apparatus. J. S. Smith, Chicago, Ill. U.S. Pat. 833,256, Oct. 16, 1906.

IN this apparatus, the generator is provided with a cone that forms the upper part of its combustion chamber, and supports some chequer-work, which is surrounded by a supplementary combustion chamber. Means are provided for supplying hydrocarbons to both combustion chambers, and also air and steam to either. The gas from the generator enters the first of a series of two or more carburetters at or near the bottom, and passes up the carburetter to the top, and thence through a passage to the top of the second carburetter. The carburetters are also connected at their lower ends by a passage, in which is a fan or other means for inducing the return of a portion of the gas which has passed down the second carburetter, to the first. The lower part of the second carburetter is provided with a gas-discharge pipe, connecting it with the scrubber.—W. C. H.

Gas; Method of producing heating and illuminating ——. J. S. Smith, Chicago, Ill. U.S. Pat. 833,346, Oct. 16, 1906.

GAS-producing materials, oil, steam, and air are forcibly conducted through a decomposing degree of heat in a generating chamber, and then subjected to a violent impact, whereby their molecules are finely divided, and concurrently subjected to an amount of heat sufficient to dissociate their vapours. These vapours are then confined in the presence of the heat, until re-associated into a volume of fixed gas. When this gas is discharged from the retort, additional steam is forcibly delivered across the path of the gas, with a violent impact, by which means the molecules become finely divided in the presence of a degree of heat sufficient to dissociate the steam into gases, which become thoroughly mixed with the gases generated in the earlier part of the process, and the heats of generation produced are utilised for maintaining a decomposing temperature in the generating chamber. A heating and illuminating gas, containing an excess of oxygen and hydrogen, derived from the decomposed steam, is thus continuously produced. (See also U.S. Pats. 817,279 and 817,280 of 1906; this J., 1906, 465.)—W. C. H.

Gas; Apparatus for producing hydro-oxygen ——. A. Lang and H. F. Smith, Assignors to C. H. Zink, Philadelphia, Pa. U.S. Pat. 833,399, Oct. 16, 1906.

THE apparatus described has a chamber with which are connected two others, one an air and the other a gas chamber. Each of these can be heated by separate burners, connected with the first-mentioned chamber, which is beyond the heat zone of the burners, *e.g.*, below them. Air under pressure is supplied to the air chamber, where it is superheated, and the gas can be similarly superheated in its chamber, the supplies of air and gas to the chambers being under separate control. The heated air and gas mix in the first-mentioned chamber, from which the new gas is led to a desired point for use.—W. C. H.

Gas; Method of producing ——. A. Lang and H. F. Smith, Assignors to C. H. Zink, Philadelphia, Pa. U.S. Pat. 833,400, Oct. 16, 1906.

THE method of producing a new and distinct gas consists in superheating a hydrocarbon gas, and leading this in its heated condition into a chamber, where it is mixed with air, supplied under pressure, and superheated or not. The product of the union of the heated gas and air may also be highly heated in the chamber in which they unite.—W. C. H.

Gas producers; Means for maintaining heat in ——. E. Capitaine, Frankfort on Maine, Germany. U.S. Pat. 833,673, Oct. 16, 1906.

SEE Fr. Pat. 353,065 of 1905; this J., 1906, 901.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 1035.)

Coals; Determination of calorific value of —— *by the Parr calorimeter.* E. J. Constam and R. Rougeot. Z. angew. Chem., 1906, **19**, 1796—1806.

The authors have measured the calorific values of a large number and variety of coals by Parr's method, and have investigated the effect of a number of details in the working, comparing the results with those obtained from the same coals with the Mahler bomb. The chief conclusions are as follows:—(1) The factor to be used (no. of calories corresponding to 1° C. observed rise of temperature in the instrument) is, with the same coal, variable with the quality (content of sodium peroxide and of water) and with the coarseness of grain of the sodium peroxide used, and also according as correction for loss of heat by radiation is or is not made. The variation from these causes may amount to 3 per cent. of the total value. (2) The magnitude of other errors renders it superfluous to correct for loss of heat by radiation. (3) The difference between the Parr result and the Mahler result is not greater when ordinary high-grade commercial peroxide is used than when the peroxide is finely powdered; the closest agreement is obtained by using excess of finely-ground peroxide, together with potassium persulphate. In no circumstances, however, have the authors ever obtained complete combustion of a sample of coal in the Parr calorimeter, and they do not regard its results as sufficiently trustworthy to serve as basis for a decision as to the calorific value of a coal.—J. T. D.

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Water vapour and carbon dioxide; Dissociation of —— *at high temperatures.* I. Langmuir. VII., page 1094.

English Patents.

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Air, substantially free from moisture, is passed without the admixture of steam through a deep bed of fuel (say 3 ft. to 5 ft.), so as to produce a gas consisting substantially of carbon monoxide and nitrogen, with less than 5 per cent. each of carbon dioxide and hydrogen. The cooled and purified gas is mixed with air in predetermined proportion in the cylinder of a gas engine, compressed to between 11 and 16 atmospheres, and then ignited. It is claimed that the elimination of hydrogen from the gas, leads to increased efficiency, owing to the high compression thereby rendered permissible. If the fuel used be coal, or other clinkering material, a mixture of air and carbon dioxide or gaseous products of combustion, may be used instead of pure air; the endothermic reaction of the carbon dioxide upon the carbon thus reduces the temperature and prevents clinkering.—H. B.

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See Fr. Pat. 358,624 of 1905; this J., 1906, 309.—T. F. B.

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The carburetter is constructed in sections, each provided with its own air-inlet and gas-outlet valves, these being so connected to the bell of the gas-holder that the number of sections in operation is controlled by the movements of the bell. Each section is fitted with a jacket through which hot water or other heating fluid can be passed, the admission valves being likewise controlled by the movements of the gas-holder bell, so that only the sections in operation are heated. Thermostatic devices are also used in connection with the air valves, so as to counteract the influence of changes of temperature upon the richness of the carburetted air produced.—H. B.

Furnaces used in connection with gas retorts. J. H. Brown, Nottingham. Eng. Pat. 18,723, Sept. 16, 1905.

In a generator for heating gas retorts, having a series of overlapping flat bars under its charging inlet, the level grate at the foot of the said step-like arrangement of bars, and the door at the front of the same, are dispensed with.—H. B.

Gas generators; Suction ——. J. G. L. Bormann, Charlottenburg, Germany. Eng. Pat. 7499, March 28, 1906.

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Ferrocyanides; Manufacture of —— *from gas-purifying masses or other ferrocyaniferous masses.* T. Bollowitsch. Eng. Pat. 8362, April 6, 1906. VII., page 1095.

Gases; Process for removing sulphide of hydrogen from ——. E. Burschell, Landau, Bavaria. Eng. Pat. 11,133, May 12, 1906.

See Fr. Pat. 366,047 of 1906; this J., 1906, 976.—T. F. B.

inert atmosphere (or, when oxygen or sulphur compounds are used, in a reducing atmosphere). The connections between the filaments and the supply conductors may be made of similar plastic materials, in a thinner paste, which is heated to a white heat in a neutral or reducing atmosphere. (See also Eng. Pats. 15,462 of 1905 and 8057 of 1906; this J., 1906, 307; 841; and Fr. Pat. 364,613 of 1906; this J., 1906, 920.)—W. C. H.

Luminous bodies for electric incandescence lamps; Process of making ——. H. Kusel. Third Addition, dated April 3, 1906, to Fr. Pat. 359,025, Jan. 9, 1905. Under Int. Conv., Aug. 3, 1905.

See Eng. Pat. 8057 of 1906; this J., 1906, 841.—T. F. B.

Luminous bodies of tungsten for incandescence lamps and their mode of manufacture. Consortium für Elektrochem. Ind., G.m.b.H. Fr. Pat. 367,009, June 9, 1906. Under Int. Conv., July 5, 1905.

By this invention, a tungsten body, suitable for use as a filament in incandescence electric lamps, is obtained by heating the tungsten, preferably by electrical means, almost to its fusing point, in an inert atmosphere, prior to its introduction into the lamp. The claims also include bodies obtained by this process.—W. C. H.

Illuminating metallic bodies for incandescence electric lamps; Process of manufacture of ——. Deutsche Gasglühlicht A.-G. (Auergesellschaft). Fr. Pat. 367,033, June 9, 1906.

This patent is for a process of manufacturing illuminating metallic bodies for incandescence electric lamps, that shall be of uniform size and suitable shape, and consists in heating to redness, by an electric current, the threads, bent into the form of a stirrup, after they have been finished, and in stretching them by a force applied to the lower part of the stirrup.—W. C. H.

Incandescence bodies for electric lamps. Consortium für Elektrochem. Ind., G.m.b.H. Fr. Pat. 367,045, June 11, 1906.

This patent is for an incandescence body for electric lamps, supplied preferably with an alternating current, and burning *in vacuo*, or in inert gases. The body is composed of a conductor of the second group, such as thoria, zirconia, yttria, &c., and a metal, in this case, tungsten or an alloy of it. In order to obtain as fine a division and as intimate distribution as possible of the tungsten in the conductor of the second group, compounds of the two constituents are first produced by heating them together (for example, a tungstate of thorium is formed), and these compounds are afterwards heated in a reducing atmosphere, by which means metallic tungsten and the conductor of the second group are re-obtained in a finely divided and intimately mixed condition.—W. C. H.

Incandescence bodies of high illuminating power; Process for making strong ——. H. C. Albrecht. Fr. Pat. 367,028, June 25, 1906.

See Eng. Pat. 15,295 of 1906; this J., 1906, 877.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 1036.)

Fats and mineral oils; Cholesterol content of ——, *and probable genetic connection between them.* M. A. Rakusin. Chem.-Zeit., 1906, **30**, 1041—1042.

Among animal oils, fish-liver oil and lanolin give the cholesterol reactions, and their optical activity is probably mainly due to that substance or an isomeride of the same. He assumes that almost all mineral oils of high boiling point also contain cholesterol products, the colour reactions in some cases being almost identical with those of fish-liver oil; and the cholesterol content seems to increase with the sp. gr., boiling point, and viscosity of the distillate, the percentage being ascertainable colorimetrically when the tests are performed quickly. The optical activity is a less decisive proof in the case of mineral oils, since it is also a characteristic of the naphthenic acids. American lubricating oils appear to give clear indications of racemised cholesterol products, the reactions being quite as intense as those of Caucasian oils having eight times the rotatory power. This fact is considered to be of great importance in connection with the physico-chemical geology of mineral oils. The author regards the presence of cholesterol as suggestive of the organic origin of petroleum in oilfields where it may occur, collateral circumstances pointing to a mixed animal and vegetable origin. The low optical activity of Pennsylvania petroleum derivatives can only be attributed to the presence of racemised cholesterol. No artificially prepared petroleum can be considered identical with the natural oil unless it exhibits optical activity, opacity to the polarised ray in dilute solution, the reactions for cholesterol, and the phenomenon of dichroism, even though only manifest in dilute solutions. The presence of organogens (oxygen in the form of cholesterol and naphthene acids, and sulphur, phosphorus, and nitrogen as organic bases) in many mineral oils should not be under-estimated. The possession of the first three essential properties seems to be of great importance for the geology of petroleum, and in conjunction with "Day's filtration phenomena," is considered to afford valuable information on the relative geological age of mineral oils, and on the conditions of deposition in a given field.—C. S.

French Patent.

Lubricant for machine parts, &c. L. A. A. Hennequin and G. J. B. Cayeux. Second Addition, dated May 29, 1906, to Fr. Pat. 350,090, Aug. 1, 1904. (See Eng. Pat. 11,679 of 1905; this J., 1905, 1008.)

Approximately equal quantities of powdered camphor and naphthalene are mixed together, and 60—125 grms. of this mixture are dissolved in 1 litre of petroleum.—C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 1038.)

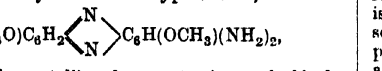
Aminoalizarins; Derivatives of ——. G. Schultz and I. Erber. J. prakt. Chem., 1906, **74**, 275—296.

On boiling α-aminoalizarin with acetic anhydride in excess the diacetyl derivative is obtained. This forms reddish-brown leaflets, melting at 245° C., dissolves in glacial acetic acid, chloroform, and toluene, is sparingly soluble in benzene and acetone, and almost insoluble in ether. Moderate action with acetic anhydride leads to the formation of an isomeric diacetyl derivative, which crystallises from alcohol in yellow lustrous needles, melting at 205° C. The benzoyl derivative obtained by heating a suspension of the α-base in nitrobenzene with benzoyl chloride forms reddish-brown needles, melting at 310° C. It is almost insoluble in alcohol and ether, sparingly soluble in other media, and remains unchanged when boiled with hydrochloric acid. The action of benzoyl chloride in excess leads to the formation of a dibenzoyl derivative, which crystallises in light brown needles melting at 255° C. The benzoylation of the β-base gives rise to the formation of a dibenzoyl derivative crystallising in matted yellow needles, which melt at 252° C., and are changed into the mono-derivative melting at 275° C. when dissolved in strong sulphuric acid. Diazotisation of α- and β-aminoalizarin leads to the formation of corresponding diazo derivatives. The diazonium compound of the α-base yields purpurin by sublimation, whilst the β-diazo compound decomposes when similarly treated. On boiling the latter with alkalis a red solution is obtained, which, when acidified, gives a brown precipitate yielding alizarin by sublimation. Attempts to prepare dyestuffs gave negative results in the case of the α-diazonium salt; β-diazoalizarin, however, was found to interact with β-naphtholdisulphonic acid R in alkaline

solution to form a product possessing dyeing properties, although only to a slight extent. When *α*-aminoalizarin is heated with sulphuric anhydride, 1.2-dihydroxy-4-aminoanthraquinone-3-sulphonic acid is obtained, which gives purpurin- and alizarinsulphonic acids on diazotisation.—D. B.

3.4-*Diaminoguaiacol; Note on* ——, [*Formation of an azine dyestuff*]. F. Fichter and J. Schwab. Ber., 1906, **39**, 3339—3341.

4-AMINOGUAIACOL, on acetylation and nitration, yields, after elimination of the acetyl groups, 3-nitro-4-aminoguaiacol melting at 169°—171° C., which on reduction gives the *o*-diamine, 3:4-diaminoguaiacol. When a current of air is passed through the aqueous solution, 2:3-diamino-8-hydroxy-1:9-dimethoxyphenazine,



$$(HO)(CH_3O)C_6H_2\begin{matrix}N\\ \diagup\diagdown\\ N\end{matrix}C_6H(OCH_3)(NH_2)_2,$$

is obtained, which crystallises from water in nearly black, glistening needles. The substance gives a green solution with concentrated sulphuric acid, which on dilution with water turns successively blue, violet, and red. The aqueous solution is brown-red, and on addition of alkalis becomes reddish-yellow. The brown-red alcoholic solution has a green fluorescence. Animal and vegetable fibres are dyed brownish-red from a bath acidified with acetic acid.

—J. C. C.

Triphenylmethyl. XV. M. Gomberg and L. H. Cone. Ber., 1906, **39**, 3274—3297.

A LARGE number of halogen-substituted derivatives of triphenylmethyl chloride have been prepared, which by the action of molecular silver in benzene solution and in absence of air give rise to coloured substances. The *o*-substituted derivatives acquire the deepest shades, and the phenomena correspond with the variation in colour observed by Noelting consequent on the introduction of halogen in the *o*-position of the phenyl group in Malachite Green. By the action of silver the "carbinol chlorine" is removed, and on exposure of the coloured solution to the air, the colour disappears and peroxides are formed. In the case of the *p*-substituted derivatives, however, if the action of the silver be continued so as to remove as much halogen as is possible by this means, the colour is not thereby diminished, but is lost on exposure to the air, peroxides in this case, not being formed. The authors consider that these coloured compounds, obtained by removal of the "carbinol chlorine," must possess the same constitution as triphenylmethyl itself, as they yield peroxides of the same type as does the latter. There must be a very close similarity in the constitution of the stable triphenylmethane dyestuffs and the unstable coloured substances here described. The origin of colour in the latter must be due to one of the phenyl groups assuming a quinonoid structure; and, as the colour of the triphenylmethane dyestuffs is attributed to the similar behaviour of one of the phenyl groups, the hypothesis of a quinonoid structure for these colouring matters receives direct experimental support from the foregoing researches.—J. C. C.

Benzidinedisulphonic acid; Constitution of Griess' ——. G. Schultz and W. Kohlhaus. Ber., 1906, **39**, 3341—3345.

BENZIDINEDISULPHONIC acid, prepared by Griess by treating benzidine with fuming sulphuric acid, was diazotised, and the diazo-group eliminated by alcohol, whereby diphenyl-3:3′-disulphonic acid was obtained. The free acid is a yellow, syrupy mass; the potassium salt crystallises from water in colourless leaflets containing two molecules of water of crystallisation. On fusion with potash, 3:3′-dihydroxydiphenyl resulted which was identical with the compound known to possess that constitution. Hence Griess' benzidinedisulphonic acid is 4:4′-diaminodiphenyl-3:3′-disulphonic acid.—J. C. C.

Benzidine; Oxidation of —— [*Azo dyestuffs*]. R. Willstätter and L. Kalb. Ber., 1906, **39**, 3474—3482.

BY the oxidation of benzidine with silver oxide or lead peroxide in presence of an indifferent solvent, the authors had previously observed the formation of a substance crystallising in yellowish-red needles which easily yielded benzidine on reduction (this J., 1905, 432). It is now shown that this consists of diaminoazodiphenyl, $NH_2.C_6H_4.C_6H_4.N_2.C_6H_4.C_6H_4.NH_2$. The exact behaviour of benzidine towards oxidising agents is as follows:—(1) In neutral solvents—An ethereal solution of benzidine shaken with lead peroxide becomes brownish-yellow; on adding very dilute acetic acid to a filtered portion and shaking, an indigo-blue coloration is produced which on further addition of acid turns violet. This colour reaction can only be due to the presence in the solution of di-imino-diphenyl $NH:C_6H_4:C_6H_4:NH$, which is probably the first product of oxidation of benzidine in the above reaction, and which, by the coalescence of two molecules, is rearranged into diaminoazodiphenyl. (2) In aqueous solution—On adding lead peroxide or a solution of permanganate to a solution of benzidine in dilute acetic acid, a deep indigo-blue coloration is produced; with more of the oxidising agent this becomes pure yellow. Both solutions are unstable, the former gradually becoming violet-red (especially with acids), and the latter turning blue and finally colourless, a dark precipitate being formed. Probably the yellow solution contains the di-imonium salt, and the blue an intermediate product of a quinhydrone character. The diaminoazodiphenyl produced in the above-mentioned way was identical with the substance prepared synthetically as follows:—1 grm. of 4-nitro-4′-aminodiphenyl was dissolved in 250 grms. of alcohol, and a mixture of 150 grms. of water and 75 grms. of a 33 per cent. caustic soda solution added. Five grms. of zinc dust were now shaken with the hot liquid until the colour disappeared. The mixture was boiled for a short time, until the air was expelled from the flask, and filtered. The filtrate rapidly became orange, and the oxidation was completed by a stream of air; 0·4 grm. of diaminoazodiphenyl separated in yellowish-red microscopic needles which on crystallising from benzene melted at 287°C. The substance has practically no affinity for the fibre; wool and silk are dyed a faint brown, which, however, disappears on washing. The tetrazochloride was prepared by grinding the hydrochloride of the base (4 grms.) with 400 c.c. of 1 per cent. hydrochloric acid, cooling, and shaking with a large excess of sodium nitrite (40 c.c. of a 10 per cent. solution). The resulting clear solution, on standing for half an hour in ice, began to deposit the tetrazochloride, which was completely precipitated by the addition of 40 c.c. of concentrated hydrochloric acid, and allowing to stand a further half-hour. Prismatic crystals with a violet reflex were obtained which, on powdering, became orange-red. The substance contains 2 mols. of water of crystallisation This tetrazochloride is a substantive cotton dyestuff, and also dyes silk remarkably well. A 1 per cent. solution dyes mercerised cotton from a cold bath ochre-yellow, silk fiery orange. The dyestuff has so great an affinity for silk that the bath is exhausted in 15 minutes. The dyeings are fast to soaping, alkalis, acids, and boiling. The dyestuff produced by combining the tetrazo-salt with 2 mols. of naphthionic acid is less substantive than Congo Red and of little value.—J. C. C.

Azo dyestuffs; Heats of combustion and constitutional formulæ of ——. P. Lemoult. Compt. rend., 1906, **143**, 603—605.

RESULTS of determinations of the heat of combustion of a number of azo-dyestuffs confirm the azoic ($RN:N.C_6H_4.NH_2$ or OH) rather than the quinonoid ($\begin{matrix}R\\ H\end{matrix}>N.N:C_6H_4:NH$ or O) formula for these substances.

—J. T. D.

Quinone-azine. R. Willstätter and M. Benz. Ber., 1906, **39**, 3482—3491).

THE authors have studied the behaviour of *o*- and *p*-amino and hydroxy-derivatives of compounds, consisting of two benzene rings united by groups, capable of yielding quinones, towards silver oxide or lead peroxide in benzene solution. *Oxidation of aroplenol.*—A solution of 5 grms.

of *p*-azophenol containing water of crystallisation, in 1 litre of ether, was shaken mechanically with silver oxide prepared from 15 grms. of silver nitrate (double the theoretical amount) and 10 grms. of anhydrous sodium sulphate. After a few minutes the liquid became green, and finally, after about an hour, deep orange-red. The end of the reaction was reached when a test gave no immediate precipitate on shaking with water and a little dilute ammonia, and adding a drop of lead acetate solution. On evaporation of the ethereal solution 2 grms. of quinone-azine $O:C_6H_4:N.N:C_6H_4:O$ were obtained, a further quantity being yielded by extracting the residue with chloroform. The total yield was about 90 per cent. of the theoretical. The oxidation of anhydrous azophenol proceeds much more slowly, and the use of lead peroxide offers no advantage. Quinone-azine is easily soluble in hot ethyl acetate, acetone, alcohol, or glacial acetic acid, sparingly so in the cold; it is also readily soluble in benzene or chloroform, sparingly so in ether, and nearly insoluble in light petroleum. It is only slightly soluble in boiling water, and may be crystallised from this solvent by boiling for a short time with a large quantity (2000:1), and quickly cooling. In general, however, quinone-azine is decomposed by water; on heating the aqueous-alcoholic solution a brown tar separates. Alkalis convert the substance into an amorphous black-green mass, and it is dissolved by acids with a carmine-red colour. The solutions of quinone-azine are much more intensely coloured than those of azophenol; ethereal solutions of the latter are pure yellow, whilst dilute solutions of the former are deep orange-red. Quinone-azine crystallises from organic solvents in two modifications, namely: in large, dark orange-red prisms or needles yielding a brick-red powder, and in dark-yellow rhombohedric leaves or tables, the powder of which is deep yellow. Both forms exhibit a blue reflex under the microscope. The substance is stable in the air, odourless, and non-volatile. On heating, it does not melt, but burns at 158° C., previously becoming dark. Its ethereal solution liberates iodine from iodine-starch solution and oxidises hydroquinone (quinol), converting it into the corresponding quinhydrone. The quinhydrone of quinone-azine crystallises in blue-black, bronzy needles, melting at 181°—182° C. from a solution of equimolecular quantities of quinone-azine and azophenol in ether. Quinone-azine is reduced by powerful reducing agents, such as aluminium amalgam, zinc dust, and water, or stannous chloride and hydrochloric acid to *p*-aminophenol, by sulphurous acid or phenylhydrazine to azophenol. This is, however, not identical with the azophenol from which the substance is derived (see succeeding extract). *Oxidation of p-dihydroxystilbene.*—2 grms of dihydroxystilbene were suspended in 500 c.c. of ether, and shaken for some hours with 25 grms. of lead peroxide. The lead residue which contained the product was heated for a short time on the water-bath with 500 c.c. of benzene and 50 grms. of peroxide. The quinone $O:C_6H_4:CH.CH:C_6H_4:O$ crystallised from the filtrate in brown needles. *p*-Azoaniline is not attacked by silver oxide in ethereal solution, and only very slightly by lead peroxide in benzene solution. In the preparation of this substance from diazoacetanilide and aniline, *p*-acetaminodiazoaminobenzene was obtained, which crystallises from an ethyl acetate solution on addition of light petroleum in orange-yellow needles melting at 150°—152° C. It is easily soluble in alcohol or ethyl acetate, sparingly so in ether or benzene, and only very slightly so in light petroleum. On saponification with sodium ethoxide, *p*-aminodiazoaminobenzene is obtained which crystallises from dilute alcohol in brownish-yellow needles, melting with decomposition at 157° C. It is easily soluble in alcohol, sparingly so in ether, and insoluble in light petroleum or water.—J. C. C.

Azophenols; Contribution to our knowledge of ——. R. Willstätter and M. Benz. Ber., 1906, 39, 3492—3503.

When quinone-azine (see preceding abstract) is reduced to *p*-azophenol a new modification results, which differs in many physical properties from that prepared in the ordinary manner, and from which quinone-azine is obtained by oxidation. The ordinary azophenol is called α, and the new modification β. The chief points of difference are shown in the following table:—

Properties.	α.	β.
Appearance of crystals.	Amber-yellow or light-brown tables	Reddish-brown tables with strong blue-reflex.
Colour of powder.	Dark yellow	Bluish brown-red
Colour of powder when heated	Chrome-green	Brick-red
Behaviour of heated powder with moist air.	No action.	Combines with 1 mol. of water
Solubility in benzene at 17 °C.	1:10800	1:1500

The two modifications have, however, so many properties in common that they are probably geometrical isomerides. Azophenol β is converted into α by distillation in a vacuum, but much decomposition occurs. Both varieties yield the same diammonium salt, and give the same addition compound with phenylhydrazine. *o*-Azophenol readily absorbs 1 mol. of ammonia, but when fused, sublimed in a vacuum, or distilled, passes into a condition in which no reaction with ammonia takes place. When, however, the stream of ammonia gas is passed over the latter modification in presence of aqueous ammonia, the ammonium salt is finally obtained.—J. C. C.

Azomethine dyestuffs; Influence of the carbon double linking on the colour of ——. R. Möhlau and R. Adam. Z. Farben-Ind., 1906, 5, 402—412. (See this J., 1906, 1037.)

A large number of azomethine dyestuffs has been prepared and their colour investigated by rubbing them in a finely-divided condition on coarse filter paper. The shades observed were compared on the "Radde" international colour scale. The characteristic colorations obtained with concentrated sulphuric acid were useful in indicating the influence of the various chromophore and auxochrome groups on the tinctorial properties. The results are shown in the following table:—

Components. Aldehydes.	Amine	Colour on Radde scale.	Colour in concentrated H_2SO_4.
Benzaldehyde	*p*-aminodimethylaniline.	8 r	colourless
Cinnamic aldehyde		7 m	pale yellow
Nitrobenzaldehyde, *o*-		1 e	colourless
,, *m*-		4 m	,,
,, *p*-		27 f	,,
Nitrocinnamic aldehyde, *o*-		26 q	yellow
,, ,, *m*-		1 l	pale yellow
,, ,, *p*-		25 h	yellow
Dimethyl-*p*-aminobenzaldehyde		7 s	pale yellow
Dimethyl-*p*-aminocinnamic aldehyde		4 k	dark yellow
Benzaldehyde	*p*-aminophenol.	12 v	pale yellow
Cinnamic aldehyde		8 p	orange-yellow
Nitrobenzaldehyde, *o*-		8 n	yellow
,, *m*-		34 n	pale yellow
,, *p*-		5 o	orange
Nitrocinnamic aldehyde, *o*-		6 p	dark yellow
,, ,, *m*-		8 q	yellow
,, ,, *p*-		5 l	dark orange
Dimethyl-*p*-aminobenzaldehyde		5 l	pale yellow
Dimethyl-*p*-aminocinnamic aldehyde		4 l	yellow
Benzaldehyde	*o*-aminophenol.	34 k	pale orange
Cinnamic aldehyde		6 n	orange
Nitrobenzaldehyde, *o*-		8 s	dark yellow
,, *m*-		9 q	yellow
,, *p*-		8 p	orange
Nitrocinnamic aldehyde *o*-		7 s	,,
,, ,, *m*-		8 p	,,
,, ,, *p*-		7 o	dark orange
Dimethyl-*p*-aminobenzaldehyde		7 r	yellow
Dimethyl-*p*-aminocinnamic aldehyde		3 l	dark yellow

Components. Aldehydes.	Amine	Colour on Radde scale.	Colour in concentrated H_2SO_4.
Benzaldehyde	1:4-aminonaphthol.	35 p	pale yellow
Cinnamic aldehyde		6 q	orange
Nitrobenzaldehyde, *o*-		1 g	reddish-orange
,, *m*-		4 l	pale orange
,, *p*-		1 l	red
Nitrocinnamic aldehyde, *o*-		4 h	dark orange
,, ,, *m*-		7 q	orange
,, ,, *p*-		2 m	red
Dimethyl-*p*-aminobenzaldehyde		6 m	pale orange
Dimethyl-*p*-aminocinnamic aldehyde		—	—
Benzaldehyde	1:2-aminonaphthol.	35 o	yellow
Cinnamic aldehyde		6 m	dark orange
Nitrobenzaldehyde, *o*-		5 m	reddish-orange
,, *m*-		6 p	orange
,, *p*-		29 f	dark red
Nitrocinnamic aldehyde, *o*-		5 l	reddish-orange
,, ,, *m*-		6 n	dark orange
,, ,, *p*-		27 h	dark red
Dimethyl-*p*-aminobenzaldehyde		8 o	dark orange
Dimethyl-*p*-aminocinnamic aldehyde		—	—
Benzaldehyde	1:2:5-aminosalicylic acids.	8 s	colourless
Cinnamic aldehyde		5 o	pale yellow
Nitrobenzaldehyde, *o*-		8 q	yellow
,, *m*-		8 s	pale yellow
,, *p*-		8 q	yellow
Nitrocinnamic aldehyde, *o*-		1 l	red
,, ,, *m*-		4 n	pale yellow
,, ,, *p*-		3 l	dark yellow
Dimethyl-*p*-aminobenzaldehyde		3 m	pale yellow
Dimethyl-*p*-aminocinnamic aldehyde		26 l	dark yellow

The conclusions drawn are: (1) the influence of the —C:C— group on the shade of azomethine compounds can in each case be detected. (2) When the nitro-group is present in the aldehydic component an increase in colour is produced. The *p*-position of the nitro-group exerts the greatest influence, the *o*-position rather less, and the *m*-position the least. The influence of the auxochrome dimethylamino-group in the aldehydic component is weaker than that of the chromophoric nitro-groups in the same relative position. (4) The auxochrome groups, OH and $N(CH_3)_2$, contained in the amino-component likewise produce an increase in colour, the latter group to the greater extent. Among the hydroxy-compounds the OH-group exerts the greatest influence when it is in the ortho-position.—J. C. C.

Bixin, the dyestuff of Bixa Orellana; Studies on ——. I. L. Marchlewski and L. Matejko. Anz. Akad. Wiss. Krakau, 1905, 745—753. Chem. Centr., 1906, 2, 1264—1265.

The bixin was prepared by drying Orlean (annatto) on the water-bath, and extracting it for two days with cold chloroform, the first extract being rejected. From the solution, after evaporating the chloroform, a brittle reddish-brown mass was obtained, which yielded rhombic crystals (m.pt. 198° C., or 191·5° C. on slow heating) from a mixture of chloroform and alcohol, or from boiling glacial acetic acid. Bixin is slightly soluble in chloroform (0·34 grm. in 100 grms. at 25° C.), and almost insoluble in alcohol, ether, and glacial acetic acid; its best solvent is pyridine, and it is also soluble in quinoline and boiling nitrobenzene. It has the composition, $C_{27}H_{31}O_4(OCH_3)$, and on methylation with dimethyl sulphate, yields the dimethoxy-compound, $C_{27}H_{30}O_3(OCH_3)_2$. Monosodium and potassium salts of bixin were prepared. On reduction with zinc dust and glacial acetic acid, bixin yielded a substance forming orange-coloured rhombic crystals having a metallic lustre, m.pt. 200·5° C. (208°—210° C. on rapid heating), soluble in glacial acetic acid, and slightly soluble in chloroform, alcohol, and ether. This product contains 75·3—75·42 per cent. of carbon and 7·64 to 7·73 per cent. of hydrogen. On standing in the air, and more rapidly on heating at 100° C., the colour of the product fades, and an almost white substance is finally obtained containing 69·2 to 69·36 per cent. of carbon and 9·62 to 9·93 per cent. of hydrogen.—A. S.

Dyestuffs of the root of Datisca Cannabina; Studies on the ——. A. Korczynski and L. Marchlewski. Anz. Akad. Wiss. Krakau, 1906, 95—101. Chem. Centr., 1906, 2, 1265.

Schunck and Marchlewski (Annalen, 277, 261) isolated from the root of *Datisca Cannabina* a glucoside, which, on hydrolysis, yielded rhamnose and a compound, $C_{15}H_{12}O_6$, probably a dihydroxymethoxyxanthone. The authors have worked on fresh material from the Punjaub. By extracting the roots with boiling alcohol, evaporating the alcoholic solution, extracting the residue with boiling water, and cooling the solution, a glucoside was obtained as a yellowish-white precipitate, melting at 190° C. After recrystallising from a mixture of alcohol and ether, the product was hydrolysed, yielding a sugar and a compound, $C_{15}H_{10}O_6$, named *datiscetin*, which was purified by crystallisation from glacial acetic acid and dilute alcohol. Datiscetin contains four hydroxyl groups, yielding tetra-acetyl (m.pt. 138° C.) and tetrabenzoyl (m.pt. 190°—191° C.) derivatives. It is isomeric with luteolin and fisetin, and is probably a flavone- or flavonol-derivative; on heating with alkalis, it yields phenol and salicylic acid.—A. S.

Fluorescence and chemical constitution of organic substances; Relations between ——. L. Francesconi and G. Bargellini. Atti R. Accad. dei Lincei Roma, 1906, 15 [2], 184—191. Chem. Centr., 1906, 2, 1240—1242.

In examining substances for fluorescence, the authors place the solution of the substance in a small tube, the lower portion of which is disposed in a dark chamber. The tube is then placed at the focus of a converging lens about 12 cm. distant, which is exposed to the rays of the sun. On looking at the solution through the mouth of the tube, fluorescence is indicated by the appearance of a luminous sphere having a different colour to that of the solution. The authors have examined in this way about 500 different organic substances in various solvents, at different concentrations and temperatures, and have in many cases detected fluorescence where it was not visible to the naked eye—for example, in solutions of naphthalic anhydride and naphthalic-imide in alcohol, acetic acid, and acetone. Fluorescence was never observed with compounds of the methane series. It depends upon special modifications of the molecule, such as can only occur in aromatic nuclei, and is possibly due to a kind of tautomerism (compare Hewitt, this J., 1902, 127). All aromatic compounds are capable of exhibiting fluorescence, but the different nuclei possess the power in different degrees; in some it is latent, in others very weak, and in others strong. Where the fluorescence is latent, it can be made visible by introducing certain radicals into the compound. Benzoic acid, for example, is non-fluorescent, whilst *o*-amino-, methylamino-, and dimethylamino-benzoic acid are fluorescent. The authors classify substituting groups as "auxoflors" and "batoflors" according as they increase or diminish (or destroy) the power of exhibiting fluorescence. Amino and alkylamino groups are the most energetic auxoflors, to which class belong also the groups, OH, CN, COOH (and $COOC_2H_5$), and CH:CH. The groups, N:N, NO_2, Cl, Br, I, and COC_6H_5, especially the first, are batoflors, as also is the group, $COCH_3$, if it replaces a hydrogen of a hydroxyl or an amino group. The groups, SO_3H and CHO, have no decided action, but are not batoflors. (See also this J., 1902, 1327; 1903, 1311.)—A. S.

Catechu; Detection of adulteration in ——. D. Hooper. XXIII., page 1121.

Indigo crop of India. Chem. Trade J., Oct. 10, 1906. [T.R.]

The first General Memorandum on the indigo crop of the season 1906-07 has now been issued by the Commercial Intelligence Department of the Government of India. The provinces dealt with in this Memorandum contain 97·7 per cent. of the total area under indigo in British India, calculated on the averages of the five years ending 1904-05. The average acreage under the crop in that period was 755,900 acres, but in 1905-06 the total

acreage reported at the corresponding period was only 330,400, and the figures for 1906-07 are 329,800, the contraction in Bengal, the United Provinces, and the Panjab being almost counterbalanced by a large increase in Madras, attributed to seasonable rainfall. The condition of the crop is reported to be "fair to good" in Madras, and "average" in the Panjab, but there has been some damage done to the young plants by excessive rainfall in Bengal and the United Provinces.

ENGLISH PATENT.

Dyestuff of the anthracene series; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5890, March 10, 1906.

SEE Fr. Pat. 364,005 of 1906; this J., 1906, 923.—T. F. B.

UNITED STATES PATENTS.

Dye; Green anthraquinone ——. [*Anthracene dyestuffs*]. R. E. Schmidt, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. Reissue No. 12,548, dated Oct 23, 1906, of U.S. Pat. 812,284, Feb 13, 1906.

DISULPHONIC acids of 1.4-diaryldiamino-8-hydroxyanthraquinones, probably containing one sulpho-group in the anthraquinone nucleus, and one in the aryl nucleus, are produced by sulphonating the monosulphonic acids (see Fr. Pat. 353,549 of 1905; this J., 1905, 1010). They dye wool yellowish-green shades. On heating with stannous chloride in hydrochloric acid solution, they are decomposed, a leuco compound of 1.4.8-trihydroxyanthraquinone-monosulphonic acid being formed.—T.F.B.

Hydro-azo derivatives; [Electrolytic] Manufacture of ——. O. Dieffenbach. U.S. Pat. 833,513, Oct. 16, 1906. XI*A*., page 1103.

Dyestuff; Blue azo ——. P. Julius, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 833,605, Oct. 16, 1906.

SEE Eng. Pat. 7287 of 1906; this J., 1906, 922.—T.F.B.

Indigo white; Alkali salt of ——, *and process of making same.* R. Wimmer, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U S. Pat. 833,654, Oct. 16, 1906.

SEE Eng. Pat. 23,122 of 1905; this J., 1906, 65.—T. F. B.

FRENCH PATENTS.

Dyestuffs of the quinoline series [*Cyanine dyestuffs*]; *Process for making blue* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,686, Aug. 10, 1905.

SEE Eng. Pat. 16,227 of 1905; this J., 1906, 368.—T.F.B.

Dyestuffs; Process for making acid mordant ——. [*Triphenylmethane dyestuffs*]. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,736, Sept. 1, 1905.

SEE Eng. Pat. 17,382 of 1905; this J., 1906, 750.—T.F.B.

Dyestuffs susceptible to chroming on the fibre; Production of azo ——. Soc. pour l'Ind. Chim. à Bâle. Third Addit., dated Feb. 6, 1906, to Fr. Pat. 351,125, Jan. 4, 1905.

IN certain places in the original specification and its First and Second Additions (this J., 1905, 840 and 1168; 1906, 923), the words "caustic soda of 30° B." occur; these should be replaced by the expression "30 per cent. caustic soda liquor."—T. F. B.

Thioindoxyl derivatives with isatin; Process for preparing a condensation product of ——, *and its applications for dyeing and printing.* Kalle und Co. Fr. Pat. 366,875, June 5, 1906. Under Int. Conv., Nov. 13 and 14, 1905.

SEE Eng. Pat. 17,163 of 1906; this J., 1906, 1023.—T.F.B.

Dyestuff [*Thioindigo Red*]; *Process for preparing a red sulphurised* ——. Kalle und Co. Akt.-Ges. Fr. Pat. 367,772, July 5, 1906. Under Int. Conv., Dec. 26, 1905.

SEE Eng. Pat. 14,057 of 1906; this J., 1906, 922.—T.F.B.

Dyestuff; Production of a blue [*sulphide*] ——. Badische Anilin und Soda Fabrik. Fr. Pat. 367,526, June 8, 1906. Under Int. Conv., May 17, 1906.

SEE Eng. Pat. 13,057 of 1906; this J., 1906, 751.—T.F.B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 1043.)

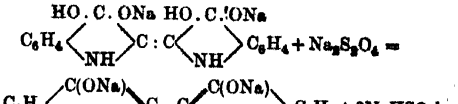
Dyeing processes. X. Solvents for, and mordanting power of metallic mordants. P. Heermann. Färber-Zeit., 1906, 17, 343—344.

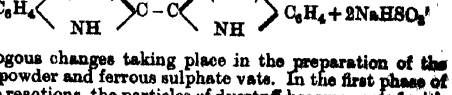
BOILED-off silk was mordanted with solutions of tin, iron, and chromium mordants, in water, and mixtures of water and alcohol, and water and glycerol; all the solutions were made up to contain the same amounts of metal, and the mordanting was carried out under the same physical conditions in each case. The use of alcohol as a solvent, up to a mixture containing 50 per cent. of alcohol, was found to have very little effect on the quantity of mordant taken up by the fibre; in fact, with tin and iron mordants, the amount increased slightly. In the case of glycerol however, although small percentages exerted very little influence, the use of solutions containing 25 per cent. of glycerol or more caused a very considerable reduction in the amount of mordant absorbed by the silk: thus, a stannous chloride mordant dissolved in water gave a silk containing 8·7 per cent. of tin compounds calculated as stannic oxide, whilst the same weight of mordant dissolved in a mixture of 3 parts of glycerol to 5 parts of water (by volume) produced a fibre containing only 0·26 per cent. of tin compound calculated as stannic oxide.—T.F.B.

Indigo; Addition-compounds of alkalis and ——. A. Binz. Z. angew. Chem., 1906, 19, 1415—1418.

IN view of the facts (1) that neutral sodium indigotindisulphonate forms, as has been shown (this J., 1903, 901), addition-compounds with the hydroxides of sodium and calcium, (2) that indigo is electrolytically reducible by a zinc anode (loc. cit.), Binz and Walter conclude that in the setting of a hyposulphite (hydrosulphite) indigo vat the following reactions occur:—

(1) $C_{16}H_{10}N_2O_2 + 2NaOH = C_{16}H_{10}N_2O_2.2NaOH$





analogous changes taking place in the preparation of the zinc powder and ferrous sulphate vats. In the first phase of these reactions, the particles of dyestuff become coated with the sodium- or calcium hydroxide-indigo compounds which are formed. In the next phase, these compounds are deoxidised, the resulting products passing into solution as salts of Indigo White. The changes proceed in this manner until the whole of the indigo has been acted upon. The first reaction has been made the subject of a patent by the Badische Anilin- und Soda-Fabrik (Ger. Pat. 158,625 of 1903), who have described the formation of addition-compounds of alkali and alkaline-earth hydroxides and indigo, the existence of which had previously been pointed out by Binz and Walter. The preparation of these and similar compounds in the pure state offers considerable difficulties. In the present communication, the results of experiments made with this object are described.

1. *The addition of sodium hydroxide to Indigo.*—20 grms. of 99 per cent. indigo powder were shaken for 11 days with 840 c.c. of a filtered alcoholic sodium hydroxide solution prepared by dissolving 96 grms. of sodium hydroxide in 104 c.c. of water, and 640 c.c. of alcohol. Part of the mixture was filtered. The remainder of it was agitated during eight days longer. Part of this was also filtered. The residues, after pressing on porous plates, appeared as dark green, dry powders. On immersion in water or allowing to stand for some time exposed to the air, their colour changes to blue. Decomposition into indigo and alkali is effected still more slowly by alcohol. On analysis, the pressed masses were found to contain, per mol. of indigo, 1·90 and 2·0 mols. of sodium hydroxide. A determination of the amount of alkali mechanically or less powerfully retained by the indigo, was made by agitating the dyestuff with alcoholic potash, and immediately filtering, the pressed residue containing, per mol. of indigo, 0·89 of a mol. of sodium hydroxide. The differences, namely, 1·01 and 1·11, give the molecular proportions of alkali combined with 1 mol. proportion of indigo. The regenerated indigo, on testing, was found to be as pure as the original product. From the above results, it would appear that the alkali becomes strongly combined with half of the indigo molecule, the latter thus behaving, in relation to alkalis, the same as it does towards acids, with which it forms, *e.g.*, a stable and crystallisable monohydrochloride and monosulphate, but an unstable disulphate (this J., 1903, 20). The combination of indigo with alkali hydroxides may be brought about more rapidly by heating, than by agitating the aqueous or alcoholic mixtures. It begins to take place at about 40° C.; at 60° C. it is completed in a few minutes.

2. *The addition of sodium phenolate to Indigo.*—Mixtures of indigo and sodium phenolate were heated together in absolute alcohol, in one experiment, for 20 minutes at 77° C., in another, for an hour at 80° C. 0·73 and 0·60 mol. of sodium phenolate, per mol. of indigo, were respectively found to have become combined. Although the attraction of indigo for sodium phenolate is weaker than its attraction for alcoholic sodium hydroxide, the green coloration of the dyestuff produced on heating it with the former compound indicates that a reaction occurs, and that indigo, like quinone, has the power of forming an addition-compound with sodium phenolate.

3. *Influence of alcohol on the reduction of Indigo.*—The results of experiments made with aqueous and alcoholic mixtures of indigo, zinc dust, and sodium hydroxide, show that, under similar conditions, reduction of the dyestuff takes place about 30 times more rapidly in the alcoholic than in the aqueous mixtures. Alcoholic sodium hydroxide itself has no reducing action on indigo. At the temperature of boiling, a slight reaction occurs, with the formation, not of Indigo White, but of a decomposition-product which dissolves in alkalis with a green, and in acids and ether with a red colour. Alcohol aids the reducing action by its solvent action on the sodium-indigo. The latter in the aqueous mixtures, like the analogous calcium compound in the lime vats, continuously passes in minute quantities into solution, and in this condition becomes reduced. The fact that the reduction is retarded by the presence of a large excess of alkali, which hinders the solution of the sodium-indigo compound, is a further proof of this.

The essential difference between alkaline and acid reduction-processes, in the opinion of the author, is that, in the former, a molecular addition of alkali takes place, followed by a de-oxidation of the resulting product, whilst in the latter, hydrogen is directly added.—E. B.

Aniline black. C. Sünder. Z. Farben-Ind., 1906, 5, 400—401.

In order to obtain Prud'homme's Aniline Black, which does not turn green, the following conditions should be observed: The oxidation should not be too violent, or the colour may be dulled or even partially destroyed. Great care is necessary if an after treatment is resorted to; this also takes up much time, and is not a practical method. The black should not become appreciably darker on drying and stoving before being printed, and should be more neutral than a "Printing Black." If it is more difficult to obtain an ungreenable Prud'homme Black by the use of pure aniline than with the help of Oehler's salt (containing toluidine), it is, nevertheless, possible to approach this very nearly by careful choice of conditions. It is possible to oxidise so far, that the fabrics, after steaming, are not green but black. The shade is deepened by chroming or washing, but it is not greened by treatment with bisulphite and hydrochloric acid. Considering that a black is never greened so much by exposure to the air as by treatment with sulphurous acid, it is possible to say that a sufficiently nongreening Prud'homme black may be obtained with pure aniline, and it is very seldom necessary to use other bases.—J. C. C.

Silk; Determination of the Weighting of ——. J. Persoz. XXIII., page 1121.

English Patents.

Silk, artificial; Manufacture of ——. W. R. Lake, London. From R. Linkmeyer, Brussels. Eng. Pat. 3549, Feb. 13, 1906.

See Fr. Pat. 361,061 of 1905; this J., 1906, 692.—T.F.B.

Dyeing or treating with liquids, raw cotton, loose wool, or silk and like loose fibre or material; Machine for ——. F. Milan, Huddersfield. Eng. Pat. 21,311, Oct. 20, 1905.

The machine comprises a rotary cage having an inner shell or casing and an outer perforated shell, with radial, perforated, dividing walls or partitions. V-shaped perforated hollow ribs or prominences extend from the inner and outer shell, and from each partition, into the several chambers for the purpose of opening out the material to allow of the even distribution of the dye liquor. Buckets may also be fixed at or near the outer corner of each chamber, for the purpose of lifting liquor from the vat, and discharging it upon the fibres in the compartments, when the material is out of the liquor in the vat.—B. N.

Cleaning, dyeing, or otherwise treating wool, textile fabrics, and other like material; Apparatus for ——. M. Nicholas, London. Eng. Pat. 23,509, Nov. 15, 1905.

A cylinder is provided at each end with stuffing-boxes, through which pass two rods, the latter being connected inside the cylinder to two perforated plungers placed some distance apart. The material to be cleaned or dyed is introduced through water-tight man-holes in the cylinder, and is placed between the plungers. The outer ends of the rods are attached to an outside frame, which may be given a reciprocating motion by means of a suitable handle, and the dye-liquor is thus passed to and fro through the material.—B. N.

Bleaching or dyeing hanks, cops, and other fibrous materials; Apparatus for ——. J. Wilkinson, Colne, Lancaster. Eng. Pat. 12,117, May 24, 1906.

The bleaching or dyeing liquid contained in a receptacle separate and apart from the vat, in which the fabric is treated, is forced by means of a pump through the bottom of the vat, and after percolating through the material is returned to the receptacle. This operation is repeated until the desired shade or colour is obtained, the yarn being compressed by mechanical means and retained in this state during the entire process.—D. B.

Cleaning, dyeing or otherwise treating wool, hair, cotton, and other animal or vegetable fibrous or textile material; Apparatus for ——. T. A. S. Wood, London. Eng. Pat. 14,344, June 22, 1906.

Water is admitted into the fixed tank, 1, (see figure), having stationary blades, 14, across the bottom to prevent centrifugal movement. After heating to the desired temperature by introducing steam at 33, the doors, 28, are opened, and the fabric placed in the revolving cage, 12. The reciprocating action of the plunger, 18, in its downward movement, forces a great part of the liquid in the cage out through the perforations, 13, and opens out the

material, whilst during the upward movement a vacuum is created in the cage, thus lifting the material, and ensuring the contact of the liquid with every portion of the fabric.—D. B.

Formaldehyde hydrosulphites and sulphoxylates; Manufacture of ——. G. B. Ellis, London. From Chem. Fabr. von Heyden Akt.-Ges., Radeboul, Saxony. Eng. Pat. 13,788, June 15, 1906.

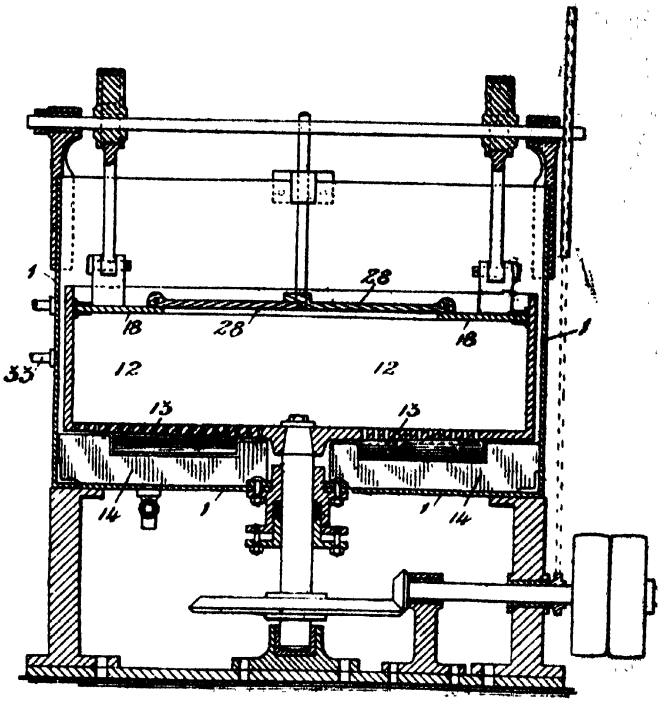
See Fr. Pat. 366,867 of 1906; following these.—T.F.B.

Silk; Treatment of —— with thiourea, its salts, or its substitution derivatives. H. H. Lake, London. From Soc. Anon. Co-operativa per la Stagionatura e. l'Assaggio delle Sete ed Affini, Milan, Italy. Eng. Pat. 25,752, Dec. 11, 1905.

See Fr. Pat. 358,033 of 1905; this J., 1906, 262.—T.F.B.

Drying cylinders [for fabrics]; Steam ——. W., J. G., and J. A. Buck, Manchester. Eng. Pat. 21,594, Oct. 24, 1905.

To facilitate repairs in connection with steam-drying cylinders, and provide means for automatically discharging condensed water, an iron flange having T-shaped apertures is fitted within each end of the cylinder. T-headed screw bolts are placed in the apertures, and the cylinder doors are secured by passing the bolts through holes formed at corresponding distances apart. Each half of the cylinder is provided with a pair of double condensing water-lifting buckets, semi-circular in shape, and tapering longitudinally, and arranged so that the water scooped up by the bucket nearest the steam inlet end is tipped into the adjacent bucket, which delivers it into one of the buckets at the other end of the cylinder, and this in turn discharges it into its adjacent bucket, which is provided with means for removing the condensed water.—D. B.



Oil from cleaning wool, cotton waste, and the like; Centrifugal machines for removing ——. E. Fischer, P. Arnold, and E. Illig, Chemnitz, Germany. Eng. Pat. 10,517, May 4, 1906.

See Fr. Pat. 365,910 of 1906; following these.—T.F.B.

United States Patent.

Silk; Method of winding —— to facilitate treatment thereof [with liquids]. L. Détré, Rheims, France. U.S. Pat. 833,374, Oct. 16, 1906.

See Fr. Pat. 348,368 of 1904; this J., 1905, 495.—T.F.B

French Patents.

Artificial silk and collodion products; Manufacture of ——. Fabr. de Soie Artificielle de Tubize. Fr. Pat. 361,690, Aug. 11, 1905.

By adding a sulphonated hydroxy-acid or a sulphonated fatty acid in acid, neutral, or alkaline solution to the materials used in the manufacture of nitrocellulose or collodion, it is found that the nitrated product is much more soluble in the usual solvents than the ordinary product. The acids mentioned form a stable compound with the nitro-cotton, so that the artificial silk produced does not consist only of nitrocellulose, but of this compound, and as a result, the specific gravity of the product is nearer to that of real silk. The sulpho acids can be added to the cotton before or after nitration, or else to the solvent liquids.—A. B. S.

Artificial fibres; Washing and drying of ——. E. W. Friedrich. Fr. Pat. 366,793, June 2, 1906. Under Int. Conv., June 15, 1905.

The bobbins of artificial silk fibres, after being removed from the spinning machine, are placed in a horizontal position in washing baths, the liquid in which reaches up to the axis of the bobbin. The bobbins are slowly rotated on their axes in the liquid. The action of centrifugal force is avoided by the slowness of the rotation, so that the liquid is absorbed by the fibre, and penetrates to the lower layers. To dry the bobbins, they are placed in a drying chamber, and a similar slow rotary motion is given to them.—A. B. S.

Sheet or film; Thin ——, *and process for making same* W. A. Ker. Fr. Pat. 366,891, June 5, 1906.

See U.S. Pat. 826,781 of 1906; this J., 1906, 1040.—T.F.B.

Cleaning wool, &c.; Centrifugal turbine for degreasing —— *with the aid of steam.* E. Fischer and Co. Fr. Pat. 365,910, May 4, 1906.

The grease-charged materials to be treated are packed in baskets or perforated boxes of a special shape, which fit into the perforated, rotary drum of a centrifugal machine into which they are placed, in such a manner that spaces are left between and around them. Steam is passed into the chamber in which the drum is inclosed. This penetrates into the spaces surrounding the baskets, and thence into the materials, which it heats, thus melting the grease and facilitating its removal from the materials by the centrifugal action of the apparatus.—E. B.

Antimony compounds, obtained by reaction with lactates of alkalis or alkaline-earths; Process and materials for mordanting with tannic acid and ——. A. Eberdt Söhne. Fr. Pat. 365,722, April 28, 1906.

Antimony compounds which, like "Antimonine" (this J., 1897, 737), are advantageously employed as fixing agents for tannic acid, in the mordanting of textile materials, are obtained by mixing together, in solution or in the dry state, lactates of alkalis or alkaline-earths and antimony

salts, such as tartar emetic, "de Haeus's" (de Haen's) "antimony salt," $SbF_3.(NH_4)_2SO_4$, Köpp's salt, $SbF_3.NaF$, von Raad's double fluoride salt, &c., in the proportions required for the replacement by lactic acid of the acid combined with the antimony, *e.g.*, $2SbF_3.NaF$ and $3Ca(C_3H_5O_3)_2$, and "$2KSb(C_4H_4O_6)\frac{1}{2}H_2O$" and $Ca(C_3H_5O_3)_2$. When the salts are mixed in solution, a clear solution is obtained with tartar emetic and calcium lactate; the fluoride double salts give with the latter salt a finely divided precipitate of calcium fluoride, which does not, however, interfere with the fixing of the tannic acid. The mixtures, *e.g.*, powders, of the respective compounds in the dry state, have the advantage, compared with "Antimonine," of being obtainable in a colourless, dry, easily soluble state, containing definite amounts of antimony oxide, whilst the latter preparation, in which at least 6 mols. of lactic acid are combined with "1 mol." (2Sb) of antimony, is sold as a strongly smelling, cheese-like mass, in which the content of antimony oxide (about 15 per cent.) varies according to the degree of humidity of the pasty mass. According to the salts employed, the (calcium lactate) mixtures contain the following percentages of antimony trioxide: De Haen's salt, 18 per cent.; Köpp's salt, 21 per cent.; von Raad's salt, 25 per cent; the tartar emetic mixture, 30 per cent.—E. B.

Cotton, ramie, and other textile fibres in the loose or partially spun state; Apparatus for bleaching and dyeing ——. E. Steiner. Fr. Pat. 365,793, May 1, 1906.

COTTON, ramie, &c., in the loose state or in the form of sliver or slubbing, are placed in a cylindrical vessel, provided with liquor-circulating pipes, a steam-injector, and a steam-coil placed below a false bottom. Loose fibres are directly pressed into the vessel, and covered with a perforated plate. Slubbing is put into the apparatus in compact masses, coiled round short rods, and compressed between cross-shaped end-pieces. The fibres are then bleached or dyed by circulating, by means of a centrifugal pump, the necessary liquors through them. —E. B.

Fur; Apparatus for the "secrétage" and dyeing of ——. T. Pernin. Fr. Pat. 367,163, June 14, 1906.

THE machine consists essentially of a large cylinder, around which a number of revolving brushes and pressure rollers are fitted which are in contact with the central cylinder. The skin to be treated is placed on a sloping table, and is seized by a revolving brush which passes it along the face of the large cylinder until it comes under a small spring roller, which the thickness of the skin pushes away from the central cylinder. This spring-roller is connected by means of a series of levers with the driving arrangement of the first brushing wheel, and its movement causes the direction of rotation of the latter to be reversed. Thus, as soon as the skin is seized by the second roller, the brushing of the fur takes place in the opposite direction. One or more other brushes may be fitted around the large cylinder. The brushes dip into vessels containing the liquids which it is desired to apply to the skins, these vessels being furnished with a constant level arrangement. —A. B. S.

Printing with sulphide dyestuffs; Process for ——. L. Cassella und Co. Fr. Pat. 361,742, Sept. 2, 1905.

SEE Eng. Pat. 1300, of 1906; this J., 1906, 586.—T. F. B.

Ketone and aldehyde-hyposulphites (hydrosulphites) and sulphoxylates; Preparation of ——. Chem. Fabr. von Heyden A.-G. Fr. Pat. 366,867, June 5, 1906.

KETONE-HYPOSULPHITES (hydrosulphites) of the type, $R_2S_2O_4.2(CH_3)_2CO$, can be obtained by treating free or combined sulphurous acid with zinc powder, or with zinc powder and an acid, in the presence of ketones. The proportions to be employed are about one atom of zinc for every 2 mols. of sulphurous acid taking part in the reaction, and 2 mols. or an excess of ketone. Example: 120 kilos. of sulphurous acid are introduced with constant stirring into a mixture of 120 kilos. of acetone, 70 kilos. of zinc powder, and 200 litres of water, the temperature being kept at 20°—30° C. The zinc acetone-hyposulphite obtained can be converted into the sodium salt by treatment with sodium carbonate in the usual way. The ketone-sulphoxylates are obtained by complete reduction of sulphurous acid in the presence of acetone by means of zinc or of zinc and acid. This reduction is carried out warm. One atom of zinc is taken for 1 mol. of sulphurous acid and one of acetone. The reaction probably proceeds as follows:—

$$(CH_3)_2CO + SO_2 + Zn + H_2O = (CH_3)_2C.(OH)(SO_2)ZnOH.$$

The acetone hyposulphite may be formed first, and then further reduced by zinc dust to the sulphoxylate, thus:—

$$ZnS_2O_4.2(CH_3)_2CO + Zn + 2H_2O = 2(CH_3)_2.C(OH)(ZnOH)SO_2.$$

The acetone-sulphoxylates are employed as reducing agents for Indigo, &c.—A. B. S.

Waterproofing of fibres, fabrics, paper, &c. E. Meulders and C. Bourlet. Fr. Pat. 366,951, March 17, 1906.

THE material is padded with a solution of aluminium acetate, and after drying is soaked for two days in a dilute solution of tannin. Another method is to soak in a solution prepared by mixing a solution of aluminium acetate with a very dilute solution of tannin. The material is exposed to the air for some days, whereby, it is stated, a "sub-tannate" of aluminium is produced.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 982.)

Dyed materials [*Wood*]; *Penetration of the bleaching action of light on* ——. W. H. Schramm and A. Jungl. Färber-Zeit., 1906, 17, 333—342.

THE authors have investigated the action of light on various dyed materials, especially on wood of various kinds. After exposure to light a section was cut at right angles to the surface, and the thickness of the bleached layer was measured with a micrometer eye-piece. It was found that for the dyestuffs and woods employed, the thickness of the bleached or altered layer after six weeks' exposure to the sun in July and August averaged 0·033 mm. The effect of longer exposure showed that the bleached layer had little moderating action on the effect of the light on the lower dyed layers. The placing of thin coloured layers of wood or other semi-transparent material on the surface of the dyed wood had a very large effect on the bleaching of the latter. The authors conclude that for wood dyeing, in cases where the wood has to stand no mechanical wear, a dyed layer, 0·03—0·06 mm., is enough, and this is obtainable by simply brushing the dye-liquor over the surface of the wood.—A. B. S.

ENGLISH PATENT.

Skins, waste of skins, and hair; The dyeing and secreting of ——. C. and E. Pichard, Paris. Eng. Pat. 9629, April 24, 1906. Under Int. Conv., June 9, 1905.

SEE Fr. Pat. 355,121 of 1905; this J., 1905, 1227.—T. F. B.

FRENCH PATENT.

Wood dyeing; Apparatus for ——. M. Schmidt. Fr. Pat. 367,059, June 11, 1906.

THE wood to be treated is supported in a horizontal position by means of metallic supports placed at each end. The wood is gripped between two vertical pieces attached to the metallic supports and faced with a layer of caoutchouc to make good contact with the surface of the wood. One of the supports can be moved horizontally by means of a screw worked by a capstan wheel in order to fit various lengths of wood. A tube passes through each support, emerging at the centre of the rubber surface, the other ends being connected by flexible pipes with the vessels containing the dyeing or other liquids. The liquid is contained in a hermetically-sealed vessel, from which it is forced by means of compressed air into the tube passing through one of the supports

of the wood. The liquid passes along the wood in a horizontal direction, and the excess emerges through the pipe at the other end. If necessary, the direction of flow can be reversed.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 1045.)

Sulphuric acid; Contact process for ——. L. Wöhler, A. Foss, and W. Plüddemann. Ber., 1906, **39**, 3538—3549.

The authors have used as contact substances the metals, platinum, palladium, and iridium, and their oxides, and have measured the speed of the reaction in each case. In every case the oxide was inferior as a catalyst to the metal which it contained, and the intensity of its action increased just in proportion as it decomposed into metal and oxygen. Moreover, whilst the stability of the oxides increases in the order: platinum, palladium, iridium, the temperature of maximum catalytic activity rises in the order, platinum, iridium, palladium. The working of the contact-process, therefore, is clearly not dependent on the formation and decomposition of either of the oxides, PtO or PtO_2. The authors have already obtained indications that the decomposition of hydrogen peroxide by platinum is due to the presence and action of an endothermic platinum peroxide, and they suggest the possibility of this peroxide being the active substance in the contact process of sulphuric acid manufacture.

—J. T. D.

Hydrogen sulphide; Oxides of ——. E. Fromm and J. de S. Palma. Ber., 1906, **39**, 3317—3326.

As from sulphurous acid, H_2SO_3, are derived the sulphonic acids $R.SO_3H$, so from hyposulphurous acid, H_2SO_2 (Bernthsen's sulphoxylic acid), are derived the sulphinic acids, $R.SO_2H$, and the sulphones, $R.SO_2.R$; whilst the unknown H_2SO may be looked on as the parent of the sulphoxides R.SO.R. The authors have found that benzyl chloride in alkaline solution reacts quantitatively with sodium sulphite to form sodium benzylsulphonate, and they have applied this reaction to the other oxides of hydrogen sulphide. Sodium hyposulphite, $Na_2S_2O_4$, thus treated, yields sodium benzylsulphonate and sodium benzylsulphinate, the latter of which is converted by excess of benzyl chloride into benzylsulphone; thus evidence is afforded in favour of Binz's formula for sodium hyposulphite, O:(SNa).O.(NaS)O$_2$. The same reaction has enabled the authors to prove that when sulphuryl chloride and zinc dust react, there is formed not zinc hyposulphite, $2SO_2Cl_2 + 3Zn = 2ZnCl_2 + ZnS_2O_4$, but zinc sulphoxylate, $SO_2Cl_2 + 2Zn = ZnCl_2 + ZnSO_2$, for the reaction of benzyl chloride and alkali on the product yields benzylsulphone unmixed with any sodium benzylsulphonate. The reaction of benzyl chloride and alkali on sodium hyposulphite is very sharp, and may possibly be used for the quantitative determination of hyposulphites. Attempts to form the substance, H_2SO or HS:OH (which may be regarded as intermediate between hydrogen peroxide and hydrogen persulphide), and to prove its formation by the benzyl chloride and alkali reaction, were all fruitless.—J. T. D.

Sodium hypochlorite; Depreciation of electrolytically-produced solutions of ——. W. P. Digby. Paper read before Faraday Soc., Nov. 13, 1906. [Advance proof.]

Details of experiments are given, showing that certain conditions of storage injuriously affect the stability of hypochlorite solutions; more particularly contact, in such cases, with dissimilar metals, resulting in galvanic action, is liable to result in decomposition. The relative order of values of different metals is given as causing such depreciation, but these figures are stated to be absolute only as regards the product of the factory dealt with. The author has devised a "galvanic couple test," which in a given time, for any solution, will indicate what may be called its "stability coefficient." Detailed tests are now being made with various hypochlorite solutions both "chemical" and "electrolytic," with a view to simplify the methods, and a further paper is promised.

—B. N.

Ammonium salts; Hydrolysis of ——. A. Naumann and A. Rücker. J. prakt. Chem., 1906, **74**, 249—275.

A method has been devised by the authors by means of which the hydrolysis of ammonium salts was calculated from the quantity of ammonia obtained by distillation. By its use, determinations of the extent of hydrolytic dissociation have been made at the boiling point of aqueous solutions of the following compounds:—Ammonium chloride, bromide, and thiocyanate, ammonium sodium sulphate, $NH_4NaSO_4.3H_2O$; ammonium sulphate, chromate, bichromate, and oxalate, $(NH_4COO)_2.H_2O$; Mohr's salt, $(NH_4)_2SO_4.FeSO_4.6H_2O$; iron ammonium alum, $(NH_4)_2SO_4.Fe(SO_4)_3.24H_2O$; microcosmic salt $(NH_4)NaHPO_4.4H_2O$; ammonium phosphate, $(NH_4)H_2PO_4$; diammonium phosphate, $(NH_4)_2HPO_4$; triammonium phosphate, $(NH_4)_3PO_4$; and ammonium molybdate, $(NH_4)_6Mo_7O_{24}.4H_2O$. The distillation of pure solutions of ammonia gave results, which proved the absence of proportionality between the concentration of the solution and the partial pressure of ammonia. The latter was found to decrease considerably as the concentration diminishes, a circumstance which harmonises with the conclusions previously drawn concerning the composition of aqueous solutions of ammonia. The hydrolysis of salts increases with decreasing salt concentration, although not in accordance with Ostwald's equation governing the law of mass action: $\frac{x^2}{n-x} = K$, which can be made to apply only to ammonium chloride and bromide, *i.e.*, salts containing strong monobasic acids. It is stated that titrations of ammonia, especially in dilute solution, should be made with hydrochloric acid. Sulphuric acid, owing to the dissociation of ammonium sulphate, tends to exhibit an acid reaction at too early a stage. (See also Watson Smith, this J., 1896, 4.)—D. B.

Potassium-lead chlorides. R. Lorenz and W. Ruckstuhl. Z. anorg. Chem., 1906, **51**, 71—80.

The authors determined the cooling curve of fused mixtures of lead chloride and potassium chloride, the mixtures being heated in a tube of hard glass in which a thermo-couple was fixed. Evidence was obtained of the formation of three double chlorides, and the existence of these compounds was confirmed by crystallographic examination of the solidified melts. The compound, $2PbCl_2.KCl$, was obtained as a nearly transparent, glassy mass, on the surface of which a distinct crystalline structure could be observed. The compound, $PbCl_2.2KCl$, was obtained in a fairly pure condition by repeated very slow cooling of the melts, the solid being powdered each time before fusing. It formed a mass of tightly-packed, well-defined crystals, which had a tendency to appear in twisted prismatic forms. The crystals exhibited a distinct similarity to rhombic cerussite ($PbCO_3$). The compound, $PbCl_2.4KCl$, was obtained by slowly cooling a melt of the requisite composition, as a reddish-white mass of granular structure. The compounds, $PbCl_2.2KCl$ and $PbCl_2.4KCl$, decompose when heated above 440° C. and 490° C. respectively.—A. S.

Steam; Dissociation of ——. H. v. Wartenberg. Z. physik. Chem., 1906, **56**, 513—533.

Two methods were used, and it is shown that at about 1100° C. the reaction is trimolecular. A porcelain bulb of 13 c.c. capacity, with two long capillary arms, was heated electrically, and the temperature measured by a thermo-couple placed outside the bulb to avoid catalytic action. A current of steam was passed through the bulb at different rates, and the amounts of free hydrogen and oxygen formed were measured in a 3 c.c. eudiometer graduated to 0·02 c.c. At 1130° the reaction was slow, and equilibrium was not reached. Experiments were also made with steam mixed with known amounts of hydr-

hydrogen gas obtained electrolytically. Curves drawn with the observed dissociations as ordinates and the reciprocals of the rates of flow of steam as abscissæ enable the degree of dissociation for equilibrium at this temperature to be determined by extrapolation. The value found is 0·007 per cent. The value calculated for a trimolecular reaction is 0·0078 per cent. Similar experiments with carbon dioxide showed that at 1200°—1300° the reaction is probably trimolecular in this case also. The second method used, suitable for higher temperatures, consisted in measuring the partial pressure of the hydrogen which diffused into a vacuous iridium bulb placed in a current of steam passing through an iridium tube heated to nearly 2000°. The temperature was measured by the optical method, and is probably correct within 10° or 15°. The degree of dissociation was found to be 1·18 per cent. at 1882°, and 1·77 per cent. at 1984°.

—A. T. L.

Steam; Dissociation of ——. W. Nernst and H. v. Wartenberg. Z. physik. Chem., 1906, **56**, 534—547.

THE experiments were made with apparatus similar to that described in the preceding abstract (first method), but the temperature was measured by means of a thermocouple in a sealed, thin-walled porcelain tube placed inside the porcelain bulb. The quantity of electrolytic oxyhydrogen gas added to the steam was determined from measurements of the current used; the water used was slightly alkaline, to avoid the formation of hydrogen peroxide. Experiments were carried out at three temperatures; in each case, curves were plotted having as ordinates, the oxyhydrogen gas found, and as abscissæ, the oxyhydrogen gas added, and were interpolated to find the equilibrium value at which the ordinates and abscissæ of the curve are equal. The final values are:—

Temperatures.	Degree of dissociation.
1124° C.	0·0078 per cent.
1207°	0·0189 per cent.
1288°	about 0·034 per cent.

A formula is deduced from thermal data, from which the degree of dissociation at any temperature can be calculated, and the agreement with the observed values is practically complete. The formula is used to calculate the degree of dissociation of steam at several pressures and temperatures.

Degree of dissociation (x) of steam at atmospheric pressure.

Temp. absolute.	x per cent.	Log. x.	Temp. absolute.	x per cent.	Log. x.
1000	$3·00 \times 10^{-5}$	−4·523	1800	0·199	− 0·702
1100	$1·82 \times 10^{-4}$	−3·740	1900	0·354	− 0·451
1200	$8·13 \times 10^{-4}$	−3·090	2000	0·588	− 0·231
1300	$2·91 \times 10^{-3}$	−2·536	2100	0·935	− 0·029
1400	$8·61 \times 10^{-3}$	−2·065	2200	1·42	+ 0·152
1500	$2·21 \times 10^{-2}$	−1·655	2300	2·08	+ 0·318
1600	$5·07 \times 10^{-2}$	−1·295	2400	2·92	+ 0·465
1700	0·105	−0·980	2500	3·98	+ 0·599

Values at intermediate temperatures may be found by taking proportional differences of log. x.

Degree of dissociation of steam at different pressures.

Temp. absolute.	P=10 atm.	P=1 atm.	P=0·1 atm.	P=0·01 atm.
1000	$1·39 \times 10^{-5}$	$3·00 \times 10^{-5}$	$6·46 \times 10^{-5}$	$1·39 \times 10^{-4}$
1500	$1·03 \times 10^{-2}$	$2·21 \times 10^{-2}$	$4·78 \times 10^{-2}$	0·103
2000	0·272	0·588	1·26	2·70
2500	1·93	3·98	8·16	16·6

The results are used to show that the electromotive force corresponding to the reaction is

$$1·232 - 0·00085(t - 17) \text{ volts},$$

where t is the temperature (°C.), a value considerably higher than that obtained by direct measurements.

—A. T. L.

Carbon dioxide; Dissociation of ——. W. Nernst and H. v. Wartenberg. Z. physik. Chem., 1906, **56**, 548—557.

THE method and apparatus used were similar to those described in the preceding abstract. The carbon dioxide could be mixed with its dissociation products by sparking. It was found necessary to dry the gas very thoroughly, as water exercises a powerful catalytic influence on the reaction. The degree of dissociation at 1205° C. was found to be 0·029 per cent. The degree of dissociation at 1300° C. is deduced indirectly from the equilibrium $CO + H_2O \rightleftharpoons CO_2 + H_2$, and the results given in the preceding abstract. The value obtained is 0·00414 per cent. Thermal data give a formula, connecting the degree of dissociation with the temperature, which agrees with these values. The following values are calculated from this formula:—

Degree of dissociation (x) of carbon dioxide at atmospheric pressure.

Temp. absolute.	x per cent.	Log. x.	Temp. absolute.	x per cent.	Log. x.
1000	$1·58 \times 10^{-5}$	− 4·71	1800	0·507	− 0·295
1100	$2·00 \times 10^{-4}$	− 3·801	1900	0·978	− 0·010
1200	$8·94 \times 10^{-4}$	− 3·048	2000	1·77	+ 0·248
1300	$3·89 \times 10^{-3}$	− 3·410	2100	3·03	+ 0·481
1400	$1·38 \times 10^{-2}$	− 1·861	2200	4·88	+ 0·688
1500	$4·06 \times 10^{-2}$	− 1·392	2300	7·55	+ 0·878
1600	0·104	− 0·981	2400	11·3	+ 1·054
1700	0·242	− 0·617	2500	15·8	+ 1·200

Degree of dissociation of carbon dioxide at different pressures.

Temp. absolute.	P=10 atm.	P=1 atm.	P=0·1 atm.	P=0·01 atm.
1000	$7·31 \times 10^{-6}$	$1·58 \times 10^{-5}$	$3·40 \times 10^{-5}$	$7·31 \times 10^{-5}$
1500	$1·88 \times 10^{-2}$	$4·06 \times 10^{-2}$	$8·72 \times 10^{-2}$	0·188
2000	0·818	1·77	3·73	7·88
2500	7·08	15·8	30·7	53·0

—A. T. L.

Water vapour and carbon dioxide; Dissociation of —— at high temperatures. I. Langmuir. J. Amer. Chem. Soc., 1906, **28**, 1357—1379.

THE experiments described by the author were made with the view to test a suggestion of Nernst, that around a glowing metallic wire, in a gas capable of dissociating, there would probably be only very slight re-combination of the dissociation products during the short time required for these to diffuse from the surface of the wire into the comparatively cold layers only a short distance from the wire; and, also, that if the wire exerted a sufficiently strong catalytic action, there would be equilibrium at the surface of the wire, and hence the cold gas some distance from the wire would have the same composition as would have been the case had the whole gas been uniformly heated to the temperature of the wire. Experiments on the dissociation of steam and carbon dioxide showed that, by this method, equilibrium around the wire is reached with great rapidity, and that the degree of dissociation is, within wide limits, independent of the velocity of the current of gas passed over the glowing wire. The temperature of the wire was ascertained by means of the change in its electrical resistance. The results obtained with steam and carbon dioxide at temperatures between 1000° and 3000° absolute were 9·5 and 7 per cent. respectively lower than those obtained by Nernst by another method (see preceding abstracts). The method has many

advantages, and would probably be especially useful in measuring dissociation at high pressures. In the course of the experiments, it was found that platinum and platinum-rhodium (10 per cent. of rhodium) wires do not disintegrate perceptibly in steam or carbon dioxide up to 1300° C., but at 1400° C. platinum-rhodium begins to disintegrate in steam.—A. S.

Deacon [chlorine] process; Equilibrium in the ——. G. N. Lewis. J. Amer. Chem. Soc., 1906, **28**, 1380—1395.

Previous investigations of the Deacon process have been conducted under actual working conditions, in which the gases are passed over the catalyser too rapidly for the establishment of equilibrium (see Lunge and Marmier, Z. angew. Chem., 1897, 105). In the author's experiments the catalyser was prepared by boiling pumice stone, in pieces about the size of a pea, with hydrochloric acid, saturating them with a 10 per cent. solution of cupric chloride, and drying in a current of dry hydrochloric acid gas at 250° C., until evolution of water vapour ceased. On passing the mixture of oxygen and hydrochloric acid gas, no concordant results could be obtained until after several days, owing to slow changes in the catalyser. The time required to attain a state of equilibrium in the gaseous mixture was greater the lower the temperature, and the smaller the percentage of oxygen present. A summary of the results obtained is given in the following table, wherein x represents the ratio of free chlorine to total chlorine in the final gaseous mixture, and K is the equilibrium constant of the reaction:—

Temp. ° C.	Average pressure, atmospheres.	Mols. of oxygen per 100 mols. of hydrochloric acid		x.	K.
		In original gas.	In final gas.		
352	1·00	92·7	544·0	0·869	4·15
352	0·93	29·7	49·5	0·808	3·95
386	0·98	327·0	1970·0	0·845	2·04
386	0·96	48·8	146·0	0·804	3·01
419	1·08	327·0	1700·0	0·820	2·40

It is shown that the equilibrium constant, K, at any temperature can be calculated by the formula: $\log K = \frac{1509}{T} - 1{\cdot}811$, where T is the absolute temperature. The yield of chlorine from a given mixture is greater the lower the temperature.

From the results obtained in this investigation, together with some results of Dolazalek (Z. physik. Chem., 1898, **26**, 334), the E.M.F. of the hydrogen-oxygen cell at 25° C. is calculated to be 1·207 volts, a result agreeing well with that previously obtained by the author (J. Amer. Chem. Soc., 1906, **28**, 158) in a different manner, *viz.*, 1·217±0·010 volts, but about one-tenth of a volt higher than the value accepted at present.—A. S.

Oxygen and nitrogen; Mixtures of liquid ——. A. Stock and C. Nielsen. Ber., 1906, **39**, 3393—3397.

As the result of a series of very careful experiments, the authors show that the boiling point even of dilute solutions of nitrogen in liquid oxygen is lower than that of pure oxygen, and accordingly that liquid oxygen can be completely freed from nitrogen by boiling. On mixing equimolecular weights of liquid oxygen and nitrogen at −197° C., a rise in temperature of about ½° and a diminution in volume of about ½ per cent. are observed; these small changes are ascribed to association phenomena, and are of the same order as those observed on mixing indifferent substances, such as hydrocarbons.—E. F. A.

Hermite electrolytic process. [*Manufacture of hypochlorites.*] C. V. Biggs. XIA., page 1102.

Silver chloride; Solubility of —— in hydrochloric acid and in sodium chloride solutions. [*Determination of sulphur in organic compounds.*] W. E. Barlow. XXIII., page 1121.

Italy; Chemical industry of ——. Oil and Colour Trade J., Oct. 27, 1906. [T.R.]

Chemical industries in Italy have been handicapped by the operations of fiscal legislation and commercial treaties in addition to the scarcity of ores, the want of coal, dearness of transport, and difficulties in river communication. Several large factories have been erected of late for the manufacture of beetroot sugar, calcium carbide, the electrolytic production of caustic soda, and of hypochlorites. The factories for making chemical manures and sulphuric acid have developed considerably. The production and value of chemicals, &c., during the year 1901 was as follows:—Sulphuric acid, 2,778,440 quintals, 9,468,070 lire; calcium carbide, 273,149, 5,872,980; superphosphates, 4,590,190, 87,391,730; lead carbonate, 4,988, 2,226,300; carbon bisulphide, 25,230, 725,415; magnesium sulphate, 51,540, 360,880; sodium sulphate, 250,000, 825,000. (1 quintal = 2 cwts., nearly; 25 lire = £1 sterling.) The total value of the yearly output of the Italian chemical works is considerably over 100,000,000 lire. A revival in the trade is also noticeable, which is full of promise; but it is thought that a more general and at the same time more rational utilisation of water power, coupled with the progress that electro-chemistry is making, would render it possible for many industries to be started in Italy which have hitherto only existed in coal-producing countries. With the object of protecting and fostering chemical industry, an association under the style of "Associazione per l'incremento e per la tutela dell' Industria Chimica Italiana" was formed in Italy some months ago, with headquarters at Milan, by an influential body of chemists, and supported since by others.

English Patents.

Common salt; Manufacture of —— by evaporation of brine. G. R. Ray, Manistee, U.S.A. Eng. Pat. 5427, March 6, 1906.

The main through which the brine is conveyed to the "leg" of an evaporating pan is also connected to the upper portion of the pan by means of a pipe which communicates with the pan above the brine-circulating tubes, preferably at a point between the top of the tubes and the normal surface of the brine when the apparatus is in use. The larger portion of the brine is supplied to this upper inlet; the lower inlet may be disposed on the side of the "leg" nearest the elevator to prevent clogging. A pipe is also provided, leading from the brine main to a reservoir above, from which another pipe leads to the salt elevator. A portion of the brine is pumped to this reservoir, which is provided with a ball valve, and thence flows in regulated quantity to the pan by way of the elevator, thereby washing the salt as it is elevated. This "salt wash feed" may consist of the brine which strains from the salt. Thus, in triple effect apparatus, the elevators of the first and second effects are fed from a single reservoir, whilst the elevator of the third effect pan is fed by brine drained through the perforated floors of the salt bins.—A. G. L.

Ferrocyanides; Manufacture of —— from gas-purifying masses or other ferrocyaniferous masses. T. Bellowitsch, Vienna. Eng. Pat. 8362, April 6, 1906.

Masses of the material used in purifying gases, after having been washed with water, are heated to about 90° C. in an apparatus provided with stirring and loosening means; water is added, and slowly, by small portions, an intimate mixture of 6 to 14 per cent. of lime, with 4 to 10 per cent. of manganese peroxide, or its equivalent of Weldon mud, of the weight of the mass treated, air or oxygen being admitted throughout the process. The product is drained and lixiviated, and the lixivium is worked up by known methods for the production of alkali ferrocyanides. (Reference is made to Eng. Pat. 3551, of 1876; and to U.S. Pat. 649,048 of 1900.)—E. S.

Oxides of nitrogen; Method of producing —— by means of explosions such as in explosion engines. F. Häusser, Kaiserslautern, Germany. Eng. Pat. 12,401, May 28, 1906. Under Int. Conv., May 31, 1905.

See Fr. Pat. 366,804 of 1906; this J., 1906, 1045.—T. F. B.

Oxygen briquettes; Manufacture of ——. G. F. Jaubert, Paris. Eng. Pat. 12,262, May 25, 1906. Under Int. Conv., May 29, 1905.

See Fr. Pat. 361,522 of 1905; this J., 1906, 885.—T. F. B.

UNITED STATES PATENT.

Sulphur; Extraction of —— from gas-purifying materials. J. J. M. Bécigneul, Nantes, France. U.S. Pat. 833,573, Oct. 16, 1906.

See Fr. Pat. 345,071 of 1904; this J., 1904, 1216.—T. F. B.

FRENCH PATENTS.

Aluminium; Manufacture of nitrogenised compounds of —— [for production of ammonia]. O. Serpek. Fr. Pat. 367,124, June 13, 1906. Under Int. Conv., June 20, 1905.

THE object of the invention is to produce nitrogenised compounds of aluminium, which, on contact with water, preferably under pressure in an autoclave, and at a higher temperature than 100° C., give off ammonia. For this purpose, aluminium carbide, alone, or mixed with carbon, alumina, or aluminium chloride, or any mixture of these; or with metals, such as copper, aluminium, or iron, or their alloys, all in powder, is subjected at a high temperature to the action of nitrogen or air, to which may be added hydrochloric acid gas or sulphuric anhydride vapour. Instead of starting the process with a preformed aluminium carbide, a mixture of alumina with carbon may be heated, preferably by resistance in an electric furnace, in presence of nitrogen, with addition of one or more of the substances contributory to the formation of the required product already named.—E. S.

Sodium monosilicate; Manufacture of crystallised ——. W. N. Bacon. Fr. Pat. 366,895, June 5, 1906. Under Int. Conv., Nov. 23, 1905.

See Eng. Pat. 24,226 of 1905; this J., 1906, 846.—T. F. B.

Salt; Process for making common ——. G. T. Holloway. Fr. Pat. 366,904, June 6, 1906.

See Eng. Pat. 16,279 of 1905; this J., 1906, 758.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 1046.)

ENGLISH PATENT.

Waste sand from glass-works commonly known as burgy; Treatment and utilisation of —— [as filling material for linoleum, leather, paper, &c.]. W. Thompson, Birkenhead. Eng. Pat. 26,893, Dec. 23, 1905.

THE waste sand or burgy from plate glass works is levigated, and the finest portions are used as a filling in making linoleum, brown paper, "American" cloth, or leather, boot soles and heels, floor coverings, &c.—A. G. L.

FRENCH PATENTS.

Glass furnaces. H. G. Slingluff. Fr. Pat. 366,768, June 1, 1906. Under Int. Conv., June 29, 1905.

See U.S. Pat. 804,775 of 1905; this J., 1905, 1232.—T.F.B.

Glass furnace; Combined —— containing a tank and pots. E. A. Chambers. Fr. Pat. 367,780, July 5, 1906.

See Eng. Pat. 15,203 of 1906; this J., 1906, 1045.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 1046.)

Wood supply of the world. Ch. of Com. J., 1906. [T.R.]

THE American Consul at Eibenstock, reporting on the world's supply of wood, states that the demand, instead of diminishing, as was expected when coal came in use as a substitute for wood, has gone on increasing, until the question of a continued supply to meet the present rapidly increasing rate of consumption is a very serious problem. The coal mines of Belgium called for 1,742,740 square yards of wood in 1903. Each year a renewal of old supports is taking place, and new ones are being put into new galleries. Railroads use enormous quantities of wood in sleepers. The following table shows the importations of wood into the countries named:—

	Cub. yds.
England	16,342,600
Germany	11,766,667
France	8,496,300
Belgium	1,897,777
Italy	915,148
Denmark	849,630
Spain	392,222
Switzerland	313,778

The exportation of wood from the centres named below was as follows:—

	Cub. yds.
Russia*	9,544,074
Sweden	8,328,180
Austria-Hungary	6,929,260
Finland	4,340,451
Norway	1,961,110
Bosnia-Herzegovina	542,574

* Exclusive of Finland.

North America, Siberia, Africa, India, China, Korea, and South America still contain great unutilised and almost unknown forests. Many African forests are really composed of nothing better than thin bushes, and Siberia is already being systematically subjected to de-foresting, which will also begin in Korea in the near future. North America, however, at one time the wood storehouse for the world, has not now enough wood to supply its own demand, notwithstanding its 506,555,000 acres of wooded area. It now depends upon Canada, which, with its 798,133,000 acres of forests, represents probably the largest single area of any country in the world.

Timber; Experiments on the strength of treated ——. W. K. Hatt. U.S. Dept. of Agric., Circular No. 39, 31 pages.

THIS circular gives an account of an investigation of processes of preserving timber, and the influence of the processes upon the strength of the wood. The tests were confined to sap-wood, both green and seasoned, and were made upon 11-ft. railroad sleepers, and upon small pieces cut from them. The only preservatives used were zinc chloride and creosote. Tests were made of bending, compression parallel to the grain (both static and impact), compression at right angles to the grain, and shearing (static). The tests were made upon untreated pieces, treated pieces, and treated pieces that were, if necessary, re-soaked to restore the original degree of moisture. The capacity of the wood to hold a spike was also determined, and the physical characteristics of the wood noted. The results of the tests are given in a number of tables, and the following general conclusions are drawn from them:—The steaming process is injurious to wood, if it is continued too long or beyond a certain pressure (temperature). The injurious effects, or otherwise, also depend upon the quality of the wood, and its degree of seasoning. For one wood tested (loblolly pine) the limits were 30 lb. for four hours, or 20 lb. for six hours; beyond

these the wood was scorched and became discoloured. Up to a certain duration of the steaming process the weight of the sleepers increased, but beyond that point, the increase in weight was negligible. Greenwood that had been steamed and saturated, showed weakness in proportion to the duration of the steaming process and the pressure attained therein, but if air-dried the specimens regained the greater part of their strength, provided the steaming process had not exceeded the limits of safety. The dried specimens, if again immersed in water, were weaker than natural wood similarly dried and re-soaked. Wood treated with zinc chloride was not weaker than steamed wood under static loading, but was weaker under impact, and also weaker than natural wood. The presence of creosote does not of itself affect the strength of the wood, probably because it does not enter the cell walls, but only fills the openings of the cells. It does however retard the rate at which wood will season. The steamed and creosoted wood was weaker than the natural wood, but not weaker than the steamed wood.—W. C. H.

Plaster of Paris; Researches on ——. De Forcrand. Bull. Soc. Chim., 1906, **35**, 781–790.

The author has made some experiments on the heats of solution in water of the various modifications of calcium sulphate. For gypsum, $CaSO_4.2H_2O$, he accepts Thomsen's value of 330 calories with reserve; for the hemi-hydrate, $CaSO_4.\frac{1}{2}H_2O$, he finds 3560; for anhydrous calcium sulphate, $CaSO_4$, prepared at 155° C., 5655; and prepared at a red heat, 2920; Thomsen's value for anhydrous calcium sulphate prepared at a low temperature being only 4440 calories. The author believes that anhydrous calcium sulphate consists of a polymeric modification, which is incapable of changing to the hemihydrate in presence of water, the formation of hemihydrate with its high degree of solubility in water being necessary for the formation of the difficultly soluble hydrate, $CaSO_4.2H_2O$. On the other hand, anhydrous calcium sulphate formed at low temperatures is not condensed, and readily takes up water to form the hemihydrate, which then passes into solution, the dihydrate $CaSO_4.2H_2O$ crystallising out.—A. G. L.

Portland cements; Some conditions influencing constancy of volume in ——. E. D. Campbell and A. H. White. J. Amer. Chem. Soc., 1906, **28**, 1273—1303.

A series of experiments has been made with the view of studying the effect of changes in chemical composition upon the properties, especially the constancy of volume of finished cement. The present paper deals with cements, not very highly limed, in which the percentages of alumina and iron oxide are together less than half of the silica. The tests were made with bars of neat cement, and the changes of volume were determined by direct micrometric measurements; added materials, such as sand or crushed stone, act simply as diluents, so far as constancy of volume is concerned, and would render the results less comparable. The detailed results are set out in tables. They show that free lime in Portland cement is not slaked during the mixing and setting of the cement, nor does it become completely hydrated until after about 14 days, even when the cement is immersed in water. This gradual slaking is the cause of the abnormal expansion of cements containing free lime. When the cement is kept under water, any evil effects due to the presence of free lime are shown within two months; when the cement is employed in places where it is usually dry, the expansion due to hydration of free lime will be more gradual, but several times greater in volume, and after several months may become so great as to cause complete disintegration. Cement containing free lime can be rendered quite safe by ageing the ground cement, or by exposing the clinker to the weather, until a pat will show a perfect boiling test. An exposure of three months is usually sufficient in the case of clinker, whilst under favourable conditions, ground cement may be properly aged in one month. The boiling test affords a reliable method for detecting the presence of free lime.

Combined magnesia, like combined lime, has no injurious effect on the constancy of volume of Portland cement, nor has free magnesia any appreciable influence when the cement is used in places where it is always dry. In cases where the cement is wet for a part or the whole of the time, however, free magnesia is very injurious owing to its very slow hydration and consequent expansion. The expansion is not appreciable until after two months even when the cement is kept immersed in water; it becomes distinctly evident after a year, and continues at an increasing rate for at least five years and probably longer. The deleterious effect of free magnesia is not destroyed by ageing the cement. Free magnesia cannot be detected with certainty by the boiling test. The slow hydration of free magnesia is probably the cause of the expansion, frequently accompanied by more or less complete disintegration often observed in cement structures after the lapse of several years. When raw materials containing magnesium carbonate are used, if care be taken to grind them extremely fine (see this J., 1903, 1348), then where the amount of total magnesia does not exceed 3 per cent., a well-made cement should not contain sufficient free magnesia to produce injurious expansion under any conditions of practice. In structures where suitable provision can be made for expansion joints, more than 3 per cent. of total magnesia may be allowed, but even under these circumstances the amount should not exceed 5 per cent. Cement intended for use where constancy of volume is of paramount importance should always be aged; a disadvantage of this course is that the cement tends to become very quick-setting, but if the ageing be continued for a sufficiently long period, the cement becomes slow-setting again. (See also this J., 1902, 1396.).—A. S.

English Patents.

Stone; Artificial ——. T. M. Thom, Cheshunt, Herts. Eng. Pat. 20,070, Oct. 4, 1905.

The object of this invention is the production of artificial limestone for building purposes. The *débris* from quarrying and dressing stone is crushed and screened to reduce it to its natural granular condition. The crushed material is mixed with lime, with or without the addition of colouring matter, and the mixture slaked and moulded into blocks which are dried and finally carbonated. Building material so made is claimed as a new article of manufacture. (See also Eng. Pat. 13,467 of 1900; this J., 1901, 719.)—W. C. H.

Stone, blocks, pipes, and briquettes from slag; Manufacture of artificial ——. A. J. Boult, London. From Cäln Müsener Bergwerks Aktien-Verein, Crouzthal, Germany. Eng. Pat. 2207, Jan. 29, 1906.

See Fr. Pat. 362,808 of 1906; this J., 1906, 760.—T. F. B.

Bricks; Burning — —, and kilns therefor. J. Parkes, West Bromwich, Staffs. Eng. Pat. 20,153, Oct. 5, 1905.

The improved method of burning bricks in a kiln, consists in first causing the heat to pass upward from the firing holes to and through the bricks in the upper part of the kiln, and down through the mass to the main heating flue in the floor of the kiln, and when these bricks have been sufficiently burnt, causing the heat to pass directly from the firing holes, through holes in the back walls of the firing holes, to the bricks in the lower part of the kiln, thence to the main heating flue. To put this method into practice the back walls of the firing holes are provided with a loose brick or stopper, which can be pushed into the kiln at the proper time of the burning, to allow heat to pass directly into the lower part of the kiln from the firing holes. Reference is made to Eng. Pat. 22,562 of 1891.—W. C. H.

Tunnel kilns for burning bricks, briquettes, and the like. E. R. Sutcliffe and F. Speakman, both of Leigh, Lancs. Eng. Pat. 20,646, Oct. 12, 1905.

In a tunnel kiln, for continuously drying, burning, and cooling bricks, &c., a movable damper is arranged between the cooling and combustion chambers, which, when lowered, deflects the air, heated by its passage over the burnt bricks, into side flues which conduct the air into flues connecting the furnaces, or firing holes, with the combustion chamber. Along the whole length of the kiln

is an air supply passage in the floor of the kiln, and below the wagon platforms, which are consequently cooled by the incoming air; the air from this passage enters the further end of the cooling chamber. There is an outlet from the drying chamber, and means are provided for producing the necessary draught through the kiln. The wagon platforms fit into grooves at the sides of the kiln, which is thus divided into two horizontal portions, through the lower of which the incoming air passes. The damper between the cooling and combustion chambers touches a wagon platform, and thus forms a cross-partition. In connection with these kilns, claim is made for use of a coal-fired furnace, connected with the combustion chamber by a flue into which the hot-air flue leads, provided with adjustable means of supplying air above and below the grate, and for supplying steam below the grate. The use of fuel-supply hoppers, provided with counterpoised bell dampers for the introduction of fuel without an undue amount of cold air, is also claimed. By a modification of the kiln, by a suitable arrangement of the flues, heated air can be taken direct from the cooling chamber to the drying chamber, and the products of combustion can be taken direct from the combustion chamber, and not allowed to enter the drying chamber, either by a separate flue to the stack, or by a separate stack.—W. C. H.

Bricks; Manufacture of ——. A. Gordon, Weiser, Id., U.S.A. Eng. Pat. 7927, April 2, 1906. Under Int. Conv., May 4, 1905.

See U.S. Pat. 809,053 of 1906; this J., 1906, 123.—T. F. B

Wood and goods of different kinds; Apparatus for heating, steaming, and chemically treating ——, *and for drying such goods.* C. McWhirter, London. Eng. Pat. 6681, March 20, 1906.

The present patent relates to a modified form of the apparatus described in Eng. Pat. 14,869 of 1904 (this J., 1905, 443). The apparatus consists of an oven or boiler, within which is a steam generator, heated by a coil through which high-pressure steam is passed. Steam is passed from the inner generator through a pipe controlled by a valve into the oven or boiler; in order to produce a vacuum in the oven, it is provided with an ejector, steam-tight cover, safety-valve, &c. Reference is made to Eng. Pat. 4636 of 1885.—W. C. H.

United States Patents.

Kiln for burning clayware. F. W. Butterworth, Danville, Ill. U.S. Pat. 826,831, July 24, 1906.

The kiln consists essentially of a vertical shaft, joined near its bottom to a chamber slightly inclined to the horizontal. The furnace gases are introduced near the top of the shaft, pass down it, and then go up the inclined chamber, being then drawn by a fan into a chimney. The raw clay goods (bricks, &c.) are stacked on trucks which roll by their own weight down the inclined chamber, on to the top of a hydraulic elevator, placed at the bottom of the shaft. This elevator raises one truck at a time to a point in the shaft corresponding to the roof of the inclined chamber. At this point supporting rods are pushed below the load of bricks through holes in the kiln, in such a way as to relieve the truck entirely of the weight of the load; the trucks are constructed of I-beams placed longitudinally on the axles in such a way as to facilitate this operation. The elevator with the empty truck then sinks; the truck is removed through an opening in the shaft opposite to the inclined chamber; the next truck is raised on the elevator after withdrawing the supporting rods, and all the operations repeated. In this way a practically continuous movement of the bricks up the shaft, and their gradual burning is secured. At the top of the shaft a similar method of introducing supporting rods into the spaces between the bricks is used for withdrawing a truckful of burnt bricks at a time. Air is supplied at various points in the kiln to promote combustion, and also to cool the burnt bricks at the top somewhat rapidly to permit of their handling.—A. G. L.

Cement; Apparatus for producing ——. R. C. Carpenter, Ithaca, N.Y. U.S. Pat. 833,918, Oct. 23, 1906.

The upper end of a rotary cement kiln is connected with a hood from which the burnt gases from the kiln pass to an economiser and an upright water-tube boiler having widely spaced vertical tubes. The gases are finally drawn by an exhaust fan into a stack. The boiler is provided with an auxiliary furnace, situated close to the hoods, and provided with suitable flues and dampers. —A. G. L.

Cement; Magnesium ——, *and process of manufacturing same.* W. Jeroch, Berlin. U.S. Pat. 833,930, Oct. 23, 1906.

See Fr. Pat. 363,103 of 1906; this J., 1906, 848.—T. F. B.

French Patents.

Marble, granite, &c.; Manufacture of artificial ——. L. Lefranc. First Addition, dated May 26, 1906, to Fr. Pat. 355,222, of May 23, 1905 (this J., 1905, 1173).

By running the molecular mixture of fused fluorspar and calcium sulphate, entitled "spathite" and claimed in the principal patent, into moulds containing flints, pebbles, &c., a kind of concrete is obtained. By suitable disposition of the flints, &c., to which carborundum may also be added, in the moulds, patterns may be obtained. Or else, the moulds may contain a metallic skeleton, instead of the flints, &c., in which case a reinforced "spathite," similar to reinforced concrete is obtained. Finally, the calcium sulphate may be replaced by barium sulphate, or strontium sulphate, or by a mixture of the two.—A. G. L.

Silicates of lime; Process for increasing the binding power of basic ——. W. Schumacher. Fr. Pat. 366,755, June 1, 1906.

The binding power of basic silicates of lime, *e.g.*, Portland cement, blast-furnace slag, &c., is greatly increased by adding finely powdered quartz, and submitting the mixture to the action of steam under pressure.—A. G. L.

Agglomerate for building materials, and process of making the same. C. Gramiccia. Fr. Pat. 366,879, June 5, 1906.

Volcanic scoriæ, puzzuolana, tufa, &c., is mixed with one-twelfth its weight of well-slaked lime, compressed into bricks, tiles, &c., and treated for 10 hours in an autoclave under a pressure of six to eight atmospheres. The bricks, &c., obtained are claimed to be of great strength. If they are then burnt, a very refractory material is said to be obtained. The scoriæ, &c., may be partly replaced by sand, gravel, or calcareous material; in the last case a little cement is also added. In any case a suitable colouring material may be added.—A. G. L.

Clay and similar plastic materials; Method of treating ——. A. A. Scott. Fr. Pat. 367,775, July 5, 1906.

See U.S. Pats. 816,385 and 816,386 of 1906; this J., 1906, 427 and 428.—T. F. B.

X.—METALLURGY.

(*Continued from page* 1052.)

High carbon steels; Heat treatment of some ——. W. Campbell. J. Amer. Chem. Soc., 1906, **28**, 1304—1322.

The author gives an account of some work carried out in conjunction with Committee F on the "Heat Treatment of Steel," American Society for Testing Materials. The steels examined had the following composition:—

No.	C.	Mn.	P.	Si.	S.
1	2·04	0·28	0·014	—	0·014
2	1·94	0·20	0·009	0·17	0·013
3	1·72	0·075	0·013	0·20	0·013
4	1·61	0·19	0·013	0·19	0·013
5	1·04	0·13	0·012	—	0·017
6	0·70	0·068	0·012	0·141	0·019

these the wood was scorched and became discoloured. Up to a certain duration of the steaming process the weight of the sleepers increased, but beyond that point, the increase in weight was negligible. Greenwood that had been steamed and saturated, showed weakness in proportion to the duration of the steaming process and the pressure attained therein, but if air-dried the specimens regained the greater part of their strength, provided the steaming process had not exceeded the limits of safety. The dried specimens, if again immersed in water, were weaker than natural wood similarly dried and re-soaked. Wood treated with zinc chloride was not weaker than steamed wood under static loading, but was weaker under impact, and also weaker than natural wood. The presence of creosote does not of itself affect the strength of the wood, probably because it does not enter the cell walls, but only fills the openings of the cells. It does however retard the rate at which wood will season. The steamed and creosoted wood was weaker than the natural wood, but not weaker than the steamed wood.—W. C. H.

Plaster of Paris; Researches on ——. De Forcrand. Bull. Soc. Chim., 1906, **35**, 781–790.

The author has made some experiments on the heats of solution in water of the various modifications of calcium sulphate. For gypsum, $CaSO_4.2H_2O$, he accepts Thomsen's value of 330 calories with reserve; for the hemi-hydrate, $CaSO_4.\frac{1}{2}H_2O$, he finds 3560; for anhydrous calcium sulphate, $CaSO_4$, prepared at 155° C., 5655; and prepared at a red heat, 2920; Thomsen's value for anhydrous calcium sulphate prepared at a low temperature being only 4440 calories. The author believes that anhydrous calcium sulphate consists of a polymeric modification, which is incapable of changing to the hemihydrate in presence of water, the formation of hemihydrate with its high degree of solubility in water being necessary for the formation of the difficultly soluble hydrate, $CaSO_4.2H_2O$. On the other hand, anhydrous calcium sulphate formed at low temperatures is not condensed, and readily takes up water to form the hemihydrate, which then passes into solution, the dihydrate $CaSO_4.2H_2O$ crystallising out.—A. G. L.

Portland cements; Some conditions influencing constancy of volume in ——. E. D. Campbell and A. H. White. J. Amer. Chem. Soc., 1906, **28**, 1273—1303.

A series of experiments has been made with the view of studying the effect of changes in chemical composition upon the properties, especially the constancy of volume of finished cement. The present paper deals with cements, not very highly limed, in which the percentages of alumina and iron oxide are together less than half of the silica. The tests were made with bars of neat cement, and the changes of volume were determined by direct micrometric measurements; added materials, such as sand or crushed stone, act simply as diluents, so far as constancy of volume is concerned, and would render the results less comparable. The detailed results are set out in tables. They show that free lime in Portland cement is not slaked during the mixing and setting of the cement, nor does it become completely hydrated until after about 14 days, even when the cement is immersed in water. This gradual slaking is the cause of the abnormal expansion of cements containing free lime. When the cement is kept under water, any evil effects due to the presence of free lime are shown within two months; when the cement is employed in places where it is usually dry, the expansion due to hydration of free lime will be more gradual, but several times greater in volume, and after several months may become so great as to cause complete disintegration. Cement containing free lime can be rendered quite safe by ageing the ground cement, or by exposing the clinker to the weather, until a pat will show a perfect boiling test. An exposure of three months is usually sufficient in the case of clinker, whilst under favourable conditions, ground cement may be properly aged in one month. The boiling test affords a reliable method for detecting the presence of free lime.

Combined magnesia, like combined lime, has no injurious effect on the constancy of volume of Portland cement, nor has free magnesia any appreciable influence when the cement is used in places where it is always dry. In cases where the cement is wet for a part or the whole of the time, however, free magnesia is very injurious owing to its very slow hydration and consequent expansion. The expansion is not appreciable until after two months even when the cement is kept immersed in water; it becomes distinctly evident after a year, and continues at an increasing rate for at least five years and probably longer. The deleterious effect of free magnesia is not destroyed by ageing the cement. Free magnesia cannot be detected with certainty by the boiling test. The slow hydration of free magnesia is probably the cause of the expansion, frequently accompanied by more or less complete disintegration often observed in cement structures after the lapse of several years. When raw materials containing magnesium carbonate are used, if care be taken to grind them extremely fine (see this J., 1903, 1348), then where the amount of total magnesia does not exceed 3 per cent., a well-made cement should not contain sufficient free magnesia to produce injurious expansion under any conditions of practice. In structures where suitable provision can be made for expansion joints, more than 3 per cent. of total magnesia may be allowed, but even under these circumstances the amount should not exceed 5 per cent. Cement intended for use where constancy of volume is of paramount importance should always be aged; a disadvantage of this course is that the cement tends to become very quick-setting, but if the ageing be continued for a sufficiently long period, the cement becomes slow-setting again. (See also this J., 1902, 1396.).—A. S.

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The improved method of burning bricks in a kiln, consists in first causing the heat to pass upward from the firing holes to and through the bricks in the upper part of the kiln, and down through the mass to the main heating flue in the floor of the kiln, and when these bricks have been sufficiently burnt, causing the heat to pass directly from the firing holes, through holes in the back walls of the firing holes, to the bricks in the lower part of the kiln, thence to the main heating flue. To put this method into practice the back walls of the firing holes are provided with a loose brick or stopper, which can be pushed into the kiln at the proper time of the burning, to allow heat to pass directly into the lower part of the kiln from the firing holes. Reference is made to Eng. Pat. 22,562 of 1891.—W. C. H.

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storm, become charged with electricity, and that the "backstroke," or the sudden discharge of the inducing cloud, might cause a spark. This danger is remote, but it is easily and completely provided against by good earth-connection.—J. T. D.

Nitrides of zinc, aluminium, and iron. A. H. White and L. Kirschbraun. J. Amer. Chem. Soc., 1906, **28**, 1343—1350.

THE most favourable temperature for the action of dry ammonia gas on zinc dust is 600° C., but the nitride produced decomposes to a considerable extent even at its temperature of formation, and cannot therefore be obtained in a pure state by this method. The purest specimen obtained by the authors contained 10·6 per cent. of nitrogen as compared with the 12·52 per cent. required by the formula, Zn_3N_2. The product has properties similar to those of the nitride, Zn_3N_2, prepared by Frankland (Phil. Mag., **15** [4], 149) by heating zinc amide. It is probably a solid solution of the nitride in metallic zinc (compare Baur and Voerman, Z. physik. Chem., **32**, 467). Finely-divided aluminium and iron are also attacked by ammonia gas, the most favourable temperatures being 700° and 450°—475° C. respectively. The best preparation from aluminium contained 1·8 per cent. and from iron 10·1 per cent. of nitrogen. The iron preparations are regarded by the authors as solid solutions of iron nitride, Fe_3N_2, in metallic iron.—A. S.

Molybdenum; Preparation of fused ——. H. Biltz and R. Gärtner. Ber., 1906, **39**, 3370—3371.

THE aluminothermic preparation of molybdenum has hitherto given a very poor yield, on account of the volatility of molybdenum trioxide. The authors find that the yield is largely increased by substituting the dioxide for the trioxide. The dioxide is easily obtained by reducing the trioxide at a red heat in a stream of hydrogen; 80 grms. of it fired with 21 grms. of aluminium powder yielded 52 grms. (calc. 55½) of melted molybdenum of 98·6 per cent.—J. T. D.

Platinum production in 1905. Mining World. [T.R.]

A REMARKABLE rise in the price of platinum and a greatly increased production in the United States took place in 1905. Early in March, 1905, the price of ingot platinum advanced from $19.50 per ounce to $21, thus surpassing that of gold. On April 1, 1905, the price fell to $20.50, and remained firm at this quotation until February 1, 1906, when it rose to $25, where it remained until Sept. 1, when it leaped to $34. The production of platinum in the United States increased from 200 oz. in 1904 to 318 oz. in 1905. The rise in the price of platinum and its increased production in America may be ascribed to the growing demand and to the reduced yield of the Russian placers. This reduction of the output is due to the fact that the entire product for a varying term of years was bought up under contract and at prices that now seem ridiculously low. As the mine owners receive only the fixed price, they do not participate in any gain due to rise in value, and are therefore not desirous of a large production, but are husbanding the limited resources of their mines until such time as they can dispose of their product to better advantage. Meanwhile the small mines, which, generally speaking, are not hampered by such agreements, are working to their full capacity, to take advantage of the stimulated prices; but their entire output is only a small percentage of what is usually produced. A greatly increased consumption of platinum in the electrical and chemical industries, together with this stringency of supply, accounts for the prevailing high prices. The examination of black sands commenced in 1905 by the United States Geological Survey has done much toward placing platinum mining in America upon a stable footing, and developing it into a permanent and profitable industry. Not only have many discoveries of platinum in new localities been made, but the tests have revealed the fact that there are districts which contain surprising quantities of platinum. Platinum is now known to exist in California, Oregon, Idaho, Colorado, Washington, Montana, Utah, Arizona, and in Wyoming. The metal is also rarely found in Alaska, and in the gold-bearing sands of Corosal River, Porto Rico. Isolated occurrences of single nuggets or mere traces of the metal have been found in many other counties of these states, as well as in four of the eastern states, namely, New York, Pennsylvania, North Carolina and Georgia. In many of these localities the metal occurs but sparingly. The more promising fields are in the counties of southern Oregon and northern California. With proper methods a considerable annual output should be obtained. The platinum metals are usually found in working gold placers, especially where the gravels are derived from peridotites. Many have been convinced for a long time that it would pay to save the platinum in the gravels, if it could be done by some inexpensive method. The experiments of the United States Geological Survey have shown conclusively that 95 to 98 per cent. of the precious metals, both gold and platinum, contained in the sluice box sands, can be saved on concentrating tables of the Linder or Wilfley type, such as are used in everyday practice; and that in most cases the concentrates thus obtained will represent less than 1 per cent. of the total weight of sand fed to the table; a test on 15 oz. of black sand, recovered from 200 lb. of original gravel, yielded 0·7 grm. of platinum, and 0·023 grm. of irodosmium. The imports of platinum into the United States during 1905 were valued at $2,173,263, as against $1,879,155 in 1904, an increase of $294,108.

Mineral industry of Peru. Bd. of Trade J., Nov. 1, 1906. [T.R.]

DURING the first half of 1903, the number of mining claims recorded in the register was 5,310, subject to a charge of £9,752, while the register of the first half of 1906 contains 10,421 mining claims, which pay in taxes, fines, &c., £32,357. The following is a *résumé* of the mineral production during 1905:—

		Quantities.		Value.
				£
Gold*	Kilos.	733	..	97,072
Silver*	,,	176,000	..	648,000
Copper	Tons	11,000	..	622,268
Lead	,,	1,270	..	5,420
Petroleum, crude	,,	49,700	..	124,250
Coal	,,	72,665	..	98,300
Salt	,,	21,083	..	21,038
Borates	,,	1,594	..	14,346
Nickel	Kilos.	1,778	..	145
Mercury	,,	1,554	..	340
Bismuth	Tons	12	..	5,000
Molybdenum and vanadium in small quantities	not stated.			
Total value	..	—	..	£1,636,179

* In bars, in metallurgical products, and ores.

ENGLISH PATENTS.

Ores; Dry concentration of ——. A. J. Boult, London. From H. M. Sutton, W. L. Steele, and E. G. Steele, Dallas, Texas. Eng. Pat. 17,561, Aug. 30, 1905.

SEE Fr. Pat. 366,685 of 1906; this J., 1906, 1052.—A. G. L.

Sulphide ores; Treatment of ——. J. E. Bousfield, London. From F. Mackay, Melbourne, and A. J. Beckwith, South Yarra, Australia. Eng. Pat. 20,380, Oct. 9, 1905.

GOLD, silver, zinc, lead, and other metals are obtained from complex sulphide ores by finely powdering the ores, and blowing the powder, mixed with air, into a chamber previously heated by producer gas to the ignition point of the sulphide ores. The air current keeps the powder in suspension in the chamber, and oxidises it, a fume consisting of zinc oxide, lead sulphate, &c., being obtained besides gases containing sulphur dioxide and trioxide. If the ore is not rich enough in sulphides to maintain the chamber at the temperature necessary

for their proper oxidation, extraneous heat may be supplied, or coal-dust or producer gas blown in. The fume and ore dust obtained are either passed into settling chambers or filtering apparatus, or they may be passed into wet condensation chambers. The zinc oxide may be leached out from the lead sulphate by treatment with sulphuric acid, which may be made from the oxides of sulphur contained in the gases obtained by the reaction. The insoluble residue may then be smelted as usual.
—A. G. L.

Sulphide ores or compounds; Reduction of ——. C. P. Townsend, Washington, U.S.A. Eng. Pat. 6569, March 19, 1906.

SEE U.S. Pat. 815,881 of 1906; this J., 1906, 381.— T.F.B.

Metals, metalloids, or their alloys; Process for the production or isolation of ——. K. A. Kühne, Dresden, Germany. Eng. Pat. 20,884, Oct. 14, 1905.

SEE Fr. Pat. 364,329 of 1906; this J., 1906, 890.—T. F. B.

Minerals; Separation of —— H. L. Sulman, H. F. Kirkpatrick-Picard, and J. Ballot, London. Eng. Pat. 26,711, Dec. 21, 1905.

SEE Fr. Pat. 363,419 of 1906; this J., 1906, 890.—T. F. B.

[*Gold and silver*] *metals; Extraction of* —— *from their ores.* J. Turton, Johannesburg, Transvaal. Eng. Pat. 25,672, Dec. 9, 1905.

THE process described is designed especially for the extraction of gold and silver, but may also be used for platinum and base metals. It consists in systematically treating the powdered ore, after roasting if it contains pyrites, in vats with a solution containing: water, 400 lb.; sulphuric acid, 80; sodium chloride, 40; sodium or potassium nitrate, 22½; sodium or potassium permanganate, 2; and saccharin, about 2 lb. The vats used may be made of pitch-pine bound with iron bands, or of bricks lined with "non-perishable" cement on a concrete foundation, or of other acid-proof materials. The solution is always brought up to its original strength in passing from vat to vat by suitable additions. When it has become saturated with gold (or other metals) it is diluted with from three to five parts of water, and the diluted solution is passed through charcoal, which may be enclosed in bags of muslin. The charcoal retains the gold, which is recovered by burning the charcoal, and fluxing the ashes as usual.—A. G. L.

Goldschmidt or alumino-thermic process; Impts. in the ——. H. Goldschmidt, Essen on the Ruhr, Germany. Eng. Pat. 926, Jan. 12, 1906.

SEE Addition of Jan. 10, 1906, to Fr. Pat. 361,197 of 1905; this J., 1906, 765.—T. F. B.

[*Thermite.*] *Mixtures for heating by reduction of metallic compounds.* P. Jensen, London. From E. Maemecke, Berlin. Eng. Pat. 3089, Feb. 8, 1906.

A MATERIAL similar to thermite is obtained by mixing 15 per cent. by weight of granulated magnesium, 10 per cent. of granulated silicon, and 75 per cent. of magnetic oxide of iron, Fe_3O_4, or ferric oxide, Fe_2O_3, or of a mixture of the two, a liquid slag corresponding approximately to the formula $3\frac{1}{2}$ MgO, $2SiO_2$ being obtained, together with an "appreciable amount" of molten iron. The proportions of the ingredients may be varied from 9 per cent. of magnesium, 13 of silicon, and 78 of magnetic oxide, to 21 per cent. of magnesium, 6 of silicon, and 73 of magnetic oxide. The magnesium may be partly replaced by aluminium, calcium, barium, strontium, sodium, or the like, and the silicon may be used in the form of high-grade ferro-silicon. The iron oxide may be partly or wholly replaced by oxides of chromium, manganese, molybdenum, &c., and metals such as copper may be added to the molten mass if it is desired to produce alloys. The process may also be used for welding. (See also Fr. Pat. 364,312, this J., 1906, 936.)—A. G. L.

UNITED STATES PATENTS.

Metal-bearing ores, &c.; Treating refractory ——. J. W. H. James, Media, Pa. U.S. Pat. 833,394, Oct. 16, 1906.

THE ore is passed in a loose state through a retort, heated externally, from which air is excluded, and in which water-gas is generated. The escaping water-gas is treated for the removal of other gases and volatile compounds carried off from the ore.—A. S.

Ores; Method of smelting ——. A. J. Mason, Assignor to F. K. Hoover, Chicago, Ill. U.S. Pat. 833,406, Oct. 16, 1906.

THIN streams of flux and of ore, both in a finely-divided condition, are caused to impinge one upon the other, and the resulting stream of mixed ore and flux is directed into a reducing and smelting chamber, wherein it is subjected to the action of a forced blast of burning air and fuel, impinged upon it in a substantially transverse direction. The stream of partially-reduced and melted ore is then directed upon an incandescent bed of carbonaceous material such as coke. The hot waste gases are utilised for the preliminary heating of the air, fuel, ore, and fluxes.—A. S.

Ores; Process of briquetting friable ——. C. Reinke, Bredelar, Germany. U.S. Pat. 833,630, Oct. 16, 1906.

SEE Eng. Pat. 19,464 of 1904; this J., 1905, 974.—T. F. B.

Treating substances [*Ores, &c.*] *by the aid of heat; Process of* ——. W. B. Dennis, Blackbutte, Oreg. U.S. Pat. 833,679, Oct. 16, 1906.

THE ore receives a preliminary heating from the escaping gas current, and is then divided into portions which are progressively heated by a burning mixture of gas and air. Both the gas and the ore or other material treated, travel in the same general direction through the apparatus, and both leave it at the hottest end. To keep up the temperature fresh supplies of air and gas are introduced at intervals. (See following abstract.)—W. H. C.

Treating substances [*Ores, &c.*] *by the aid of heat; Apparatus for* ——. W. B. Dennis, Blackbutte, Oreg. U.S. Pat. 833,680, Oct. 16, 1906.

THE claim is for an apparatus in which the process described in the preceding abstract can be carried out, and consisting essentially of a vertical tower furnace down which the ore or other material is caused to pass. The inner space of the tower is divided into a series of chambers by horizontal grates, the alternate bars of which are fixed and movable, so that by turning the movable bars from without the furnace, the ore can be let down from chamber to chamber to the bottom where it falls into a discharge apparatus. The air and gas enter through ducts in the walls of the furnace from which they pass to primary and secondary combustion chambers formed on opposite sides of the grates. These are alternately on opposite sides of the chambers so that they face one another. The gases pass across the chambers downwards from the cooler to the hotter part of the furnace, receiving fresh supplies in each chamber, and then enter a dust-separating chamber from which they again pass up through flues in the furnace wall to the top, where they pass to the apparatus where the preliminary heating of the ore is effected.—W. H. C.

Metals [*Zinc, &c.*], *and compounds thereof; Process of obtaining* ——. H. Mehner, Berlin. U.S. Pat. 833,472, Oct. 16, 1906.

ZINC ore is added to a molten and incandescent silicate, and the fluid compound is caused to pass through an excess of carbon. Air is admitted to the vapours generated, in order to produce zinc oxide, which, with the gases, is led away for separation. The impoverished silicate is collected after passage through the fragments of carbon, and is reheated with further addition of zinc ore, to repeat the process.—E. S.

storm, become charged with electricity, and that the "backstroke," or the sudden discharge of the inducing cloud, might cause a spark. This danger is remote, but it is easily and completely provided against by good earth-connection.—J. T. D.

Nitrides of zinc, aluminium, and iron. A. H. White and L. Kirschbraun. J. Amer. Chem. Soc., 1906, **28**, 1343—1350.

THE most favourable temperature for the action of dry ammonia gas on zinc dust is 600° C., but the nitride produced decomposes to a considerable extent even at its temperature of formation, and cannot therefore be obtained in a pure state by this method. The purest specimen obtained by the authors contained 10·6 per cent. of nitrogen as compared with the 12·52 per cent. required by the formula, Zn_3N_2. The product has properties similar to those of the nitride, Zn_3N_2, prepared by Frankland (Phil. Mag., **15** [4], 149) by heating zinc amide. It is probably a solid solution of the nitride in metallic zinc (compare Baur and Voerman, Z. physik. Chem., **32**, 467). Finely-divided aluminium and iron are also attacked by ammonia gas, the most favourable temperatures being 700° and 450°—475° C. respectively. The best preparation from aluminium contained 1·8 per cent. and from iron 10·1 per cent. of nitrogen. The iron preparations are regarded by the authors as solid solutions of iron nitride, Fe_3N_2, in metallic iron.—A. S.

Molybdenum; Preparation of fused ——. H. Biltz and R. Gärtner. Ber., 1906, **39**, 3370—3371.

THE aluminothermic preparation of molybdenum has hitherto given a very poor yield, on account of the volatility of molybdenum trioxide. The authors find that the yield is largely increased by substituting the dioxide for the trioxide. The dioxide is easily obtained by reducing the trioxide at a red heat in a stream of hydrogen; 80 grms. of it fired with 21 grms. of aluminium powder yielded 52 grms. (calc. 55½) of melted molybdenum of 98·6 per cent.—J. T. D.

Platinum production in 1905. Mining World. [T.R.]

A REMARKABLE rise in the price of platinum and a greatly increased production in the United States took place in 1905. Early in March, 1905, the price of ingot platinum advanced from $19.50 per ounce to $21, thus surpassing that of gold. On April 1, 1905, the price fell to $20.50, and remained firm at this quotation until February 1, 1906, when it rose to $25, where it remained until Sept. 1, when it leaped to $34. The production of platinum in the United States increased from 200 oz. in 1904 to 318 oz. in 1905. The rise in the price of platinum and its increased production in America may be ascribed to the growing demand and to the reduced yield of the Russian placers. This reduction of the output is due to the fact that the entire product for a varying term of years was bought up under contract and at prices that now seem ridiculously low. As the mine owners receive only the fixed price, they do not participate in any gain due to rise in value, and are therefore not desirous of a large production, but are husbanding the limited resources of their mines until such time as they can dispose of their product to better advantage. Meanwhile the small mines, which, generally speaking, are not hampered by such agreements, are working to their full capacity, to take advantage of the stimulated prices; but their entire output is only a small percentage of what is usually produced. A greatly increased consumption of platinum in the electrical and chemical industries, together with this stringency of supply, accounts for the prevailing high prices. The examination of black sands commenced in 1905 by the United States Geological Survey has done much toward placing platinum mining in America upon a stable footing, and developing it into a permanent and profitable industry. Not only have many discoveries of platinum in new localities been made, but the tests have revealed the fact that there are districts which contain surprising quantities of platinum. Platinum is now known to exist in California, Oregon, Idaho, Colorado, Washington, Montana, Utah, Arizona, and in Wyoming. The metal is also rarely found in Alaska, and in the gold-bearing sands of Corosal River, Porto Rico. Isolated occurrences of single nuggets or mere traces of the metal have been found in many other counties of these states, as well as in four of the eastern states, namely, New York, Pennsylvania, North Carolina and Georgia. In many of these localities the metal occurs but sparingly. The more promising fields are in the counties of southern Oregon and northern California. With proper methods a considerable annual output should be obtained. The platinum metals are usually found in working gold placers, especially where the gravels are derived from peridotites. Many have been convinced for a long time that it would pay to save the platinum in the gravels, if it could be done by some inexpensive method. The experiments of the United States Geological Survey have shown conclusively that 95 to 98 per cent. of the precious metals, both gold and platinum, contained in the sluice box sands, can be saved on concentrating tables of the Linder or Wilfley type, such as are used in everyday practice; and that in most cases the concentrates thus obtained will represent less than 1 per cent. of the total weight of sand fed to the table; a test on 15 oz. of black sand, recovered from 200 lb. of original gravel, yielded 0·7 grm. of platinum, and 0·023 grm. of irodosmium. The imports of platinum into the United States during 1905 were valued at $2,173,263, as against $1,879,155 in 1904, an increase of $294,108.

Mineral industry of Peru. Bd. of Trade J., Nov. 1, 1906. [T.R.]

DURING the first half of 1903, the number of mining claims recorded in the register was 5,310, subject to a charge of £9,752, while the register of the first half of 1906 contains 10,421 mining claims, which pay in taxes, fines, &c., £32,357. The following is a *résumé* of the mineral production during 1905:—

		Quantities.		Value.
				£
Gold*	Kilos.	733	..	97,072
Silver*	,,	176,000	..	648,000
Copper	Tons	11,000	..	622,268
Lead	,,	1,270	..	5,420
Petroleum, crude	,,	49,700	..	124,250
Coal	,,	72,665	..	98,300
Salt	,,	21,083	..	21,038
Borates	,,	1,594	..	14,346
Nickel	Kilos.	1,778	..	145
Mercury	,,	1,554	..	340
Bismuth	Tons	12	..	5,000
Molybdenum and vanadium in small quantities	not stated.			
Total value	..	—	..	£1,636,179

* In bars, in metallurgical products, and ores.

ENGLISH PATENTS.

Ores; Dry concentration of ——. A. J. Boult, London. From H. M. Sutton, W. L. Steele, and E. G. Steele, Dallas, Texas. Eng. Pat. 17,561, Aug. 30, 1905.

SEE Fr. Pat. 366,685 of 1906; this J., 1906, 1052.—A. G. L.

Sulphide ores; Treatment of ——. J. E. Bousfield, London. From F. Mackay, Melbourne, and A. J. Beckwith, South Yarra, Australia. Eng. Pat. 20,380, Oct. 9, 1905.

GOLD, silver, zinc, lead, and other metals are obtained from complex sulphide ores by finely powdering the ores, and blowing the powder, mixed with air, into a chamber previously heated by producer gas to the ignition point of the sulphide ores. The air current keeps the powder in suspension in the chamber, and oxidises it, a fume consisting of zinc oxide, lead sulphate, &c., being obtained besides gases containing sulphur dioxide and trioxide. If the ore is not rich enough in sulphides to maintain the chamber at the temperature necessary

passed through the apparatus during eight hours, resulting in the production of hypochlorite solution containing over 4 grms. of available chlorine per litre. The process of manufacture is practically automatic, the above output being obtained at a capital cost not exceeding £500, including buildings and fittings. The series system is most suitable where continuous current is available, but with alternating current, a motor-generator must be installed, and fewer cells may then be employed. At Poplar there is an increase of 1 grm. of chlorine per litre for each ten cells employed. It is stated that a warm climate does not affect the manufacture of magnesium hypochlorite.—B. N.

Oxides and sulphides; Conductivity of ——. J. Konigsberger and O. Reichenheim. Physikal. Zeits., 1906, 570—578. Electrician, 1906, 58, 100—101.

The electric conductivities of natural crystals of specular iron ore, iron pyrites, galena, and marcasite, were determined at temperatures between −130° C. and +240° C. The higher the temperature, the more closely did the electrical behaviour resemble that of a metal; the lower the temperature, the more pronounced was the increase of resistance. No chemical action could be detected during the passage of the electric current, and the authors conclude that the conduction of these oxides and sulphides cannot be of an electrolytic nature.—T. F. B.

Sodium hypochlorite; Depreciation of electrolytically produced solutions of ——. W. P. Digby. VII., page 1093.

English Patents.

Cathodes. H. S. Hatfield and The Reason Manufacturing Co., Ltd., Brighton. Eng. Pat. 20,770, Oct. 13, 1905.

The cathode is constructed of a substance of the "iridium group," stated to include iridium, tantalum, niobium, vanadium, "graphitoidal silicon," and magnetite (artificial or natural), and is for use with electrolytes containing mercuric salts in solution.—B. N.

Electrical incandescence bodies; Method of producing metallic [tungsten] ——. Deutsche Gasglühlicht A.-G. (Auerges.). Eng. Pat. 14,901, June 30, 1906. II., page 1083.

Water and other liquids; Apparatus for purifying [electrolytically] ——. G. W. J. Allen. Eng. Pat. 9002, April 14, 1906. XVIII*B*., page 1114.

United States Patents.

Insulating composition; Electrical ——, *and process for manufacturing the same.* C. Clément, Assignor to Soc. Anon. Matthey et Cie., Vallorbe, Switzerland. U.S. Pat. 833,580, Oct. 16, 1906.

See Eng. Pat. 18,920 of 1904; this J., 1905, 850.—T. F. B.

Hydroazo derivatives; [Electrolytic] Manufacture of ——. O. Dieffenbach, Darmstadt, Germany. U.S. Pat. 833,513, Oct. 16, 1906.

Nitro-, azoxy-, and azo-compounds are reduced electrolytically, in alkaline solution, in presence of a suitable solvent, insoluble in the electrolyte, which will dissolve the reduction products formed, and thus prevent their deposition in solid form, and facilitate their removal from the cathode compartment of the apparatus.—T. F. B.

French Patents.

Protective device for electrodes of electric furnaces. L. A. David. Fr. Pat. 361,683, Aug. 9, 1905.

A sleeve of metal or refractory material, cooled by water, surrounds the electrode, and protects it from the air and from the flames of the furnace, a lateral egress being available for the gaseous products of reaction. The cooling of this protective device may be assisted by radiating plates. The sleeve can be so constructed as to allow the furnace to be almost completely enclosed, provision being made for the admission of the charge and for leading away the gases.—R. S. H.

Electrolyser for superheated steam. A. del Meglio, F. Mariani, and A. Colombani. Fr. Pat. 367,048, March 5, 1906.

A pipe traversed by the steam is provided with electrodes connected to a source of current, and with an annular chamber containing apparatus capable of subjecting the steam to the influence of "radio-active radiations."
—R. S. H.

Electrolysers. E. A. Ashcroft. Fr. Pat. 367,165, June 14, 1906.

See Eng. Pat. 5648 of 1905; this J., 1906, 766.—T. F. B.

Cathode. The Reason Manufacturing Co., Ltd. Fr. Pat. 367,067, June 12, 1906. Under Int. Conv., Oct. 13, 1905.

See Eng. Pat. 20,770 of 1905; preceding these.—T. F. B.

Electric heating or resistance plate. The Electric and Ordnance Accessories Co., Ltd., and E. G. Rivers. Fr. Pat. 367,213, June 16, 1906. Under Int. Conv., April 9, 1906.

The heating plates are formed of baked clay or other refractory material, and are provided with a groove in which silicated carbon (a mixture of carbon and water-glass) is placed. The terminal connections are made with metallic wires pressed into and surrounded by the silicated carbon.—R. S. H.

Ozoniser with dielectric. H. J. Wessels de Friese. Fr. Pat. 367,244, June 18, 1906.

The chief feature of this invention is the construction of the electrodes in the form of thin metal tubes capable of being cooled by gases or liquids, with a view to preventing thermal decomposition of the ozone.—R. S. H.

Incandescence electric lamps; Process of manufacture of luminous bodies for ——. H. Kuzel. Second addition, dated March 8, 1906, to Fr. Pat. 359,025, Jan. 9, 1906. II., page 1084.

Incandescence lamps; Luminous bodies of tungsten for ——, *and their mode of manufacture.* Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 367,009, June 9, 1906. II., page 1085.

Incandescence electric lamps; Process of manufacture of illuminating metallic bodies for ——. Deutsche Gasglühlicht Akt.-Ges. (Auerges.). Fr. Pat. 367,033, June 9, 1906. II., page 1085.

Incandescence bodies for electric lamps. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 367,045, June 11, 1906. II., page 1085.

(*B.*)—ELECTRO-METALLURGY.

Gold; Electrolytic precipitation of ——, *with the use of a rotating anode, [and electrolytic analysis of alkali halides].* J. R. Withrow. J. Amer. Chem. Soc., 1906, 28, 1350—1357.

The author has made experiments to ascertain the best conditions for the rapid electrolytic deposition of gold. The apparatus used was similar to that described by Ingham (this J., 1904, 1114). The conditions under which the best results were obtained in cyanide solutions were as follows:—

Gold taken.	KCN.	Dilution.	Current.	E.M.F.	Speed of anode.	Time.	Gold found.
grms.	grms.	c.c.	ampères.	volts.	Revs. per min.	mins.	grms.
0·2611	2·5	50	10—10·2	10—11·4	800	5	0·2612
0·2611	2·5	80	10—10·5	10—13·5	830	7	0·2611
0·5222	2·5	55	10—10·8	9·6—14·5	800	10	0·5222
0·5465	5	60	10	6·8— 7·8	790	12	0·5467

In electrolytes to which sodium sulphide solution (sp. gr. 1·165) was added, the best results were obtained under the conditions given in the following table. In these tests, the sodium sulphide solution was placed in the platinum dish serving as cathode, the anode was set in rotation, and the gold solution then run in from a pipette.

Gold taken.	Na_2S.	Dilution.	Current.	E.M.F.	Speed of anode.	Time.	Gold found.
grms.	c.c.	c.c.	ampères.	volts.	Revs. per min.	mins.	grms.
0·2878	30	60	10·1—10·3	6—6·9	840	7	0·2879
0·2878	30	60	10·2—10·5	7·4—8·8	830	7	0·2883

Some experiments were also made on the electrolytic analysis of alkali halides by a modification of Smith's method (this J., 1903, 1150), a silver-plated dish being used as anode, and a platinum spiral, rotating at 300—500 revs. per min., as cathode. Adherent deposits of silver halide were obtained, and after washing these, the alkali metal was determined by titration of the free alkali in the solution and washings.—A. S.

Micrographic examination of alloys; Application of metallic deposits in the ——. F. Giolitti. Gaz. chim. ital., 1906, **36** [2], 142—147.

In order to render the micro-structure of an alloy visible, the author recommends electrolytically coating the polished surface of the metal with a thin deposit of another metal, which can subsequently be polished or subjected to chemical treatment. The test-piece of the alloy, after being polished, can be coated either by using it as cathode in an electrolyte consisting of a dilute solution of a salt of a heavy metal, or by merely immersing it in such a solution, without the use of an electric current. In the latter case the different solution-tensions of the constituents of the alloy causes differences in the character of the deposit. In the first case, also, on using a short current-circuit and a dilute solution, the electrolytic deposit is not homogeneous, but shows the contour and structure of the different constituents. The differences in the character of the deposit can be rendered more pronounced by mechanical treatment, and by etching with suitable reagents.

Some experiments were made with a low-carbon steel, which was used as cathode in a 0·2—0·5 per cent. solution of copper sulphate, with an E.M.F. of 2—3 volts. After quite a short time the test-piece was removed, and on lightly polishing with a fine cloth, the granular structure of the ferrite showed up prominently, together with filaments of pearlite or cementite. On merely immersing a piece of the same steel in copper sulphate solution, the deposited copper adhered only to the ferrite; on subsequently polishing, the pearlite became visible. In steel containing 0·9 per cent. of carbon, ferrite and cementite were recognised. In a steel, containing 0·45 per cent. of carbon, which was heated to 825° C., cooled slowly to 690° C., and then quenched in water at 10°—15° C., the copper adhered to all of the constituents containing ferrite, but could be detached with different degrees of ease from martensite and troostite respectively. In a similar manner saturated martensite (hardenite) could be distinguished from austenite.—A. S.

Bronzes; Electrolytic corrosion of ——. B. E. Curry. Trans. Amer. Electrochem. Soc., 1906, **9**, 173—196.

Experiments by Shepherd and Blough have shown that bronzes annealed at temperatures between 200° and 400° C. can be classified as follows:—Alloys containing more than 87 per cent. of copper consist of a series of solid solutions known as α-crystals; those with from 67 to 74·5 per cent. of copper consist of another series of solid solutions, known as δ-crystals (supposed by Heycock and Neville to be the compound, Cu_4Sn), whilst those with 74·5 to 87 per cent. are composed of mixtures of α- and δ-crystals. Alloys containing from 40 to 41 per cent. of copper consist of a third series of solid solutions known as ε-crystals, those with 41 to 61·3 per cent. contain ε-crystals and the compound, Cu_3Sn, those with 61·3 to 67 per cent., mixtures of the compound, Cu_3Sn, and δ-crystals, and those with from 0—40 per cent. of copper contain crystals of tin and ε-crystals. Test-pieces of alloys containing 5, 15, 25, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, and 95 per cent. respectively of copper were used as rotating anodes in 7 per cent. solutions of sodium sulphate, sodium nitrate, sodium acetate, alkaline sodium tartrate, acid ammonium oxalate, sodium chloride, and copper sulphate, platinum wires being used as cathodes. Tests of chemical corrosion were also made by bubbling air through solutions of sodium persulphate, alkaline sodium persulphate, and sodium chloride, in which test-pieces of the alloys were immersed. The α- and δ-bronzes were annealed at 400° C., and the others at 217° C. A few experiments were also made with bronzes containing 65, 70, 75, 80, and 85 per cent. respectively of copper, after annealing at 625° C., and quenching in water. The detailed results are given in tables and curve-diagrams. It was found that the effects of chemical corrosion are practically identical with those of electrolytic corrosion. The α-bronzes corrode more rapidly than any others, and with no appreciable change of composition. The $\alpha + \delta$-bronzes become richer in tin on corrosion. The bronzes consisting of δ-crystals, δ-crystals and the compound Cu_3Sn, ε-crystals and the compound, Cu_3Sn, and ε-crystals alone are practically unaffected, and tend to become passive owing to the formation on them of a film of stannic oxide containing more or less occluded copper. The alloys consisting of ε-crystals and tin become richer in copper on corrosion, practically only tin being dissolved, in consequence of which the alloys exhibit a tendency to disintegrate. The bronzes consisting entirely of ε-crystals are more resistant than any others. None of the bronzes becomes passive in chloride solutions, alkaline tartrate solutions, and acid ammonium oxalate solutions, and none is corroded in sodium carbonate solution. An examination of laboratory water-pipes made of pure block tin showed that the protecting film on surfaces of pure tin breaks down in presence of the stronger acids, and that corrosion then takes place more rapidly. In air or in presence of oxygen and carbonic acid, the film is stable, and practically no corrosion takes place. It is pointed out that the results obtained show that the solution method for proving the existence of metallic compounds is impracticable. Heycock and Neville (Phil. Trans., 1904, 202A, 1) by this method claimed to have detected compounds of the formula, Cu_4Sn and CuSn, neither of which actually exists.—A. S.

Bronzes; Electrolytic precipitation of ——. B. E. Curry. Trans. Amer. Electrochem. Soc., 1906, **9**, 249—263.

On electrolysing the ordinary salt solutions of copper and tin, the copper is deposited first, and the solution

becomes rich in tin, so that a continuous precipitation of a bronze of definite composition is impossible under such conditions. In experiments on the electrolytic corrosion of bronzes (see preceding abstract) it had been found that, over a considerable range, bronzes dissolve quantitatively in alkaline tartrate and acid ammonium oxalate solutions. Attempts to deposit bronzes from alkaline tartrate solutions were unsuccessful, but good results were obtained with acid ammonium oxalate solutions. Electrolytes were prepared by mixing together varying proportions of the following solutions:—

Oxalic acid.	Ammonium oxalate.	Copper sulphate (cryst.)	Tin oxalate.	Water.
5 grms.	55 grms.	—	18 grms.	1 litre.
5 ,,	55 ,,	15 grms.	—	1 ,,

Experiments showed that better results were obtained by using copper chloride in place of copper sulphate. The electrodes should be rotated, and a low current density (0·2 to 2 ampères per sq. dm.) at the cathode is necessary. It is not possible to precipitate electrolytically a good bronze with less than 75 per cent. of copper.—A. S.

Sulphides; Reduction of metal, &c. ——. O. W. Brown. Trans. Amer. Electrochem. Soc., 1906, **9**, 109—115.

Molybdenum sulphide.—The author has found that molybdenite can be completely reduced to metal by smelting with lime and carbon, without any loss of metal by volatilisation of molybdenum oxide as in the usual roasting process. The molybdenite used contained 36·3 per cent. of molybdenum, 28·96 per cent. of silica, and about 5 per cent. of iron. A mixture of 160 grms. of molybdenite, 120 grms. of lime, and 84 grms of graphite, all powdered to pass a 20-mesh sieve, was smelted in a small electric resistance furnace, and about 40 grms. of white, hard metallic molybdenum were obtained. In other experiments, the charge consisted of 160 grms. of molybdenite, 112 grms. of lime, and 24 grms. of graphite, and experiments were made with various forms of electric furnace and different amounts of electrical energy. Good yields of metallic molybdenum were obtained in most cases, the fused metal being generally at the bottom of the furnace, covered by a layer of impure calcium sulphide, free from molybdenum. Analysis of a specimen of the molybdenum obtained gave the following results:—Molybdenum, 93·8; iron, 5·51; carbon, 0·87; and sulphur, 0·032 per cent. An ingot prepared by fusing together the metal obtained in several experiments was still purer, a large portion of the iron having been removed, probably by volatilisation. It contained:—molybdenum, 97·41; iron, 1·50; carbon, 1·51; and sulphur, 0·05 per cent.

Attempts to reduce the sulphides of lead, copper, iron, nickel, and antimony by smelting with lime and carbon failed to give satisfactory results.—A. S.

Molybdenum silicide; A new ——. O. P. Watts. Trans. Amer. Electrochem. Soc., 1906, **9**, 105—107.

A MIXTURE of 70 grms. of "molybdic acid, MoO_3," 30 grms. of silica, 50 grms. of boric anhydride, 106 grms. of copper, and 120 grms. of aluminium, together with some cryolite as a flux, and lime as a retarder to prevent too violent a reaction, was placed on a bed of magnesia in a horizontal electric arc furnace, and heated for 16 minutes by a current of 350 ampères at 70 volts. The ingot obtained was powdered, treated for several days with frequently renewed quantities of nitric acid (1:1), and the residue freed from silica by means of dilute hydrofluoric acid, washed with water, alcohol, and ether, and dried. In this way a product consisting of aggregations of flat, dark crystals with a metallic lustre was obtained, having the following composition:—Molybdenum, 62·4; silicon, 34·2; iron, 1·1, and boron, 2·3 per cent. By treatment with hot hydrofluoric acid, the whole of the iron was removed, and must therefore have been present as iron silicide, since iron boride is not attacked by hydrofluoric acid. If the silicon required for iron silicide, $FeSi_2$, and the molybdenum required for molybdenum boride, be deducted from the quantities present, the amounts of molybdenum and silicon remaining correspond closely with the formula, $MoSi_2$. The product is not acted upon by boiling nitric or hydrofluoric acid, or boiling *aqua regia*; it is decomposed slowly by fused sodium nitrate, and readily with incandescence, by fused sodium carbonate. Its sp. gr. is 6·31 at 20·5° C. A product containing molybdenum and silicon in the same proportions was obtained by the reduction of a mixture of molybdenite and silica with calcium carbide.—A. S.

ENGLISH PATENTS.

Di-electric separators. A. J. Boult, London. From H. M. Sutton, W. L. Steele, and E. G. Steele, all of Dallas, Texas. Eng. Pat. 17,653, Aug. 31, 1905.

THE process described consists in separating particles, which need not be electrically conductive or magnetic, by what the inventors term "dielectric hysteretic impedance." The particles fall from the shaking-pan at the end of a hopper on to the circumference of a horizontal cylinder provided with an insulating covering and an outer conducting surface, to which alternating charges are constantly given, by means of a brush, as the cylinder revolves. On one side of the cylinder, and at a short distance from it, there is placed a curved metallic plate or screen, which is either earthed or, preferably, kept supplied with a constant electrostatic charge. Some of the particles which fall between the rotating cylinder and this plate are not influenced by it; their charge at any moment is the same as that of the outer surface of the cylinder, and they leave the latter, under the influence of gravity, at the earliest possible point. Other particles, on the other hand, develop hysteresis in falling through the electrical field; their charge lags behind, and is at any moment opposite to that of the outside of the cylinder, to which they are consequently attracted, and which they leave some distance beyond the non-attracted particles. Electrical devices for obtaining alternating charges of varying periodicity, as well as pulsating charges, are also described in the patent. Certain substances are best separated with certain kinds of charges, *e.g.*, with charges having 2 to 25 alternations per second. &c.—A. G. L.

Electroplating apparatus. A. W. L'Hommedieu, Chicago. Eng. Pat. 9393, April 21, 1906. Under Int. Conv., April 22, 1905.

SEE U.S. Pat. 809,309 of 1906; this J., 1906, 187.—T. F. B.

UNITED STATES PATENTS.

Furnace; Electric ——. L. Waldo, Plainfield, N.J. U.S. Pat. 833,357, Oct. 16, 1906.

CLAIM is made for an electric furnace having a charge-receiving chamber and an inducing-circuit for melting the charge. In the chamber also are electrodes connected with a source of direct current, whereby the melted charge is electrolysed.—A. S.

Silicides and silicon alloys; Manufacture of —— [*electrically*]. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 833,427, Oct. 16, 1906.

A MIXTURE of silicon carbide with a metal-containing substance or silicious ore, in granules or in powder, is subjected to electrically-developed heat, such as may suffice to dissociate the carbide and cause the silicon to combine with the metal of the metalliferous compound.—E. S.

FRENCH PATENTS.

Electroplating apparatus. W. A. S. Bellson and Co., Ltd., and A. J. Leaver. Fr. Pat. 366,930, June 7, 1906. Under Int. Conv., Jan. 8, 1906.

SEE Eng. Pat. 516 of 1906; this J., 1906, 937.—T. F. B.

Refractory electric furnace; Arrangement of ——. [*Slag heating.*] E. Cornelius and L. Fahn. Fr. Pat. 366,961, June 8, 1906.

IN electric furnaces in which the current traverses a refrac-

tory layer of slag or similar material, which is caused to melt and may be used to transmit heat to other materials, the electrodes are so arranged that the area of their contact with the layer of slag is only a small fraction of the total surface of slag available. In this manner, the greater part of the heat is generated at the surface of contact between the electrodes and the slag. Water-cooled insulators are provided to protect those portions of the electrodes which pass through the wall of the furnace.

—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 1056.)

Enzyme action; Studies on —— Lipase. II. H. E. Armstrong and E. Ormerod. Roy. Soc. Proc., 1906, B, **78**, 376—385. (See also this J., 1905, 1242.)

THE authors have continued their investigations on the action of ricinus lipase in the form of the air-dried residue obtained after the extraction of the oil from crushed castor seeds by means of ether. This preparation has very little action on ethyl acetate, but gradually hydrolyses the butyrate. The action is stimulated by the addition to the medium of dilute acetic acid up to a certain point. In the hydrolysis of castor oil the maximum effect was obtained when the total concentration of acetic acid was about *N*/17. Other organic acids have a similar influence. Long digestion of the prepared seed, free from oil, with water or dilute acetic acid causes only a very gradual loss of lipolytic activity, but the material loses to a great extent its property of causing oil to emulsify with water. Glycerol has but little action on the activity of the enzyme, at any rate at concentrations up to 25 per cent.; alcohol, on the other hand, is directly inhibitive, and the retardation is approximately proportional to the quantity of alcohol present. The authors formulate the hypothesis that the mechanism of the action involves a direct association of the enzyme with the "carboxylic centre" of the ester, and that this association may be prevented by the hydration of this "centre." Thus, in a given series, the action will be less, the greater the solubility of the ester in water; as a rule, the solubility decreases as the molecular weight of the acid increases. Preliminary experiments with lipase extracts from pig's liver as compared with the lipase of ricinus seeds, indicated that the differences were those of degree only. In experiments with lipase, the heterogeneous nature of the system is an impediment to comparative quantitative measurements. For accurate comparison, it is highly desirable that the substances should be in solution, which is a condition difficult to realise in the case of sparingly soluble esters and natural fats. In the latter case, the lipase extracts from liver show very poor results as compared with ricinus lipase. This is probably due to the impossibility of preparing fine emulsions with the liver extracts, whereas the superiority of the ricinus seed-residue is attributed mainly to its specific property of emulsifying oils.

Lastly, comparative studies on the hydrolysis of the ethylic esters of a series of dicarboxylic acids with a chain of four carbon atoms, *viz.*, succinic, malic, and tartaric acids, showed that the succinate was hydrolysed most readily, whilst the tartrate suffered very little change, the malate occupying an intermediate position. This relation was the same both with liver lipase and ricinus lipase.—J. F. B

Saponification; Theory of ——. J. Marcusson. Ber., 1906, **39**, 3466—3474.

LEWKOWITSCH (this J., 1900, 254) concluded that mono- and diglycerides were formed in the saponification of fats, their presence being indicated by high acetyl values. Since Balbiano (Ber., 1903, 1571; also this J., 1904, 905) has shown that hydroxy-acids, lactones, &c., may be formed during saponification, the author has modified Lewkowitsch's experiments, by diluting the incompletely saponified mass with water, and dividing it into two equal parts, one of which was acidified and acetylated at once, whilst in the other the excess of alkali was neutralised, the soaps separated by the method of Spitz and Hönig, and the residual neutral fat acetylated. In no instance was the anticipated higher acetyl value of the neutral fat obtained; on the contrary, the mixture of neutral fat and free fatty acids in the first portion usually gave the higher results. Lewkowitsch's filtration method was used in each case (this J., 1897, 503). In experiments on similar lines on the partial hydrolysis of olive oil by means of castor seeds, the highest acetyl value of the products was 28·6. The acetyl values of the neutral fat were higher than those of the mixture of neutral fat and fatty acids, yet the highest difference was 9 units; and this the author opines may be due to the presence of hydroxy derivatives or decomposition products of the proteids in the seeds. His experiments on rancid fats gave analogous results, and he therefore concludes that if, as Kremann (this J., 1906, 856) found in his physico-chemical investigations, the hydrolysis of fats does proceed in stages, it is difficult, if not impossible, to isolate the intermediate compounds; and he attributes the high acetyl values observed by Lewkowitsch to alterations of the fatty acids by absorption of oxygen, formation of anhydrides, &c., rather than to the presence of mono- or diglycerides, (See also this J., 1898, 1107; 1899, 1031.)—C. A. M.

Beeswax; Annamese ——. J. Bellier. Ann. Chim. anal. appl., 1906, **11**, 366—368.

THE commercial wax has a variable greyish-yellow colour, and is not homogeneous. It appears to have been kneaded by hand into a suitable consistence for moulding. When melted and strained, it resembles European beeswax in appearance, but differs somewhat, however, from the latter in characters, which are as follows:—Loss at 100° C., 5·02 per cent.; matter insoluble in benzene, 0·5 per cent.; ash, 0·08 per cent. The dried and filtered wax has the following constants:—Sp. gr., 0·964; m. pt., 61° C.; acid value, 7·8; saponific. value, 94·4; iodine value, 6 per cent.; hydrogen evolved at 250° C. with potash and potash-lime, 60·3 c.c. per grm. at 0° C. and 760 mm.; hydrocarbons (unsaponifiable) at 250° C., 10·5 per cent. The above figures for free acid are lower, and those for esters markedly higher than those obtained with European beeswax, and the amount of hydrogen evolved with alkali is also somewhat higher. The characters closely approximate with those of the wax of *Apis dorsata* from British India (this J., 1904, 828).—J. O. B.

Fats and mineral oils; Cholesterol content of ——, and probable genetic connection between them. M. A. Rakusin. III., page 1085.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 1058).

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENT.

Paint material; Manufacture of ——. D. Lance and C. L. de Joannis, Paris. Eng. Pat. 3446, Feb. 12, 1906. Under Int. Conv., Feb. 16, 1905.

SEE Fr. Pat. 360,215 of 1905; this J., 1906, 486.—T. F. B.

UNITED STATES PATENT.

Lake [from azo dyestuff]; Colouring matter ——. C. Immerheiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 833,802, Oct. 16, 1906.

SEE Eng. Pat. 10,805 of 1904; this J., 1905, 906.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Turpentine; Crude ——*from Eastern Asia and from Mexico.* G Weigel. Pharm. Centralh., 1906, **47**, 866.

Eastern Asian turpentine has the usual viscous fluid crystalline consistence, a brownish-yellow colour, and a characteristic odour of pinene. Acid value, 145·45; saponification value, 149·38. On steam distillation it yields 14·5 per cent. of essential oil having $\alpha_D = +39° 9'$.

Mexican turpentine is of horny crystalline consistence, pale lemon-yellow colour, and has a fragrant odour of limonene. Acid value, 107·54; saponification value, 115·12. On distilling with steam it gives 14 per cent. of essential oil, with $\alpha_D = +33° 4'$. —J. O. B.

Pitch and terpenes of the Norway pine and Douglas fir. G. B. Frankforter. J. Amer. Chem. Soc., 1906, **28**, 1467—1472.

THE pitch obtained from the Norway pine, *Pinus resinosa*, by the "boxing process," or from stumps and waste by steam distillation, by slow destructive distillation, and by extraction with various solvents, was examined. By extraction, lean wood yielded 6·2 per cent. of pitch; average wood, 8·6 per cent.; stumps, 19·4 per cent.; pitchy wood, 39·1 per cent., and very pitchy wood, 42·6 per cent. The pitch has the sp. gr. 0·8137 at 20° C.; refractive index at 20°, 1·47869; optical rotation $[\alpha]_D = +4°$. It contains 22·1 per cent. of turpentine, 77·3 per cent. of colophony, and 0·6 per cent. of water. The wood of the Douglas fir or spruce, *Pseudotsuga taxifolia*, yields by extraction from 11·6 to 42·4 per cent. of pitch having the sp. gr. 0·9821 at 20°; refractive index at 20°, 1·51745; and optical rotation $[\alpha]_D = -8·82$. The pitch contains about 22 per cent. of turpentine. On examining the terpenes from the two kinds of wood, it was found that those obtained by destructive distillation of the wood appeared to be of a more complex character than those obtained from the wood and from the pitch by steam distillation, or from the wood by extraction.

	Norway pine terpene.		Douglas fir terpene.	
	Steam distillation.	Destructive distillation.	Steam distillation.	Destructive distillation.
Sp. gr. at 20°	0·8636	0·8666	0·8621	0·8662
Boiling point	153°—154°	158°—160°	153·5°—154°	157°—160°
Refractive index at 20°	1·47127	1·4716	1·47299	1·47246
Optical rotation, $[\alpha]_D$..	+17·39°	−7·56°	−47·2°	−29·4°

—A. S.

Pinene and firpene; Chlor-hydrochlorides of ——. G. B. Frankforter and F. C. Frary. J. Amer. Chem. Soc., 1906, **28**, 1461—1467.

BY the action of hydrochloric acid gas on a chloroform solution of pinene or firpene the corresponding hydrochlorides were obtained. Firpene, $C_{10}H_{16}$, is the terpene from the western fir. It has the following characters:—B. pt., 153° — 153·5° C.; sp. gr. at 20° C., 0·8598; refractive index at 20°, 1·47299; and $[\alpha]_D = -47°·2$. From pinene hydrochloride, the following chlor-hydrochlorides were prepared by the action of hydrochloric acid and potassium permanganate:—Pentachlorhydrochloride, $C_{10}H_{11}Cl_5.HCl$; hexachlorhydrochloride, $C_{10}H_{10}Cl_6.HCl$; and nonachlorhydrochloride, $C_{10}H_7Cl_9.HCl$. Firpene hydrochloride has the same melting point (130°—131° C.) as pinene hydrochloride, but is more volatile than the latter, and more soluble in most of the common solvents. Firpene dichlorhydrochloride, $C_{10}H_{16}Cl_2.HCl$, and hydrobromide, $C_{10}H_{16}.HBr$, were also prepared.—A. S.

ENGLISH PATENT.

Waste sand from glass-works, commonly known as burgy; Treatment and utilisation of —— [*as filling material for linoleum, leather, paper, &c.*]. W. Thompson. Eng. Pat. 26,893, Dec. 23, 1905. VIII., page 1096.

FRENCH PATENT.

Copal; Method of Extracting ——. R. Groppler. Fr. Pat. 366,980, June 8, 1906.

THE dried and crushed portions (fruit especially) of the trees are treated with liquid solvents, and the resulting extracts are evaporated.—C. S.

(*C.*)—INDIA-RUBBER, &c.

India-rubber; Effect of zinc oxide on the vulcanisation and oxidation of ——. R. Ditmar. Gummi-Zeit., 1906, **21**, 103—104.

PERUVIAN rubber was mixed with 4 per cent. of sulphur and rising proportions of zinc oxide, and vulcanised for two hours at six atmospheres, it having been found that milder treatment led to under-vulcanisation. The products were tested as usual. The results show that the strength of the rubber is in general increased by admixtures of zinc oxide, whilst the elasticity is favoured by 1 per cent., but diminishes with larger quantities. Tendency to oxidation is decidedly enhanced by zinc oxide.—W. A. C.

ENGLISH PATENTS.

Rubber; Manufacture of ——. M. Wildermann, Ealing. Eng. Pat. 20,606, Oct. 11, 1905.

SEE Fr. Pat. 366,704 of 1906; this J., 1906, 1057.—T. F. B.

Rubber; Preparation of —— *for vulcanisation.* B. Grätz, Berlin. Eng. Pat. 3889, Feb. 16, 1906.

SEE Fr. Pat. 363,341 of 1906; this J., 1906, 895.—T. F. B.

FRENCH PATENTS.

Rubber; Process of making tubes and rods of regenerated ——. B. Roux. First Addition, dated Aug. 10, 1905, to Fr. Pat. 350,113, Aug. 11, 1904.

SEE Eng. Pat. 16,389 of 1905; this J., 1906, 895.—T. F. B.

Rubber; Extraction of —— *from rubber waste.* W. A. Köneman. Fr. Pat. 366,805, June 2, 1906.

SEE U.S. Pat. 823,053 of 1906; this J., 1906, 704.—T. F. B.

Rubber; Extraction of —— *from waste* [*vulcanised*] *rubber.* W. A. Köneman. Fr. Pat. 366,806, June 2, 1906.

SEE U.S. Pat. 823,054 of 1906; this J., 1906, 704.—T.F.B.

Elastic product; Artificial ——. [*Rubber substitute*]. E. de Dorlodot. Fr. Pat. 366,808, June 2, 1906.

APPROXIMATELY equal quantities of gelatin (or similar albuminoid substance) and glycerol are heated together, and the resulting syrupy mass is treated with a 10 per cent. solution of formaldehyde. The product is added to about an equal quantity of a rubber mixture prepared for vulcanisation, and after thorough mixing, the whole is vulcanised in the usual manner. The elastic substance prepared from the gelatin and glycerol may, if desired, be vulcanised by heating with sulphur, before mixing with the rubber.—A. S.

Rubber; Process for forming articles of —— F. Ephraim. Fr. Pat. 367,093, July 2, 1906.

SEE U.S. Pat. 819,520 of 1906; this J., 1906, 547.—T.F.B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 1059.)

Catechu; Detection of adulteration in ——. D. Hooper. XXIII., page 1121.

Cutch and gambier trade of India. Agricul. Ledger, 1906, [3], 49—50. [T.R.]

Indian cutch is manufactured chiefly in Burmah; in 1872, 5240 tons, value £124,458, were exported to the United Kingdom; the total export in the same year was 10,782 tons. The average export during the five years ending 1895–6 was 9522 tons, valued at £227,522, whilst for the five years ending 1904-5, the average was only 4135 tons (value £98,475). The United Kingdom took one-half of the 1905 export. In 1872 England imported 21,000 tons of gambier, of the value of £451,737. The total export from Singapore in 1871 was 34,248 tons; in 1876 it reached 50,000 tons, but fell to 39,000 tons in 1877. In 1903, the sales amounted to 35,000 tons; in 1904, 25,000 tons, and in 1905, 33,000 tons.

English Patent.

Waste sand from glass-works, commonly known as burgy; Treatment and utilisation of —— [*as filling material for linoleum, leather, paper, &c.*]. W. Thompson. Eng. Pat. 26,893, Dec. 23, 1905. VIII., page 1096.

United States Patents.

Hides; Apparatus for treating ——. W. Coupe, South Attleboro, Mass. U.S. Pat. 833,443, Oct. 16, 1906.

The apparatus consists of a vat in which a wheel is caused to revolve, and which is intermittently supplied with liquor from a supply-tank communicating with the vat at or near the bottom of the latter. The valve controlling the supply of liquor to the vat is operated automatically by the wheel. At or near the top of the vat is an overflow pipe through which the liquor passes to a receiving tank, wherein it is agitated or stirred, and whence it is pumped back to the supply-tank.—A. S.

Leather; Process of treating —— *with coal tar.* L. H. Francis, Princeton, Cal., Assignor to C. L. Donohoe and F. Freeman, Willow, Cal. U.S. Pat. 834,199, Oct. 23, 1906.

The leather is immersed in a bath of coal-tar, at a temperature of about 110° F., for one to six days, after which it is passed between pressure rollers, then partially dried, and rolled again.—C. S.

French Patent.

Tanning process; Rapid ——. F. Kohl. Fr. Pat. 367,454, June 26, 1906.

See Eng. Pat. 14,602 of 1906; this J., 1906, 941.—T.F.B.

XV.—MANURES, &c.

(*Continued from page* 1059.)

English Patent.

Fertilisers; Manufacture of ——, *and apparatus therefor*; J. Crone, D. C. Taylor, and F. Williams, St. Helens. Eng. Pat. 26,780, Dec. 22, 1905.

Shoddy, hide, leather scraps, and the like are heated in a rotary furnace, as described in Eng. Pat. 5618 of 1905 (this J., 1906, 326), but the quantity of sulphuric acid added is reduced. When the reaction is nearly completed, saturated sodium chloride solution is sprayed over the material; the excess of sulphuric acid is thus converted into sodium sulphate, and the liberated hydrochloric acid is drawn off with the other gases, and passed through the condensing tower. The outlet of the latter discharges the washed gases into the lower part of a filter chamber; at the upper part of this chamber is a perforated plate supporting a layer of peat moss through which the gases pass before being discharged into the atmosphere. About 28 lb. of calcium phosphate, gypsum, or chalk may be added to the material in the furnace before adding the brine, in order to break up any lumps of material which may have formed. The quantity of brine added varies from 0·5 to 0·75 cwt., according to the nature of the raw material.—W. P. S.

French Patents.

Phosphate; Organic limed ——. [*Fertiliser and insecticide*]. Comp. Ind. des Mines et Carrières de Cierp. Fr. Pat. 367,006, June 10, 1906.

The black calcium phosphate of the Pyrenees is mixed with quicklime derived from a pure calcium carbonate, and the mixture is calcined in a furnace with good draught. The product is crushed, screened, and stored in sacks. It is stated to contain from 10 to 20 per cent. of calcium phosphate with from 50 to 70 per cent. of calcium oxide, besides 2 per cent. of graphite, and small proportions of magnesia, alumina, and iron oxide, and to be applicable as a fertiliser and insecticide.—E. S.

Nitrogen compositions [*Fertilisers*]*; Process for producing* ——. O. F. Carlson. Fr. Pat. 367,198, June 16, 1906. Under Int. Conv., Feb. 28, 1906.

See Eng. Pat. 15,445 of 1906; this J., 1906, 858.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 1059.)

Sugars, higher alcohols, and hydroxy-acids; Action of alkaline copper solutions on the rotatory power of ——. H. Grossmann. Z. Ver. deut. Zuckerind., 1906, 1024—1035.

The author has investigated the influence of alkaline copper solutions on the rotatory powers of a number of optically active organic compounds. The method of procedure was as follows:—Measured quantities of the solutions of known concentration of copper sulphate and of the organic compound were mixed, sodium hydroxide then being added until the precipitate first formed was dissolved. The mixture was made up to 20 c.c., and read in a 20 mm. tube. The source of illumination was a Nernst projection lamp, the light being filtered through Landolt's "bright blue filter." ("hellblau" (*hb*); optical "centre of gravity," 488·5 $\mu\mu$). The following are some of the results obtained: The rotatory power of dextrose was changed from $[\alpha]_{hb} = +78°$ to $-375°$; that of lævulose from $[\alpha]_{hb} = -134·5°$ to $+142·3°$; that of sucrose from $[\alpha]_{hb} = +101·2°$ to $-111·3°$; that of rhamnose from $[\alpha]_{hb} = +12°$ to $-551°$; that of quinic acid from $[\alpha]_{hb} = -61°$ to $+410°$. The above represent the maximum variations observed. The rotatory powers of mannitol, tartaric acid, isosaccharin, and asparagine were unchanged in direction, but much increased in amount. Hence copper must be classed amongst those elements which, as a result of a strong tendency to form complex ions, affect rotatory power to a high degree. Further investigations on the influence of increasing quantities of sodium hydroxide on the rotatory power of copper tartrate showed that in presence of excess of alkali, the strongly dextro-rotatory salt

$$COONa.CHO.CHO.COONa,$$
$$\quad\quad\quad\quad Cu$$

is capable of existence. With increasing dilution, or in the absence of free sodium hydroxide, a lævo-rotatory phase occurs, which is probably represented by the formula—

$$NaO_2C(CHOH)_2CO_2.Cu.O.O_2C(CHOH)_2CO_2Na.$$

This salt suffers further hydrolytic decomposition on greater dilution, and the rotation of neutral sodium tartrate results. The author also shows that by adding sodium hydroxide to ammoniacal copper tartrate solution, a great increase in the rotatory power of the latter is produced. This increase is due to the fact that the copper, which in ammoniacal copper tartrate forms a constituent of the cation, is transferred to the anion on addition

of sodium hydroxide. The following conclusions are drawn from the investigation:—The power of forming intensely coloured alkaline copper solutions, possessed by some organic compounds, is connected with the number of hydroxyl groups present in the latter. The rotatory powers of these solutions is very high, and is often much influenced by the presence of free alkali. Increase of rotatory power, caused by addition of alkaline copper solutions, is, in many cases, accompanied by change of direction of rotation. Amino-compounds, such as asparagine, behave similarly to hydroxyl-compounds. Like copper, chromium also possesses the power of forming coloured complexes of high rotatory power.—L. E.

Sucrose and raffinose in the mother-liquors from the desaccharification of molasses by Steffen's process; K. Andrlík. Z. Zuckerind. Böhm., 1906, 31, 1—6.

It is to be expected that, in the desaccharification of molasses by Steffen's process, a portion of the raffinose will be retained in the mother-liquors. On the assumption that no raffinose is so retained, the author has compiled a table which shows that the accumulation of raffinose in the molasses at the end of a campaign would be much greater than is actually found in practice. Hence it must be assumed that the raffinose does gradually pass into the mother-liquors. The author has proved that such is the case. Three samples of calcium saccharate (obtained by Steffen's process), in the preparation of which, definite degrees of alkalinity towards the end of the precipitation were maintained, were examined. The mother-liquors from these samples were also investigated. With regard to the determination of the proportions of sucrose and raffinose in the mother-liquors, the author found that by the following method, both sugars were precipitated practically quantitatively. The mother-liquor was boiled down, filtered from precipitated saccharate (which amounted to 62—70 per cent. of the whole), the residual saccharate being precipitated with 2 per cent. strontium hydroxide solution and an equal volume of 96 per cent. alcohol. The amounts of sucrose and raffinose in both precipitates were then determined. The results showed that the proportion of raffinose to sucrose in the mother-liquor increased with the alkalinity of the latter. The author concludes that in Steffen's process for the desaccharification of molasses, raffinose is left in the mother-liquors, the amount of raffinose removed in this way increasing with the alkalinity of the liquors. By maintaining a comparatively high degree of alkalinity, a saccharate containing only a small proportion of raffinose is obtained; the loss of sucrose, however, is greater by 2—2½ per cent.—L. E.

Reducing substances and their determination. H. Pellet. XXIII., page 1222.

United States Patent.

Sulphite liquor; Treating waste ——, *and* [*adhesive*] *compound obtained* [*therefrom*]. J. S. Robeson. U.S. Pat. 833,634, Oct. 16, 1906. XIX., page 1115.

French Patent.

Gum tragasol; Manufacture of —— *from locust-beans or their kernels.* P. C. D. Castle. Fr. Pat. 366,792, June 2, 1906.

See Eng. Pat. 10,822 of 1905; this J., 1906, 944.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 1062.)

Proteins of barley: their importance for its valuation and their relations to steeliness. E. Prior. Z. ges. Brauw., 1906, 29, 613—615.

The influence of proteins on barley depends on the forms in which they exist, these being, according to Osborne:—(1) Leucosin, which is soluble in water, together with small quantities of albumoses; (2) edestin, which belongs to the class of globulins, and is insoluble in water but soluble in 10 per cent. salt solution; (3) hordein, which is insoluble in water or salt solution, but dissolves in 75 per cent. alcohol; (4) insoluble proteins, which resist all these solvents. To group (1) belong also certain decomposition products, such as peptones, amides, traces of ammonia, enzymes, &c., and in the embryo and cell nucleus small quantities of nucleins are found. The author's investigations of twenty-one barleys of all kinds lead to the following results:—

	Per cent.	Per cent. of the total protein.
Leucosin	1·39— 2·79	10·49—18·70
Edestin	0·74— 1·79	5·93—12·09
Hordein	1·13— 6·01	10·27—33·02
Insoluble protein	4·47— 8·62	44·70—65·10
Hordein + insoluble protein	6·77—14·55	70·80—80·52

From the curves given, it is seen that no relation exists between the amount of leucosin or edestin and that of the total protein, but as the latter increases, the amount of hordein plus insoluble protein also increases. From the quantity of total protein present, no conclusion can be drawn concerning the quantitative relations of the separate proteins. For the brewing process, hordein and the insoluble proteins alone are of importance, since edestin and leucosin occur mainly in the aleurone grains. It is a general rule that, as the protein content of barley increases, the starch content diminishes, but many exceptions occur to this rule. Steeliness in a barley is due to the cementing of the starch-containing cells by colloidal substances, which may be either nitrogenous or non-nitrogenous. In the latter case, the cementing substance is largely dissolved in the steep water, and a large proportion of the corns hence rendered mealy. But when the starch cells are attached by means of nitrogenous substances, these do not dissolve in water, so that the steeliness persists after steeping. That the transition from the steely to the mealy condition is not due to enzyme action is shown by the fact that water containing chloroform has the same effect as water alone; confirmation of this is given by the observation that the mealiness is increased by treating the barley with 75 per cent. alcohol, which dissolves the nitrogenous substances. Steeping in a vacuum also produces a higher degree of mealiness, the removal of the air from the corns facilitating the access of water to the cementing substance. Hordein is found principally in the neighbourhood of the embryo, of which it forms the first nitrogenous nutriment, whilst the insoluble proteins occur mainly—at any rate in good barleys—in the periphery of the endosperm; only in steely barleys does the layer of insoluble proteins extend towards the middle of the corn.—T. H. P.

Protein constituents of barley. H. Schjerning. Compt. rend. Trav. Laborat. Carlsberg, 1906, 6, 229—307.

The author has investigated the formation and transformation of protein substances during the growth, ripening, and storage of barley. The samples of barley investigated were the following:—I. Two-rowed Prentice barley of the Lyngby type, grown in 1901; the period of development, reckoned from green-ripeness to full maturity—20 days—was very short. II. The same barley as in I., grown in 1903; the period of development—32 days—was rather longer than the average. III. Pure Primus barley, grown in 1905: the period of development—28 days—was approximately normal. Samples from these crops were gathered and examined at various stages of development. The chemical composition of the dry matter of 36 different samples of barley was also investigated. From the results of his work the author has drawn the following conclusions:—(1) Owing to the comparatively great error (about 1 per cent. of protein), which must be allowed for in determining the percentage of protein matter in a barley crop or lot of barley, it is misleading to use this quantity (percentage of protein) as a factor for determining the quality of malting barley. Moreover, the fact that the malting and brewing processes

vary in different localities, renders the valuation of barley according to nitrogen content, somewhat uncertain. (2) Barleys which have had a growth and ripening period of short duration are much more liable to suffer a loss of dry matter by over-ripening than barleys which have had a long period of development. Moreover, with the same species and variety, it appears that the size of the grain depends, to a certain extent, on the duration of the period of development. (3) Barley has acquired full maturity when the conversion of soluble into insoluble carbohydrates, and soluble into insoluble proteins, has ceased, or reached its maximum. (4) When the development of the barley grain—from green-ripeness to yellow-ripeness—takes place during a normal period of development, there exists an absolute equilibrium between the quantity of nitrogen received in a given time and the quantity converted in the same time into insoluble compounds, whereas the transformation of soluble into insoluble nitrogen compounds in a short period of development takes place more quickly than does the intake of nitrogen, the reverse being the case in a long period of development. (5) Condensation of amine-amide compounds into soluble proteins proceeds more quickly during a short than during a long period of development, and this process is very nearly in equilibrium with the further intake of nitrogen as soon as the stage of yellow-ripeness has been reached. (6) The proteoses cannot be supposed to act as intermediate terms in the condensation of amine-amide compounds into proteins of a higher order, but are exclusively to be regarded as hydrolytic cleavage products of higher proteins. (7) An appreciable amount of proteose in a barley crop must always be considered as indicative of rather unfavourable harvest conditions. (8) Provided that barley has properly matured before being reaped, and that it is stored under suitable conditions, a loss of dry matter (respiration loss) is not likely to occur during storage. (9) The ripening barley grain is tending towards a state of equilibrium in respect of its nitrogenous constituents; when, on reaping the barley, this state has been reached, it is not disturbed during storage except in the cases of albumins I. and II. (See this J., 1898, 1191.) (10) The amount of albumin I., in proportion to dry matter, decreases in a greater or less degree according as the barley is allowed to attain a greater and greater degree of maturity, whereas the quantities of albumin II., insoluble nitrogen, total nitrogen, and acidic substances soluble in water, increase more or less. The amount of nitrogenous compounds, soluble in water, is also subject to considerable fluctuations, which, however, are sometimes positive, sometimes negative. Denuclein, proteose, peptone, ammonia, amine-amide, and mineral constituents—in each individual barley sample—show a constant weight in the dry matter, as soon as the corn has reached its full development; consequently, the quantities of these substances remain constant during the real maturation process. (11) Reaped at an early stage, barley is less rich in nitrogen than when reaped later. (12) The chemical composition of dry matter in respect of the various groups of nitrogenous substances, mineral constituents, and acidic substances soluble in water is not dependent on the species, variety, or type of barley. (13) The cultural condition of the soil, as well as climatic conditions, exert some influence on the amount of mineral constituents in the dry matter of barley, and to a certain extent also, upon the amounts of total nitrogen and amine-amide nitrogen, whereas with regard to the other groups of nitrogenous substances, the influence of these factors is less marked than that of the degree of maturity and time of storage.—L. E.

Malt; The nitrogenous constituents of —— which are soluble in cold water and are not coagulated on boiling. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, 1, Pt. 2, 167—283.

A PRELIMINARY examination of the aqueous extract of malt "culms" resulted in the identification of asparagine, allantoin, betaine, and choline. Subsequent work on a boiled, cold-water extract of malt showed that in cases of this kind phosphotungstic acid cannot be regarded as a definite group-precipitant. This acid precipitated 51 per cent. of the total nitrogen of the extract, but the actual quantity of the substances precipitated was found to depend on an equilibrium determined by the particular conditions. It is true that the simpler organic bases are found in the precipitate and the amides and amino-acids remain in the filtrate, but the main bulk of the more complex constituents of the extract is divided in a variable manner between the liquid and precipitate. It is shown that the property of evolving nitrogen on treatment with nitrous acid is not confined to the free amino-acids and their amides, but is possessed by the more complicated nitrogenous bodies which contain apparent amino groups of this kind in their complex. Thus the "amino index," *i.e.*, the percentage of the total nitrogen which reacts with nitrous acid as amino-acid nitrogen is used as a specific constant (AoN) of any given nitrogenous complex, and serves as a measure of homogeneity in fractional separations. This constant is analogous to the cupric-reducing constants R and K in the case of carbohydrate complexes. Instead of an aqueous extract of malt, it was found more convenient to continue the work on an extract prepared with 70 per cent. alcohol, with the subsequent extraction of the dry alcoholic extract by water. This "alcohol-water" extract contained about 48 per cent. of the nitrogenous constituents of the boiled, cold-water extract. Part of the difference was made up of albumoses sparingly soluble in alcohol, whilst the rest remains uninvestigated. The alcohol-water extract yielded asparagine, tyrosine, leucine, and allantoin, not precipitated by phosphotungstic acid, whilst betaine and choline were isolated from the precipitate. Practically the whole of the amides and amino-acids were eliminated from the extract by fermentation with large quantities of yeast, under conditions which restricted reproduction. The residual liquid was then saturated with ammonium sulphate, which threw out malt albumoses, and separated into fractions I. and II. by means of 84 per cent. alcohol. The ammonia remaining after evaporation and the organic bases were next precipitated as platinochlorides. Further "salting out" of the solution with zinc sulphate then yielded a malt-albumose III. From the filtrate from this, phosphotungstic acid precipitated most of the malt-peptones, some, however, remaining unprecipitated, as the result of equilibrium, together with a little leucine which had escaped assimilation by the yeast. The malt-peptone fraction was separated into peptones I. and II., according to the relative solubilities of their phosphotungstic compounds. The malt albumoses and malt-peptones differ from the similar derivatives of other proteins in the fact that they give no biuret reaction, and are not precipitated by iron ammonium alum. The malt-albumose I. possesses the property of producing a persistent froth in aqueous solutions. The composition of the uncoagulable nitrogenous cold-water extract of malt is estimated to be as follows, the results being expressed as nitrogen per cent. of the total nitrogen:—Ammonia, 3·5; malt-albumoses, 20; malt-peptones, 31; amides and amino-acids, 8·5; organic bases, 4·0; balance (uninvestigated), soluble in water but insoluble in 70 per cent. alcohol, 33 per cent. The albumoses and peptones are probably the conversion-products of the alcohol-soluble protein of barley, the hydrolysis of which, whether by enzymes or acids, results in the production of bodies of similar character to those studied. This hydrolysis takes place with the progressive elimination of part of the amide nitrogen as ammonia and of the amino-nitrogen as free amino-acids, with a corresponding accumulation of the basic nucleus in the products.—J. F. B.

Barley; Culture of excised embryos of —— on nutrient media containing nitrogen in different forms. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, 1, Pt. 2, 288—299.

THIS investigation was undertaken in order to differentiate to some extent between the "down-grade" (katabolic) products of the nitrogenous reserves of the endosperm, and the "up-grade" (anabolic) nitrogenous bodies directly convertible by the growing embryo into living

tissue. For this purpose, excised embryos of barley corns were grown on porous plates saturated with a nutrient solution containing non-nitrogenous salts and cane sugar. To this solution were added, in separate experiments, equal quantities of nitrogen in a large number of different forms, and the availability of these nitrogenous compounds as nutrients was measured: (*a*), by the increase in weight of the dried plants, and (*b*), by the increase in the quantity of nitrogen they contained. By comparing the nitrogen results with those of a control experiment in which no nitrogen was added, a ratio was obtained expressing the "specific nitrogen assimilation" for each particular substance. In this way the quantity of nitrogen in the control plants being 1·0, the specific assimilation of tyrosine was 0·57 and of phenylalanine 0·87, showing that these bodies exert a definitely poisonous influence. The assimilation value of leucine was 1·14, but since the dry weight of the plants fell short of that of the control plants, it must be concluded that leucine also has an inhibitive effect. A result of a similar order was obtained with a crude mixture of "down-grade" products from malt, consisting mainly of malt peptones and albumoses, together with some "unclassified bodies"; here also the development of the plants was retarded, although the nitrogen assimilation was 1·18. The other substances tested showed both an increased development of dry substance and higher nitrogen ratios when compared with the results of the control plants, *viz.*, choline, 1·46; allantoin, 1·49; betaine, 1·50; ammonium sulphate, 1·64; aspartic acid, 1·84; glutamic acid, 1·95; potassium nitrate, 2·18; asparagine, 2·70. Although asparagine is the "up-grade," nitrogenous nutrient *par excellence*, the plants grown on artificial asparagine-cane sugar media are never so vigorous as those grown on their natural endosperms, in spite of an increased nitrogen assimilation amounting under the best conditions to 50 per cent. This is probably due to a defect of the cane sugar as the carbohydrate nutrient, which, although the best artificial nutrient known, is inferior to the natural material and thus becomes the limiting factor of the growth.—J. F. B.

Barley and malt; The water-soluble polysaccharides of ——. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, 1, Pt. 2, 312—337.

THE authors have begun a thorough re-investigation of the soluble gummy carbohydrates which exist in barley, and to which O'Sullivan gave the names of α- and β-amylans. The best way of separating these is to make a full conversion of the raw grain by means of an extract of kilned malt at a temperature of 50°—55° C. On the addition of alcohol of a certain strength to the filtered wort, the amylans are precipitated, whilst the conversion dextrins remain in solution. The quantity of crude amylan thus obtained amounted to 9—10 per cent. of the dry weight of the barley. When freed from nitrogenous matters the amylans gave a viscous, opalescent solution with water, possessing no cupric-reducing power, and $[\alpha]_D = +31·6°$. The rotatory powers of different preparations, however, varied considerably. The substance is readily soluble, and gives clear solutions when potash is added to the water, but the presence of potash influences the rotatory power. After hydrolysis for 24 hours by oxalic acid, it was found that the solutions contained quantities of *r*-tartaric acid, amounting to 10 per cent. of the original amylan. This acid is formed by the action of oxalic acid on pentose sugars, the primary products of the hydrolysis. Dextrose was the only fermentable sugar present in the solution. The amount of dextrose disappearing on fermentation corresponded to 60—70 per cent. of the original amylan. Of the unfermentable residue, about one-fifth consisted of pentoses, both arabinose and xylose, and the remainder of an unknown body with low cupric-reducing power and low rotatory power. Determinations of the percentage of amylans and starch at different periods of the development of the corns showed no genetic connection between the two, and their formation is apparently independent. Laevorotatory amylans can be extracted from barley by the joint action of diastase and yeast. The amylan precipitated by alcohol from the unfermentable residue was far less viscous in solution and less gummy in character than the ordinary amylan of barley. It possessed $[\alpha]_D = -100·34°$, and yielded ordinary arabinose on hydrolysis. This amylan is considered to be identical with the araban isolated from malt by Wroblewski (this J., 1897, 1031). Malt, when treated for the isolation of the amylans, yielded very much smaller quantities than the raw barley from which it was made. The product, about 3 per cent., possessed similar properties to those of barley amylan, but with a considerably higher dextrorotation, $[\alpha]_D = 118°$, and yielded dextrose on hydrolysis. —J. F. B.

Malting process; Migration of nitrogen from the endosperm to the embryo during the ——. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, 1, Pt. 2, 284—287.

WHEN the embryo of the barley corn is excised and is allowed to grow in water or in carbohydrate media, the restricted development of the root and the early appearance of signs of starvation suggest that the embryo is suffering from the absence of nitrogenous nutrition which, under normal conditions, it would obtain from the endosperm. This migration of nitrogenous compounds from the endosperm to the embryo during germination was confirmed by the analysis, at intervals of two days, of 100 corns each time, taken from the same lot of barley during the malting process. The corns were dissected, and the nitrogen was determined separately in the endosperms, in the embryos deprived of their rootlets, and in the rootlets alone. In this way a gradual and continuous decrease of the nitrogen in the endosperms was observed side by side with a corresponding increase of the nitrogen in the embryos and rootlets, until, after 9 days' germination, about 35 per cent. of the nitrogen originally present in the endosperm had migrated to the embryo. A very considerable proportion of this nitrogen must have been converted from the form of insoluble protein into soluble and diffusible compounds before the migration could take place.—J. F. B.

Yeast-juice; Alcoholic ferment of —— II. The co-ferment of yeast-juice. A. Harden and W. J. Young. Roy. Soc. Proc., 1906, B., 78, 369—374.

IN the first paper (this J., 1906, 490) it was shown that yeast-juice could be separated by filtration through a Martin gelatin filter into two portions, both of which are incapable of fermenting dextrose by themselves, whereas a mixture of the two produces a vigorous fermentation. The inactive residue which does not pass through the filter may be regarded provisionally as the ferment, whilst the filtrate may be called the "co-ferment." The complete removal of the co-ferment is not generally effected by a single filtration, but if the residue be re-dissolved and again submitted to the treatment, it can be obtained in a condition in which it is perfectly inactive towards dextrose by itself. This inactive residue, when dried *in vacuo*, retains its potential fermentative properties for a considerable time. When a small quantity of boiled yeast-juice is added to a solution of the inactive residue in presence of dextrose, fermentation proceeds until the quantity of co-ferment added with the boiled juice is exhausted; a further addition of boiled juice then induces a second fermentation, and so on until the original quantity of ferment is exhausted. Cessation of fermentation may be due to the disappearance either of the ferment or of the co-ferment, according to the relative amounts of each originally present. The authors have studied the rate of the disappearance of the co-ferment from yeast-juice as the result of autolysis. This disappearance takes place in about 48 hours at a temperature of 26° C., but in presence of dextrose a small quantity still exists after 4 days; the ferment remains active, and its presence can be observed by the addition of fresh boiled juice to the autolysed juice. Lastly, the authors show that the addition of soluble mineral phosphates to the solution of the inactive residue cannot supply the place of the co-ferment; the latter, therefore, does not consist of phosphates precipitable by magnesium mixture. This is confirmed by the fact that autolysed juice, which can

tains large quantities of phosphates in the precipitable condition, is devoid of co-fermentative properties.
—J. F. B.

Lactic acid bacteria; Vitality and fermentative capacity of industrial ——. C. Wehmer. Chem.-Zeit., 1906, **30**, 1033—1035.

ALTHOUGH it is generally supposed that the purely vegetative forms of bacteria are possessed of but little vitality in the dry state, the author shows that this is not always the case. He has studied a non-sporulating species of industrial lactic acid bacterium, possessing a maximum acid-producing power at a temperature of 40° C. The culture was preserved in the same flask in which it had carried out its fermentation. In the course of time the bacteria had dried down on the surface of the crystalline calcium lactate which they had produced. Under these conditions the vitality of the bacteria was quite unimpaired after 5 years; after 6 years, however, it was necessary to sow larger quantities of the deposit in order to find living cells, and after 10 years the whole culture was apparently dead. This great vitality of vegetative bacteria cells, almost equal to that of anthrax spores, was only exhibited when the cultures were allowed to ferment in presence of chalk. When the acid produced in the fermentation was not neutralised, the cultures died in 6—10 weeks. Determinations of the fermentative power of this species, in presence of chalk, showed that in a solution containing 15 grms. of dextrose, 10·5 grms. of lactic acid were produced, and that at the end of that time the dry weight of the bacteria was 20 mgrms., equivalent to 100 mgrms. living weight. This is a production of 100 times the weight of the bacteria, or at the rate of 10 times their weight per day. Although dextrose should yield theoretically an equal weight of lactic acid, this result is never attained, even under the best conditions; 90—91 per cent. of lactic acid, calculated on the dextrose, is the highest yield which is ever obtained, and, under industrial conditions, a yield of 60—70 per cent. is usual. In practice it is necessary to choose between losses by incomplete fermentation and losses by infective fermentation, the danger of which increases with the time. The completeness of the fermentation depends largely on the completeness of the saccharification of the mash. Butyric ferments, moulds, and even yeasts enter into competition with the lactic bacteria, and the calcium lactate which is already formed may itself be consumed in the later stages of fermentation by other organisms. When all accidental sources of loss have been eliminated, there still remains a quantity of sugar disappearing from the medium, but not converted into lactic acid, which is greater in this kind of fermentation than in others; the manner in which this sugar is consumed is, however, still undetermined.—J. F. B.

Enzymatic action of the radish (Raphanus sativus, L.). T. Saiki. Z. physiol. Chem., 1906, **48**, 469—472. Chem. Centr., 1906, **2**, 1275—1276.

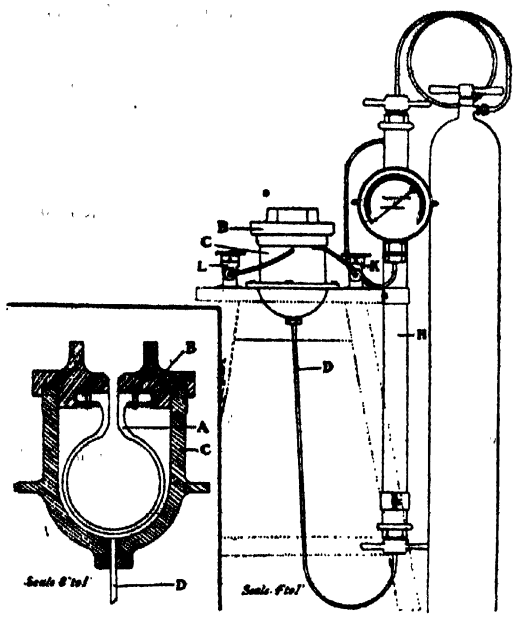
THE author has detected in radishes a very powerful diastatic ferment. *Daucas carota* and *Brassica carota* also contain a diastase, but this is less active than that of the radish. No evidence could be obtained of the presence of a proteolytic, a lipolytic, or an alcohol-forming ferment in radishes. Among the reducing substances formed on treating the expressed juice of the radish with a freshly-prepared paste of purified wheat starch, maltose was detected. After four hours at 40° C., 83·3 to 91·6 per cent. of the starch was saccharified, the reducing substances being calculated as maltose. The diastase prepared from radishes according to the usual method formed a yellowish-white, moderately hygroscopic powder.
—A. S.

Sugar; Fermentation of —— without enzymes. H. Schade. Z. physik. Chem., 1906, **57**, 1—46.

THE decomposition of dextrose by alkalis under various conditions is attended by the production of an intense brown coloration, and the possible formation of an immense number of products, some simple and some more or less uncharacterised. But the author has found that if the decomposition be carried out in presence of hydrogen peroxide, it takes place without the slightest browning, so long as the peroxide is in excess. The author explains this by the fact that acetaldehyde is one of the main primary products of the decomposition, and that the brown-coloured complex products are the result of secondary resinification of the aldehyde. Any agent which combines with the aldehyde prevents the brown coloration, the most efficient being hydrogen peroxide, which oxidises it to acetic acid, and sulphites or cyanides, which fix it by combination. The removal of the volatile aldehyde by the rapid passage of a current of gas is also efficient up to a certain point. Under certain conditions, *viz.*, 2 grms. of dextrose, 4 grms. of caustic potash, and 200 c.c. of water, digested for 8 days at 40° C., with the passage of a rapid current of air, a quantitative yield of formic acid in the ratio of 2 mols. of acid to 1 mol. of dextrose is obtained. With lævulose at similar concentrations, but at a temperature of 15°—18° C., and with the addition of hydrogen peroxide, an additional proportion of 2 mols. of acetic acid is also produced, owing to the oxidation of the acetaldehyde *in situ*. The decomposition of any monose sugar by alkali, when the solution remains colourless, is therefore represented by the equation: $C_6H_{12}O_6 = 2CH_3CHO + 2HCOOH$, with only traces of other products; this decomposition proceeds at different velocities with different monoses. It was to be expected that an equimolecular mixture of acetaldehyde and formic acid would be convertible into alcohol and carbon dioxide. This transformation was in fact brought about by the catalytic action of spongy rhodium. A 5 per cent. solution of sodium formate, slightly acidified with acetic acid, was treated with spongy rhodium and gradually heated under a reflux condenser to 60° C. At the same time an equivalent quantity of acetaldehyde was distilled into the liquid, the vapours being caused to enter at the bottom of the vessel. An evolution of carbon dioxide then took place, and ethyl alcohol was recovered from the liquid, with a yield of 60—70 per cent. of the theoretical. Thus, in two stages of purely chemical reaction, the sugar had been converted qualitatively and quantitatively into the same products as are obtained in fermentation by yeast. The splitting up of the sugar into aldehyde and formic acid is a typical catalytic phenomenon taking place under the influence of hydroxyl ions, since equivalent quantities of caustic soda and potash decompose the same amount of sugar in the same time; thus both stages are spontaneous breakdowns. The author postulates two ways in which the sugar molecule can break down, *viz.*: the aldehyde and the acid breakdown. These are analogous to the two typical decompositions, ketonic and acidic, of ethyl acetoacetate. A third way is left unformulated to account for the complex decompositions which ensue under less regulated conditions. The general tendency is vastly in favour of the aldehydic breakdown described above, but with higher concentrations of hydroxyl ions the acidic breakdown, with production of lactic acid, becomes predominant. Lastly, the author discusses the analogies between the various biological breakdowns of sugar, *viz.*, alcoholic, lactic, acetic, and formic fermentations, and his purely chemical decompositions, and shows that they are all variations or special cases of one and the same phenomenon, *viz.*, migrations and rearrangements of the hydrogen and hydroxyl ions of the labile carbohydrate molecule, with or without secondary oxidation.—J. F. B.

Nitrogenous constituents from malt extract, by porcelain filtration; Separation of ——. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, **1**, 306—311.

A SPECIAL form of porous porcelain filter is described (see figure). The apparatus consists of a porcelain filtering bulb, A, which is porous only in the lower half; this bulb is fitted to a bronze lid, B, which is screwed into the containing vessel, C. The liquid to be filtered is placed in the cylinder, H, and is forced by means of carbon dioxide under pressure into the bottom of the vessel, C, by way of the tube, D. Filtration through the lower half of the porcelain bulb then takes place under the pressure of the gas, the filtrate being withdrawn from inside the bulb by an aspirator tube. The pressure can be released by the



valves, K and L. This apparatus has been used for the removal of complex nitrogenous matters from a state of colloidal solution. The degree of fractionation obtained was measured by determination of the "amino-index" of the filtrate (see page 1110) as compared with that of the original liquid, the complexity of the compounds being inversely proportional to the "amino-index." It was found that the efficiency of the removal of the complex colloids depended to a very large extent on the clogging of the pores of the filter, and that a second filtration yielded better results than the first.—J. F. B.

ENGLISH PATENTS.

Drying apparatus for malt and the like. E. Ellermann, Berlin. Eng. Pat. 26,730, Dec. 22, 1905.

SEE U.S. Pat. 817,698 of 1906; this J., 1906, 491.—T. F. B.

Filters [for beer]. K. H. Loew, Lakewood, U.S.A. Eng. Pat. 9502, April 23, 1906.

SEE Fr. Pat. 365,562 of 1906; this J., 1906, 999.—T. F. B.

FRENCH PATENT.

Wine, beer, and similar beverages; Process for improving the quality of —— by centrifugal action. F. O. Nilsson and J. A. Jonson. Fr. Pat. 367,020, June 9, 1906. Under Int. Conv., June 16, 1905.

SEE Eng. Pat. 13,563 of 1906; this J., 1906, 1062.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 1064.)

(*A.*)—FOODS.

Formaldehyde; Presence of —— [in certain foods. G. Perrier. Compt. rend., 1906, 143, 600—603.

THE author has examined, for formaldehyde, ciders made from apples sterilised according to his proposals (this J., 1905, 537). Trillat's method gave negative results, but the more delicate method of Voisenet (this J., 1905, 1326) showed that most of the samples contained from 1/500,000th to 1/300,000th of formaldehyde. The proved occurrence of formaldehyde in the air, and in products of combustion, especially wood-smoke, led the author to examine a number of smoked foods—bacon, ham, sausages, herrings, &c.—in all of which he found quantities of formaldehyde, varying from 1/3,000,000th to 1/40,000th. Strict administration of the law prohibiting the presence of formaldehyde would preclude the use of these articles of food; and the author contends in favour of an alteration in the law, with prescription of allowance up to a maximum limit, instead of prohibition.—J. T. D.

ENGLISH PATENTS.

Proteids from ground-[earth-] nuts; Preparation of ——. W. M. Williams, Harlesden, Middlesex. Eng. Pat. 17,116, July 30, 1906.

THE earth-nuts (*Arachis hypogæa*), are decorticated, as much as possible of the oil is removed, and the residue reduced to a fine meal. This meal is then extracted with a 15 per cent. sodium chloride solution, using about 1 gall. for each 0·75 lb. of meal; the mixture is stirred frequently for one hour, and filtered through cloth of very fine texture. The proteids in the filtrate are then precipitated by saturating the solution with carbon dioxide under pressure, or by the addition of successive small quantities of dilute hydrochloric acid, with or without previous treatment with carbon dioxide, using the minimum of acid required for a distinct precipitation at each operation. The proteids obtained are washed with water saturated with carbon dioxide, and re-dissolved in ammonium carbonate solution. If desired, the paste may be dried in thin sheets or layers, or forced through small holes in a plate, and dried in the form of threads. The product may be mixed with other foods, such as flour, meat preparations, &c.—W. P. S.

Centrifugal separators for cream and other liquids. C. G. P. De Laval and E. E. F. Fagerström, Stockholm. Eng. Pat. 18,708, Aug. 21, 1906.

ANNULAR flanges are placed on the wall of the separator drum opposite to partition plates extending from the central feed-pipe nearly to the wall of the drum. The flanges project inwardly towards the edges of the plates, and cause any sediment in the liquid to be deposited in annular chambers formed below and above the flanges. Obstruction of the openings between the plates and the flanges is thus prevented.—W. P. S.

FRENCH PATENTS.

Milk and other liquids containing proteids; Process for the desiccation of ——. J. R. Hatmaker. Fr. Pat. 366,751, June 1, 1906.

MILK, or solutions of eggs, blood, and the like, are dried on rotating rollers heated to a high temperature; the liquid is not in contact with the roller for more than two seconds, and the dry film is removed by means of a scraper. If desired, the operation may be carried out under reduced pressure. The dry products obtained are also claimed.—W. P. S.

Butter; Process of making artificial ——. D. Müller, J. Gottlieb, and A. Meisels. Fr. Pat. 366,766, June 1, 1906.

SEE Eng. Pat. 12,916 of 1906; this J., 1906, 903.—T. F. B.

Flour, grain, rice, and other substances; Process and apparatus for the electrical purification of ——. J. L. Lawson. Fr. Pat. 367,596, July 2, 1906. Under Int. Conv., July 6, 1905.

SEE Eng. Pat. 13,909 of 1906; this J., 1906, 921.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Water, sewage effluent, and the like; Process for the purification of ——. P. Kestner, Lille, France. Eng. Pat. 20,750, Oct. 13, 1905.

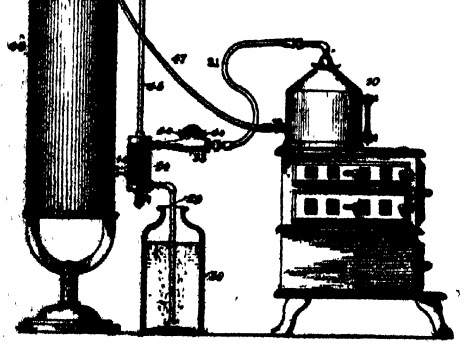
The water, with or without the addition of an antiseptic agent, is sprayed on to a centrifugal fan having a large number of blades placed close together, or preferably, into the open end of an atomising drum such as is described in Eng. Pat. 20,697 of 1905 (this J., 1906, 915). The fan, or drum, is rotated at a high speed, and a current of air is forced in so as to be mixed intimately with the atomised water.—W. P. S.

Water and other liquids; Apparatus for purifying [electrolytically] ——. G. W. J. Allen, Bristol. Eng. Pat. 9002, April 14, 1906.

The water is passed through a narrow earthenware channel, in which it is repeatedly electrolysed by means of electrodes placed in pairs across the channel. The electrodes consist of platinum wire gauze, and each pair is connected with a separate trembling coil. Between the electrodes, the bottom of the channel is slightly depressed so as to form a hollow in which some water will always remain to make electrical connection between the poles of each pair. To prevent the coils becoming over-heated through continuous working, an automatic contact-breaker is provided, consisting of a rotating shaft on which are placed a number of metallic arms corresponding with the number of coils in use. The rotation of the shaft causes the arms to dip consecutively into mercury troughs, and, the necessary conducting wires being provided, allows the current to pass through the separate coils. The arms are so arranged on the shaft that one coil is cut off while the other two are in connection with the battery, and so on. The shaft is rotated at a suitable speed by a small motor, or other device, and means are also provided for cutting out the contact-breaker, and connecting the coils directly with the battery. —W. P. S.

United States Patent.

[Water] Distilling apparatus. G. F. Wentz, St. Louis, Mo. U.S. Pat. 833,271, Oct. 16, 1906.



A still or generator, 10, heated in any suitable manner, has a vapour-pipe, 31, leading to the condensing coil, 24, which is provided with an injector, 38, to draw in air through the capped opening, 40. The air and vapour pass through the coil where the latter is condensed, and liquid and air pass to the receiver, 30, by the pipe, 29, which dips into the liquid, as shown, so that the escaping air is compelled to bubble through the condensed liquid. The condenser is connected to the water store tank, 43, by the pipes, 44 and 45, and the still is fed by the pipe, 47, with water from 43. The capped air inlet, 40, is so arranged that the supply of air can be regulated by screwing down the cap over a perforated nipple, and the air may be filtered, if desired, through porous material placed in the cap.—W. H. C.

French Patents.

Effluents; Apparatus for filtering and purifying works and other ——. G. Dünkelberg. Fr. Pat. 366,991, June 8, 1906. Under Int. Conv., June 6, 1906.

See Ger. Pat. 165,414 of 1904; this J., 1906, 492.—T. F. B.

Sewage and waste waters; Apparatus for the bacterial purification of ——. A. Gilson. Fr. Pat. 366,974, June 9, 1906.

The process and apparatus provide for the anaërobic and aërobic treatment of sewage and the like, the latter being conducted to the bottom of a vessel, which is closed to the air, and consists of several concentric chambers connected with each other alternately at the top and bottom. After passing through a further series of rectangular closed vessels, the sewage enters the aërobic part of the plant, which consists of a number of compartments filled with porous and other materials, and connected with each other by means of automatically acting siphons. Traps are provided to prevent the admission of air to the anaërobic parts of the plant, whilst air-supply pipes are fitted to the aërobic compartments.—W. P. S.

(*C.*)—DISINFECTANTS.

French Patent.

Phosphate; Organic limed ——. [*Fertiliser and Insecticide.*] Comp. Ind. des Mines et Carrières de Cièrp. Fr. Pat. 367,006, June 10, 1906. XV., page 1108.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 1064.)

Bamboo and Pousolsia [for papermaking]. Kaindler. Monit. Pap. Franç.; through Paper Making, 1906, **25**, 522—523.

The possibilities of bamboo as a paper-making material are well known; it closely resembles straw in character, with a slight advantage from the point of view of quality. Its use for paper-making is limited, first, by the fact that it has a considerable value for other purposes, and, secondly, because in order to get good results the plants must be converted into pulp whilst still in the green state. Pousolsia (*Memorialis pentandra*) is a member of the nettle family which grows in India, but has not yet been cultivated for exportation. The isolated bast fibre is extremely long and wide; it easily attains a length of 750 mm. It possesses the peculiarity of splitting up longitudinally into fine fibrillæ, with a minimum amount of mechanical treatment. This property would be extremely valuable for the preparation of strong white papers of even texture and smooth surface. The fibres in present use, *viz.*, flax and hemp, which are capable of giving these fibrillæ, require such prolonged beating to produce this effect that the paper acquires a greyish appearance. The cleaned bast of Pousolsia requires only a very slight chemical treatment with caustic soda and "bleach" to convert it into a pure white pulp of the best quality; it is stated that several crops a year could be obtained without special care in the cultivation.—J. F. B.

Paper industry of Russia. Bd. of Trade J., Nov. 1, 1906. [T.R.]

The demand for paper in Russia is still very small; it is mostly satisfied by Russian paper mills, of which there are 98, the production being 1,300,000 metric quintals (1 met. quintal = 100 kilos.). Finland is the chief "foreign" purveyor of paper, turning out 516,000 quin-

tals. Finland supplies mostly common sorts and newspaper paper, which is cheaper than Russian, in spite of Customs duties and other expenses on delivery into Russia. This is due to the abundant and inexpensive motive power and vast resources of material, necessary in the manufacture of paper, of which Finland disposes. Of Russian firms, only one successfully competes with Finland in the commoner sorts of paper, due to this mill having free water power at its disposal. Russia is becoming more dependent on her own resources for supplies of certain kinds of paper and of material for its manufacture. Imports of rags from Germany have declined, and exports of them from Russia to Germany have increased. Decreases are also shown in the imports of paper pulp, cellulose, and wall papers.

ENGLISH PATENT.

Waste sand from glass-works, commonly known as burgy; Treatment and utilisation of —— [*as filling material for linoleum, leather, paper, &c.*]. W. Thompson. Eng. Pat. 26,893, Dec. 23, 1905. VIII., page 1096.

UNITED STATES PATENTS.

Degumming fibrous plants; Process for ——. C. Colahan, Chicago. U.S. Pat. 833,507, Oct. 16, 1906.

FIBROUS plants are degummed by heating with the waste products of petroleum or other mineral oil refineries, steam being injected during the process; the fibres, thus thoroughly freed from mucinous substances, are dried in the open, and subjected to a "braking" action to remove the "hurds."—T. F. B.

Wood pulp; Manufacture of chemical or sulphite ——. R. Roe, jun., Niagara, Wis. U.S. Pat. 833,750, Oct. 23, 1906.

UNSEASONED or wet wood is cut up into chips, which are then dried artificially, subsequently being digested with an acid liquor under steam pressure.—J. F. B.

Sulphite liquor; Treating waste ——, *and* [*adhesive*] *compound obtained* [*therefrom*]. J. S. Robeson, Camden, N.J. U.S. Pat. 833,634, Oct. 16, 1906.

WASTE sulphite liquor from the digestion of spruce wood is neutralised by milk of lime, and concentrated *in vacuo* to a density of about 30° B. to form an adhesive product, soluble in water, clear or translucent, and in strong solution not precipitating glue solution.—E. S.

[*Wood pulp*] *Sulphite process; Recovery of valuable gases in the* ——. E. Morterud, Christiania, Norway. U.S. Pat. 833,936, Oct. 23, 1906.

IN the manufacture of sulphite wood pulp, the liquid and gaseous contents of the digester are discharged, after boiling, into a closed chamber in which a low pressure (about or below atmospheric pressure) is maintained. The gases and steam collected in this chamber are passed through a closed apparatus where they come in contact with water of such a temperature that the vapours are condensed without an appreciable absorption of the gases. The heated liquid is then cooled, and used again for condensing the vapours of a subsequent charge. The uncondensed gases are passed on to a chamber in which they are absorbed and utilised for the production of fresh digesting liquor.—J. F. B.

Resin soap; Process for emulsifying —— *in water*. M. Erfurt, Straupitz, Germany. Re-issue No. 12,549, dated Oct. 23, 1906, of U.S. Pat. 781,506, Jan. 31, 1905.

SEE Addition of Aug. 29, 1903, to Fr. Pat. 325,901 of 1902; this J., 1904, 202.—T. F. B.

FRENCH PATENTS.

Paper marbled on one side; Preparation of —— *in the paper machine by carrying the colour on the continuous web of paper by means of cloths, felts, &c.* K. Franz. Fr. Pat. 361,725, Aug. 26, 1905.

SEE Eng. Pat. 3799 of 1905; this J., 1906, 1251.—T. F. B.

Waterproofing of fibres, fabrics, paper, &c. E. Moulders and G. Scarlet. Fr. Pat. 360,951, March 17, 1906. V., page 1092.

Artificial silk and collodion products; Manufacture of ——. Fabr. de Soie Artificielle de Tubize. Fr. Pat. 361,690, Aug. 11, 1905. V., page 1091.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 1067.)

Calumba [*Columba*] *root; Alkaloids of* ——. J. Gadamer. Chem.-Zeit., 1906, **30**, 924.

BESIDES amorphous alkaloids, calumba root contains considerable quantities of two crystallisable alkaloids, and a small amount of a third. After extracting the root with alcohol, treating the extract with water, and separating gummy and resinous matters, the alkaloids are precipitated with potassium iodide, and the iodides separated by a laborious fractional solution, and crystallisation from alcohol. The most soluble, for which the name *jateorrhizine* is proposed, has been investigated by Feist, and has the formula $C_{20}H_{20}NO_5.OH$; the second is Günzel's *columbamine*, $C_{21}H_{22}NO_5.OH$; and the least soluble is called by the author *palmatine*—its formula is probably $C_{22}H_{24}NO_5.OH$, but it has as yet been obtained in such small quantity that this is not certainly established. —J. T. D.

Hordenine. G. O. Gaebel. Arch. Pharm., 1906, **244**, 435—441.

WHEN hordenine, the base isolated from malt culms by Léger, to which the empirical formula $C_{10}H_{15}NO$ has been given, is methylated, and oxidised with alkaline permanganate, it yields anisic acid. Since the base is optically inactive, and when methylated and subsequently decomposed, yields trimethylamine, it must have the constitution. (1)HO.C_6H_4.CH_2.$CH_2N(CH_3)_2$(4).—J. O. B.

Peppermint oil; Russian ——. J. Schindelmeiser. Apoth-Zeit., 1906, **21**, 927—928.

THE oil, distilled from plants cultivated in the Province of Tambow, had the sp. gr. 0·908 at 19° C.; α_D = —19°45'; b.pt. 200°—255° C.; solubility in 70 per cent. alcohol 1:4, in 95 per cent. alcohol, 2:1. It solidified on long exposure in a mixture of ice and salt. It contained 16·36 per cent. of menthone, 51·22 per cent. of free menthol, and 4·8 per cent. of menthyl esters, calculated as acetic ester; but valeric acid was present as well as acetic acid in these esters. Pinene, *l*- and *d*-limonene, cineol, and a sesquiterpene were also present. No phellandrene, which occurs in American peppermint oil, and no menthene, as recorded by Andrejeff and Andres as occurring in Russian oil, were found.—J. O. B.

Myrrh; Essential oil of ——. K. Gorter. Arch. Pharm., 1906, **244**, 412—435.

CUMINALDEHYDE was isolated, to the extent of 1 per cent., from three of the four specimens of oil examined. Eugenol and a small trace of *m*-cresol was present in all four oils. Old myrrh oil has an acid reaction, due to the presence of free acetic and palmitic acids. In the freshly distilled oils these acids exist as esters. A resin was isolated from old oils by shaking out with light petroleum spirit. On reducing this with sodium and amyl alcohol, a hydrocarbon was obtained, which gave a crystalline hydrochloride, probably cadinene dihydrochloride. On fractionating over sodium, several terpenes were obtained; pinene, dipentene, and limonene were identified, and a fourth body with the same formula, belonging to the limonene group, was isolated. This had the optical rotation α_D = + 80°, and afforded a crystalline tetrabromide and hydrochloride. It is not certain whether the dipentene originally occurs as such, or is formed from the limonene, and whether, as is probable, the new terpene may be an intermediate product between limonene and

dipentene. Two sesquiterpenes, one with the sp. gr. 0·926, b.pt. 163° under 12 mm., the other with the sp. gr. 0·911, b. pt. 151° under 15 mm., were isolated, and could not be definitely identified with the known sesquiterpenes. The sesquiterpene which forms a well-crystallised hydrochloride is closely related to, or identical with cadinene. —J. O. B.

Carbon diselenide. A. von Bartal. Chem.-Zeit., 1906, **30**, 1044—1045.

SUPERHEATED steam is passed through a tube containing phosphorus pentaselenide at a low red heat, and the liberated hydrogen selenide is conveyed into a flask charged with a nearly saturated solution of cadmium sulphate at 70°—80° C., a deposit of reddish-brown flakes of cadmium selenide being produced. The precipitate is filtered, washed with water until the washings cease to give a turbidity with barium chloride, and then dried for several hours at 130°—140° C. This product is mixed with asbestos, and placed in a bulb tube connected with a flask containing about 150 c.c. of carbon tetrachloride and with a Liebig condenser, the receiver of which is cooled with ice-water. The tetrachloride flask is warmed on the water-bath, and the liberated vapour is passed through the bulb heated to low redness, this operation being repeated twelve times with the liquid collected in the receiver. The final distillate is fractionated on the water-bath; the bulk passes over at 79°—80° C., and consists mainly of carbon tetrachloride. The fraction, 80°—90° C. (a red, somewhat fuming distillate), after being diluted with water and boiled under a reflux condenser to decompose selenium chloride, is filtered and redistilled, furnishing at 78°—90° C., a greenish-brown liquid, smelling like carbon bisulphide. Treated with a concentrated solution of caustic potash in absolute alcohol, added drop by drop, this liquid deposits dark, orange-yellow needles of potassium selenoxanthate, thus demonstrating the possibility of producing carbon diselenide by the above process. The operation is, however, difficult, and the product is extremely unstable. Carbon oxyselenide, or an analogous product, can be prepared by passing phosgene over cadmium selenide at red heat, and cooling the gaseous product with ice water and a mixture of solid carbon dioxide and alcohol in succession. The gas burns with the characteristic blue flame, and gives an abundant deposit of selenium.—C. S.

Citral in lemon oils and extracts; Method for the determination of ——. E. McK. Chace. J. Amer. Chem. Soc., 1906, **28**, 1472—1476.

THE author has applied the magenta-sulphurous acid reaction of aldehydes (see this J., 1897, 265) to the colorimetric determination of citral in lemon oils and extracts. The reagents used are:—(1) 0·5 grm. of magenta dissolved in 100 c.c. of water, and a solution containing 16 grms. of sulphur dioxide added. After standing until decolorised, the whole is made up to 1 litre. (2) 1 grm. of pure citral dissolved in and made up to 1 litre with 50 per cent. (by vol.) alcohol, free from aldehydes. The solution of the lemon oil or extract in alcohol is treated with a definite quantity of the magenta solution, and compared with standards prepared in an exactly similar manner with known quantities of citral. It is important that the comparison of colours be made at a temperature not above 15° C. The method gives very good results with lemon extracts, whilst, in the case of lemon oils, the maximum error is usually less than 0·5 per cent.—A. S.

Pinene and firpene; Chlor-hydrochlorides of ——. G. B. Frankforter and F. C. Frary. XIII*B*., page 1107.

Pitch and terpenes of the Norway pine and Douglas fir. G. B. Frankforter. XIII*B*., page 1107.

Origanum oil; Manufacture of ——. Bd. of Trade J., Nov. 1, 1906. [T.R.]

ACCORDING to the annual report for 1905–6 on Cyprus, the manufacture of origanum oil in the island, undertaken by the Agricultural Department, has during the last year assumed more important proportions, and a sample of the product was submitted to Professor Dunstan, F.R.S., of the Imperial Institute. The preliminary report showed that the oil was of good quality, and would sell readily to soap manufacturers, makers of perfumery, and dealers in essential oils, and actual sales were effected at remunerative prices. The Agricultural Department has been carrying on the distillation of this oil for some four years, and has proved that the product is easily made, and can be profitably disposed of in a ready market. The origanum plant, from which it is made, grows freely in the forests. Permission to utilise the plant can be obtained from the Department, which is ready to withdraw from the business, and to give advice and assistance to any approved person who may desire to engage in the industry.

UNITED STATES PATENT.

Camphene; Production of ——. E. Berge, Assignor to Badische Anilin und Soda Fabrik. Ludwigshafen on Rhine, Germany. U.S. Pat. 833,606, Oct. 16, 1906.

SEE Eng. Pat. 16,429 of 1906; this J., 1906, 909.—T. F. B.

FRENCH PATENTS.

Glycidic esters and aldehydes; Process for synthesising ——. G. Darzens. Fr. Pat. 361,698, Aug. 16, 1905.

A VARIETY of alkaline condensing agents can be used for condensing ketones with monohalogenated acetic esters, to form glycidic esters (see Fr. Pat. 337,175 of 1903; this J., 1904, 455); for example, a sodium alcoholate, sodium amide, sodium cyanamide, or dicyanodiamide. The glycidic esters may be saponified by either aqueous or alcoholic solutions of alkali hydroxides. The alkali salts may, in certain cases, be decomposed at once by distillation, *in vacuo*, or the free acids may be converted into the corresponding aldehydes by heating or by any other suitable means. A list is given of eighteen new β-glycidic esters and fourteen aldehydes obtained by the above process, all applicable to perfumery.—T. F. B.

Δ_4-Cyclogeranic acid; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Aug. 17, 1905, to Fr. Pat. 361,637, July 19, 1905.

THIS addition is for the purpose of including in the process (see U.S. Pat. 805,924 of 1905; this J., 1906, 39) the preparation of derivatives of Δ_4-cyclogeranic acids from isophoronecarboxylic acid.—T. F. B.

Hydroxy-derivatives of the benzene series; Process for preparing ——. Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet et Cartier. Fr. Pat. 361,732, Aug. 31, 1905.

SEE Ger. Pat. 167,211 of 1904; this J., 1906, 608.—T. F. B.

Aminobenzoic acid alkamine esters [amino-alcohols] and their derivatives; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 361,734, Aug. 31, 1905.

SEE Eng. Pat. 17,162 of 1905; this J., 1906, 607.—T. F. B.

Formates; Process of making ——. Nitritfabrik G.m.b.H. Fr. Pat. 367,088, April 13, 1906. Under Int. Conv., April 15, 1905.

SEE Eng. Pat. 9008 of 1906; this J., 1906, 909.—T. F. B.

Isoborneol esters; Direct process for preparing —— from pinene hydrochloride or hydrobromide. Chem. Fabr. von. Heyden A.-G. First Addition, dated June 5, 1906, to Fr. Pat. 365,814, May 1, 1906. (See Eng. Pat. 10,999 of 1906; this J., 1906, 714.)

FATTY acid esters of isoborneol may be obtained direct from pinene hydrochloride or hydrobromide by heating with a fatty acid and an oxide or carbonate of a heavy metal, or with fatty acid salts, oxide, or carbonate of magnesium, or of metalloids which form salts with acids (*e.g.*, vanadium, arsenic, antimony, or titanium); the zinc salts of organic acids, or inorganic acids not possessing oxidising properties may also be used, as also may the

halides of heavy metals, earths, or magnesium. 172 parts of pinene hydrochloride are boiled with 500 parts of 98 per cent. formic acid, 200 parts of antimony oxide, and 30 parts of ferric chloride, for 20 hours under a reflux condenser; the product is poured into water, washed, and distilled *in vacuo*. A good yield of isobornyl formate is said to be obtained. Thirteen other examples are given. —T. F. B.

Vanilla; Process and apparatus for preparing ——. L. de Montesquoiu. Fr. Pat. 367,285, June 9, 1906.

Vanilla beans collected in cool countries (*e.g.*, Guadeloupe) are usually dried rapidly, by artificial heat, but it is stated that by this method a portion of the vanillin is decomposed; to prevent this, it is proposed to place the beans, in single layers, between sheets of fabric, and to keep them for six to ten days at a uniform temperature of 60° C. This process is stated to produce beans as rich in vanillin as those prepared by natural heat in tropical countries, *e.g.*, Mexico.—T. F. B.

[*Alkyloxyacetyl*] *Esters of alcohols of the terpane or camphane group; Process for preparing new* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 367,057, June 11, 1906. Under Int. Conv., Jan. 18, 1906.

An alkylhydroxyacetic acid or one of its derivatives (*e.g.*, chloride) is esterified by means of santalol, menthol, borneol, or other terpane or camphane alcohol, in presence of a suitable solvent. Thus, 122·5 parts of ethoxyacetyl chloride are added to a solution of 154 parts of borneol in 500 parts of benzene and 79 parts of pyridine; the product is washed first with dilute acid, and then with water, dried, and fractionated; ethoxyacetyl-borneol as thus obtained has a b.pt. of 175°—178° C. (20 mm. pressure).—T. F. B.

Hydrogen peroxide; Manufacture of ——. R. Wolffenstein. Fr. Pat. 367,199, June 16, 1906. Under Int. Conv., June 17, 1905.

Barium peroxide (or its "hydroxide") instead of being decomposed by water saturated with carbon dioxide (in which case the peroxide is liable to become coated by a layer of carbonate which arrests the reaction) is treated with water, and only so much carbon dioxide as may leave the solution alkaline, under which conditions it is stated that barium percarbonate (and perhaps a soluble "bipercarbonate") is formed, which is subsequently decomposed into barium carbonate and hydrogen peroxide on further treatment with carbon dioxide. Directions are given for dealing with solutions of varying strength.—E. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 1067.)

Photographic plates; Cause of the fogging of —— in tropical climates. J. McDowall. Chem. News, 1906, 94, 209.

Photographic plates which had been kept in wooden dark slides in Egypt, when the temperature was about 40° C., were found to fog badly on development; this was traced to vapours exhaled from the wood at the high temperatures, which reduced the silver halide. It can be prevented by interposing a piece of tissue paper between the plate and the shutter of the dark slide. —T. F. B.

English Patent.

Printing papers for use in photography; Self-toning silver chloride ——. O. H. Steudel, Dresden, Germany. Eng. Pat. 10,051, April 30, 1906.

"Self-toning" papers, as known at present, can only be toned to a purplish tint by the use of a special toning bath, in addition to the sodium chloride baths. The present invention relates to papers on which cold tones can be produced simply by the use of sodium chloride solution; this result is achieved by the addition of a lead salt (*e.g.*, the nitrate or acetate) to the emulsion, suitable proportions being 10 to 16 parts of lead nitrate and 2 to 5 parts of gold chloride to every 100 parts of silver in the emulsion. These papers are also stated to be more permanent as regards storage before use.—T. F. B.

French Patent.

Photographic paper which darkens directly; Preparation of a ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 361,720, Aug. 24, 1905.

Photographic "printing out" papers are obtained by incorporating a reducing agent with a silver salt emulsion; the reducing agent may be either a hydroxy-derivative of benzene, or an inorganic salt, such as a nitrite, arsenite, or manganous salt. Further details are given in the paper by Lumière (this J., 1906, 90).—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 1068.)

Nitrocellulose; Causes of decomposition of, and methods for determining the degree of instability of——. M. Jacqué. Z. ges. Schiess- u. Sprengstoffwesen, 1906, 1, 395—8.

The author reviews the various tests proposed for determining the stability of nitrocellulose (this J., 1905, 148, 347; 1904, 953; 1903, 511, 924, 1208; 1902, 819—825, 1470—1, 1554; 1901, 8—13, 609—617; 1899, 174, 857—8; 1898, 1180; 1897, 283—290). The method proposed by the author is a modification of the test introduced by Sy. This consists in heating the sample of nitrocellulose (4 grms.) at a temperature of 115° C., for several days, for a period of eight hours per day, and determining the daily loss in weight. The latter, taken in conjunction with the time of heating, is an index of the stability of the compound. For purposes of factory control this test has the disadvantage of being rather prolonged, and the author has modified it as follows:—The sample to be tested is heated at 130°—140° C., and weighed after successive periods of heating of two hours duration. Nitrocellulose when dried to constant weight at 50°—60° C. still retains a certain percentage of moisture which is only driven off at temperatures above 100° C., or by prolonged exposure, *in vacuo*, over sulphuric acid. It is important that this last trace of moisture should be got rid of before beginning the test proper. From 2—3 grms. of nitrocellulose are placed in a glass dish provided with a light, well-fitting cover to prevent absorption of moisture during weighing. The sample is heated to constant weight at 50°—60° C. and afterwards for 10 minutes at 130° C. to drive off the last traces of moisture, and then weighed. It is kept for two hours at a temperature of 130°—140° C., cooled in a vacuum dessicator over sulphuric acid, and the loss in weight rapidly determined on a Curie balance. This process is then repeated some fifteen times further. The results are calculated on the basis of the *loss in mgrms per grm. of nitrocellulose* taken, and these are the figures which appear in the subjoined tables. In general, the samples are heated with free access of air. Should it be desired, however, to study the decomposition in the presence of the products of decomposition, the glass weighing vessel can be enclosed in another, provided with a cover fitting air-tight by means of a rubber ring and spring. In the author's experience it is only when the nitrocellulose is unstable, that the presence of the products of decomposition accelerates the rate of decomposition. Standard stable samples of nitrocellulose are prepared by careful purification in the laboratory, and the factory output is checked against these as a standard of comparison. The following tables show the effect of the various steps in the manufacture and purification and at the same time the corresponding results obtained by other tests are also given. For a description of Obermüller's manometer test see this J., 1905, 347. The fume test at 135° C. is carried out as follows:—Nitrocellulose (2·5 grms.) dried at 70° C., is filled into a tube 32 cm. long and 16 mm. diameter, to a height of 4 cm. The tube is corked and placed in a bath heated to 135° C., to a depth of 10 cm. At the expiration of ten minutes the moisture condensed in the upper part of the tube is removed with a piece of filter paper, and the tube recorked. A standard for estimating the depth of tint of the evolved oxides of nitrogen is obtained by filling one of the tubes with a

solution of 8 mgrms. of potassium bichromate and 0·4 grm. of cobalt sulphate dissolved in 1 litre of water.

Collodion cotton (11·8 *per cent.*—11·9 *per cent. N.*) *for blasting gelatin.*

Purification.—Boiled twice, before pulping, for 12 hours in slightly acid water. Washed six times for three hours. The boilings and washings are followed by rinsing with cold water.

Temperature of test 140° *C.*

Weighings after 2 hrs. heating.	Loss in mgrms. per grm. of nitrocellulose.			
	Standard collodion cotton.	After pulping.	Fine pulping and three washings.	Four washings. Final stabilising.
1	4	7	5	5
2	4	5	4½	4
3	4½	6½	5	5
4	5	7	6	5
5	5	7	6	5½
6	5½	9	7½	6
7	6	10	7	6½
8	6	10	7	6½
9	6	12	8	7
10	7	12	9	8
11	7½	12	9	8
12	7	12	10	8
13	9	12	10	10
14	10	12	11	9
15	10	12	10	11
16	11	12	12	13
17	13	12	12	13
	—	—	—	—
Manometer test (Obermüller) (mm. of Hg.)	5	6½	6	6
	6	8	7	5½
	6	9½	8	6½
	7	10	8	7½
	9	11	9	9
Abel test, 80° C...	33 min.	10 min	17 min.	21 min.
Vieille test, 110° C.	23 hrs.	8 hrs.	12 hrs.	19 hrs.
Light brown fumes, 135° C. ..	45 min.	18 min.	29 min.	45 min.

Nitrocellulose (12·35 *per cent. N.*) *for military powder.*

Purification.—Boiled, before pulping, three times for 12 hours, in slightly acid water. Then six times for three hours. Each washing with hot water is followed by washing with cold water.

Temperature 140° *C.*

Weighings after 2 hrs. heating.	Loss in mgrms. per grm. of nitrocellulose.				
	Standard nitrocellulose.	Pulping and one washing.	Fine pulping and three washings.	Four extra washings.	Addition of $HgCl_2$ ($\frac{1}{10000}$)
1	5	10	8	7	9
2	4	9	7	6	7
3	4	8	7	6	6
4	6	10	8	7	8
5	5	12	9	7	7
6	7	14	8	8	9
7	7	17	10	8	8
8	7	17	12	9	9
9	9	17	12	9	10
10	9	17	12	9	10
11	11	17	12	11	11
12	10	17	12	11	11
13	11	17	12	12	13
14	13	17	12	15	14
	6	12	8	7	9
	6	18	9	7	8½
	8	26	10½	9	8½
Manometer test (Obermüller) at 140° C. (mm. of Hg.)	9	29	11½	10	11
	11	34	13	12	11
	11	—	—	12	13
	12	—	—	13½	13
	13	—	—	15	14
Abel test, 80° C.	31 min.	4 min.	8 min.	16 min.	over 1 hr.
Vieille test, 110° C.....	22 hrs.	7 hrs	11 hrs.	17 hrs.	15½ hrs.
Light brown fumes, 135° C.	48 min.	19 min.	26 min.	39 min.	33 min.

***Explosives; Velocity of detonation of* ——.** M. Dautriche, Compt. rend., 1906, 142, 641—4.

THE method depends upon the use of detonating filaments. The velocity of detonation of such filaments, has been determined by placing the explosive in a tube some 50m. long, and determining the velocity by means of a Schultz chronograph owing to the breaking of the conducting wires at either end of the tube. The filaments used in the experiments had a determined regular velocity of 6500 m. per second. Such a filament can be utilised to register very accurately small intervals of time, since 1 mm. in length corresponds to $\frac{1}{6500000}$ part of a second. The experiment is carried out as follows:—Two lengths of filament of 2·2 m. are taken, and an end of each piece inserted in the opposite ends of a tube primed with fulminate. The free ends of the filaments are then overlapped for a length of 400 mm., and bound together. There is formed thus a circuit along which, after the primer of fulminate is exploded, the detonating waves in each filament meet in an opposite direction at a point midway along the overlap; *i.e.*, 2 m. from the end at which the explosion originates. If the filaments so arranged are detonated in contact with a sheet of lead of 25 mm. thickness, there is produced a depression in the lead corresponding to the position of the filaments, and at the point where the detonations have met, a very characteristic mark, lying at an angle of 45° to the direction of the filaments. If the point in the filaments where the detonations should meet, be placed on a line drawn on the sheet of lead, any displacement of the detonating mark from this index line can be measured. By lengthening one of the filaments by 100 mm., 200 mm., and 300 mm., measurements of displacement of 50 mm., 100 mm., and 145 mm., have been obtained. In order to determine the velocity of detonation of any explosive, one of the filaments is cut, and a tube of zinc, 20 mm. diameter and 50 cm. long, filled with the explosive, is interposed. The lengths of the filaments in the two branches of the circuit still remain equal, but a retardation of the velocity of the detonation results owing to the interposed explosive, with a consequent measurable displacement of the detonating mark described above. To compensate for the delay of transmission from filament to explosive, and again from explosive to filament, the other branch of the circuit can be furnished with a similar

halides of heavy metals, earths, or magnesium. 172 parts of pinene hydrochloride are boiled with 500 parts of 98 per cent. formic acid, 200 parts of antimony oxide, and 30 parts of ferric chloride, for 20 hours under a reflux condenser; the product is poured into water, washed, and distilled *in vacuo*. A good yield of isobornyl formate is said to be obtained. Thirteen other examples are given. —T. F. B.

Vanilla; Process and apparatus for preparing ——. L. de Montesquoiu. Fr. Pat. 367,285, June 9, 1906.

Vanilla beans collected in cool countries (*e.g.*, Guadeloupe) are usually dried rapidly, by artificial heat, but it is stated that by this method a portion of the vanillin is decomposed; to prevent this, it is proposed to place the beans, in single layers, between sheets of fabric, and to keep them for six to ten days at a uniform temperature of 60° C. This process is stated to produce beans as rich in vanillin as those prepared by natural heat in tropical countries, *e.g.*, Mexico.—T. F. B.

[*Alkyloxyacetyl*] *Esters of alcohols of the terpane or camphane group; Process for preparing new* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 367,057, June 11, 1906. Under Int. Conv., Jan. 18, 1906.

An alkylhydroxyacetic acid or one of its derivatives (*e.g.*, chloride) is esterified by means of santalol, menthol, borneol, or other terpane or camphane alcohol, in presence of a suitable solvent. Thus, 122·5 parts of ethoxyacetyl chloride are added to a solution of 154 parts of borneol in 500 parts of benzene and 79 parts of pyridine; the product is washed first with dilute acid, and then with water, dried, and fractionated; ethoxyacetyl-borneol as thus obtained has a b.pt. of 175°—178° C. (20 mm. pressure).—T. F. B.

Hydrogen peroxide; Manufacture of ——. R. Wolffenstein. Fr. Pat. 367,199, June 16, 1906. Under Int. Conv., June 17, 1905.

Barium peroxide (or its "hydroxide") instead of being decomposed by water saturated with carbon dioxide (in which case the peroxide is liable to become coated by a layer of carbonate which arrests the reaction) is treated with water, and only so much carbon dioxide as may leave the solution alkaline, under which conditions it is stated that barium percarbonate (and perhaps a soluble "bipercarbonate") is formed, which is subsequently decomposed into barium carbonate and hydrogen peroxide on further treatment with carbon dioxide. Directions are given for dealing with solutions of varying strength.—E. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 1067.)

Photographic plates; Cause of the fogging of —— in tropical climates. J. McDowall. Chem. News, 1906, 94, 209.

Photographic plates which had been kept in wooden dark slides in Egypt, when the temperature was about 40° C., were found to fog badly on development; this was traced to vapours exhaled from the wood at the high temperatures, which reduced the silver halide. It can be prevented by interposing a piece of tissue paper between the plate and the shutter of the dark slide. —T. F. B.

English Patent.

Printing papers for use in photography; Self-toning silver chloride ——. O. H. Steudel, Dresden, Germany. Eng. Pat. 10,051, April 30, 1906.

"Self-toning" papers, as known at present, can only be toned to a purplish tint by the use of a special toning bath, in addition to the sodium chloride baths. The present invention relates to papers on which cold tones can be produced simply by the use of sodium chloride solution; this result is achieved by the addition of a lead salt (*e.g.*, the nitrate or acetate) to the emulsion, suitable proportions being 10 to 16 parts of lead nitrate and 2 to 5 parts of gold chloride to every 100 parts of silver in the emulsion. These papers are also stated to be more permanent as regards storage before use.—T. F. B.

French Patent.

Photographic paper which darkens directly; Preparation of a ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 361,720, Aug. 24, 1905.

Photographic "printing out" papers are obtained by incorporating a reducing agent with a silver salt emulsion; the reducing agent may be either a hydroxy-derivative of benzene, or an inorganic salt, such as a nitrite, arsenite, or manganous salt. Further details are given in the paper by Lumière (this J., 1906, 90).—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 1068.)

Nitrocellulose; Causes of decomposition of, and methods for determining the degree of instability of——. M. Jacqué. Z. ges. Schiess- u. Sprengstoffwesen, 1906, 1, 395—8.

The author reviews the various tests proposed for determining the stability of nitrocellulose (this J., 1905, 148, 347; 1904, 953; 1903, 511, 924, 1208; 1902, 819—825, 1470—1, 1554; 1901, 8—13, 609—617; 1899, 174, 857—8; 1898, 1180; 1897, 283—290). The method proposed by the author is a modification of the test introduced by Sy. This consists in heating the sample of nitrocellulose (4 grms.) at a temperature of 115° C., for several days, for a period of eight hours per day, and determining the daily loss in weight. The latter, taken in conjunction with the time of heating, is an index of the stability of the compound. For purposes of factory control this test has the disadvantage of being rather prolonged, and the author has modified it as follows:—The sample to be tested is heated at 130°—140° C., and weighed after successive periods of heating of two hours duration. Nitrocellulose when dried to constant weight at 50°—60° C. still retains a certain percentage of moisture which is only driven off at temperatures above 100° C., or by prolonged exposure, *in vacuo*, over sulphuric acid. It is important that this last trace of moisture should be got rid of before beginning the test proper. From 2—3 grms. of nitrocellulose are placed in a glass dish provided with a light, well-fitting cover to prevent absorption of moisture during weighing. The sample is heated to constant weight at 50°—60° C. and afterwards for 10 minutes at 130° C. to drive off the last traces of moisture, and then weighed. It is kept for two hours at a temperature of 130°—140° C., cooled in a vacuum dessicator over sulphuric acid, and the loss in weight rapidly determined on a Curie balance. This process is then repeated some fifteen times further. The results are calculated on the basis of the *loss in mgrms per grm. of nitrocellulose* taken, and these are the figures which appear in the subjoined tables. In general, the samples are heated with free access of air. Should it be desired, however, to study the decomposition in the presence of the products of decomposition, the glass weighing vessel can be enclosed in another, provided with a cover fitting air-tight by means of a rubber ring and spring. In the author's experience it is only when the nitrocellulose is unstable, that the presence of the products of decomposition accelerates the rate of decomposition. Standard stable samples of nitrocellulose are prepared by careful purification in the laboratory, and the factory output is checked against these as a standard of comparison. The following tables show the effect of the various steps in the manufacture and purification and at the same time the corresponding results obtained by other tests are also given. For a description of Obermüller's manometer test see this J., 1905, 347. The fume test at 135° C. is carried out as follows:—Nitrocellulose (2·5 grms.) dried at 70° C., is filled into a tube 32 cm. long and 16 mm. diameter, to a height of 4 cm. The tube is corked and placed in a bath heated to 135° C., to a depth of 10 cm. At the expiration of ten minutes the moisture condensed in the upper part of the tube is removed with a piece of filter paper, and the tube recorked. A standard for estimating the depth of tint of the evolved oxides of nitrogen is obtained by filling one of the tubes with a

shaft, and are provided with hollow teeth extending downwards into the bowl, these teeth being disposed at varying distances from the shaft, so that the paths of travel of the teeth upon adjacent rake-heads do not coincide. The teeth on the outer ends of the rake-heads are deflected outwards, and those nearest the driving shaft are deflected inwards, whilst the intermediate teeth are vertical. Means are provided for supplying fluid to the shaft and rakes, for rotating the shaft, and for imparting a longitudinal movement to the same during the rotation.

—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

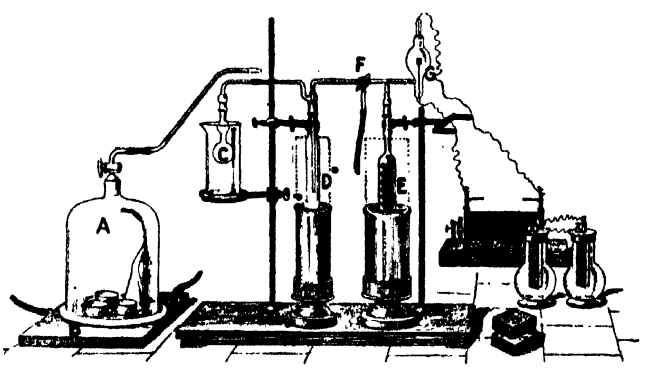
(*Continued from page* 1070.)

APPARATUS, &c.

Gases; Analysis of nearly pure ——. A. Stock and C. Nielsen. Ber., 1906, **39**, 3389—3393.

A SMALL, accurately-graduated burette is fused on to an ordinary Hempel absorption pipette, and the residual gas, after absorption of the main constituent, is returned to this for measurement. In analysing, for example, nearly pure oxygen, a number of determinations are first performed, so as to "wash out" by the oxygen any nitrogen dissolved in the absorbing reagent, of which the free surface is covered with liquid paraffin to reduce the absorption of nitrogen from the atmosphere to a minimum. The amount of nitrogen thus taken up by the oxygen diminishes in successive tests; finally, a small constant amount is always yielded by the reagent, but this error is too small to be of any consequence. The actual analysis of the oxygen to be tested is then carried out, and the amount of residual nitrogen measured as before. By means of the small burette, quantities such as 0·2 per cent. can be readily measured. The authors point out that water, which has been boiled to expel air, very rapidly absorbs this again: 1360 c.c. of water absorbed 5·8 c.c. of gas in less than two minutes.—E. F. A.

Distillation and desiccation in vacuo at low temperatures. D'Arsonval and Bordas. Compt. rend., 1906, **143**, 567—570.



THE apparatus consists of a condensing-tube, D, communicating on the one hand with the flask, C, or the bell-jar, A, containing the substance to be distilled or dried, and on the other with the tube, E, containing charcoal, and with the Crookes tube, G. On passing sparks through the latter, the nature of the discharge observed therein indicates the state of vacuum in the apparatus. The 3-way cock, F, allows of connection to a water-aspirator, or of communication between or separation of D and E. All the joints are ground and greased, and the tube connecting D and E reaches about three-quarters of the way to the bottom of D. To work the apparatus, the vacuum-vessel, filled with liquid air, or carbon dioxide dissolved in acetone, is gradually brought up over D, and the water-pump set in action. When the effect of this has reached its limit, it is shut off, the second vacuum vessel is brought up over E, communication between D and E established, and the apparatus left till the distillation or desiccation is complete, after which air is admitted. The height of the vacuum vessel round D must be regulated so as to avoid the condensation of solid matters on the end of the tube in D, and consequent blocking of this tube. Should the tube become blocked, the distillation must be interrupted, the apparatus taken apart, the tube, D, cleaned and replaced. With this apparatus, three hours suffice for the desiccation of extracts from wines, and a few minutes are enough for drying completely flours, sugars, serums, vaccines, &c.—J. T. D.

Nitrogenous constituents from malt extract, by porcelain filtration; Separation of ——. H. T. Brown and others. XVII., page 1112.

UNITED STATES PATENT.

Gas analysis; Apparatus for ——. A. Bayer, Brünn, Austria-Hungary. U.S. Pat. 834,040, Oct. 23, 1906.

THE apparatus comprises two gas-meters, connected with the gas pipe, which drive shafts in opposite directions, and an absorbent-container connected between the two meters. The motion of the shafts is transmitted by differential gearing to a toothed rim, which engages with a toothed wheel mounted on a third shaft, on which a friction pulley is also keyed. A sliding bar, guided to move vertically, is pressed against this pulley by a spring, and a style is mounted on the bar, and marks a rotary drum. A pinion with a lateral stud may be mounted on one of the first-named shafts, and combined with a toothed wheel, which, on rotating, causes the stud to engage a projection on a pivoted lever, actuated by a spring and pressed against the pulley, the lever also carrying a friction roller. Before entering the first meter, the gas passes through one compartment of a cooler, and after leaving the absorbent container, it passes through the second compartment of the cooler, before entering the last meter. The cooler consists of a vessel with chambers at the ends, separated by perforated partitions from the rest of the vessel. Each chamber is divided by a wall into two compartments, the compartments at one end of the vessel being provided with gas-inlets, and those at the other end with gas-outlets. The holes in one perforated partition are connected by pipes with the corresponding holes in the other partition, and water is made to circulate round the pipes. The apparatus also includes a solid absorbent container, comprising a vessel with a gas-inlet near the bottom, and an annular trough to hold a fatty sealing medium at the top. Into this trough the guttered rim of a cover fits, the cover being provided with a gas-outlet.—W. C. H.

INORGANIC—QUALITATIVE.

Nickel; Delicate reaction for ——. H. Grossmann and B. Schück. Ber., 1906, **39**, 3356—3359.

THE test depends on the formation of nickel-dicyandi-

amidine, $Ni(N_4H_5C_2O)_2.2H_2O$, which is a very slightly soluble, yellow precipitate of stellate-grouped needles. It is less soluble in ammonia than in water, and is not decomposed by boiling with potassium hydroxide solution. Potassium cyanide dissolves it readily. To apply the test, a five per cent. solution of dicyandiamide is boiled for a minute with a few drops of hydrochloric acid; the nickel solution is added, and then an excess of potassium hydroxide solution. In very dilute solutions the precipitate only comes down after long standing. The presence of a large excess of cobalt does not interfere with the reaction.—J. T. D.

INORGANIC—QUANTITATIVE.

Uranium and vanadium; Determination of ——. A. N. Finn. J. Amer. Chem. Soc., 1906, **28**, 1443—1446.

In the usual method for separating uranium and vanadium, the former is precipitated as alkali or ammonium uranate, but the precipitate is gelatinous, and cannot be washed free from vanadium. The author describes a method in which the uranium is precipitated as ammonium uranyl phosphate. An amount of the substance containing not more than 0·25 grm. of uranium oxide, U_3O_8, is dissolved in sulphuric acid (1:5), and the solution evaporated till white fumes appear. After cooling, the solution is diluted, an excess of sodium carbonate added, and the whole boiled until the precipitate settles well. The precipitate is filtered off, washed with hot water, dissolved in the smallest possible quantity of sulphuric acid, the solution diluted, an excess of sodium carbonate added, and the whole again boiled. The precipitate is filtered off and washed, and the combined filtrates and washings are acidified with sulphuric acid. Ammonium phosphate (about 0·5 grm.) is next added, the solution heated to boiling, and made alkaline with ammonia, and after boiling for a few minutes, the ammonium uranyl phosphate is filtered off, and washed with hot water containing a little ammonium sulphate. In the filtrate the vanadium is determined as usual by acidifying with sulphuric acid, reducing with sulphur dioxide, and titrating with permanganate. The uranium precipitate is dissolved in sulphuric acid, and the uranium determined in the ordinary manner by reducing with zinc and titrating with permanganate.—A. S.

Beryllium; Separation of —— from aluminium. R. Glassmann. Ber., 1906, **39**, 3366—3367.

The solution is nearly neutralised by sodium carbonate, excess of sodium thiosulphate added, the liquid boiled till all sulphur dioxide is expelled, then heated for half an hour longer on the water-bath, and filtered. The precipitated alumina and sulphur are ignited together, and the remaining alumina is weighed. The beryllium in the filtrate, after destroying excess of thiosulphate with hydrochloric acid, is precipitated either by ammonia or, by iodide and iodate (see following abstract).—J. T. D.

Beryllium; Determination of ——. R. Glassmann. Ber., 1906, **39**, 3368—3369.

Beryllia is precipitated completely from hot solutions of beryllium salts by a mixture of potassium iodide and iodate; the completion of the reaction is hastened by removing the resulting iodine by means of thiosulphate, and the precipitate is in a form which rapidly subsides and can be easily and thoroughly washed. The solution must be neutral or very slightly acid; to it is added excess of a mixture of equal volumes of 25 per cent. potassium iodide solution and saturated potassium iodate solution. After about five minutes the separated iodine is exactly decolorised by 20 per cent thiosulphate solution, a few c.c. of the iodide-iodate solution are added in order to ensure that excess is present, then a few drops of the thiosulphate solution, and the liquid is heated on the water-bath for half an hour. The precipitate is filtered off through filter-paper of open texture, washed with boiling water, ignited, and weighed.—J. T. D.

Gold; Electrolytic precipitation of —— with the use of a rotating anode, [and electrolytic analysis of alkali halides]. J. E. Withrow. XIB., page 1103.

Silver chloride; Solubility of —— in hydrochloric acid and in sodium chloride solutions. [Determination of sulphur in organic compounds.] W. E. Barlow. J. Amer. Chem. Soc., 1906, **28**, 1446—1449.

Dudley (Amer. Chem. J., 1902, **28**, 62) has shown that when sodium dioxide is fused in a silver crucible, the metal is rapidly attacked, a complex oxide being formed. If the melt be evaporated or heated with hydrochloric acid (as in the method of determining sulphur by fusion with sodium dioxide), the silver is converted into chloride, which dissolves to a certain extent in the solution. Barium sulphate precipitated in such solutions almost invariably contains silver. Determinations of the solubility of silver chloride in solutions of sodium chloride and of hydrochloric acid showed that in sodium chloride solutions the amount dissolved decreases at a gradually diminishing rate as the concentration of sodium chloride is reduced, and that in hydrochloric acid solutions, the solubility is directly proportional to the concentration of the acid. As an example, it may be stated that 300 c.c. of solution containing 23 grms. of sodium chloride dissolved 0·0745 grm. of silver chloride at 90° C., whilst at the same temperature, 300 c.c. of a solution containing 10 c.c. of concentrated hydrochloric acid dissolved 0·0169 grm. The author recommends the use of a nickel dish in making determinations of sulphur by fusion with sodium peroxide.—A. S.

ORGANIC—QUALITATIVE.

Catechu; Detection of adulteration in ——. D. Hooper. Agric. Ledger, 1906, [3], 44—45.

One to two grms. of finely-divided catechu are digested for 24 hours with 90 per cent. alcohol, with occasional agitation; the extract is removed, and the residue washed until colourless, the extract and washings being then evaporated to dryness at 100° C.; a good quality of catechu should yield 70 per cent. of extract and upwards, and a fair quality, 60 to 70 per cent., whilst 50 per cent. or less should be regarded as very inferior. The Indian and Colonial Addendum to the Brit. Pharmacopœia gives 80 per cent. as the limit of extract, which is considered too high; the same work also mentions 6 per cent. as the maximum for ash, whilst the U.S. Pharmacopœia gives 5 per cent.; the average ash content of a large number of samples of Burmese cutch was only 2·9 per cent.—T. F. B.

ORGANIC—QUANTITATIVE.

Silk; Determination of the weighting of ——. J. Persoz. Rev. Gen. Mat. Col., 1906, **10**, 321—328.

The following process has been used by the author for a number of years for the determination of the weighting of black silks:—The silk is dried by keeping for some time in a dry place at the ordinary temperature; drying at higher temperatures removes moisture which it is considered should be regarded as weighting. The dry sample is heated for some time in dilute ammonia, and then subjected to successive extractions in the cold with hydrochloric acid (1 vol. of 30 per cent. acid to 3 vols. of water) and subsequently with caustic soda solution (4° to 4·5° B.), until the acid extracts give no precipitate, or only a very slight one, with ammonia. It is advantageous to add alkali sulphide to the alkali solution, as this aids in the removal of the tin. One of the extractions with hydrochloric acid is replaced by extraction with dilute hydrofluoric acid (1·5 per cent.) at 60° C. In all cases tried except one, this had the effect of producing a silk fibroïn which gave no ash on incineration. The silk is finally, washed, dried, and weighed. The percentage weighting can then be calculated from the expression $(100 - n)\frac{a}{b} - 100$, where a = weighted silk used, b = pure silk obtained, n = per cent. decrease in weight of original (unweighted) silk on boiling off. For silks other than black, extraction with hydrofluoric acid is recommended as generally applicable, the extent of weighting being calculated in the known manner from the percentage of ash obtained from the extracted silk. (See also Gnehm and Dürsteler, this J., 1906, 1090.)—T. F. B.

Reducing substances and their determination. H. Pellet. Internat. Comm. for standard methods of sugar analysis, Berne, 1906; Z. Ver. Deutsch. Zuckerind., 1906, 1012—1022.

Of the numerous copper solutions recommended for the determination of reducing substances in products of sugar manufacture, the author gives preference to that proposed by Violette. It is prepared as follows: 34·66 grms. of crystallised copper sulphate are dissolved, and made up to 500 c.c. with distilled water; 200 grms. of Rochelle salt and 130 grms. of caustic soda are dissolved and made up to 500 c.c. Equal volumes of the solutions are mixed as required. Ten c.c. of the mixture are equivalent to 0·050 grm. of invert sugar. The author recommends the following volumetric process for products containing small quantities of reducing bodies, and which are not too dark in colour: 2, 5 or 10 c.c. of Violette's solution are measured into a boiling tube (length 20—22 cm., diameter 20 mm.); the solution under investigation is then added in small portions, the whole being boiled after each addition. The end point of the reaction is indicated by the disappearance of the blue colour, and is readily detected after a little practice, even in artificial light. If excess of reducing solution has been added, the liquid becomes yellow in colour. The copper solution is standardised with a solution containing 0·050 grm. of invert sugar per 10 c.c. and a small quantity of salicylic acid, to render it more stable. If the sample contain a very small quantity of reducing bodies, the standardising solution of invert sugar must be correspondingly diluted. For products the colour of which does not permit the use of the above process, the author recommends the following modification of the gravimetric process. If the sample contain a large proportion of reducing substance, it must be diluted so as to contain 5—10 grms. of reducing substance per litre. If necessary, the solution is heated with a trace of sodium carbonate to remove a possible excess of calcium salts; it is then filtered in order to remove suspended mineral matter, 40 c.c. of the copper solution are poured into a Bohemian flask of special glass, and 20 or 10 c.c. of the solution under investigation are added, the total volume being made up to 60 c.c. The flask is then heated in a boiling water-bath which contains so much water that the surface of the outer liquid is slightly above that of the solution in the flask. The solution is heated to 85°—88° C., and kept at this temperature for three minutes; 50 c.c. of distilled water are then added, the flask is shaken, the cuprous oxide allowed to settle somewhat, and then filtered off through an ashless filter (9—11 c.m. diameter) previously moistened with water, and finally washed with hot water until the washings are neutral. The precipitate and filtrate are incinerated (preferably in a muffle heated with gas or electricity), the copper oxide (CuO) being weighed. From 2—5 mgrms. must be subtracted from the weight of copper oxide to compensate for the absorption of salts by the filter paper; the actual amount must be directly determined. The amount of invert sugar is determined by multiplying the weight of cupric oxide by 0·454. For very accurate work, however, the coefficient must be determined by a control analysis with invert sugar. The above method possesses the following advantages over those which involve boiling the copper and sugar solutions:—(1) Several determinations can be made simultaneously; (2) heating is very uniform; (3) reduction is complete; (4) influence of secondary products, and especially of sucrose, on the copper solution, is diminished. Numerous experiments have shown that heating to 85°—88° C. is sufficient to cause reduction by all the reducing substances; the method gives very concordant results, and clarification with lead acetate is unnecessary.

Supplement 1.—In filtering the alkaline copper solution through filter paper, the latter retains both copper and tartrate.

Supplement 2.—The author quotes analyses from various sources which show that Clerget's inversion method gives an accurate result for the amount of crystallisable sugar in a product containing this together with invert sugar.

Supplement 3.—The author is of the opinion that the reducing substances in cane and beetroot sugar products are identical, that they differ only in amount, and that they consist of dextrose and lævulose in varying proportions. If, in the determination of the invert sugar in molasses by the gravimetric method above described, the heating be continued considerably beyond the prescribed period, a much higher result is sometimes obtained than that obtained under normal conditions. The author does not consider that this is due to the presence of reducing substances, other than lævulose and dextrose, in the molasses, but that it is caused by non-reducing substances which act on alkaline copper solution during protracted heating. Hence, by using the gravimetric process described above, and adhering to the conditions defined, the amount of lævulose and dextrose is determined accurately.—L. E.

Citral in lemon oils and extracts; Method for the determination of ——. E. McK. Chace. XX., page 1116.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 1070.)

Steam; Dissociation of ——. H. v. Wartenberg. VII., page 1093.

Steam; Dissociation of ——. W. Nernst and H. v. Wartenberg. VII., page 1094.

Carbon dioxide; Dissociation of ——. W. Nernst and H. v. Wartenberg. VII., page 1094.

Water vapour and carbon dioxide; Dissociation of —— at high temperatures. I. Langmuir. VII., page 1094.

Nickel and cobalt; Distribution of —— in nature. K. Kraut. Z. angew. Chem., 1906, **19**, 1793—1795.

With the aid of Tschugaeff's reagent (dimethylglyoxime; see this J., 1905, 941), the author has proved the presence of nickel in the ashes of a number of German peats and coals, and in tufa from Vesuvius. If the nickel compound, after evaporation to dryness, be taken up with water and ammonia and a little additional oxime, and filtered off, any associated cobalt passes into the filtrate; and on adding to this, hydrogen sulphide or ammonium sulphide, a blue-violet or deep red coloration is struck, which forms a most delicate test for cobalt. Most of the peat- and coal-ashes mentioned, showed the presence of cobalt when thus tested, as did also the spent salt from a potash factory.—J. T. D.

Colloidal solutions; Action of electrolytes on ——. E. F. Burton. Phil. Mag., 1906, **12**, 472—478.

Very dilute solutions of aluminium sulphate were added to colloidal solutions of silver (containing 65 mgrms. per litre) and of gold (62 mgrms. per litre), and the velocity of migration of the particles was measured. It was found to lessen as the amount of electrolyte added, increased till it passed through zero, and then after changing sign gradually increased. The original solutions, and those containing enough electrolyte to impart a considerable reversed speed, were stable, while those exhibiting a slow speed in either direction, readily coagulated. The results confirm those of Hardy on egg-albumin, and indicate that the metallic particles absorb the metallic ions, and thus neutralise their charges; when the isoelectric point is reached, the surface tension of the particles is a maximum, and they tend to decrease the surface exposed to the liquid by uniting with each other, thus bringing about coagulation.—J. T. D.

Methylamine; Liquid —— as a solvent, and a study of its chemical activity. H. D. Gibbs. J. Amer. Chem. Soc., 1906, **28**, 1395—1422.

Liquid methylamine is a remarkably good solvent for organic compounds, being better in this respect than liquid ammonia, and also, probably, than methyl alcohol. It is not such a good solvent for inorganic compounds as liquid ammonia is. It combines readily with both organic and inorganic compounds, and new addition products of methylamine with the following compounds have been prepared: Phenol, quinol, resorcinol, α-naphthol, *m*-nitrobenzaldehyde, acetic acid, phenylacetic acid,

diphenyl-ketoxime, nitromethane, bismuth chloride, cadmium iodide, calcium chloride, chromic chloride, lithium chloride, lithium nitrate, lead nitrate, mercuric chloride, methyl-mercuric chloride, mercuric iodide, and silver nitrate.—A. S.

Reversible reactions among organic acid derivatives. J. Biehringer and W. Borsum. Ber., 1906, 39, 3348—3356.

The qualitative conditions are discussed under which a number of simple interactions of derivatives of organic acids take place in either direction. Thus, in sealed tubes at 150° C., benzoic acid and acetyl chloride form benzoyl chloride and acetic acid, but at 120° C., under ordinary pressure, change proceeds in the contrary direction. Whereas the interaction of benzoic acid and acetamide takes place in one direction only, ethyl acetate and benzamide yield acetamide and ethyl benzoate when heated for six hours under pressure at 260° C., whilst the reverse change takes place on heating under pressure from 270°—290° C. Phenyl benzoate and ammonia interact in sealed tubes at 150° C., whilst benzamide and phenol yield phenyl benzoate on heating. Other cases considered, are the interaction of oxalic acid and acetamide, of benzoic acid and acetanilide, and of acetanilide and benzoyl chloride.—E. F. A.

Trade Report.

Patent Law Reform.

Chem. of Com. J., Nov., 1906.

A deputation from the Associated Chambers of Commerce waited upon the President of the Board of Trade on Oct. 18, in continuation of the larger deputation on April 9, on the subject of Patent Law Amendment. Although the proceedings were private, it is understood that the Government intend to introduce a Bill into Parliament at an early opportunity, dealing with the grievances of the manufacturing and commercial community in regard to the present working of the Patents Act.

Australian Commerce Act Regulations.

Chem. of Com. J., Nov., 1906.

With reference to the new Australian Commerce Act, the following is the text of Part II. of the (Amended) Provisional Regulations relative to imported goods, and which become operative on Jan. 1, 1907:—

5. (1) The importation of the goods enumerated in this regulation is prohibited unless there is applied to the goods a trade description in accordance with this Part.

(2) The goods to which this regulation applies are as follows:—

(*a*) Articles used for food or drink by man, or used in the manufacture or preparation of articles used for food or drink by man;

(*b*) Medicines or medicinal preparations for internal or external use;

(*c*) Manures, including all articles for use as fertilisers of the soil, except farmyard or stable manures, and crude materials for the manufacture of manures;

(*d*) Apparel (including boots and shoes), and the materials from which such apparel is manufactured;

6. (1) The trade description to be applied in accordance with this Part shall comply with the following provisions:—

(*a*) It shall be in form of a label or brand affixed in a prominent position to the goods, or to the coverings containing the goods; and

(*b*) The label or brand shall set out in legible characters a true description of the goods, and the name of the country or place in which the goods were made or produced; and

(*c*) In cases where any weight or quantity is set out, the label or brand shall specify whether the weight or quantity so set out is gross or net.

(2) In the case of the following goods, the trade description shall, in addition, comply with the following provisions:—

(*a*) In the case of medicines prepared ready for use, and containing 10 per cent. or more of ethyl alcohol, if the average dose recommended exceeds one teaspoonful (60 minims), the trade description shall set out the proportion or quantity of alcohol in the medicine.

(*b*) In the case of medicines prepared ready for use, and containing any of the following drugs (or the salts or derivatives thereof), *viz.*:—Opium, morphine, cocaine, heroin, stramonium, nux vomica, cannabis indica, bromides, sulphonal, trional, veronal, paraldehyde, or any synthetic hypnotic substance, phenazonum, phenacetinum, or acetanilidum, or any allied synthetic substance, chloral hydrate, belladonna, cotton-root, ergot, or any abortifacient, the trade description shall set out the names of all such drugs so contained.

(*c*) In the case of manures, the trade description shall set forth the principal active constituent thereof.

(*g*) In the case of leather containing any loading of any mineral or other weighting substance, the trade description shall state the name of the loading or other weighting substance contained in the leather, and the percentage thereof.

New Books.

The Cyanide Process. An Introduction to the Cyanide Process, including the Determination of the Applicability of the Process to an Ore. By Alfred S. Miller. Second Edition, revised and enlarged. John Wiley and Sons, New York. Chapman and Hall, Ltd., London, 1906. Price 4s. 6d. net.

Small 8vo volume, containing 89 pages of subject matter, 29 illustrations, table of atomic weights, and the alphabetical index. The text is subdivided as follows:—I. General description of the cyanide process. II. Interfering substances. III. Chemistry of the cyanide process. IV. Determining the applicability of the cyanide process to an ore. V. Notes as to strengths of solutions, and general processes. VI. Special descriptions of some cyanide processes. VII. Volumetric methods.

The Mineral Industry during 1905: Its Statistics, Technology, and Trade. Founded by Richard P. Rothwell. Edited by W. R. Ingalls. Vol. XIV. Engineering and Mining Journal, New York and London, 1906. Price, £1 0s. 10d., or 5 dollars.

Large 8vo volume, containing 728 pages of subject matter, and the alphabetical index. There is a staff of 51 contributors, the names of whom, with their subjects, are given on the first page. The subjects treated of, after an introduction setting forth the methods pursued in the volume, are the following:—I. Aluminium. II. Antimony. III. Arsenic. IV. Asbestos. V. Asphaltum. VI. Barytes. VII. Bauxite. VIII. Bismuth. IX. Borax. X. Bromine. XI. Carborundum. XII. Cement. XIII. Chromium and Chrome Ore. XIV. Coal and Coke. XV. Copper. XVI. Copperas. XVII. Corundum and Emery. XVIII. Fluorspar. XIX. Fuller's Earth. XX. Garnet. XXI. Gems and Precious Stones. XXII. Gold and Silver. XXIII. Graphite. XXIV. Gypsum. XXV. Iron and Steel. XXVI. Lead. XXVII. Limestone. XXVIII. Magnesite. XXIX. Manganese. XXX. Mica. XXXI. Molybdenum. XXXII. Monazite. XXXIII. Nickel and Cobalt. XXXIV. Petroleum. XXXV. Phosphate Rock. XXXVI. Platinum. XXXVII. Potassium Salts. XXXVIII. Mercury. XXXIX. Salt. XL. Sodium, and Soda Salts. XLI. Sulphur and Pyrites. XLII. Talc and Soapstone. XLIII. Tin. XLIV. Tungsten. XLV. Zinc. XLVI. Progress in Ore-dressing and Coal-washing in 1905. XLVII. Improvements in Sampling and Assaying. XLVIII. Statistics of Production and Commerce.

Mines and Quarries: General Report and Statistics for 1905. Part II.—Labour. [Cd. 3179.] Wyman and Sons, Fetter Lane, London, E.C. Price, 10d.

This publication contains a general report and statistics relating to persons employed, and accidents at mines and

quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts. According to these statistics the total number of persons employed at mines and at the quarries under the Quarries Act in the United Kingdom and the Isle of Man during the year 1905 was 982,343, of whom 887,524 were employed in or about mines, and 94,819 in or about quarries. Compared with the preceding year, there is an increase of 10,467 persons employed at mines. In 1905, 1103 separate fatal accidents occurred in or about mines and quarries, causing the loss of 1304 lives, showing a decrease of 55 in the number of fatal accidents and an increase of 102 in the number of lives lost as compared with 1904.

CHURCH'S LABORATORY GUIDE. A Manual of Practical Chemistry for Colleges and Schools, specially arranged for Agricultural Students. Revised and partly re-written by EDWARD KINCH, F.I.C., &c., Professor of Chemistry in the Royal Agricultural College, Cirencester, &c. 8th Edition. Gurney and Jackson, 10, Paternoster Row, London, E.C. Oliver and Boyd, Edinburgh. 1906. Price, 6s. 6d. net.

SMALL 8vo volume, containing 336 pages of subject matter, with 42 illustrations. The subject matter is subdivided as follows:—I. Chemical Manipulation. II. Qualitative Analysis. III. Quantitative Analysis, which includes: (i.) Sampling and Analysis of Manures; (ii.) Analysis of Soils; (iii.) Analysis of Waters; (iv.) Analysis of Foods.

DIE ELEKTROCHEMISCHEN DEUTSCHEN REICHSPATENTE. [Monographien über angewandte Elektrochemie, XXIV Band.] Auszüge aus den Patentschriften gesammelt, geordnet und mit Hinweisen versehen von Dr. P. FERCHLAND und Dr. P. REHLÄNDER. Wilhelm Knapp's Verlag, Halle a. S. 1906. Price, M. 10.

8vo volume, containing 230 pages of subject-matter, with 124 illustrations. The text is distributed under the following heads:—PART I. INORGANIC ELECTROCHEMISTRY. —I. Light Metals. II. Alkalis and Halogens. III. Hypochlorites ("Bleaching Liquor"). IV. Oxygenated Salts. V. Alkaline Earths. VI. Carbides. VII. Water Decomposition. VIII. Ozone. IX. Nitrogen Compounds. X. Heavy Metals. XI. Compounds of the Heavy Metals. XII. Apparatus. XIII. Furnaces. PART II. ORGANIC ELECTROCHEMISTRY.—I. Aniline. II. Benzidine and its Intermediate Products. III. Paraminophenols. IV. Dyestuffs and Intermediate Products. V. Pharmaceutical Products. APPENDIX.—Brief Abstracts of Patents granted during period from Jan. 1, 1905, to May, 1906. Also Patents which were still in force in May, 1906.

PROBENAHME UND UNTERSUCHUNG VON KOKS, KOHLEN, UND BRIKETTS. Taschenbuch für Chemiker, Hütteningenieure, Kohlen- und Zechenlaboratorien und Gasanstalten. Von Dr. ADOLF BERTHOLD. G. D. Baedeker, Verlagsbuchhandlung, Essen-Ruhr. 1906. Price, M. 2.

SMALL volume of pocket-book size, containing 61 pages with 37 illustrations, and an alphabetical index. The text is subdivided as follows:—I. Investigation of Cokes, including Sampling. II. Investigation of Coals and Briquettes, inclusive of Sampling.

PRODUCER GAS. By J. EMERSON DOWSON and A. T. LARTER, B.Sc., &c. Longmans, Green, and Co., 39, Paternoster Row, London, New York, and Bombay. 1906. Price, 10s. 6d.

8vo volume, containing 276 pages of subject matter, including two Appendixes, filling 24 pages, and the alphabetical index. There are 73 illustrations. The subject matter is subdivided as follows:—I. Theory of Producer Gas. II. Furnace Work. III. Heating Work. IV. Engine Work. V. Suction Plants. VI. Gas from Bituminous Coal for Engine Work. VII. Stand-by Losses. VIII. Comparison of Gas and Steam Power. IX. Fuel. X. Analysis of Fuel and of Producer Gas. XI. Calorific Power of Solid and Gaseous Fuels. XII. Practical Notes. XIII. (Appendix) Theoretical Explanations and Reference Data.

SMALLER CHEMICAL ANALYSIS. By G. S. NEWTH. Demonstrator in the Royal College of Science, London, &c. Longmans, Green, and Co., 39, Paternoster Row, London, New York, and Bombay. 1906. Price, 2s.

SMALL 8vo volume, containing 144 pages of subject matter, with 16 illustrations, and the alphabetical index. It is "practically an abridged edition of the qualitative section of" the author's "Manual of Chemical Analysis," and designed for students taking a less advanced stage than those for whom the latter and larger work was intended.

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1905. PART III.—OUTPUT. [Cd. 3196.] Wyman & Sons, Fetter Lane, London, E.C. Price 1s. 6d.

THIS return, which is prepared annually by the Home Office, contains statistics as to the quantity and value of various minerals raised in the United Kingdom. The value of the mineral output of the United Kingdom in 1905 was £95,870,723, a decrease of £1,606,916 as compared with the preceding year.

IMPERIAL INSTITUTE. Indian Section. Annual Report for the year 1905-6. [Cd. 3216.] Wyman & Sons, Fetter Lane, London, E.C. Price 2½d.

THIS report deals with the work of the Indian Section of the Imperial Institute during the year ended 31st March last. To the statement of the Indian Committee of the Imperial Institute is appended a report by Professor Wyndham Dunstan, F.R.S., on the Indian work of the Imperial Institute, together with a detailed account by Mr. C. E. Jones, superintendent of the Indian Section, on the work of the section during the year. A report by Mr. B. J. Rose on the Indian Trade Inquiry Office at 73, Basinghall Street, E.C., is also appended.

COLONIAL IMPORT DUTIES RETURN. [Cd. 3195.] Wyman & Sons, Fetter Lane, London, E.C. Price 2s. 6d.

THIS is a new issue of the return, showing the rates of import duty levied in the British Colonies, Possessions, and Protectorates, upon the principal and other articles of trade, which is prepared annually in the Statistical Department of the Board of Trade. The present issue contains a statement of the duties in force in 1906. The duties leviable in British Protectorates are, for the first time, incorporated in the body of the return, with the exception of those enforced in the Federated Malay States, British North Borneo, Sarawak, and Zanzibar, which are given as appendices.

FOREIGN IMPORT DUTIES, 1906. [Cd. 2340.] Wyman & Sons, Fetter Lane, London, E.C. Price 2s. 10d.

THIS return, which has been prepared in the Commercial Department of the Board of Trade, contains a statement of the rates of import duty, with their equivalents in English weights and currency, which are leviable in the principal European countries, the United States, China, Japan, Egypt, Persia, and Mexico, upon textiles, manufactures of iron and steel and other metals, earthenware, glass, leather and india-rubber wares, paper, stationery and books, paints, chemicals, articles of food, and numerous other articles of trade when imported from the United Kingdom. The changes observable on a comparison of this return with that issued a year ago [Cd. 2797] are numerous and important, owing mainly to the enforcement during the current year of new tariffs in Switzerland, Bulgaria, Russia, Germany, Austria-Hungary, Roumania, Spain, and Japan, while important alterations have also been made in the tariffs of Italy, France, Sweden, Belgium, and Greece. Particulars as to Mexico are included for the first time. A table is included showing the equivalent in English weights and currency of such rates of duty expressed in various foreign weights and currency.

Journal of the Society of Chemical Industry

No. 23.—Vol. XXV. SUPPLEMENT. DECEMBER 15, 1906.

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Journal and Patent Literature.

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PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—
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United States.—1s. each, to the Secretary of the Society.
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Official Notices.

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Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the By-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this By-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

DECENNIAL INDEX, 1896—1905.

IMPORTANT NOTICE.

The Hon. Treasurer is prepared to receive subscriptions for the Decennial Index (1896—1905). The Authors' Names portion is now in the press and will be issued early in the new year; and the subject-matter portion will follow as soon as possible afterwards. The price is 10s. for the whole Index, or 11s. ($2.75) post free.

Copies of the Collective Index (1881—1895) may be had at the same price.

Cheques of members' own bankers, or money orders, payable at the G.P.O., London, should be made payable to Samuel Hall and sent to the Hon. Treasurer, East London Soap Works, Bow, E., with the signed by-leaf of a similar which will be sent out with the ordinary subscription notice, and to any others who make application for it.

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The return, whenever possible, of the [illegible] to the subscription notice, is specially recommended as a means whereby the sender may be assured that changes of address recorded, on which depends the receipt of the Journal.

"INDUSTRIAL DISEASES COMMITTEE."

With reference to a notice which appeared in the November 15th issue of the JOURNAL (p. 1035), announcing the appointment of a Departmental Committee to inquire and report what diseases and injuries, other than injuries by accident, are due to [illegible] and are distinguishable as such, and can properly be added to the diseases enumerated in the Third Schedule of the Workmen's Compensation Bill, 1906," members who desire to assist the Committee by tendering evidence are requested to communicate with the Society.

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Deaths.

Chandler, Prof. Wm. H., Lehigh University, South Bethlehem, Pa., U.S.A., Nov. 30.
Poole, Herman, 331, West 57th Street, New York City, U.S.A.

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 26,150. Von Radlovski. *See under* IX.
" 26,241. Hunt. Continuous vacuum filter. Nov. 20.
" 26,507. Blair. Apparatus for separating in water materials of different specific gravity. Nov. 22.
" 26,732. Weekes. Kilns and the like. Nov. 24.
[A.] 26,864. Jensen (Gaara). Rotary filters. Nov. 26.
" 26,875. Warren. Rotary kilns.* Nov. 26.
" 27,064. Symonds. Apparatus for measuring and recording the temperature of furnaces or the like. Nov. 28.
[C.S.] 24,175 (1905). Hulme and Crosfield. Centrifugal machines. Nov. 28.
" 1665 (1906). Haslam. Apparatus for drying and cooling air. Dec. 5.
" 3458 (1906). Mower and Bassett. Drying kilns. Dec. 5.
" 15,285 (1906). Draper (Christ). Apparatus for separating substances of different specific gravities. Nov. 28.
" 20,894 (1906). Allison (Christ). Apparatus for separating substances of different specific gravities. Nov. 28.

II.—FUEL, GAS, AND LIGHT.

[A.] 26,209. Kirke (Kirke). Manufacture of a hydrocarbon fuel. Nov. 19.
" 26,306. Zwicky. Carburetting apparatus. [Swiss Appl., Nov. 21, 1905.]* Nov. 20.
" 26,314. Smith. Carburetting air and mixing gases.* Nov. 20.
" 26,542. Barlen. Vertical coke oven. [Ger. Appl., Feb. 9, 1906.]* Nov. 22.
" 26,641. Lee. Metallic filaments for electric lamps. Nov. 23.
" 26,698. Kurzer. Apparatus for gasifying oils and carburetting air. [Ger. Appl., Nov. 30, 1905.]* Nov. 24.
" 26,819. Thwaite. Generation of combustible gas. Nov. 26.
" 26,882. Brown. Ovens for the manufacture of coke for metallurgical purposes. Nov. 27.
" 26,994. Hersey. Apparatus for separating cyanogen from coal gas. Nov. 27.
" 27,247. Hess. Apparatus for purifying gases.* Nov. 30.
" 27,355. Crossley and Rigby. Manufacture of producer gas. Dec. 1.
[C.S.] 23,966 (1905). Walker. Apparatus for the manufacture of air gas. Nov. 28.
" 25,046 (1905). McRae and Ingram. Manufacture of acetylene gas. Dec. 5.
" 1397 (1906). Stauber. *See under* III.
" 1417 (1906). Dowson. Gas generators. Dec. 5.
" 14,947 (1906). Siemens. Regenerative gas furnaces. Nov. 28.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 24,886. Williams. *See under* XII.
[C.S.] 1397 (1906). Stauber. Ovens for coking or carbonising peat, wood, or the like. Nov. 28.
" 14,263 (1906). Emery. Lubricating compounds. Dec. 5.

IV.—COLOURING MATTERS AND DYESTUFFS

[A.] 26,190. Johnson (Badische Anilin und Soda Fabrik). Manufacture of thioindoxyl derivatives Nov. 19.
" 26,416. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-oxymonoazo colouring matters Nov. 21.
" 26,508. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-oxydisazo colouring matters. Nov. 22
" 27,213. Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of black sulphurised dyestuffs. [Ger Appl., Dec. 5, 1905.]* Nov. 29.
" 27,322. Ransford (Cassella und Co.). Manufacture of diacetyldiaminophenol and of dyestuffs therefrom. Nov. 30

[C.S.] 2797 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of pure Bordeaux-red sulphurised dyestuffs. Dec. 5.
,, 3506 (1906). Hirschberger, Hoffa, and Levinstein, Ltd. New colouring matter and the production thereof. Dec. 5.
,, 5245 (1906). Ransford (Cassella und Co.). Manufacture of polyazo dyestuffs. Nov. 28.
,, 6374 (1906). Newton (Bayer und Co.). Manufacture of new disazo dyestuffs. Nov. 28.
,, 8066 (1906). Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of new sulphur dyestuff compounds. Dec. 5.
,, 9774 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of phenylglycin or its homologues. Nov. 28.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 26,125. Philip and Macintyre. Degumming certain fibres. Nov. 19.
,, 26,126. Philip and Macintyre. Process of degumming fibres. Nov. 19.
,, 26,526. Clerc-Renaud. Method and apparatus for treating textile fabrics. [Fr. Appl., Dec. 28, 1905.]* Nov. 22.
,, 26,843. Hey, Smith, Mitchell, and Askham. Apparatus for washing, impregnating, drying, or extracting liquids from fabrics and other goods. Nov. 26.
,, 26,954. Kaisser and Riche. Apparatus for torrefying threads and textile fabrics. [Belg. Appl., Nov. 28, 1905.]* Nov. 27.
,, 27,047. Holt. Apparatus for wringing or squeezing used in bleaching, dyeing, and washing fabrics. Nov. 28.
,, 27,072. Fulton and Hardcastle. Extraction of grease or oleaginous gum or resinous matter from textiles, wool, sawdust, wood shavings, &c. Nov. 28.
,, 27,128. Kaisser. Apparatus for torrifying thread and textile fabrics.* Nov. 28.
[C.S.] 3709 (1906). Kay and McGregor. Printing textile fabrics. Nov. 28.
,, 5246 (1906). Ransford (Cassella und Co.). Production of easily dischargeable claret shades on cotton goods. Nov. 28.
,, 16,908 (1906). Kalle und Co. Production of red dyeing on fibre. Nov. 28.
,, 17,163 (1906). Kalle und Co. Dyeing and printing red on textile fibre. Nov. 28.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 9830A. Garroway. Preparation of hyposulphurous acid or its salts as a bleaching agent.* Nov. 23.
,, 26,223. Grossmann. Treatment of ammonia liquors. Nov. 20.
,, 26,319. Tully. Manufacture of sulphate of ammonia. Nov. 21.
,, 26,808. Frank. Production of pure hydrogen. [Ger. Appl., Nov. 28, 1905.]* Nov. 26.
,, 26,928. Frank. Production of pure hydrogen from water-gas. [Ger. Appl., March 7, 1906.]* Nov. 27.
,, 27,006. Moscicki. *See under* XI.
,, 27,290. Cie. des Prod. Chim. d'Alais et de la Camargue. Removing silica from aluminate of soda in the manufacture of alumina. [Fr. Appl., Aug. 13, 1906.]* Nov. 30.
,, 27,316. Flügge. Manufacture of ferrous carbonate in the cold. [Ger. Appl., Nov. 30, 1905.]* Nov. 30.
C.S.] 16,681 (1905). Craig. Apparatus for producing ozone from oxygen or air. Nov. 28.
,, 24,840A (1905). Clarke, Chapman & Co., and Robson. Absorbers for ammonia. Dec. 5.
,, 16,612 (1906). Heinrici. Preparation of a stable solution of hydrogen peroxide. Dec. 5.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 27,034. Gaved. Dry process of extracting china clay, mica and quartz from decomposed granite. Nov. 28.
,, 27,048. Zahn. Process and stove for burning objects to be enamelled. [Ger. Appl., Nov. 28, 1905.]* Nov. 28.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 26,150. Von Radlovski. Burning and calcining lime, cement, chemicals, &c., in a rotable pipe kiln.* Nov. 19.
,, 26,755. Boult (Raithel). Gypsum burning kilns. Nov. 24.
,, 27,059. Hooke. Process of calcining the raw material for manufacturing cement.* Nov. 28.
,, 27,137. Turns. Manufacture of Portland cement and the like. Nov. 29.
,, 27,194. Thompson (Ahrendts). Manufacture of bricks, building blocks, or artificial stone. Nov. 29.
[C.S.] 23,816 (1905). Peters. Manufacture of Portland cement. Nov. 28.
,, 24,219 (1905). Gardeur. Manufacture of artificial sandstone. Dec. 5.
,, 24,224 (1905). Klinge and Schourup. Manufacture of artificial stones and similar building materials. Dec. 5.
,, 14,233 (1906). Liebold, Wittig, and Grimm. Manufacture of cement. Dec. 5.
,, 15,553 (1906). Schoügaard. Manufacture of artificial marble. Dec. 5.

X.—METALLURGY.

[A.] 26,202. Powell. Manufacture of steel. Nov. 19.
,, 26,284. Wheatley. Manufacture of a metallic alloy. Nov. 20.
,, 26,311. Rübel. Manufacture of metallic alloys.* Nov. 20.
,, 26,317. Auchinachie. Manufacture of an alloy of vanadium-iron or steel. Nov. 20.
,, 26,664 and 26,665. Hadfield. Manufacture of magnetic material. Nov. 23.
,, 26,882. Brown. *See under* II.
,, 26,934. Baker. Treatment of complex sulphide ores. Nov. 27.
,, 27,120. Jumau. *See under* XI.
,, 27,209. Muller and Baraduc. Production of metals, alloys, and metallic compounds such as silicides. [Fr. Appl., Nov. 29, 1905.]* Nov. 29.
[C.S.] 24,238 (1905). Ogle. Treatment of complex ores (sulphides) containing copper, zinc and lead. Dec. 5.
,, 25,004 (1905). Brayshaw. Process of hardening carbon steel. Dec. 5.
,, 10,097 (1906). Frick. *See under* XI.
,, 13,033 (1906). Dymond (Gathmann). Armour plate. Nov. 28.
,, 18,080 (1906). Ramen. *See under* XI.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 26,212. Cowper-Coles. Anodes for electro-deposition. Nov. 19.
,, 26,867. British Thomson-Houston Co. (General Electric Co.). Electric furnaces. Nov. 26.
,, 26,929. Roach. Electric furnaces.* Nov. 27.
,, 26,981. Reynolds. Electric furnaces. Nov. 27.
,, 27,006. Moscicki. Apparatus for producing oxides of nitrogen by the electric process. [Swiss Appl., Aug. 8, 1906.]* Nov. 27.
,, 27,120. Jumau. Electro-metallurgical process for extracting copper from its ores. [Fr. Appl., Nov. 29, 1905.]* Nov. 28.

[A.] 27,215. Marino and Barton-Wright. Agglutinant for consolidating the active material of accumulators.* Nov. 29.
„ 27,420. Reynolds. Electrical heating apparatus. Dec. 1.
„ 27,421. Reynolds. Method and apparatus for electrical heating. Dec. 1.
[C.S.] 4336 (1906). Bingham. Electric furnaces. Nov. 28.
„ 4684 (1906). Cowper-Coles. Production of electrotypes. Nov. 28.
„ 10,097 (1906). Frick. Method and plant for the reduction of ores and the like by electric transformer furnaces. Dec. 5.
„ 18,080 (1906). Ramen. Method of precipitating metals electrolytically. Dec. 5.
„ 18,599 (1906). Pauling. Production of arcs for the electrical treatment of gases. Dec. 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 26,886. Williams. Conversion of liquid fats into solids and reduction of unsaturated organic liquids and solids. Nov. 27.
„ 27,072. Fulton and Hardcastle. *See under* V.
„ 27,280. Bacon. Manufacture of soap. Nov. 30.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*B.*)—Resins, Varnishes.

[A.] 26,593. Schmidt. Linoleum.* Nov. 23.
„ 27,072. Fulton and Hardcastle. *See under* V.
[C.S.] 24,622 (1905). Kershaw. Elastic material or plastic compound suitable for varnishes, &c. Nov. 28.
„ 15,338 (1906). Justice (McKenzie). Extraction of turpentine and other products from wood. Dec. 5.

(*C.*)—India-Rubber.

[C.S.] 24,622 (1905). Kershaw. *See under* XIII*B.*
„ 6183 (1906). Granier and Froger-Delapierre. Compound for coating caoutchouc to preserve its natural properties. Dec. 5.
„ 10,704 (1906). Roland. Elastic substance similar to india-rubber. Nov. 28.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

[A.] 26,188. Howorth (Oesterreich. Pluviusin A.-G.). Manufacture of imitation chamois leather.* Nov. 19.
„ 26,555. Fontana. Process for removing colouring materials from tanning liquors. Nov. 23.
„ 26,673. Lambert. Liquid for use in melting and diluting glue. Nov. 24.
[C.S.] 25,467 (1905). Inrig. Treatment of waste leather. Nov. 28.

XV.—MANURES, &c.

[A.] 26,635. Bazin. Increasing the quantity of nitrogen in peat, with a view to its employment as manure. [Fr. Appl., Dec. 14, 1905.]* Nov. 23.
„ 26,790. Colburn. Treatment of animal and vegetable matter for the production of manure. Nov. 26.

XVI.—SUGAR, STARCH, GUM, &c.

[A.] 26,871. Newton-Clare. Manufacture of sugars. Nov. 26.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 26,169. Sleeman. Apparatus for washing, steeping, aërating, and germinating grain. Nov. 19.
„ 26,689. Frestadius. Production of alcohols from peat. Nov. 24.
[A.] 27,343. Bailey. Conversion machine and processes for use by brewers. Dec. 1.
[C.S.] 24,739 (1905). Pollak. Production of ferments and fermented materials. Dec. 5.
„ 37 (1906). Tonnaer and De Keersmaecker. Fermenting vats for use in making beer. Nov. 28.
„ 12,838 (1906). Bergo and Kainscop. Process of manufacturing beer. Nov. 28.
„ 13,915 (1906). Schalk. Fermenting wort. Nov. 28.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

[A.] 27,041. Fuglistaller. Manufacture of chocolate. Nov. 28.
„ 27,153. Kurz. Process for preserving meats.* Nov. 29.
[C.S.] 6389 (1906). Little. Bleaching or conditioning flour or other ground cereal. Nov. 28.

(*B.*)—Sanitation; Water Purification.

[C.S.] 19,214 (1905). Wixford. Process and system for purifying water. Dec. 5.
„ 19,215 (1905). Wixford. Process of purifying water. Dec. 5.

(*C.*)—Disinfectants.

[C.S.] 24,618 (1905). England. Antiseptic or disinfecting compounds. Dec. 5.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 26,501. Lederer. Process for obtaining cellulose esters from solutions. Nov. 22.
„ 26,502. Lederer. Preparation of acidylised cellulose solutions. Nov. 22.
„ 26,503. Lederer. Cellulose compounds or compositions. Nov. 22.
„ 26,944. Pering. Machine for making washable fat- and water-proof paper in the cold way.* Nov. 27.
„ 26,962. Beck. Manufacture of paper, paperboard, and moulded products.* Nov. 27.
„ 27,125. Beck. Apparatus for making half-stuff from peat turf.* Nov. 28.
„ 27,126. Beck. Apparatus for making half-stuff from peat.* Nov. 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 23,648A. Newton (Bayer und Co.). Manufacture of mono-iodobehenic acid. Nov. 19.
„ 26,689. Frestadius. *See under* XVII.
„ 26,838. Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of a new pharmaceutical product. Nov. 26.
[C.S.] 5032 (1906). Weizmann, and Clayton Aniline Co. Manufacture of camphene. Nov. 28.
„ 5039 (1906). Abel (Act.-Ges. f. Anilinfabr.). New salts of hexamethyleneamine and the manufacture thereof. Dec. 5.
„ 8527 (1906). Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of quinine oxymagnesium haloid compounds and of quinine esters therefrom. Dec. 5.
„ 19,960 (1906). Basler Chem. Fabr. Manufacture of camphene. Nov. 28.

XXII.—EXPLOSIVES, MATCHES, &c.

[C.S.] 6581 (1906). Nathan, Thomson, Rintoul, and Scott. Manufacture of nitroglycerine. Dec. 5.
„ 17,414 (1906). Reschke. Manufacture of safety explosives. Nov. 28.

London Section.

Meeting held at Burlington House, on Monday, November 3, 1906.

MR. R. J. FRISWELL IN THE CHAIR.

THE ALLEN-MARQUARDT PROCESS FOR THE ESTIMATION OF HIGHER ALCOHOLS.*

BY E. A. MANN AND C. E. STACY.

IN the course of an extended investigation of samples of whisky for the Western Australian Government, in which the Allen-Marquardt method was employed for the estimation of higher alcohols, certain results were obtained which led us to make a special examination of this process. The method was used exactly as described by Allen and Chattaway (Analyst, Vol. XVI.). In sub-tropical countries like Western Australia we are doubtless confronted with difficulties in chemical processes which never occur to workers in colder climates, and this occurred in the present instance.

We had been engaged for six months in examining a large number of samples of whisky, which were worked off in batches of 10 each. The examination was begun in early winter (June) and concluded in the middle of summer (the following January). Early in December, when the first severe heat of summer began to make itself felt, discrepancies began to appear in our estimations of the higher alcohols. Very much higher proportions of these constituents appeared than the rest of the analysis would have led us to expect, and we naturally looked to the climatic conditions for an explanation. In winter the laboratory temperature frequently falls as low as 50° F., while in summer it frequently rises to 96°—98° F.† One series of tests was specially designed to investigate the influence (if any) of these temperatures upon the process. The other series of tests was made with a view to studying the end reactions obtained in the final titration with barium hydroxide, and especially as to the necessity and desirability of the preliminary titration with methyl orange for mineral acids.

Influence of temperature.—In cases where the higher alcohols had been extracted with carbon tetrachloride during high summer temperatures, we obtained very low combining weights for the acids contained in the final barium salts, in other words, large proportions of acetic acid were present with the valeric acid. This indicated that, at the higher temperatures, the ethyl alcohol was dissolved in the tetrachloride to an increased extent.

This suggested the following questions:—(1) Were the higher alcohols completely extracted under these circumstances? (2) Was the amount of ethyl alcohol dissolved affected by and proportional to the temperature? (3) How could a correction be made for the error thus introduced in the final titration.

In order to test the first question pure alcohol had to be prepared, and known quantities of higher alcohols added.

Preparation of pure alcohol.—About two litres of commercial absolute alcohol were taken, sufficient concentrated alkali solution added to neutralise acids and saponify esters, and the whole boiled under a rectifying column for half an hour without, however, allowing any to distil over. Seventy-five c.c. were then distilled off very slowly (about one drop every two seconds) and rejected; a further 750 c.c. was then collected at the rate of about one drop per second. This distillate was diluted to a strength of 15·6 under proof—and used for the subsequent tests.

Addition of higher alcohols.—To 700 c.c. of the diluted pure alcohol was added 0·777 grm. of amyl alcohol giving 0·111 grm. per 100 c.c. The amyl alcohol used was Merck's "*purissimum*," boiling between 128° and 131° C. It was enclosed in a small, specially-blown glass bulb, previously tared, which was sealed off before weighing; the bulb was then broken after immersion in the ethyl alcohol.

Three lots of 100 c.c. of pure alcohol were shaken out, oxidised, and titrated according to Allen and Chattaway's method. The laboratory temperatures during the shaking out gradually rose from 86° to 92° F.

TABLE I.—*Tests on pure alcohol.*

Test.	1.	2.	3.
Barium hydroxide required for mineral acid	1·6	1·6	1·6
Barium hydroxide required for mineral acid in organic acid	14·7	15·4	14·9
Equivalent to amyl alcohol per 100 c.c. (in grms.)	0·1294	0·1355	0·1311

These results seemed extraordinarily high for purified ethyl alcohol, and we therefore took the combining weight of the acids in the barium salt obtained, and found, as we supposed, that the greater portion of the acid was acetic acid. In all cases, therefore, the true amount of valeric acid was arrived at by calculation.* The above three results then became:—

TABLE No. 2.

	Volume of *N*/10 barium hydroxide used.	Equivalent amyl alcohol by direct reading.	Weight of barium salts, less barium chloride.	Combining weight of mixed acids.	Calculated barium acetate.	Calculated barium valerate.	True amyl alcohol.	Grms. per 100 litres of absolute alcohol.
	c.c.							
1	14·7	0·1294	0·1959	65·7	0·1615	0·0344	0·0178	36·96
2	15·4	0·1355	0·2077	67·4	0·1618	0·0459	0·0238	49·60
3	14·9	0·1311	0·1985	65·7	0·1640	0·0345	0·0179	37·14

From this it would appear that even the carefully-prepared ethyl alcohol contained quite notable quantities of higher alcohols. This, however, was largely corrected by subsequent investigations.

Three lots of 100 c.c. of the control amyl alcohol solution were then treated in similar manner. The titration of these gave inflated figures for amyl alcohol in the same way as the pure alcohol solutions, but, when checked by the combining weight determination, the following results were obtained:—

* By the following formula $x = \frac{W - w}{1{\cdot}329} - 1$

Where x = acetate of barium in mixed salts; W = barium hydroxide used in titration (in grms.) calculated to barium valerate; w = Weight of mixed acetate and valerate of barium found. 1·329 = ratio of molecular weights of barium acetate and barium valerate.

* This paper was received in June last, just after the last meeting of the Session 1905-1906, and was taken as read.

† A temperature of 100° F. has been recorded on one occasion in the laboratory during last summer.

TABLE No. 3.

Tests on ethyl alcohol containing 0·111 *grm. amyl alcohol per* 100 *c.c.* (230 *grms. per* 100 *litres*).

	No. of c.c. *N*/10 barium hydroxide used	Equivalent amyl alcohol by direct reading.	Weight of barium salts, less barium chloride.	Combining weight of mixed acids.	Calculated barium acetate.	Calculated barium valerate.	True amyl alcohol.	Grms. per 100 litres of absolute alcohol.
4	22·9	0·2015	0·3272	84·4	0·1184	0·2188	0·1099	228·11
5	22·6	0·1989	0·3217	79·4	0·1496	0·1721	0·0893	195·36
6	23·8	0·2094	0·3540	81·2	0·1496	0·2044	0·1061	220·22

The amyl alcohol found in each case was, therefore, considerably less than that taken. As we expected, at these high temperatures, considerable quantities of ethyl alcohol were removed by the tetrachloride in the shaking out—also apparently the extraction of amyl alcohol was not quite, though nearly complete. Considering the great difference effected in a result by a very small error in the determination of the combining weight (*vide infra*), we think that some at least of the discrepancies are due to slight errors introduced into the combining weight determination through the presence of large quantities of barium acetate.

The above experiments were under actual working temperature conditions; it now became necessary to compare the results with those obtained at low temperatures. The use of ice to cool the solutions while shaking out was not found satisfactory in reducing the working temperatures, as it was found difficult by this means to maintain uniform conditions. Arrangements were therefore made to carry out the extractions with tetrachloride for a series of tests in a refrigerating chamber. Through the courtesy of the manager of the Government Refrigerating Works, a room was placed at our disposal at which a uniform temperature of 60° F. was maintained. The solutions, previously prepared, and the required apparatus and reagents were transferred to this chamber, and allowed to acquire the temperature of the air before any shaking out was attempted—the processes were then carried out as usual, and the separated tetrachloride containing the higher alcohols was returned to the laboratory for oxidisation and the subsequent manipulation. Six tests corresponding precisely to those described above were carried out with the following results. Nos. 7, 8 and 9 were made with pure ethyl alcohol. Nos. 10, 11, and 12 with solutions containing 0·111 grms. of amyl alcohol per 100 c.c.:—

TABLE No. 4.—*Tests at temperature of* 60° *F.*

	No. of c.c *N*/10 barium hydroxide. used.	Equivalent amyl alcohol by direct reading.	Weight of barium salts, less barium chloride.	Combining weight of mixed acids.	Calculated barium acetate.	Calculated barium valerate.	True amyl alcohol	Grms. per 100 litres of absolute alcohol.
7.	3·4	0·0299	0·0478	70·3	0·0297	0·0181	0·0094	19·57
8.	3·5	0·0308	0·0480	69·6	0·0343	0·0137	0·0071	14·72
9	3·5	0·0308	0·0494	73·6	0·0300	0·0194	0·0100	20·67
10.	12·6	0·1109	0·1968	88·7	0·0534	0·0484	0·0744	154·35
11.	11·9	0·1047	0·1925	94·3	0·0276	0·1049	0·0856	177·65
12.	12·0	0·1076	0·1906	91·5	0·0386	0·152	0·0789	163·81

The following points were at once suggested:—

1. That the ethyl alcohol apparently goes into solution in the tetrachloride to a much smaller extent at the lower temperature, and consequently much less acetic acid is obtained on oxidation, but that nevertheless titration alone cannot be relied upon; in all cases the combining weights of the organic acids must be determined, and the amount of valeric acid calculated therefrom.*

2. That the figures for the "purified" ethyl alcohol show a much smaller proportion of higher alcohols, *i.e.*, that little, if any, of these bodies remains in the purified spirit, as we expected. The difference between the tests 1, 2, and 3, and 7, 8, and 9 in this respect, is, we believe, due to the presence of the larger proportion of barium acetate present in the first three tests, which tends to introduce slight errors and magnify the effect of those errors in the determination of the combining weights.

3. The extraction in tests 10, 11, and 12 is again considerably below the theoretical.

The first two of these conclusions confirmed our expectations. The third called for further inquiry. This, however, was conducted in connection with the other series of experiments already referred to, and these will first be described.

Experiments with regard to the titration.—At an early stage of our work we became convinced that the preliminary titration "for mineral acids," using methyl orange as an indicator, was not reliable, because the methyl orange was sensibly affected by fatty acids. Thus acetic acid gives an acid reaction with methyl orange which is not quantitative. Even after a titration with barium hydroxide has been conducted to distinct alkalinity with methyl orange, a considerable amount of acidity is disclosed by the further addition of phenolphthalein. The following tests illustrated this:—Four solutions of acetic acid in distilled water were prepared containing respectively (13) 0·03012 grm., (14) 0·06024 grm., (15) 0·09036 grm., (16) 0·12048 grm. of acetic acid in 100 c.c. These were titrated with *N*/10 barium hydroxide using methyl orange, and the neutral and distinctly alkaline points noted. The titration was then continued to the end point with phenolphthalein. The amounts of *N*/10 barium hydroxide required to titrate acetic acid were:—

TABLE No.

Test.	Methyl Orange neutral point c.c.	Distinct alkalinity c.c.	Phenolphthalein end reaction c.c.
13	0·6	0·9	4·9
14	1·6	2·0	9·8
15	2·7	3·9	14·7
16	3·9	5·0	19·6

* This latter conclusion, however, was found to be fallacious.

It is therefore evident that the use of methyl orange is inadmissible when acetic acid is present.*

We then proceeded to inquire what was the probability of the formation of mineral acid in the process, and whether the preliminary titration for these acids should not be entirely dispensed with. Three lots of 100 c.c. of carbon tetrachloride were treated with the usual amount of oxidising mixture, and in exactly the same way as in an estimation of higher alcohols, except that, of course, no ethyl alcohol was present. The distillate obtained after oxidation gave no reaction whatever with methyl orange, so that no mineral acids were present as the result of the oxidising mixture alone or from action upon the tetrachloride. In one case, however, the first two drops of methyl orange were *bleached* and chlorine could be detected by smell; traces of this substance could also be detected by smell in the residues of the other two tests. This bleaching of methyl orange has been noticed in a number of cases where potable spirits have been examined, and may be due to (1) decomposition of carbon tetrachloride†; (2) oxidation of chlorides, present as impurities in the oxidising mixture; or (3) introduction of chlorine compounds in the sample in the case of potable spirits.

Three extractions (each with 100 c.c. of tetrachloride) were then carried out precisely as in the Allen-Marquardt process, in all respects except that alcohol was absent. That is to say, the shaking with salt solution, and subsequent washing with saturated salt and sodium sulphate solutions, was applied in each case, and then the oxidation again carried out as in the last three tests. Again no action on the indicator (except slight bleaching) was discernible on adding methyl orange; the smell of chlorine was again detected. It would appear therefore that no mineral acids are formed in the process or from the materials used.

The following table gives the results of tests Nos. 1 to 12 recalculated so that no deduction is made for mineral acid, but all acidity is taken as organic acid:—

* *Vide* also Sutton—"Volumetric Analysis," and Biedemann, Chem. Kal., 1906.

† Throughout the experiments pure carbon tetrachloride prepared by Merck, specially procured from Europe, was employed.

It was now possible (since the action on mineral acids had been eliminated) to test the action of valeric acid on methyl orange. This was done as follows:—Pure amylic alcohol (b. pt. 128°—131°) was added in the following respective amounts to three portions of carbon tetrachloride:—(23) 0·0383 grm., (24) 0·0677 grm., (25) 0·1360 grm. These solutions were oxidised and titrated with both indicators, as in the case of experiments Nos. 1—4, with the following results:—

TABLE No. 7.

N/10 *Barium hydroxide required to titrate valeric acid.*

No.	Methyl Orange.		Phenolphthalein.		
	Neutral c.c.	Alkaline c.c.	End reaction c.c.	Equal to amyl alcohol.	Difference from theoretical.
23	0·4	0·6	4·6	0·0401	0·0018
24	0·6	0·9	7·2	0·0634	0·0047
25	1·0	1·5	16·0	0·1408	0·0152

It is evident, therefore (as was of course to be expected), that valeric as well as acetic acid effects methyl orange. In the last two tests it will be noticed that apparently a considerable loss of amyl alcohol occurs, equal to 10 and 31 grms. respectively in 100 litres of absolute alcohol, and this loss, apparent in tests 1—12, has already been referred to in connection with the first series of tests. This was further investigated. The residues from the final distillation (after oxidation) in tests 24 and 25 were diluted and again distilled. The distillates, when titrated required 0·1 c.c. and 0·2 c.c. *N*/10 barium hydroxide solution respectively. The corks used during the oxidation* were boiled, and the solutions obtained in each case took a further 0·1 c.c. of alkali. These figures give a further yield of 0·00176 grm. and 0·00264 grm. of amyl

* All corks used throughout the process were protected with tin foil.

TABLE No. 6.—*Tests on pure alcohol.*

Temperature rising from 86° to 92° F.

Test.	Volume of *N*/10 barium hydroxide used.	Equal to amyl alcohol.	Combining weight of acid	Barium acetate.	Barium valerate.	Equal to amyl alcohol.	Amyl alcohol, parts per 100 litres absolute alcohol.
	c.c.	grms.		grms.	grms.		
1.	16·3	0·1434	61·1	0·2027	0·0060	0·0036	7·46
2.	17·0	0·1496	62·7	0·2027	0·0187	0·0097	20·04
3.	16·5	0·1452	61·1	0·2048	0·0074	0·0038	7·88
	Tests on ethyl alcohol containing 0·111 *grm. of amyl alcohol per* 100 *c.c.*						
4.	24·9	0·2191	70·3	0·1945	0·1635	0·0849	176·25
5	24·3	0·2138	70·8	0·2294	0·1068	0·0555	115·21
6.	25·8	0·2270	77·8	0·1896	0·1952	0·1013	210·24

Tests on pure alcohol.

Temperature of 60° F.

Test.	Volume of *N*/10 barium hydroxide used.	Equal to amyl alcohol.	Combining weight of acid.	Barium acetate.	Barium valerate.	Equal to amyl alcohol.	Amyl alcohol, parts per 100 litres absolute alcohol.
	c.c.	grms.	grms.	grms.	grms.		
7.	4·0	0·0352	67·5	0·042	0·012	0·0062	12·86
8.	3·9	0·0343	66·3	0·0456	0·0066	0·0034	7·06
9.	3·9	0·0343	59·9	0·0377	0·0159	0·0082	17·02
	Tests on ethyl alcohol containing 0·111 *grm. of amyl alcohol per* 100 *c.c*						
10.	13·7	0·1205	84·4	0·0659	0·1412	0·0733	152·16
11.	13·2	0·1162	88·6	0·0538	0·1522	0·0790	163·99
12.	13·0	0·1144	86·8	0·0595	0·1411	0·0732	151·95

alcohol respectively. The loss could not therefore be accounted for in these directions. In case the error might be due to impurities in the amyl alcohol used, that employed in the previous tests was refractionated, and only that portion boiling between 129·5° and 130° C. was used for a further series of tests.

Tests 26 to 35—ten lots (each 100 c.c.) of purified ethyl alcohol were diluted to 15° under proof, and amyl alcohol added so that the first five solutions contained 0·0867 grm., and the second five 0·04906 grm. They were then salted out and extracted in the usual way, except that two successive washings of 40 c.c. of tetrachloride solution were used, and then the usual washings of 30, 20, and 10 c.c., making 140 c.c. of tetrachloride in all.* The end titration was made with phenolphthalein alone, and the total acidity reckoned as organic acids. In other respects the process was conducted in exactly the usual way. The room temperatures during the tests varied from 68°—74° F. The results are given in Table No. 8.

loss in others, trifling, in fact, as compared with the loss when oxidation was conducted under a reflux condenser. After titration, the carbon tetrachloride was separated from the aqueous solution of barium valerate, the flask and separator washed, and the washings added to the aqueous solution, which was evaporated in large platinum dishes to dryness, and the residues further dried for one hour at 100° C. In no case was the theoretical amount of barium valerate obtained, and in most cases the loss was very serious. In one experiment, a weighed quantity of barium carbonate was added to the solution during evaporation, to see if this would prevent loss of valeric acid, but without result.

In any attempt to correct the titration result in the Allen-Marquardt method, when, by reason of the temperature of "shaking out," acetic acid may be present, it is obvious that this loss of valeric acid, by lowering the apparent combining weight of the organic acids, will introduce a grave error. Thus, taking the maximum loss in the present series of experiments (test No. 43), the

TABLE No. 8.

Experiments on ethyl alcohol of 85 per cent. proof spirit, containing quantities of amyl alcohol boiling between 129·5° and 130° C.

Temperature of 60° F.

No. of test.	Amount of amyl alcohol added.	Vol. of *N*/10 barium hydroxide used.	Weight of barium salts obtained	Amount of amyl alcohol recovered.	Amount of ethyl alcohol recovered.	Combining weight of mixed organic acids.	Amount of amyl alcohol taken, expressed as grms. per 100 litres of absolute alcohol.	Amount of amyl alcohol recovered, expressed as grms. per 100 litres of absolute alcohol.	Loss of amyl alcohol, expressed as grms. per 100 litres of absolute alcohol.	Laboratory temperature during the the process of shaking out. °F.
	grms.	c.c.	grms.	grms.	grms					
26.	0·0867	19·6	0·2873	0·07850	0·0491	79·1	178·70	161·80	16·90	74
27.	0·0867	19·7	0·2860	0·07320	0·0523	77·7	178·70	150·88	27·82	74
28.	0·0867	19·2	0·2803	0·07471	0·0492	78·5	178 70	154·00	24·70	74
29.	0·0867	19·2	0·2754	0·0644	0·0546	75·7	178·70	132·74	45·96	74
30.	0·0867	16·9	0·2480	0·0682	0·0431	78·6	178·70	140·56	38·14	68
31.	0·04906	14·4	0·2029	0·04050	0·0450	73·4	101·11	83·48	17·63	68—69
33.	0·04906	14·7	0·2083	0·04376	0·0447	74·9	101·11	90·19	10·92	68—69
33.	0·04906	13·2	0·1868	0·03910	0·0402	74·0	101·11	80·59	20·52	68—69
34.	0·04906	14·2	0·1995	0·03873	0·045	73·0	101·11	79·77	24·34	70
35.	0·04906	12·8	0·1795	0·03444	0·0408	72·8	101·11	70·99	30·12	70
						Average	loss of amyl	alcohol ..	25·40	

It will be seen that a loss occurred in all cases, which has been calculated into grms. per 100 litres of absolute alcohol. The original alcoholic strengths of the solutions were those of ordinary bottled commercial spirits, and therefore the loss is that which might be expected in the examination of such spirits. The average loss is more than half the maximum, and more than twice the minimum. The uniform amount of ethyl alcohol extracted in these tests as shown in column 6 is particularly interesting.

It has been pointed out by Schidrowitz (Analyst, **30**, p. 191) that some loss is incurred through the incomplete condensation of tetrachloride containing valeric acid in the reflux condensers used during the oxidation process, and he recommends the use of special rod and disc condensers and ground in glass connections. These were not procurable here, so we made experiments with the oxidation process carried on in pressure bottles. The results of these were so satisfactory that in future we intend to use this apparatus in preference to reflux condensers. The method has also the great advantage of saving at least half the time in oxidation, though it requires more personal attention on the part of the analyst.

Tests in closed bottles.—Thirteen tests with varying quantities of pure amyl alcohol dissolved in purified carbon tetrachloride were carried out. The tests were enclosed in 8 oz. flat stoppered bottles, clamped in specially prepared brass frames. They were heated for four hours in a water oven, at a temperature of about 96° C., and were shaken for one minute about every seven minutes. From the annexed table it will be seen that, by direct titration, there was no loss in some cases, and very slight

* This precaution was taken to see if any further extraction of amyl alcohol occurred. The results showed that no such effect

theoretical amount of barium valerate was 0·161 grm., but the actual weight of barium valerate obtained was only 0·1468 grm.*; the difference, 0·0142 grm., indicates *directly* a loss of 0·007 grm. of amyl alcohol; this difference however, also increases the apparent amount of barium acetate present, and taking into account the lowering effect of this upon the combining weight, it represents a loss of 0·0298 grm. of amyl alcohol or a total of 0·0836 grm. as found by titration. The error thus introduced is described in the appended table as "working error," while the direct error is shown in column 5.

TABLE No. 9.—*Tests in pressure bottles.*

1 No.	2 Amyl alcohol used.	3 Amyl alcohol found by titration.	4 Amyl alcohol found by combined weight method.	5 Loss of amyl alcohol calc. directly from loss of valeric acid	6 Resulting working error. Loss of amyl alcohol.
	grm.	grm.	grm.	grm.	grm.
36	0·0345	0·0356	0·0239	0·0029	0·0117
37	0·0392	0·0370	0·0348	0·0005	0·0022
38	0·0603	0·0585	0·0435	0·0035	0·0150
39	0·0633	0·0633	0·0438	0·0050	0·0195
40	0·0716	0·0713	0·0430	0·0071	0·0283
41	0·0741	0·0729	0·0585	0·0035	0·0144
42	0·0777	0·0765	0·0552	0·0050	0·0213
43	0·0834	0·0836	0·0536	0·0073	0·0298
44	0·0863	0·0840	0·0687	0·0038	0·0153
45	0·0923	0·0902	0·0626	0·0068	0·0276
46	0·0986	0·0959	0·0661	0·0073	0·0298
47	0·0996	0·1012	0·0741	0·0067	0·0271
48	0·1040	0·1047	0·0763	0·007	0·0284

* The [illegible] figures not shown in the table.

The loss in the reflux condenser would appear therefore to be a very serious and constant one, as pointed out by Schidrowitz; but a still more serious one appears to have been overlooked, viz., that due to the loss of valeric acid by evaporation from the barium salt during the estimation of the combining weight. This error is so great that in our opinion it entirely vitiates the value of this operation.

A peculiar circumstance was noticed during these special tests, which we have not seen previously recorded. In all cases where the amount of amyl alcohol acted upon approached 0·1 grm., a heavy precipitate was produced during the oxidation. In the subsequent distillation, at the point when the last tetrachloride was boiled off a heavy, dry looking scum formed in the distilling flask, and only disappeared when the remaining aqueous liquid, had boiled for some little time. Only in one case during the analysis of over 100 samples of commercial spirits was this effect observed, and that was a case where the higher alcohols were present in exceptionally large quantities.

Although the conclusions arrived at may appear in some instances to be based on a very small series of tests, we would like to say that in every instance the results of these special series have been confirmed by others obtained in a very extensive examination recently made in the laboratory, embracing 105 different brands of commercial spirits.

Conclusions.

1. In order to obtain complete oxidation of the amyl alcohol and recovery of the valeric acid, the pressure bottle method is preferable to the use of reflux condensers.

2. Serious loss of valeric acid occurs in the process of drying the barium salts for estimation of the combining weight of the acid.

3. At temperatures exceeding 60° F., the solubility of ethyl alcohol in carbon tetrachloride, and subsequent formation of acetic acid during oxidation, render it impossible to calculate the higher alcohols from the titration alone; this solubility increases with the working temperature.

4. The titration for mineral acids is unnecessary, and introduces errors.

5. Accurate results may be obtained by observing the following points:—

(*a*) The shaking out to be performed at a temperature of 60° F., or less.

(*b*) The oxidation to be conducted in pressure bottles.

(*c*) The higher alcohols to be determined by *direct titration* only, calculating all acidity as valeric acid.

Newcastle Section.

Meeting held at Armstrong College on Thursday, November 8, 1906.

DR. J. T. DUNN IN THE CHAIR.

The Saville Shaw Medal (awarded annually to a student of Armstrong College) was presented to Mr. F. G. Trobridge.

THE GASES ENCLOSED IN COAL AND CERTAIN COAL DUSTS.

BY F. G. TROBRIDGE.

Communicated by Professor Bedson.

This note sets forth the results of the analysis of the gases enclosed in the coal constituting the Busty Seam, at Birtley, in the County of Durham, together with the examination of the gases enclosed in the dust formed in the screening of the coal, and in samples of dust collected on the timbers in the mine. The samples were supplied by Mr. Philip Kirkup, who also kindly gave a section of the seam, showing the relative proportions of bright coal and "dant" which constitute this seam.*

The method of extracting the gases from the coal is practically that adopted by W. J. Thomas. A weighed amount of the coal or dust contained in a round bottomed flask is sealed on to a mercury air-pump, *e.g.*, either a Töpler or Geissler pump. The air was removed in the usual manner, and in establishing a vacuum the last portion of air was collected, and analysed. The coal was now allowed to remain in the exhausted flask, &c., for several days, the gas evolved being pumped off from time to time, collected over mercury, and subsequently analysed. After removal of these gases the coal was next heated for several hours by means of water kept boiling, the gas so driven off was pumped off, collected, measured, and analysed. This procedure was repeated until it was judged that the whole of the gas obtainable under these conditions had been expelled.

The gases obtained in this manner were analysed, the apparatus devised by Dr. Sodeau being used for this purpose.

The following table contains a statement of the results:—

	Bright coal.	"Dant."	Surface dust.	Dust from timbers.
Weight of coal ..	296 grms	246 grms.	156 grms.	201·0 grms.
Last portion of air	23·04 c.c. N.T.P.	30·47 c.c. N.T.P.	11·17 c.c. N.T.P.	17·46 c.c. N.T.P.
Gas at ordinary temperature ..	63·1 c.c. N.T.P.	35·62 c.c. N.T.P.	8·54 c.c. N.T.P.	2·92 c.c. N.T.P.
Time of standing..	16 days	167 hours	7 days	—
Gas at 100° C. ...	414·0 c.c. N.T.P.	86·0 c.c. N.T.P.	14·25 c.c. N.T.P.	22·67 c.c. N.T.P.
Time of heating..	68 hours	—	—	—
Volume of gas at 100° C. per 100 grms. of coal ..	139 c.c. N.T.P.	35·0 c.c. N.T.P.	9·2 c.c. N.T.P.	11·4 c.c. N.T.P.

Parts per cent.

	Bright coal.			"Dant."			Surface dust.			Dust from timbers.		
	a.	*b*	*c.*	*a.*	*b.*	*c.*	*a.*	*b.*	*c.*	*a.*	*b.*	*c.*
Carbon dioxide ..	3·0	7·0	4·0	2·9	17·1	35·8	3·0	4·0	55·8	5·6	4·7	85·1
Oxygen	22·5	3·2	0·3	25·1	10·8	0·6	23·5	8·5	2·6	19·4	13·7	2·9
Carbon monoxide	—	0·7	0·8	—	—	1·5	0·0	—	4·2	1·4	—	0·4
Olefines	—	—	—	—	—	—	—	—	—	—	—	—
Paraffins (C_nH_{m+2})	16·1	53·4	93·9	3·1	9·4	60·5	4·7	2·6	22·5	1·9	2·2	—1·8
Nitrogen	58·4	35·7	1·0	68·9	62·7	1·6	68·8	84·9	14·9	71·7	79·4	—9·8

(*a*) Last portion of air. (*b*) Ordinary temperature. (*c*) At 100° C.

* The term "dant" applies in the North of England to the black substance sometimes called "Mother of Coal" or "Mineral Charcoal," which is found in thin layers in the seams of coal.

The proximate analysis of these samples of coal, dust, &c., has been made by Miss E. Oliver, B.Sc.; the following table contains a statement of the results:—

	Bright coal.	"Dant."	Surface dust.	Dust from timbers.
Moisture	0·63	1·09	0·81	3·07
Volatile matter ..	31·47	15·20	28·4	22·33
Fixed carbon ...	64·12	75·41	61·82	29·01
Ash	3·78	8·3	8·97	45·59
	100·00	100·00	100·00	100·00

Although the investigations of von Meyer, W. J. Thomas, Bedson, and McConnell, Dr. Brookmann, the Reports of the Fire-Damp Commissions in Prussia and Austria, &c., have made us familiar with the general character of the gases enclosed in coal and coal dust, there are still some points of interest brought to light in the analyses detailed above. In the first place, it is evident that the bright coal is mainly responsible for the occluded gases in a sample of coal, yielding not only the larger volume, but also the larger proportion of combustible gas. Further, the results of the explosion of the combustible gas show this constituent to be almost entirely marsh gas, as is that from the "dant" also; whereas the combustible gas yielded by the dust formed in screening the coal gives results which are most easily interpreted as indicating the presence with marsh gas of other hydrocarbons of the paraffin series; although this indication is not so marked as that obtained by Bedson in his examination of the gases obtained from the dust produced in the screening of coal at Ryhope, and communicated to the North of England Mining Institution in 1888. The presence of the higher homologues of marsh gas in similar dusts has also been drawn attention to in the Report of the Austrian Fire Damp Commission.

The proportion of oxygen in the last portion of air removed in the evacuation of the vessels containing the coal calls for remark. It will be noted that its proportion to the nitrogen is greater than in air. This confirms an observation described by Bedson (Trans. of Federated Institution of Mining Engineers, 1902), in which pieces of freshly hewn coal were let up into the Torricellian vacuum of a specially constructed barometer; and the gases given off removed and analysed. Coal of the same origin was, after being exposed to the air of the laboratory, treated in a similar manner. The analysis of the gases obtained in this way gave the following results:—

	Freshly hewn coal.	Coal after exposure to the air.
Carbon dioxide ..	1·65	1·18
Oxygen	8·79	23·80
Marsh gas	44·60	3·58
Nitrogen	44·76	71·44
	100·00	100·00

showing that coal, after removal from the mine, not only gives off its "enclosed gases," but takes up gases from the air and oxygen preferentially to nitrogen.

Attention is being directed to the nitrogen contained in the occluded gases, with the object of ascertaining the presence or otherwise of the inert gases, which are associated with atmospheric nitrogen. As the experiments are still in progress it has not been thought desirable to include an account of these in this note.

A similar examination has been made of the occluded gases in a sample of coal dust from the Fernie Mine in British Columbia, where an explosion occurred in 1902. The sample of dust (remarkable for its fineness), and also of the coal from the same mine were obtained by Dr. Bedson from Mr. J. Ashworth, Mining Engineer, Derby, England.

The gases differ from those of the Busty seam, in character of the combustible constituents, which are undoubtedly mixtures of higher homologues of the marsh gas series. In fact, the composition of these gases is not dissimilar to that of the gases obtained by Bedson (*loc. cit.*) from the Ryhope coal dust and coal.

The following table contains the results of the analyses of the occluded gases:—

Fernie coal.

	Vol. from 100 grms. coal.	Carb. diox.	Oxygen.	C_nH_{2n}.	Carbon monoxide.	C_nH_{2n+2}.	Nitrogen.
Coal Dust—	c.c						
(*a*) Gas at ordinary temperature	12·8	25·5	9·7	0·0	0·0	5·3	59·5
(*b*) Gas at 100° C.	16·2	36·7	11·7	0·0	0·0	10·8	40·6
Coal—							
(*c*) Last portion of air	—	7·5	10·6	0·0	0·0	8·6	73·3
(*d*) Gas at ordinary temperature	22·2	16·5	7·2	0·0	0·9	24·3	57·1
(*e*) Gas at 100° C.	23·1	35·4	1·0	0·4	7·9	52·7	2·6

The results of the explosion of the combustible constituents of these gases, gave the following values for "n" in the formula C_nH_{2n+2}, in "*a*" n = (approximately) 1, in "*b*," n = 4·4, in "*c*," n = 2·1, in "*d*," n = 1·8, and in "*e*," 2·5.

Scottish Section.

Meeting held at Glasgow on Friday, November 9, 1906.

PROF. THOMAS GRAY IN THE CHAIR.

THE MANUFACTURE OF CYANOGEN BROMIDE.

BY THOMAS EWAN, M.SC., PH.D.

The use of cyanogen bromide as a solvent for gold was first proposed by Dr. Gaze, of Westport, New Zealand, in 1892, shortly after the introduction of the cyanide process of gold extraction. Sulman and Teed in 1894 showed that it was only efficient as a solvent for gold when used with an alkali cyanide, its function being the same as that of oxygen in the solution. The greater rapidity of extraction which may be obtained by the use of cyanogen bromide does not, as a rule, make up for the extra cost of the reagent, and its use is therefore limited to a few refractory ores which cannot be treated satisfactorily by cyanide alone.

Before the introduction of Sulman and Teed's process cyanogen bromide was made by adding a solution of a cyanide to bromine, thus, $Br_2 + KCN = KBr + BrCN$. It was soon found, however, that cyanogen bromide itself polymerises much too readily to permit of its transport,

more especially through tropical latitudes. Similar difficulties in the case of bromine led to the introduction of two new processes of manufacture, which were described by C. Göpner in 1901 (Zeits. angew. Chem., 1901, 355). In the first of these dilute sulphuric acid was added to a solution containing sodium bromide, bromate, and cyanide in the proportions $5NaBr + NaBrO_3 + 3NaCN$ at 70° C., the cyanogen bromide produced distilling over. In this process only one-half of the bromine is obtained in the form of cyanogen bromide. The second process, which is that now employed, avoids the loss of bromine by using a larger quantity of bromate, the reaction being $2NaBr + NaBrO_3 + 3NaCN + 3H_2SO_4 = 3BrCN + 3Na_2SO_4 + 3H_2O$.

The reaction of bromic and hydrobromic acids was studied by Judson and Walker (J. Chem. Soc., 1898, **73**, 410). They showed that it occurs in stages; the first change is a slow one represented by the equation, $2H' + Br' + BrO_3' = HBrO + HBrO_2$. This is followed by the two instantaneous changes, $HBrO + HBr = Br_2 + H_2O$ and $HBrO_2 + 3HBr = 2Br_2 + 2H_2O$. The rate at which the change proceeds is that of the first reaction and is expressed by the equation—

$$-\frac{dC_{BrO_3'}}{dt} = k\,[C_{H'}]^2\,[C_{Br'}]\,[C_{BrO_3'}] \quad \ldots\ldots 1.$$

where $C_{H'}$, $C_{Br'}$, and $C_{BrO_3'}$ are the concentrations, in gram molecules per litre, of the hydrogen, bromide, and bromate ions respectively.

Judson and Walker made two sets of measurements of the velocity of the reaction between pure bromic and hydrobromic acids in aqueous solution at 25°. The average values of k in equation (1) calculated from the results of these measurements are 285 and 309.

I made a few measurements by the method described by Judson and Walker, using a commercial "bromine salt" containing sodium bromate and bromide in the proportion $NaBrO_3$:5NaBr. The reaction was started by adding the exact quantity of hydrochloric acid required to liberate the bromic and hydrobromic acids and to neutralise a small quantity of sodium carbonate which was present in the salt. The results obtained at 25° were:—

Time in mins.	$C_{BrO_3'}$.	k.	Time in mins.	$C_{BrO_3'}$.	k.
0	0·0254	—	0	0·0127	—
3	0·0126	269	5	0·0094	273
6	0·0094	348	17	0·0068	296
15	0·0083	211			
	Average ..	276		Average ..	285

The presence of sodium chloride has, therefore, as was to be expected, no effect on the rate of the reaction. The value of k at 25° may be taken as 290.

When bromic and hydrobromic acids react in presence of hydrocyanic acid, it appears possible that in addition to the simple reaction of bromine on hydrocyanic acid, $Br_2 + HCN = HBr + BrCN$, other changes may occur. The bromous and hypobromous acids produced as intermediate products of the change might react thus, $HCN + HBrO = H_2O + BrCN$

$$3HCN + HBrO_2 = 2H_2O + BrCN + C_2N_2$$

The first of these reactions would not affect the rate of change, because it is equivalent to the reactions $HBrO + HBr = Br_2 + H_2O$ and $Br_2 + HCN = BrCN + HBr$, but the second reaction would leave hydrobromic acid in solution which would otherwise have been decomposed, and in this way would accelerate the reaction. The same would be true of the reaction $HBrO_3 + 5HCN = BrCN + 2C_2N_2 + 3H_2O$.

Measurements of the velocity of reaction were, therefore, made partly in order to clear up the mechanism of the reaction, partly to find the time required for complete reaction under various conditions.

The experiments were made as follows: The necessary quantities of sodium bromate, bromide, and cyanide were mixed in small flasks with india-rubber stoppers, diluted to the strength desired and placed in a water bath heated to 25° C. until the solutions had acquired that temperature. The quantity of hydrochloric acid required to neutralise the cyanide and to liberate the bromic and hydrobromic acids was then run in quickly, and the mixture allowed to stand at 25° for a measured time. The reaction was then stopped by adding an excess of caustic soda, which converts the cyanogen bromide into cyanate and bromide. The unchanged cyanide was then titrated with silver nitrate and potassium iodide indicator, after which the solution was acidified, excess of potassium iodide added, and the iodine liberated by the action of the unchanged bromic acid on the hydriodic acid titrated with sodium thiosulphate.

The results obtained are contained in the following tables. The initial concentration (in grm. mols. per litre) of the bromic acid is given and also the relative quantities of the other substances present in the solution. The presence of a little sodium carbonate in the salts used accounts for the extra sodium chloride present.

I.

Initial concentration of bromic acid = 0·0102 gr. mol. per litre. Composition of solution—

$$HBrO_3 + 4{\cdot}96HBr + 3{\cdot}04HCN + 9{\cdot}88NaCl.$$

Time in mins.	Per cent. of hydrocyanic acid unchanged.	Per cent. of bromic acid unchanged.	k.
8	69·2	72·7	270
14	61·8	64·1	244
27	43·2	46·1	264
64	23·9	24·4	266
87	14·3	16·6	307
117	10·3	12·2	297
		Average	275

II.

Initial concentration of bromic acid = 0·0204 gr. mol. per litre. Composition of solution—

$$HBrO_3 + 4{\cdot}96HBr + 3{\cdot}04HCN + 9{\cdot}88NaCl.$$

Time in mins.	Per cent. of hydrocyanic acid unchanged.	Per cent. of bromic acid unchanged.	k.
2	56·2	58·3	250
3	48·5	45·1	262
4	39·6	43·0	253
6	31·6	34·4	238
9	22·3	23·7	250
30	1·7	5·8	279
		Average	255

III.

Initial concentration of bromic acid = 0·02136 gr. mol. per litre. Composition of solution—

$$HBrO_3 + 2HBr + 3HCN + 6{\cdot}11NaCl + 0{\cdot}012NaBrO_3 + 0{\cdot}024NaBr.$$

Time in mins.	Per cent. of hydrocyanic acid unchanged.	Per cent. of bromic acid unchanged.	k.
4	85·2	85·6	314
12	70·6	72·2	275
21	61·8	63·2	270
38	52·8	54·2	296
78	41·0	41·8	288
101	36·5	38·8	344
247	25·5	28·4	336
		Average	304

IV.

Initial concentration of the bromic acid = 0·02322 gr. mol. per litre. Composition of solution—

$$HBrO_3 + 2HBr + 3HCN + 6{\cdot}11NaCl + 0{\cdot}15HCl.$$

Time in mins.	Per cent. of hydrocyanic acid unchanged.	Per cent. of bromic acid unchanged.	k.
3	83·5	83·2	316
5	78·1	80·4	264
13	62·7	64·0	344
29	45·7	51·0	254
73	35·4	38·0	322
		Average	300

The nearly constant difference between the loss of hydrocyanic acid and of bromic acid which is apparent in the above tables appears to be due to volatilisation of hydrocyanic acid. Two blank experiments, in which no bromic acid was used, gave losses of 1·3 and 2·3 per cent. of the hydrocyanic acid in 30 and 45 minutes respectively.

It is now necessary to deduce the equations for the velocity of the reactions studied; for comparison, the reaction between bromic and hydrobromic acids may also be included.

Provided that no secondary reactions occur the changes are:—

$$HBrO_3 + 5HBr + 3HCN = 3BrCN + 3HBr + 3H_2O \quad (A)$$

$$HBrO_3 + 2HBr + 3HCN = 3BrCN + 3H_2O \quad (B)$$

$$HBrO_3 + 5HBr = 3Br_2 + 3H_2O. \quad (C)$$

Regarding the strong acids as completely dissociated and the hydrocyanic acid as entirely undissociated, the concentrations of the reacting ions after t minutes, when the fraction m of the bromic acid remains unchanged, are:—

	A	B	C
$C_{BrO_3'}$	mC	mC	mC
$C_{Br'}$	$(3-2m)C$	$2mC$	$5mC$
$C_{H'}$	$(3-3m)C$	$3mC$	$6mC$

where C is the initial concentration of the bromic acid.

Substituting these values in the differential equation (1) and integrating, we obtain finally,

$$Ct = \frac{1}{27k}\left(2{\cdot}3026\log_{10}\frac{(1{\cdot}5+m)^4}{m(1+m)^3} - \frac{3}{1+m} - 0{\cdot}086\right) \quad .. (A^1)$$

$$Ct = \frac{1}{54k}\left(1-\frac{1}{m^3}\right) \quad ..... (B^1)$$

$$Ct = \frac{1}{540k}\left(1-\frac{1}{m^3}\right). \quad ..... (C^1)$$

The values of k in Tables I. and II. are calculated by means of equation A^1. Equation B^1 does not apply exactly to the figures in Tables III. and IV., because in one case there was a slight deficiency and in the other a small excess of acid. The values of k in these tables were, therefore, obtained directly from the differential equation, the values of the differential co-efficients being obtained graphically from a curve drawn through the experimental points. The values calculated by means of B^1 are, however, very little different from those obtained in this way.

The values of k, at 25°, for the three different reactions are, (A) 255 and 275, (B) 300 and 304, (C) 276 to 309; the agreement is sufficiently close to warrant the conclusion that no secondary changes of any importance occur.

Experiments with sulphuric acid.—Two experiments were made in exactly the same way as those described in Tables I. and II., except that sulphuric acid was used instead of hydrochloric acid. The results are given in Tables V. and VI., and, for comparison, the times required to reach the same stage in the change using hydrochloric acid are interpolated from Tables I. and II.

TABLE V.—*Initial concentration of bromic acid*, 0·0102 grm. mol. per litre. Composition of solution, $HBrO_3 + 4{\cdot}06HBr + 3{\cdot}04HCN + 4{\cdot}94Na_2SO_4$:—

Per cent. of hydrocyanic acid unchanged.	Time in mins.	Time with hydrochloric acid.	Ratio.
89·3	8	—	—
76·9	20	6·0	3·3
69·5	37	9·0	4·1
60·4	52	14·4	3·6
53·9	70	19·4	3·6
27·9	224	51·8	4·3
23·4	334	60·8	5·5
2·3	971	—	—

TABLE VI.—*Initial concentration of bromic acid*, 0·0204 *gr. mol. per litre.* Composition of solution, $HBrO_3 + 4{\cdot}06HBr + 3{\cdot}04HCN + 4{\cdot}94Na_2SO_4$:—

Per cent. of hydrocyanic acid unchanged.	Time in mins.	Time with hydrochloric acid	Ratio.
72·4	5	—	—
54·5	13	2·3	5·6
37·0	31	4·4	7·0
11·4	116	16·0	7·3
0·0	980	—	—

It appears, thus, that a given stage in the decomposition is reached from three to seven times sooner with hydrochloric than with sulphuric acid.

It is impossible to calculate the concentration of the hydrogen ions in the solutions containing sulphuric acid, because the value of the equilibrium constant of the reaction $H^+ + SO_4'' \rightleftarrows HSO_4'$ is unknown. A rough estimate may be based on O. Tower's determinations of the concentrations of the hydrogen ions in solutions of sodium hydrogen sulphate (Zeits. phys. Chem., 18, 5, **18**, 45), and on the conductivity of sulphuric acid solutions.

The initial solutions in Experiments V. and VI. may be regarded as containing 3·92 $NaHSO_4$: 1·02 H_2SO_4. At the concentrations used, these two substances yield approximately equal quantities of hydrogen ions, and therefore the dissociation of either of them is not affected much by the presence of the other.

The concentrations of the hydrogen ions in the two solutions used in Experiments V. and VI., estimated in this way, are 0·027 and 0·05 grm. mol. per litre, that is 2·2 and 2·4 times less than in the corresponding experiments with hydrochloric acid. Since the velocity of change is proportional to the square of the concentration of the hydrogen ions, it should be 4·8 and 5·8 times greater with hydrochloric than with sulphuric acid. The difference between the rate of reaction observed with sulphuric and hydrochloric acids appears, therefore, to be satisfactorily accounted for by the smaller dissociation of the sulphuric acid.

The results obtained are valuable as affording a clue to the effect of the initial concentration of the solution on the yield of cyanogen bromide which can be obtained in a given time. The following table (calculated by means of Equation B^1) applies to the reaction, $HBrO_3 + 2HBr + 3HCN = 3CNBr + 3H_2O$ which is the only one which is of importance in practice.

Initial concentration of bromic acid (grm. mols. per litre.)	Percentage of the possible cyanogen bromide formed.		
	90.	95.	99.
0·05	8½ hours	67½ hours	1 year
0·1	68 mins.	8½ ,,	6½ weeks
0·2	8 ,,	63 mins.	132 hours
0·5	0·5 ,,	4 ,,	8½ hours

Since the acid used in practice is sulphuric acid, the times required will be still greater than those tabulated. Of course the time required for the last stages of the change could be shortened by using an excess of acid, but since the cyanogen bromide solution is to be mixed subsequently with a solution of an alkali cyanide, it is desirable to have it as nearly neutral as possible.

Mixing the charge.—In mixing a charge, the temperature should not be allowed to rise above about 35° C., since cyanogen bromide boils at 61° C. Good agitation should also be provided, in order to prevent the solution from becoming locally alkaline. Although hydrocyanic acid and cyanogen bromide have no action on each other, potassium or sodium cyanide reacts quickly with cyanogen bromide, thus, $KCN + CNBr = KBr + C_2N_2$; the sodium carbonate which is often present in commercial cyanide also decomposes cyanogen bromide thus, $CNBr + 2Na_2CO_3 + H_2O = 2NaHCO_3 + NaCNO + NaBr$. The further action of sodium bicarbonate is so slow that it may be neglected.

It may be remarked that even water decomposes cyanogen bromide; although the reaction is extremely slow at the ordinary temperature, it is very easily observed at 100°. Probably this accounts for the instability of imperfectly dried cyanogen bromide; the trace of hydrobromic acid formed by the action of moisture would, in presence of atmospheric oxygen, yield the bromine required to bring about rapid polymerisation.

The reactions of cyanogen bromide with alkali hydroxides and carbonates, and water, appear to be fundamentally the same, namely, $CNBr + 2OH' = Br' + CNO' + H_2O$. The different velocities of the reactions are due to the different concentrations of the hydroxyl ions in the reagents.

Analysis of solutions.—The working of the process may be controlled by analyses of the final solution. I have found the following methods to be convenient and accurate.

To an aliquot portion of the solution considerable excess of potassium iodide and hydrochloric acid are added, and the iodine liberated titrated with sodium thiosulphate. The quantity of iodine found should be the same as that which would have been produced by the bromic acid originally used. Any difference indicates a loss either of bromic acid or cyanogen bromide.

A second sample is treated in the same way after destroying the cyanogen bromide by adding sodium hydroxide. The difference between these results gives the cyanogen bromide present. The second result gives the quantity of bromic acid left unchanged. The quantity of cyanide left unchanged is determined in the way described previously. If the quantities left unchanged are excessive, it indicates that the time allowed for the reaction was insufficient, or that too little acid was used. The quantity of free acid in the final solution is easily determined by titration with a standardised solution of sodium bicarbonate, using methyl orange as indicator.

A few preparations of cyanogen bromide were carried out in order to confirm the results obtained by the study of the reaction. The "bromine salt" and cyanide used had the following compositions:—

Bromine salt.		Cyanide.	
$NaBrO_3$	14·61	KCN	30·33
$KBrO_3$	23·91	NaCN	51·17
NaBr	49·39	Na_2CO_3	13·70
Na_2CO_3	5·22	NaCNO	3·61
NaOH	0·45	Na_2O	0·54
Water	5·24	Na_2S	0·01
Fe_2O_3	0·78	NaCl	0·82
	99·60		100·18

5·27 grms. of the bromine salt and 2·47 grms. of cyanide were used in each experiment. The calculated quantity of 64 per cent. sulphuric acid (4·35 c.c.) was placed in a 200 c.c. burette with a tap funnel ground to fit its upper end, and provided with a small washing apparatus to catch cyanogen bromide vapour. The solid bromine salt was then placed in the tube, out of contact with the acid, the ground stopper carrying the funnel inserted, and the salt and acid mixed together, shaking and cooling the tube as well as possible. The cyanide was then added slowly in the form of a concentrated solution. The whole mass soon solidified to a thick paste of crystals of cyanogen bromide. After standing for a measured time, the product was diluted to 200 c.c. and measured quantities drawn off for analysis. The results of two such experiments were:—

	I.	II.
Initial concentration of bromic acid	0·7	0·7
Time of reaction	7 mins.	17½ hours
Per cent. of theory—		
Loss of cyanogen bromide	4·2	5·4
Yield of cyanogen bromide	81·3	85·7
Per cent. of theoquantity used—		
Unchanged bromate	14·5	8·9
Unchanged cyanide	11·5	6·1
Free acid	2·9	0·6
Free acid calculated	6·5	3·8

In the first experiment, the time was too short, and in both of them the concentration was too large, the mixture became so thick owing to the separation of cyanogen bromide that proper mixing was impossible. The main fault, however, was a deficiency of sulphuric acid; 57 per cent. of the acid is required to neutralise the cyanide and the carbonate in the bromine salt; of the remainder, 14·5 per cent. should be left unchanged in Experiment I., that is, 6·5 per cent. of the total quantity used.

A larger quantity of the acid was, therefore, used in the next experiments, and, in order to avoid the difficulty of mixing, the bromine salt and cyanide were mixed and added to the sulphuric acid in the form of a concentrated solution. Although the solution was only about one-half the former strength it still became pasty owing to the crystallisation of cyanogen bromide. The following results were obtained:—

	III.	IV.
Initial concentration of bromic acid	0·407	0·372
Time of reaction	3 hrs. 23 mins.	17½ hrs.
Per cent. of theoretical quantity—		
Loss of cyanogen bromide	2·6	1·9
Yield of cyanogen bromide	88·9	94·2
Per cent. of the quantity used—		
Unchanged bromate	8·5	3·9
Unchanged cyanide	6·4	1·7
Free acid	3·5	3·7
Free acid calculated	3·9	1·8

The results of these experiments show that the more closely the experimental conditions approach those which the theoretical study of the reactions has shown to be necessary, the more nearly do the yields obtained approach the theoretical value.

I am indebted to the courtesy of the directors of the Cassel Cyanide Company, Ltd., for permission to publish these results.

THE RELATION OF SOLUTION PRESSURE TO SURFACE CONDITION IN METALS.

CHARLES E. FAWSITT, D.SC., PH.D.

THE manner in which a metal is dissolved by an acid depends on the concentration of the acid and on the presence of impurities in it. It also depends on the temperature, the presence of impurities in the metal, and on the state of the metal surface. Many observers have noticed that the condition of the surface has a very great effect on the rate of solution. From a recent investigation (Trans. Amer. Chem. Soc., 1906, 9, 199; see page 1149) by

Burgess and Engle into the rate of solution of iron in acids, the following figures are taken :—

Loss in grms. per square inch of iron in normal sulphuric acid on a 17-hour run.

Compact, soft sheet iron	0·0279
Coarsely crystaline electrolytic iron.....	0·4805
The same, but denser deposit	0·3291
The same, heated red hot, and slowly cooled	0·225

The variation in these numbers may be taken as being solely due to difference in the surface condition.

The exact investigation of the surface condition by experiments of this kind is somewhat difficult, as the original surface is soon dissolved away and a new one exposed. There exists a more accurate method of treating the surface, which is, however, a measure of the static condition with regard to solution, and not the kinetic condition. This method lies in the determination of the electrolytic potential of a metal with respect to a solution of any one of its own salts in water. The potential varies with the concentration of the solution employed, but by using always a particular concentration—say normal—different specimens of metal may readily be compared.

The metals employed were in the form of thin rods. These were mostly about 4 ins. long and one-eighth of an inch in diameter. When being tested, the surface of the metals was coated with wax, except for a very small part specially selected for examination. The E.M.F. determinations were made by the compensation method, the calomel normal electrode being taken as standard for a single potential difference = +0·560 volt. It was often noticed that the potential of a rod of metal changed considerably when left in the solution. Iron is very bad in this respect, whether placed in a ferrous or ferric solution ; in fact, it is impossible to obtain any constant readings at all if the rods are kept still. By rotating the rods at about six revolutions per second, I obtained constant results, an increased rate of rotation had in most cases no effect.

The metals experimented with were silver, gold, and iron. The silver and gold used were pure ; the iron was used in several grades of purity. The presence of impurities in iron did not, however, have any considerable effect on the potential, as the following figures show. The surface in these cases was rubbed clean with coarse emery.

Single potentials in ferrous sulphate ($\frac{1}{2}$*-molecular*).

Iron (purest obtainable)	−0·082 volt.
0·18 per cent. carbon steel (slowly cooled) ..	−0·078 ,,
0·23 per cent. ,, ,,	−0·078 ,,
0·4 per cent. ,, ,,	−0·077 ,,
0·9 per cent. ,, ,,	−0·076 ,,

The potential of those steels is the potential of the ferrite they contain ; any cementite present has very little effect. It has been shown by Beilby (this J., 1904, 788) that metals exist in two phases, hard and soft. I have found that when (the surface of) a metal is in the crystalline or soft condition, its solution pressure is not so great as when in the amorphous or hard condition.

Silver in silver nitrate (*molecular*).

Brightly polished silver	+1·055 volt.
The same annealed by heating red hot	+1·066 ,,
The annealed silver after being hammered till hard	+1·057 ,,

The potential in the case of the silver hardened by hammering differs by about 0·01 volt from the annealed variety. The effect of polishing is to form a surface skin of hardened metal which is extremely thin, but the potential as found above is very nearly the same as for the hammered silver.

I give next similar measurements for gold :—

Gold in gold chloride (1-100-*molecular*).

Polished gold	+1.447 volt.
The same annealed	+1.454 ,,
Hammered gold	+1.422 ,,

Here again the hardened variety has a greater solution pressure than the annealed, but apparently the polished layer is not thick enough to give the same potential as the hammered specimen.

I wish next to show that a rough surface of a metal has a greater solution pressure than a smooth surface, the metal surfaces being otherwise in a similar condition.

Thus, a specimen of annealed silver with a smooth surface was found to have a potential of +1·066 volt. The rod was then etched with nitric acid until the surface became quite rough. The rod was then found to have a potential of +1·051 volt.

I give next some measurements on iron and steel in solutions of ferrous sulphate ($\frac{1}{2}$-molecular) and ferric chloride ($\frac{1}{2}$-molecular).

	Ferrous sulphate.	Ferric chloride.
Pure compact iron—		
Polished	—	+0·129
Rubbed with coarse emery	−0·082	+0·128
Electrolytic iron —		
Fresh from depositing bath	−0·147	+0·040
Heated gently in hydrogen	−0·071	+0·121
Heated red hot in hydrogen	−0·037	+0·138
Steel containing 0·4 per cent. carbon—		
Polished	−0·074	+0·146
Rubbed with coarse emery	−0·077	+0·144
Etched with nitric acid ..	−0·087	+0·132
Pumice blasted	—	+0·118
Cast iron shot blasted	−0·104	+0·097

With iron or steel, a roughening of the surface, whether produced by etching or blasting, produces an increase in the solution pressure. One may conclude that the greater solution pressure is due to the larger number of points exposed to the liquid. Theoretical considerations indeed would show that a point of metal should have a greater tendency to dissolve than a plane surface.

It will be noticed that the numbers obtained for electrolytic iron are similar to the solution numbers as found by Burgess and Engle. It may be assumed that an electrolytic deposit is crystalline, but that it is also somewhat loosely attached to the metal underneath, and will present many points or surfaces of great convexity to the solution. As a crystalline modification its solution pressure should be small, but as a surface exposing many points its solution pressure should be large. The freshly precipitated form has a large solution pressure which is, however, greatly reduced by heating. This may possibly be due to the iron shrinking to a more compact form, as well as to a rounding off of the points of metal at a temperature far below the melting point. I am much indebted to the Brymbo Steel Co., Ltd., for specimens of steel which they placed at my disposal, and to Mr. H. L. Heathcote, of Coventry, for several suggestions in regard to the potential of iron and steel.

ERRATUM.

This Journal, Nov. 30th, p. 1080, col. 2, line 4, for "unchemical" read "as chemical."

Deaths.

Chandler, Prof. Wm. H., Lehigh University, South Bethlehem, Pa., U.S.A., Nov. 30.

Poole, Herman, 331, West 57th Street, New York City, U.S.A.

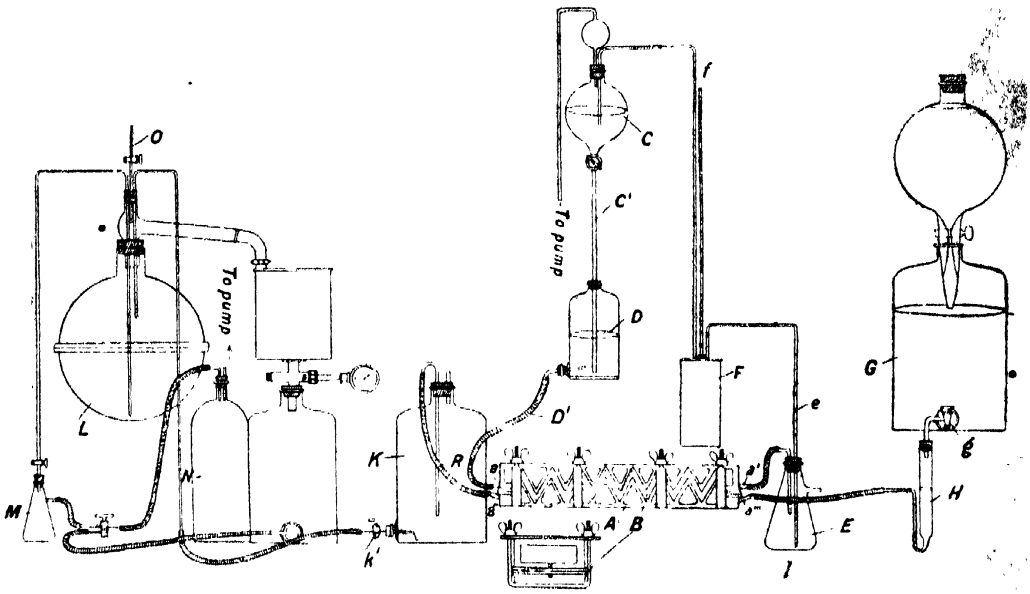
Journal and Patent Literature.

I.—PLANT, APPARATUS, & MACHINERY.

(*Continued from page* 1081.)

Dialysis under sterile conditions; New method for ——. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. Trans. Guinness Research Lab., 1906, 1., 300—305.

THE authors have designed a diffusion apparatus which possesses the advantage of enabling a relatively small volume of liquid to be dialysed on a large area of dialysing membrane, the liquid on either side of the membrane being kept in motion, and means being provided for ensuring the sterility of the liquid in the cell. The dialysing cell is shown in the figure at A. It consists of two brass frames clamped together with the membrane of parchment paper between them. The faces of the two frames are cast in a zig-zag



or corrugated form so as to afford rigidity, and a maximum length in a minimum of space. The faces are channelled out to the depth of $\frac{1}{8}$ in., so that when clamped together they form a diffusion cell $\frac{1}{4}$ in. deep, divided into two equal compartments by the paper diaphragm. The brass tubes, *a*, *a'*, are in connection with the two end of the upper chamber and the tubes, *a''*, *a'''*, with those of the lower chamber. The solution flows through the upper compartment from left to right, and the water through the lower one from right to left. The solution, 1000 c.c., is placed in the tapped funnel, C, about 300 c.c. being allowed to flow down the tube, C', into the vessel D, in the bottom of which is placed a seal of mercury to prevent back suction up C'. The circulation of the liquid takes place by gravity from C, through D, D', *a*, A, *a'*, into E. From E, it is sucked by a pump through the vertical tube, *c*, passing through a coil in the copper sterilising vessel, F, and then by way of *f*, back into C. The liquid is re-sterilised every day by boiling the water in F. The circulation of water takes place from the 8-litre vessel, G, fitted with a 5-litre funnel in its neck, constituting a constant-level reservoir. The water passes out through *g* into H, in which its flow is measured. From H, it passes through the cell, A, and comes out at *a''*. The diffusate is collected in the vessel, K, which is open to the air, and the flow is regulated at the rate of 5 litres in 6 hours. As the diffusate accummulates, it is sucked into the vacuum pan, L, in which it is concentrated, and the product is withdrawn into the flask, M, by suction applied to the vessel, N.—J. F. B.

ENGLISH PATENTS.

Measuring the flow of gases and other fluids and liquids; Apparatus for ——. E. W. Monkhouse, London, and F. W. Burstall, Birmingham. Eng. Pat. 837, Jan. 12, 1906.

THE claim is for a method of applying the principle of measuring the flow of fluids by observing the difference of pressure between two points in a pipe. The difference of pressure between the two points depends upon the length and cross-sectional area of the pipe, and the quantity of fluid flowing through it in a given time. The invention consists in causing the fluid which is to be measured to pass equally through a number of calibrated parallel pipes, so that, by measuring the flow in any one or more, the flow through the whole number can be calculated. The pipes are arranged either in an annular ring or in groups between two plates, which are attached at each end to a casing which serves to connect the apparatus to the main. If the pipes are of equal diameter and are arranged in a ring, the equal distribution of the fluid is attained by placing a distributing cone with its apex pointing in the opposite direction to that in which the fluid is moving. If, however, the arrangement in groups or concentric rings is adopted, the cone is omitted, and the pipes are made of different diameters, those in the direct path of the fluid being smaller than the outer ones in order that an equal volume may flow through each of the pipes.—W. H. C.

Centrifugal machines for drying purposes. R. Haddan, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 16,003, July 14, 1906.

Fig. 1.

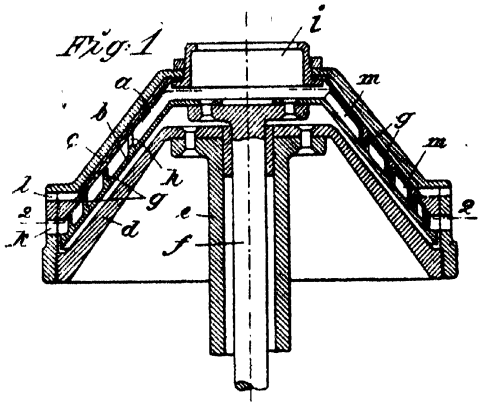
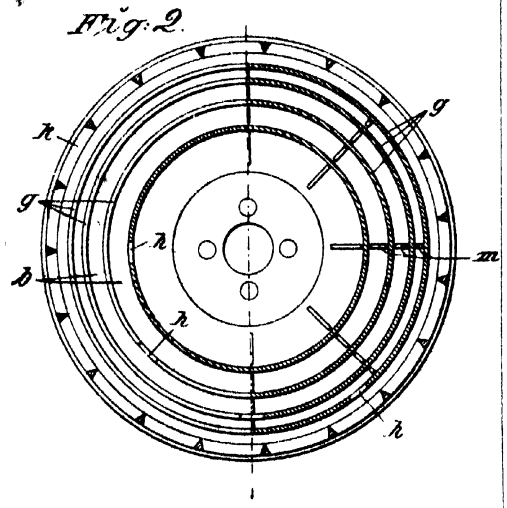


Fig. 2.



In the figures, two constructional forms of the invention are shown; one on the left and the other on the right. The material to be separated is fed through the opening, *i*, and flows between the upper perforated disc, *a*, and the lower solid disc, *b*. The disc, *a*, is carried by the cover, *c*, which is attached to the bottom piece, *d*, carried and rotated by the hollow shaft, *e*. The disc, *b*, which is provided with rings, *g*, shown attached to the disc, *b*, on the left, and to the disc, *a* on the right of the figure, is carried and rotated by the solid shaft, *f*. The material is pressed against the disc, *a*, and the upper ring, *g*, by centrifugal force, and the liquid passes through the perforations to the liquid outlet, *l*. The two discs are rotated at different speeds, and the ring, *g*, which has an opening, *h*, moves, in the case shown on the left of the figure, relatively to the mass pressed against the disc, *a*, so that the solid matter passes continuously through the opening, *h*. It then presses against the next ring, *g*, and passes from ring to ring until it escapes from the solids outlet, *k*. On the right of the figure the rings, *g*, are shown attached to the disc, *a*, and scrapers, *m* (see Fig. 2), are provided, attached to the disc, *b*, to cause the solids to pass through the openings, *h*.—W. H. C.

Centrifugal separators for liquids. C. G. P. de Laval and E. E. F. Fagerström, Stockholm. Eng. Pat, 18,707, Aug. 21, 1906.

The proportion between the quantities of the liquids separated is controlled by the insertion of a ring or flange inside the neck portion of the drum-cover, or of the top plate, or both. The flanges or rings are provided with one or more apertures, the size of which can be adjusted by other rings which are relatively movable and are provided with corresponding openings.—W. H. C.

United States Patents.

Separator; Centrifugal ——. N. S. Bök, Stockholm. U.S. Pat. 834,254, Oct. 30, 1906.

See Eng. Pat. 9115 of 1905; this J., 1905, 1004.—T.F.B.

Dehydrating apparatus. E. W. Cooke, New York, Assignor to The Cokel Co. U.S. Pat. 834,265, Oct. 30, 1906.

See Eng. Pat. 14,854 of 1905; this J., 1905, 1319.—T.F.B.

Dryer. J. M. White, Mapletonborough, Pa., Assignor to F. O'Connor, Mapleton Depot, Pa., and R. Tyne Smith, jun., Baltimore, Ind. U.S. Pat. 834,696, Oct. 30, 1906.

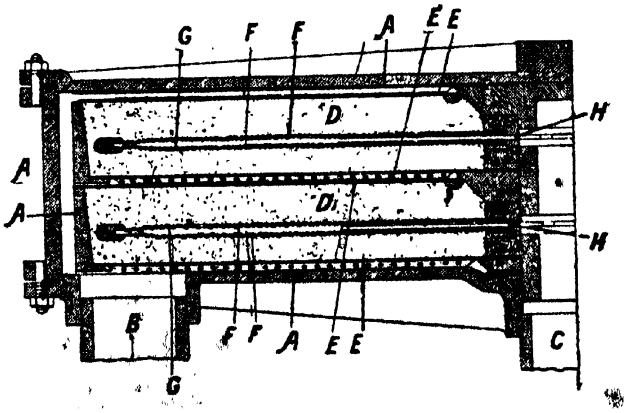
A furnace is built at the bottom of a stack or drying-tower, the lower half of which is fitted with alternately disposed, inclined plates, having curved upper edges and upturned lower rims. Spaces are left at the sides of the plates to allow the upward passage of the gases, and the material to be dried travels downwards from plate to plate. In the upper part of the tower, above the plates, are oppositely inclined series of sloping screens, the uppermost series of which is surmounted by a conical screen. —W. H. C.

Air-drying apparatus. C. O. Williams, Assignor to Federal Gas Co., St. Louis, Mo U.S. Pat. 834,698, Oct. 30, 1906.

The air is passed through chambers provided with slightly inclined corrugated shelves on which the drying medium is placed. The shelves spring alternately from opposite sides of the chamber, leaving a space on alternate sides of each shelf, so that there is a continuous passage through the chamber for the air. Several chambers may be combined into a series, and provided with a suitable arrangement of pipe connections and valves so that any chamber in the series may be cut out of action. Each chamber has a drain pipe at the bottom to convey away any liquid to a bank placed below.—W. H. C.

Filter. J. T. H. Paul, Assignor to E. Goldman and Co., Chicago, Ill. U.S. Pat. 834,637, Oct. 30, 1906.

The claim is for a filter, a half sectional view of which is



shown in the figure, and which consists of a casing, A, having an inlet pipe, B, and a central outlet, C. Filter elements, D, are arranged in the casing, and the liquid to be filtered enters at B, circulates in the direction indicated by the arrows, passes through the perforated plates, E,E, through the filtering material, D, and escapes through the perforated sides, F,F, of the collecting chambers, G, from which it flows through the openings, H, into the central discharge pipe, C.—W. H. C.

French Patents.

Concentrating liquids; Apparatus for ——. J. F. P. Kestner. Fr. Pat. 361,739, Sept. 2, 1905.

The claim is for increasing the output of ordinary single or multiple effect evaporators by the addition to each effect of the "Kestner" evaporator tubes described in Fr. Pat. 315,973 of 1901 (this J., 1903, 788).—W. H. C.

Drying chamber. C. H. Vandamme. Fr. Pat. 357,536, June 25, 1906.

The claim is for the division of the drying chamber into parallel compartments and for the sub-division of the latter into triangular spaces. This is effected by causing the continuous travelling band which carries the material to pass over rollers arranged in triangles in the parallel chambers. The latter are provided with fans and heating pipes, which are close to but do not touch the band.—W. H. C.

Drying apparatus; Continuous - . Aktiebolaget Separator. Fr. Pat. 368,118, July 17, 1906.

See Eng. Pat. 16,000 of 1906; this J., 1906, 1081.—T.F.B.

Ammonia vapour of high tension for use as a motive power; Process for the continuous production of - -. Neue Betriebskraft Ges. Fr. Pat. 367,679, June 29, 1906.

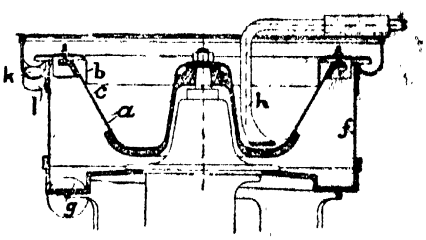
A 25 per cent. solution of ammonia is heated under a pressure of eight atmospheres in the boiler, A, to about 100° C., so that a portion only of the gas is evolved. This gas leaves the boiler by the pipe, *a*, which is surrounded by the concentric pipe, *b*, and the hot weak liquor from the boiler is drawn off through the pipe, b^1, and the annular space between the pipes, *a* and *b*. The two travel side by side as far as the inlet valve, *c*, of the engine, D, so that the temperature and consequently the pressure of the gas is maintained. The exhaust ammonia gas passes from the cylinder by the pipe, *d*, to the oil-catcher, *e*, and thence to the interior of the surface condenser, C, by the pipe, d^1. The condenser, C, contains a large number of cooling pipes through which cold water circulates, and cool weak liquor from the heat interchanger, B, is injected into C in the form of fog by the pulveriser, *g*. The gas and fog condense together, producing a vacuum in the condenser, C, and collect at the bottom in the chamber, A. From A, the cold strong liquor is drawn off through the pipe, *k*, by the pump, *i*, and delivered by the pipe, *l*, into the bottom chamber, *m*, of the heat interchanger, B; it passes up the tubes and takes up heat from the hot weak liquor which enters at the top of the space surrounding the tubes by the pipe, b^2. When the strong liquor reaches the upper chamber, *n*, it is already nearly at the same temperature as the liquid in the boiler, A, to which it is returned by the pipe, *o*, whilst the weak liquor, having become quite cold, leaves the bottom of the heat interchanger, B, by the pipe, *f*, to re-absorb gas in the surface condenser, C. It is stated that, as only a small quantity of heat is required to boil off a portion of the ammonia in the boiler, A, compared with the amount required to completely deprive the liquor of its gas, the consumption of fuel is very low.—W. H. C.

Evaporation and desiccation of materials at a low temperature; Apparatus for the progressive ——. C. E. Chamberland. Fr. Pat. 367,783, July 5, 1906.

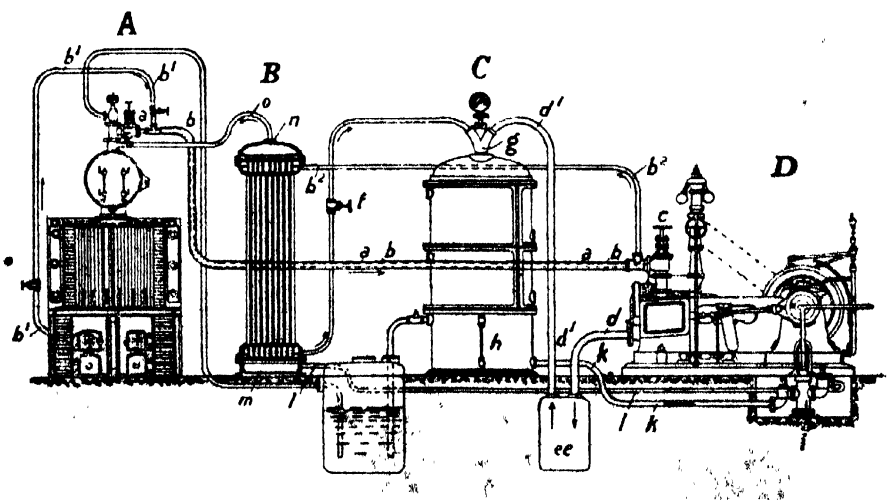
The apparatus consists of a drying chamber, preferably with a glass top, in which the material to be dried is placed in layers and through which air or some other suitable gaseous medium, maintained at a low degree of saturation, is circulated by a pump or fan. The same volume of gas is used continuously, being drawn from the drying chamber through a water-cooled condenser, where the liquid it has taken up is condensed and drawn off by the pump or fan, and delivered to a heater from which it returns to the drying chamber. The pump may be driven by a water motor, and the waste water used to cool the condenser.—W. H. C.

German Patent.

Centrifugal apparatus for the separation of liquids from suspended solid matter. C. G. Haubold, jun. Ger. Pat. 171,291, Oct. 25, 1903.



The apparatus is shown in the accompanying figure. A movable ring, *b*, is suspended in the upper part of the rotating bowl, *a*, so as to leave an annular slit, *c*. The



liquid is introduced through the pipe, *h*; as the bowl is rotated, the heavier solid particles passing through the slit, *c*, over the edge, *e*, of the bowl into the containing vessel, *f*, from which they are removed at *g*. The liquid, freed from solids, overflows into the channel, *k*, and is removed through the pipe, *l*.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 1085.)

Coal and other combustibles; Calorific value of ——. G. Arth. Bull. Soc. d'Encouragement, 1906, Rev. Metall., 407—408.

The author points out that in the usual determination of the calorific value of a fuel, it is assumed that the products of combustion are cooled to the ordinary temperature, and that the result is therefore higher than can ever be realised in technical practice, where the resulting gases always leave the flues at a temperature above 100° C. The association of German and Austrian engineers have agreed that calorific values should be calculated on the assumption that the whole of the products are cooled only to 100° C., and that the water formed remains as steam. The author advises the adoption of this plan in France, under the name of "lower calorific value," distinguishing the calorific value as at present stated as "higher calorific value." With bituminous coals or other fuel containing 4—6 per cent. of hydrogen, the difference between these values, due to hydrogen, will be from 3—4·5 per cent. of the total.—J. T. D.

Acetylene; Causes of explosions with ——. N. Caro. Verein z. Beförd des Gewerbefleisses Verh., 1906. 205—236, 245—292. Science Abstracts, 1906, 9A, 523.

To explain the causes of the mysterious explosions which have sometimes occurred with acetylene, the author has made an exhaustive investigation of (1) the explosive properties; (2) the effect of the decomposition process upon explosive properties; (3) the effect of heat and steam; (4) effect of impurities. With regard to (1) the author's experiments on the explosion of acetylene under various pressures in a steel bomb gave resulting pressures considerably higher than Berthelot's (*viz.*, at 12 atmos. initial, the end pressures are: Berthelot, 93; Caro, 128 atmos.). The closer approximation of the acetylene molecules increases the propagation of the decomposition, and gives rise to the explosive effect; even when dissolved in acetone, acetylene is explosive, and gives the same final pressures as pure acetylene, and even higher end-pressures with higher initial pressures, owing to decomposition of the acetone. Acetylene mixed with inert gases under pressure (for the purpose of separating the molecules) has a somewhat diminished explosibility. At −80° C. neither compressed nor liquid acetylene can be exploded, hence the diluting substance which reduces explosibility is considered to act as an internal cooling agent. As regards dilution with air, 25 per cent. of air to acetylene, or 3 per cent. of acetylene to air, is enough to produce an explosive mixture. (2) The heat set free during decomposition of the carbide neither directly nor indirectly increases the explosibility of pure acetylene at atmospheric pressure. (3) Heating produces an increase in the explosibility at higher pressures, so that sometimes at little over 1½ atmos. only, acetylene has been exploded, in the case of dry gas. With steam present, the explosibility is increased, without the usual softening influence of the hydrogen being observable. As regards acetylene and air mixtures, heating increases the explosibility; the presence of water vapour, which, being endothermic, should reduce the explosibility, was found to actually do so when the explosion takes place at constant pressure (when the gases can at once expand). In closed vessels, however, with excess of acetylene the explosibility is apparently increased. Finely-divided metals or sulphides cause ignition.

Power obtainable from metallurgical waste gases. C. Richter. X., page 1151.

Carbon monoxide; Action of —— on steam at red heat, and action of hydrogen on carbon dioxide. A. Gautier. VII., page 1145.

English Patents.

Coke ovens. A. O. Jones, New Brancepeth, Durham. Eng. Pat. 11,660, May 18, 1906.

A vertical coke oven is heated by a series of independent, horizontal, combustion flues which extend along one side of the oven, from the front to the back, across the back, and along the other side to the front, where they open into a common flue leading to the chimney. The upper portion of the oven is provided with a surrounding flue, through which air is circulated, to cool the upper portion, and prevent decomposition of the evolved gases. The oven is charged through an opening at the top, of the full size of the upper part of the oven, by means of a travelling hopper, running on rails mounted on the front and rear walls of the battery of ovens. The charging opening is closed by a hinged cover. Discharging is effected by means of a sliding door at the foot of the oven.—H. B.

Gas producers. Cleland's Graving Dock and Slipway Co., Ltd., Willington Quay on Tyne, and A. B. Roxburgh, Whitley Bay, Northumberland. Eng. Pat. 22,046, Oct. 30, 1905.

The producer is preferably of rectangular cross-section, and has a grate consisting of vertical bars forming a vertical surface in line with the brick lining above it to allow free descent of the fuel; or the grate may be outwardly inclined towards the bottom. By this arrangement the air is admitted above the ash and clinker. The grate is carried by a casing in the producer wall closed by a door, and forming a chamber for admission of air and steam. The lining opposite the grate slopes inwardly, and the bottom of the producer terminates in a water seal with sloping front for removal of ash and clinker. The gas outlet is near the top of the side opposite the grate, and is provided with a grating of slats inclined upwards. The hot gas passes through a brick-lined chamber containing a boiler, from which steam is led to the admission chamber. —A. T. L.

Gases under pressure for power purposes; Combustion apparatus for production of —— G. J. Weber, Kansas City, U.S.A. Eng. Pat. 22,229, Oct. 31, 1905.

A combustion-chamber with non-conducting lining is connected by a pipe to the valve-chest of an engine of the condensing and expansion type. The chamber is fitted with a grate, doors for charging with coal and withdrawing ashes, and a safety valve. The fuel is ignited, the doors closed, and air admitted under pressure from a receiver by an inlet pipe below the grate. The receiver is charged by a hand-pump at starting. Products of combustion are generated under pressure and used in the engine, which drives an air-compressor from an eccentric on the crank-shaft, to supply air for combustion. The pressure in the combustion chamber actuates a piston controlled by a spring, so that when the pressure exceeds the desired limit, the piston is forced back and operates the air-supply valve through a system of levers. A second combustion chamber may be used for burning oil, such as gasoline. The oil and air enter by concentric pipes, and the supply of each is controlled by the pressure in the combustion chamber, as described above. The top of the oil tank is connected to the air reservoir to obtain the pressure necessary to force oil into the combustion-chamber.—A. T. L.

Gas producer apparatus; Construction and working of ——. T. W. S. Hutchins, Manchester, and J. B. Wilkie, Liverpool. Eng. Pat. 24,443, Nov. 27, 1905.

A gas producer plant, in which the gas is drawn from the scrubbers and producer by an exhausting fan, is combined with a gas pressure governor connected to the outlet of the fan, and arranged so that an increase of pressure causes a throttling of the gas supply from the fan. The producer thus delivers a variable supply of gas at constant pressure according to the consumption, without the use

of a gas-holder. The governor described has a bell working in a water or other seal, and actuating a lever which brings a plate opposite the outlet of the fan.—A.T.L.

Illuminating and heating gas [from oils]; Process for the production of permanent ——. W. J. Dibdin and H. C. Woltereck, London. Eng. Pat. 26,666, Dec. 21, 1905.

A MIXTURE of hydrocarbons (paraffin) and superheated steam, in finest division, is passed at high temperature (bright orange) over a porous, spongy contact material consisting of ferrous-ferric oxide, containing, preferably, free protoxide. The contact material may be obtained, preferably, by passing steam and an excess of hydrocarbons for several days through an iron or steel retort, filled with thin iron tubes and kept at a bright red heat, until no metallic iron is left in the thin tubes. For the production, with such material, of gas of 16-candle power, the ratio of hydrocarbons to steam is kept at about 1 to 10. It is stated that 1 ton of crude petroleum will produce about 100,000 cb. ft. of 16-candle gas, of composition resembling that of ordinary illuminating gas.—H. B.

Incandescent electric lamp filaments; Manufacture of —— from thorium. British Thomson-Houston Co., Ltd., London. From General Electric Co., of Schenectady, N.Y. Eng. Pat. 14,972A, July 20, 1905.

THORIUM powder (obtained, for example, according to Eng. Pat. 14,972 of 1905; this J., 1906, 866) is mixed with from 20 to 100 per cent. of clean magnesium filings; the mixture is compressed into a lump, and heated in a vacuum furnace (such as described in Eng. Pat. 20,809 of 1904; this J., 1905, 976) till all the magnesium has been driven off; and the porous, sintered mass of thorium thus obtained, after cleansing with nitric acid, can be compressed into a dense metallic state, and rolled and drawn into wire.—H. B.

UNITED STATES PATENTS.

Producer-gas; Apparatus for manufacturing ——. W. H. Adams and F. Powell, Portland, Oreg., Assignors to the Ladd Metals Co., Oregon. U.S. Pat. 834,238, Oct. 30, 1906.

THE fuel chamber of the producer described is elongated in a horizontal direction, and fuel is fed in at the centre from above. The air inlets are all arranged at one end of the longer dimension, and the gas outlet is a forward horizontal extension, at the other end. The inlets and outlet are both located at the same level, and below the plane of the bed of fuel in the chamber. In this way a horizontal zone of incandescence is established along the chamber, the anterior portion of which acts as a generator, and the posterior portion as a regenerator, acting on the products of combustion from the anterior portion. The grate of the producer is surrounded by a "skirt" that dips into the water of the ash-pan, and the space enclosed by the skirt is divided by a vertical diaphragm. This diaphragm shuts off air or steam, admitted by suitable inlets into the water-sealed space below the grate, from a portion of the grate.—W. C. H.

Illuminating gas; Apparatus for the manufacture of ——. W. H. Adams and F. Powell, Portland, Oreg., Assignors to The Ladd Metals Co., Oregon. U.S. Pat. 834,239, Oct. 30, 1906.

THE generator of this apparatus is elongated in a horizontal direction, and provided with a fuel supply hopper at the top, to supply fuel without admitting air to the generator. The air supply inlets are at one end of the longer horizontal dimension, and the outlet for products of combustion at the other end, both being below the level of the top of the bed of fuel, whereby a horizontal zone of combustion is maintained in the generator, which is provided with a water-seal ash-pan (see preceding abstract). The products of combustion pass into a chamber containing a retort, which is thereby heated. Above the top of the bed of fuel in the generator is an outlet for products of distillation of the fuel; these products are led into the heated retort, and there converted into fixed gases.—W. C. H.

Illuminating gas; Process of manufacturing ——. W. H. Adams and F. Powell, Portland, Oreg., Assignors to The Ladd Metals Co., Oregon. U.S. Pat. 834,241, Oct. 30, 1906.

THE process described consists in establishing a horizontal zone of combustion in a long horizontal body of fuel, and a zone of distillation above the zone of combustion; the products of these two zones are removed through separate channels, and the outflow of the distillation products is regulated in accordance with the colour of the two products when burned. (See U.S. Pat. 834,239 above.)—W. C. H.

Carburetter. C. O. Williams, Assignor to Federal Gas Co., St. Louis, Mo. U.S. Pat. 834,697, Oct. 30, 1906.

A VERTICAL casing is divided into compartments by horizontal plates, which have openings arranged on the opposite sides of alternate plates, so that the air or gas which enters through a pipe at the bottom of the casing is forced to take a tortuous path through the apparatus. Steam is delivered into the apparatus through a pipe which enters the casing some distance up, and passes centrally down through the plates into a heating drum disposed in a space below the lowest plate, and provided with a pipe for the escape of condensed water. Oil is fed into the apparatus through a pipe above the steam-inlet pipe, and drops on to the bend of the steam pipe, and thence into a series of oil funnels, surrounding the steam pipe where it passes through the plates. The oil is vaporised in these funnels, and the vapour is taken up by the ascending current of air or gas.—W. H. C.

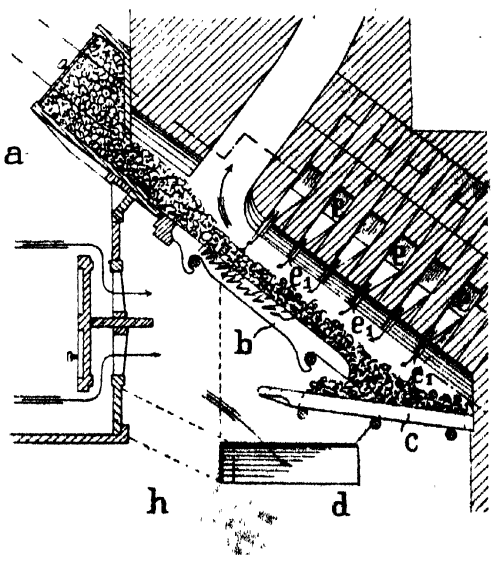
FRENCH PATENTS.

Coal; New artificial ——, *composed of a mixture of beet pulp, fine coal, wood charcoal, or coke, and a binding medium.* J. P. Reneaux, Addition, dated June 19, 1906, to Fr. Pat. 366,141, April 28, 1906.

THE ingredients mentioned in the original patent may be supplemented by powdered anthracite and fine coal, charcoal, anthracite or coke, ground beet leaves, the sludge or cakes of scum from the clarification and filtration of beet juice, beet vinasse or molasses residue, or all waste and by-products from the treatment of beet in sugar making.—C. S.

Smoke-consuming furnace. A. Sickert. Fr. Pat. 367,785, July 5, 1906.

THE fuel is charged at the top, *a*, of the inclined bars, *b*, and passes down to be finally completely burnt on the



horizontal bars, *c*. Air is drawn from the ash-pit, *h*, through openings, *d*, on each side into the flues, *e*, where it is heated and discharged downwards upon the fuel on the inclined bars, *b*, through the ports, e^1, so that it effects the complete combustion of the smoke.—W. H. C.

Gas-producer; Carburetting ——. G. Lézier. Fr. Pat. 361,752, Sept. 6, 1905.

THIS producer is arranged to yield a mixture of gas obtained from the distillation of wood, water-gas, and the permanent gases derived from a carburetting liquid, and a portion of the gases from the fire used to heat the distillation retort, after they have been reduced by passing through the incandescent material in the retort. The apparatus consists of a retort, heated by a suitable fire, in which wood, &c., can be distilled. Air, water, carburetting liquid, and products of combustion from the fire can be admitted, in regulated quantities, into the upper part of the retort, and the mixed gas produced is withdrawn from the bottom of the retort in such a way that the gaseous elements admitted to the upper portion become reduced by passing through the incandescent carbonaceous material in the lower portion.
—W. C. H.

Hydrogen; Manufacture of ——. Mme. Elworthy, née E. G. Cooper. First Addition, dated June 16, 1906, to Fr. Pat. 355,324, of June 17, 1905 (this J., 1905, 1164).

THE present addition relates to the separation of carbon dioxide from the mixture of gases derived from water gas, containing hydrogen, carbon monoxide, methane, and carbon dioxide, described in the main patent. The carbon dioxide is separated by simple compression of the cooled gaseous mixture, or by compression followed by expansion, when the carbon dioxide is liquefied or solidified, and can be removed. The gases escaping from the apparatus are utilised for cooling the incoming gases.
—E. S.

Incandescence gas mantles. T. P. Laycock. Fr. Pat. 367,488, June 27, 1906. Under Int. Conv., May 17, 1906.

THIS invention consists in coating or impregnating mantles for incandescence gas lighting with platinum bichloride, by immersing them in, or spraying them with an alcoholic solution of the salt.—W. C. H.

Candles or other illuminating bodies for nightlights, lamps, or other applications; Process for making —— by means of petroleum or other mineral oils. V. J. Kuesp. Fr. Pat. 367,448, June 26, 1906. III., page 1141.

Luminous bodies; Manufacture of electric — — by heating to incandescence metallic filaments in an atmosphere of a suitable gas by means of the electric current. Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 367,467, June 26, 1906.

SEE Eng. Pat. 14,901 of 1906; this J., 1906, 1083.—T.F.B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 1085.)

Petroleum fields of Trinidad. C. Craig. Petroleum, 1906, 2, 86—88.

THE position of Trinidad at the mouth of the Orinoco has led to the gradual deposition of alternating fluvial and marine strata, favouring the formation of petroleum from accumulations of vegetable matter, such as can be seen in adjacent marshes and lagoons. Where the cover rock of these accumulations has permitted the escape of the gaseous decomposition products, the residue has the character of lignite or coal; but where such escape was impossible, the residue is petroliferous or bituminous, without any trace of vegetable matter. The tertiary strata contain three oil horizons, the Galeota oil sand being lowest and nearest the chalk. Next, at an interval of 3600—4000 ft., is the Rio-Blanco oil sand; and some 1400—1500 ft. above this is the La Brea oil sand, forming the source of the pitch lake, and only containing oil in the western side of the island. These oil horizons rise to or near the surface along three anticlinals—one extending from Galeota Point to Icacos Point; the second from Mayaro Bay to Point Ligoure, and the third from Mayaro Point to the mouth of the Vance River. There is also another anticlinal in the central mountain chain, with a few smaller ones elsewhere. Surface indications of oil are frequent in the cliffs, along watercourses, and in springs in the forests, in addition to numerous mud volcanoes, many of which are active, especially in the Cedros district. Shows of oil are plentiful all along the first anticlinal; and in the second between Mayaro and Point La Fortunée, as well as in the Guapo district, where the cliffs show five layers of petroliferous and bituminous sand 120 ft. thick. Further inland the same formation furnishes enormous deposits of soft and hard asphalt. The only known deposits of any extent in the La Brea oil sand are near La Brea and the pitch lake. All three horizons are accessible to boring along the anticlinals, and many of the shows are favourably situated for proving the deposits. The oil is low in sulphur, and the oil from the Galeota oil sand has the sp. gr. 0·880—0·910, and yields 12—20 per cent. of petroleum naphtha 30—50 per cent. of burning oil, 30—45 per cent. of lubricating oil, and only about 5 per cent. of residual resin. That from the Rio Blanco sand is richer in lubricating oil and residue. The total area of the oil-field is estimated at not less than 500 sq. miles.—C. S.

Petroleum; Bromine value of ——. Utz. Petroleum, 1906, 2, 43—45.

THE Vaubel method for determining the bromine value of oil of turpentine requires modification before it can be advantageously applied to petroleum, the best results being obtained with a solution containing 2·783 grms. of potassium bromate, instead of 13·92 grms. per litre. The following values were obtained in this way: Roumanian petroleum, 0·56—0·8; Russian "Meteor" oil, 0·72; "Nobel" oil, 0·8; Austrian oil, 0·88; Galician export oil, 1·44; Deutsch-Amerikanische Co.'s oil, 1·76; Pennsylvania oil, 2·0; "Arc light" oil, 2·56. American oil has thus the highest bromine-absorption value; Russian and Austrian the lowest, whilst Galician occupies an intermediate position. The results follow the same general trend as the iodine values, though the figures are lower; but there is no regular relation between the two values, the bromine absorption of the several fractions varying irregularly in the different oils. Nevertheless the method enables American oil to be easily distinguished from that of European origin, and the modified Vaubel method enables the determination to be made in less time than the iodine test. The bromate solution should be added by degrees, 1 c.c. at a time at the beginning, and 1/10th c.c. afterwards. The Graefe method may also be used as a preliminary test.—C. S.

Petroleum; Bromine value of ——. M. Weger. Petroleum, 1906, 2, 101—102.

THE author's determinations of bromine values of various samples of petroleum agree fairly well with those calculated from Graefe's iodine values, except in the case of Roumanian oils. Both sets of figures have, in his opinion, less importance than in the case of fatty oils, which are of more accurately known composition. He also thinks the bromine value gives no reliable indication of the origin of petroleum samples as claimed by Utz (see preceding abstract). The circumstance that water-white oil has a bromine value only about half that of standard white seems to indicate that the difference is due to decomposition of the oil during distillation—to which American oil is, from its composition, more liable than Russian oil.—C. S.

Petroleum distillates and residuum; Determination of the pitch content of —— by the sulphuric acid method. K. Charitschkow. Petroleum, 1906, 2, 99—101.

THE method furnishes results that are in no wise con-

cordant with the depth of colour of the oils. For example, in one case where the colour indicated a pitch ratio of 6·5:7 between two samples, the sulphuric acid test (diminution of volume on treatment with the acid) gave the proportion as 1:2; and in others a still greater discrepancy was observed. Potassium bichromate is also inefficient as a decolorising agent; and the Landsberg acetone method only dissolves out the heavier portions of the oil, masut, for instance, being soluble to the extent of 50 per cent., and "goudron" to 32·3 per cent., the residue having the appearance of solar oil, though of higher viscosity than the latter. The acetone method, however, appears suitable for the cold fractionation of petroleum.—C. S.

Petroleum refining; U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T.R.]

THE industry engaged in the refining of petroleum reported 98 establishments in 1905 having a product valued at $175,005,320, as compared with 67 establishments having a product of $123,929,384 in 1900. The capital of the industry in 1905 was $136,280,541, as compared with $95,327,892 in 1900. It should be understood in this connection that the item of capital in all census reports embraces tangible assets only and bears no relation to issues of stocks and bonds. The following table shows the materials used by kind, quantity, and cost, and the products, by kind, quantity, and value:—

	1905.	1900.
Materials used, total cost..	$139,387,213	$102,859,341
Crude petroleum—		
Barrels (42 galls.)	66,982,862	52,011,006
Cost	$107,487,091	$80,424,207
Sulphuric acid—		
Short tons	162,152	*
Cost	$2,003,031	*
Caustic soda—		
Pounds	11,161,376	*
Cost	$208,440	*
Sulphur—		
Short tons	888	—
Cost	$13,380	†$1,735,782
Pyrites—		
Long tons	20,661	‡
Cost	$79,784	‡
Coopers' and carpenters' materials	$5,628,274	$3,576,943
Tinners' materials	$6,361,764	$4,643,985
Barrels, cases, and tin cans	$5,880,310	$2,930,805
Fuel	$5,139,934	$3,120,441
All other materials	$6,585,205	$6,427,178
Products, total value	§$175,005,320	$123,929,384
Illuminating oils—		
Barrels (50 galls.)	26,897,984	25,171,289
Value.....	$91,366,434	$74,694,297
Fuel oils—		
Barrels	7,281,584	6,095,224
Value.....	$9,205,391	$7,550,664
Residuum—		
Barrels	2,514,198	596,615
Value.....	$3,138,361	$688,455
Paraffin oils—		
Barrels	1,644,400	1,606,783
Value.....	$6,210,279	$3,987,037
Reduced oils—		
Barrels	2,783,148	676,163
Value.....	$6,068,360	$1,669,287
Neutral filtered oils—		
Barrels	504,042	608,185
Value.....	$1,942,153	$2,256,626
Filtered cylinder oils—		
Barrels	1,366,661	565,894
Value.....	$9,332,299	$3,443,491
Grease (lubricating, &c.)—		
Barrels	202,439	524,033
Value.....	$1,394,130	$1,995,390
Naphtha and gasoline—		
Barrels	5,811,289	5,615,554
Value.....	$21,314,837	$15,991,742
Paraffin wax—		
Barrels	794,068	774,924
Value.....	$10,007,274	£7,791,149
Sludge acid—		
Short tons	165,104	‡
Value.....	$400,480	‡
Coke and black naphtha	$149,653	$176,281
All other products.....	$14,475,669	$3,684,965
Equipment:—		
Stills—		
Heated by steam	282	290
Heated by superheated steam	15	26
Heated by fire	1,610	1,458
Agitators	374	327
Chilling houses for paraffin	67	48
Hydraulic or other presses	311	510
Storage tanks—		
For crude petroleum—		
Number	304	257
Capacity (galls.)	245,760,493	¶
For refined petroleum—		
Number	3,575	2,869
Capacity (galls.)	576,458,825	¶
Cooper shops	64	48
Tin shops	17	13

* Reported as acids, alkalis, and sulphur.
† Includes value of sulphuric acid and caustic soda.
‡ Not reported separately.

§ In addition, 49,379 tons of sulphuric acid were made and consumed by the establishments reporting.
¶ Not reported.

UNITED STATES PATENT.

Emulsions [of bitumen, &c.] and process of producing them. K. Mann, Zurich, Switzerland. U.S. Pat. 834,830, Oct. 30, 1906.

SEE Fr. Pat. 354,648 of 1905; this J., 1905, 1103.—T.F.B.

FRENCH PATENTS.

Candles or other illuminating bodies for nightlights, lamps, or other applications; Process for making —— by means of petroleum or other mineral oils. V. J. Kuess, Fr. Pat. 367,448, June 26, 1906. Under Int. Conv. April 3, 1906.

TEN parts each of an animal and vegetable fat (*e.g.*, stearin and coprah oil) are melted together and saponified with 9 parts of commercial caustic potash dissolved in 18 of water. One hundred parts of petroleum are stirred in at a temperature of 30°—35° C., the whole setting to a solid mass. After several days, this mass is melted at 105°—115° C. and incorporated with 2—3 parts of water containing in solution alum, boric acid, or magnesium sulphate (according to the result desired) equivalent to 2—5 per cent. of the mass. The operation is conducted so that only a little over 5 per cent. of water is left in the product, the remainder being removed by evaporation. This product may be incorporated with its own weight of a mixture of equal parts of melted stearin and hard paraffin scale, and moulded into candles.—C. S.

Petroleum or other mineral oils; Process of solidifying ——, and transforming them into a solid hydrocarbon soap. V. J. Kuess, Fr. Pat. 367,449, June 26, 1906. Under Int. Conv., April 3, 1906. (See preceding abstract.)

PETROLEUM is mixed with 10 per cent. each of melted saponifiable animal and vegetable substances, the mixture being saponified with 9 parts of caustic potash dissolved in 24 parts of water, and left for 1—2 days, after which the mass is remelted and mixed with 2—5 per cent. of boric acid, borax, or other boron derivative (dissolved in a little water), and cast in moulds. The hardness of the product is in proportion to the amount of added boron derivative. To convert the product into soap, it is boiled

along with a lye (18° B.) of caustic soda and potash in equal proportions, 5 per cent. of coprah oil being added, for 24 hours at a temperature of 110°—115° C. The soap contains about 33 per cent. of water.—C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 1089.)

Sodium hyposulphite [hydrosulphite]; Use of —— as a reducing agent. E. Grandmougin. Ber., 1906, **39**, 3561—3564.

FURTHER examples are given (see this J., 1906, 805) of the use of sodium hyposulphite as a reducing agent. Thus β-naphthoquinone is obtained from Orange II. by boiling a solution of 100 grms. of the dyestuff in 750 c.c. of water with 100 grms. of sodium hyposulphite, concentrated (B.A.S.F.), which have been gradually added. The aminonaphthol is filtered off, and oxidised by dissolving in 200 c.c. of dilute sulphuric acid (1:2), and, after cooling, adding a solution of 30 grms. of sodium bichromate. The naphthoquinone separates and is filtered off. In a similar manner 1:4-naphthylenediamine is obtained from benzeneazo-α-naphthylamine. The reagent may also be used for the reduction of the nitro-group in nitrobenzene and o-nitrophenol, but in this case does not present any advantage over the sodium sulphide method. Quinones are easily reduced to the corresponding quinols; thus benzoquinone gives quinol, β-naphthoquinone gives β-naphthoquinol, from phenanthraquinone is obtained phenanthraquinol, and anthraquinone yields oxanthranol. Benzil is reduced smoothly to benzoïn.—J. C. C.

Colouring matters in pastry-ware; Use of carbon tetrachloride for the detection of —— forbidden by public health laws. A. Piutti and G. Bentivoglio. XVIIIA., page 1168.

Dyestuffs and extracts; U.S. census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T.R.]

A VERY important increase in the output of dyestuffs and extracts was recorded in 1905, as compared with 1900. Ninety-eight establishments reported an output valued at $10,893,113, as compared with 77 establishments having an output of $7,350,748 in 1900. The following table shows materials used, by kind, quantity, and cost, and the products, by kind, quantity, and value:—

	1905.	1900.
Materials used, total cost..	$6,829,340	$4,745,912
Wood—		
Cords	258,981	211,040
Cost	$795,786	$675,321
Bark—		
Tons	103,119	99,587
Cost	$948,997	$502,853
Logwood—		
Tons	37,733	49,494
Cost	$678,590	$1,064,746
Sumac leaves—		
Tons	4,456	8,333
Cost	$93,519	$150,259
Indigo, natural—		
Pounds	96,500	82,500
Cost	$82,000	$98,500
Coal-tar colours—		
Pounds	1,802,826	3,022,217
Cost	$293,573	$1,140,979
Sulphuric acid—		
Pounds	3,557,884	1,628,000
Cost	$49,779	$16,757
Other acids—		
Pounds	5,301,413	364,428
Cost	$71,393	$9,197
All other components of products	$2,834,176	$487,836
All other materials	$981,527	$599,464
Products, total value	$10,893,113	$7,350,748
Dyestuffs, natural—		
Pounds	8,172,552	7,409,280
Value.....	$233,935	$1,035,711
Do., artificial—		
Pounds	4,600,462	6,581,850
Value.....	$1,764,454	$1,806,730
Mordants—		
Pounds	733,245	734,000
Value.....	$64,656	$85,466
Iron liquor—		
Pounds	1,860,744	954,240
Value.....	$30,757	$7,525
Turkey red oil—		
Pounds	3,022,470	2,210,000
Value.....	$159,666	$14,757
Logwood extract—		
Pounds	29,799,606	39,252,743
Value.....	$1,472,047	$1,485,971
Ground bark—		
Pounds	38,001,017	27,028,000
Value.....	$249,101	$149,365
Ground and chipped wood—		
Pounds	9,999,906	12,690,037
Value.....	$95,237	$201,931
Ground sumac—		
Pounds	5,061,333	9,284,000
Value.....	$65,190	$114,660
Extracts:—Sumac—		
Pounds	4,093,619	4,349,742
Value.....	$95,958	$103,085
Hemlock—		
Pounds	18,833,450	26,011,714
Value.....	$406,619	$563,591
Oak and chestnut—		
Pounds	156,520,123	28,983,036
Value.....	$2,411,184	$529,670
Palmetto—		
Pounds	1,740,000	1,050,000
Value.....	$34,800	$20,000
Tanning liquors—		
Pounds	44,418,929	16,144,292
Value.....	$1,704,243	$405,659
Tannic acid—		
Pounds	5,165,500	1,326,515
Value.....	$200,136	$149,662
Sizes—		
Pounds	7,812,433	101,920
Value.....	$217,859	$2,548
All other products	$1,687,271	$674,417

ENGLISH PATENTS.

Phenylnaphthimidazole or homologues or derivatives thereof; Manufacture of amidooxy sulphonic acids of ——, and of intermediate products. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 21,175, Oct. 18, 1905.

A MONOAZO dyestuff, obtained by combining a diazo compound with a suitable monoaminonaphtholsulphonic acid (*e.g.*, 2:8:6, or 1:8:4), in which the azo group is in the o-position to the amino group in the naphthalene nucleus, is condensed at ordinary or reduced temperatures with a nitro- or aminobenzaldehyde, or a homologue or derivative of one of these, and the product is reduced, *e.g.*, by stannous chloride in hydrochloric acid solution; the result of the reduction is that one diazo component is split off as an amino compound, whilst the residual compound undergoes intramolecular condensation, to form an aminohydroxysulphonic acid of phenylnaphthimidazole. If a nitrobenzaldehyde has been used in the process, the nitro group will be reduced to an amino group. (See also this J., 1906, 215 and 750.)—T. F. B.

Sulphur colours [Sulphide dyestuffs] and a process for making the same. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 4097, Feb. 19, 1906.

WHEN dehydrothio-p-toluidine, or one of its derivatives

containing more sulphur in the molecule (primuline bases), is heated with sulphur and benzidine or thiobenzidine, yellow substances are obtained, which are converted into soluble dyestuffs dyeing fast yellow shades on cotton, by heating with alkali sulphides or hydroxides. Sixteen kilos. of dehydrothio-*p*-toluidine, 19 kilos. of benzidine, and 70 kilos. of sulphur, are heated for about 12 hours at 210° C. The melt is ground and added to 240 kilos. of sodium sulphide crystals which have been melted, and the mixture heated to 120° or 125° C. until it is soluble in water; it is then diluted with 600 litres of water, and the solution precipitated with 75 kilos. of hydrochloric acid.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,633, Sept. 17, 1906.

THE acetyl derivatives of halogenated 1-aminoanthraquinones are heated either alone, or in presence of a solvent or a condensing agent, whereby they are converted into dyestuffs which dye from the vat, yielding yellow to orange-yellow shades. If the acetyl compounds are heated alone for some time, at temperatures above their melting points, the dyestuffs may be extracted by means of nitrobenzene, or the impurities may be removed from the melt by treatment with sodium hypochlorite. It is preferable, however, to carry out the condensation in presence of a solvent or diluent, such as nitrobenzene or naphthalene, the yield and purity of the dyestuff being thus enhanced. The products are soluble in alkaline hydrosulphite solutions, yielding yellow-brown vats which dye cotton dull brown shades; on washing, these shades become first greenish-yellow and then slowly orange (or more rapidly by treatment with sodium hypochlorite). The dyed fibre becomes blue by treatment with neutral hydrosulphite solutions.
—T. F. B.

UNITED STATES PATENTS.

Colouring matter for producing silk-like or pearl-lustre effects. L. Lilienfeld, Vienna. U.S. Pat. 834,739, Oct. 30, 1906.

SEE Eng. Pat. 14,483 of 1903; this J., 1903, 1345.—T. F. B.

Indigo white; Process of making halogenated ——. P. E. Oberreit, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 835,462, Nov. 6, 1906.

SEE Eng. Pat. 21,746 of 1905; this J., 1905, 1298.—T. F. B.

FRENCH PATENTS.

Anthracene; Production of a new series of derivatives and dyestuffs from ——, *and their application in dyeing and printing* [*Nitrobenzanthrones*]. Badische Anilin und Soda Fabrik. Eighth Addition, dated June 25, 1906, to Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., April 27, 1906.

SEE Eng. Pat. 12,518 of 1906; this J., 1906, 844.—T. F. B.

Dyestuffs; Production of sulphurised vat —— [*Thio-indigo Red, &c.*]. Badische Anilin und Soda Fabrik. Fr. Pat. 367,431, June 25, 1906. Under Int. Conv., May 16, 1906.

THE chlorides of arylthioglycolic acids, $R.S.CH_2.COCl$, when treated with aluminium chloride, undergo intramolecular condensation, hydrochloric acid being eliminated, and compounds of the general formula $R<\begin{matrix}S\\CO\end{matrix}>CH_2$ produced; on oxidation, these latter are readily converted into the corresponding "vat" dyestuffs, which are similar in properties to indigo. The acid chlorides need not be isolated in the first place, the leuco-compound being prepared in one operation from the arylthioglycolic acid by the action of phosphorus oxychloride and aluminium chloride.—T. F. B.

Dyestuffs; Manufacture of new condensation products and leuco-derivatives of sulphurised vat ——. [*Leuco-thioindigo derivatives.*] Badische Anilin und Soda Fabrik. Fr. Pat. 367,709, June 25, 1906. Under Int. Conv., May 26, 1906.

THIOSALICYLIC ACID, or one of its derivatives or analogues, is condensed with formaldehyde, formaldehyde bisulphite, trioxymethylene, &c., and the condensation product heated with alkali; the leuco-derivatives of vat dyestuffs are thus obtained. 154 kilos. of thiosalicylic acid are dissolved on the water-bath with 100 kilos. of 40 per cent. formaldehyde, three kilos. of hydrochloric acid are added, and the heating is continued until a thick mass is obtained; the solid product is separated, washed, dried, and heated with 600 kilos. of alkali hydroxide, for about half an hour, at 200°—220° C.—T. F. B.

Dyestuffs; Production of sulphurised vat —— [*Thio-indigo dyestuffs*]. Badische Anilin und Soda Fabrik. Fr. Pat. 367,739, July 4, 1906. Under Int. Conv., June 5, 1906.

THE leuco compounds of thioindigo derivatives (see Fr. Pats. 359,398 and 367,709; this J., 1906, 424 and the preceding abstract) can be converted into the corresponding dyestuffs by treatment with sulphur or sulphur chloride in presence or in absence of a solvent. A red dyestuff is obtained by adding 15 parts of thioindoxyl to 28 parts of melted sulphur; colour formation is complete in a short time, when the dyestuff is extracted by sodium sulphide or hydrosulphite, or by an organic solvent.
—T. F. B.

Aminonaphthols; Process for producing ——. F. Sachs. First Addition, dated June 22, 1906, to Fr. Pat. 359,064, Nov. 2, 1905. Under Int. Conv., Aug. 23, 1905.

AMINONAPHTHOLS may be obtained by heating naphthols or their alkali salts with sodium amide, with or without a diluent (a high boiling point substance not attacked by sodium amide). For example, a mixture of equal parts of β-naphthol and naphthalene is heated with one-fourth of its weight of sodium amide, at 220° C., for two hours; the melt is poured into water and acidified, the naphthalene distilled off by means of steam, the unaltered β-naphthol filtered off, and the 1.6-aminonaphthol precipitated. By similar means 1.5-aminonaphthol may be obtained from α-naphthol. When no diluent is used, the temperature of the melt should not exceed 200°—210° C. (See also this J., 1906, 369.) Two errors occur in the original patent (*loc. cit.*, col. 2, lines 23 and 24): "2.5-aminonaphthol" should read "5.2-aminonaphthol."—T. F. B.

Dyestuffs; Production of new mordant monoazo ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 367,504, June 28, 1906. Under Int. Conv., Dec. 19, 1905.

DIAZO derivatives of *o*-aminophenol derivatives containing a nitro group, or a halogen group, or both, but not containing a sulphonic acid group, are combined with 2-arylamino-5-naphthol-7-sulphonic acids. (5-nitro-4-chloro-2-aminophenol, which is claimed in Fr. Pat. 365,415 of 1906, this J., 1906, 923, is excepted.) The resulting dyestuffs dye wool from acid baths in red to violet shades, which are modified by chroming, to blues, violets, and blacks.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 1092.)

Wool; Chlorination of ——. L. Vignon and J. Mollard. (See Knecht, this J., 1892, 131.) Bull. Soc. Ind. Mulhouse, 1906, 76, 254—262.

SAMPLES of wool were submitted to the action of chlorine under the following conditions: (1) Chlorine gas: (*a*) dry at the ordinary temperature and at 50° C.; (*b*) moist, at the ordinary temperature and at 50° C. (2) Chlorine

water in neutral, acid, and alkaline solution. (3) Bleaching powder; the samples being in one set of experiments afterwards treated with sodium bisulphite. The wool was afterwards dyed with Orange I., and also with Methyl Violet. Under these conditions, wool acquires certain altered properties: (1) it loses weight, and the elasticity and tenacity are diminished; (2) it is moistened very easily, and gives deeper and more brilliant shades on dyeing. The authors reject the hypothesis of a direct combination of wool and chlorine, as free chlorine can be detected in the wool by the usual reagents. When treated with sodium bisulphite, which destroys the free chlorine, the wool retains its new properties. The action of the chlorine appears to consist in reacting with the organic substances to form hydrochloric acid and oxidation products by which the molecule is changed and the weight altered. This action may, in certain cases, extend to the ultimate decomposition of the albuminoid constituents, with formation of ammonia, oxalic acid, &c. On the large scale the treatment with chlorine is carefully regulated. It is, however, sufficient to destroy the most prominent parts of the wool-scales, and on this account, apparently, the tendency of the wool to felt and to shrink, is much diminished. Lastly, the increased affinity of chlorinated wool for dyestuffs may be due to an augmentation of its acidic and basic properties, owing to the rupture of some of the chains of amino-acids.—J. C. C.

English Patents.

Textile fibre from reeds or the like; Method of obtaining ——. C. de Hatvany-Deutsch, Budapest, Austria-Hungary. Eng. Pat. 21,768, Oct. 26, 1905.

See Fr. Pat. 358,828 of 1905; this J., 1906, 372.—T. F. B.

Silk; Manufacture of artificial ——. J. E. Bousfield, London. From La Soc. Anon. Fabr. de Soie Artificielle de Tubize, Belgium. Eng. Pat. 3,025, Feb. 7, 1906.

To unwind skeins of silk in an almost perfect manner, when used by manufacturers, the reeling is effected by passing the silk from an ordinary reel, upon which it is wound, to a measuring reel, thus forming the silk into skeins of given length directly without an intermediate winding.—D. B.

Dressing or sizing for yarns and other textile materials. L. Paechtner, London. Eng. Pat. 15,300, July 5, 1906.

In preparing dressings by boiling flour with water in presence of acids or alkalis, the finished base has to be carefully neutralised before it can be used, whilst by treating starch paste with a solution of chloride of lime, a calcium starch compound is formed. A more useful and economical product is obtained by replacing the above substances by chlorine water or a solution of sodium or potassium hypochlorite, although when the former is used, the solution has to be carefully neutralised, by an alkali before application.—D. B.

United States Patents.

Threads from collodion; Machine for producing ——, *and recovering the solvents of nitrocellulose or cellulose.* M. Denis, Mons, Belgium. U.S. Pat. 834,460, Oct. 30, 1906.

See Fr. Pat. 341,173 of 1904; this J., 1904, 864.—T. F. B.

Dyeing machine. W. H. Fletcher, Paterson, N.J. U.S. Pat. 834,284, Oct. 30, 1906.

The machine consists of a frame, supporting rollers with gearing attached, in order to give the skeins on adjacent rolls such a motion that the portions likely to touch, move in the same direction. Suitable means are provided for raising the frame and the skeins out of the liquid, for the purposes of loading and unloading.—B.N.

Printing warps; Apparatus for ——. G. Morton, Carlisle. U.S Pat. 834,396, Oct. 30, 1906.

See Eng. Pat. 9341 of 1904; this J., 1905, 616—T. F. B.

Textile goods; Finishing —— P Krais, Ilkley, Assignor to The Bradford Dyers' Association, Ltd., Bradford. U.S. Pat. 834,913, Nov. 6, 1906.

See Eng. Pat. 18,742 of 1904; this J., 1905, 886.—T. F. B.

French Patents.

Silk, artificial, &c.; Recovery of the alcohol and ether contained in ——. Soc. pour la Fabr. en Italie de la Soie Artif. par le Procédé de Chardonnet. Fr. Pat. 367,803, July 6, 1906.

The bobbins on which the artificial fibre is wound are washed during the winding process, either with pure water or with water containing a calcium or magnesium salt, the latter making the artificial fibre uninflammable. The water is distilled to recover the alcohol and ether.—A. B. S.

Cellulose threads; Process of making ——. E. Thiele, and Soc. Gén. de la Soie Artificielle Linkmeyer. Fr. Pat. 367,979, July 11, 1906.

See Eng. Pat. 15,133 of 1906; this J., 1906, 1040.—T. F. B.

Silk, artificial; Apparatus for the manufacture of ——. E. Thiele. Fr. Pat. 367,980, July 11, 1906. Under Int. Conv., Oct. 26, 1905.

See Eng. Pat. 16,078 of 1906; this J., 1906, 924.—T. F. B.

Scouring, dyeing, or otherwise treating fabrics, textile materials, and other similar material; Apparatus for ——. M. Nicholas. Fr. Pat. 368,017, June 23, 1906.

See Eng. Pat. 23,509 of 1905; this J., 1906, 1090.—T. F. B.

Fabrics; Apparatus for steaming, treating, and drying ——. Mather and Platt, Ltd. Fr. Pat. 367,911, July 9, 1906. Under Int. Conv., Aug. 4, 1905.

See Eng. Pat. 15,951 of 1905; this J., 1906, 586.—T. F. B.

Drying apparatus, with arrangement for washing, impregnating, dycing, heating, or cooling the material. Aktiebolaget Separator. Fr. Pat. 368,119, July 17, 1906.

See Eng. Pat. 16,001 of 1906; this J., 1906, 1081.—T. F. B.

Printing of fabrics; Machine for the ——. W. Pickup and W. Knowles. Fr. Pat. 367,837, July 6, 1906. Under Int. Conv., April 26, 1906.

The claim is for a printing machine fitted with an arrangement of cams and levers whereby the printing rollers can be removed from contact with the material, so as to cause intermittent printing.—A. B. S.

Finishing material for braids, laces, or fabrics in horsehair or artificial silk. P. Forest. Fr. Pat. 361,759, Sept. 9, 1905.

A hot aqueous solution of gelatin or other albuminous matter is prepared, to which is added at least an equal amount of acetic acid. After cooling, alcohol is added. This liquid is applied to the materials in a thin layer, and allowed to dry in the air, a hot iron being finally passed over the surface to render it uniform.—A. B. S.

Finishing soap [for textiles and paper]; Manufacture of a ——. E. Agostini. Fr. Pat. 361,772, Sept. 16, 1905. XII., page 1160.

Cotton impregnated with methylene ditannate [Antiseptic fabrics]; Manufacture of ——. W. Merck. Fr. Pat. 367,725, July 4, 1906. Under Int. Conv., Feb. 27, 1906.

The cotton material is treated for about half an hour in a boiling concentrated solution of tannin. It is dried, and then introduced, first into a bath of tartar emetic, and then into a cold bath containing 10 parts of formaldehyde (40 per cent.), 10 parts of common hydrochloric acid, and 100 parts of water. The material is finally washed with soap and dried.—A. B. S.

Half-wool fabrics impregnated with methylene ditannate [Antiseptic fabrics]; Manufacture of ——. W. Merck. Fr. Pat. 367,726, July 4, 1906. Under Int. Conv., July 7, 1905.

The material is treated for half an hour with a boiling concentrated solution of tannin, and then washed in cold water in order to remove the excess of the tannin from the cotton. The material is then treated in a cold bath containing 15 parts of formaldehyde (40 per cent.) and 15 parts of crude hydrochloric acid per 100 parts of water for 1—1½ hours. It is then washed, pressed, and dried in the air.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 1096.)

Molybdic acid; Reduction of —— *in solution by molybdenum, and the titration of the reduced solution by means of permanganate.* M. Guichard. Compt. rend., 1906, **143**, 744—746.

When neutral or slightly acid solutions of molybdic acid are reduced by means of metallic molybdenum, the blue oxide of molybdenum (molybdenum molybdate) is formed. If, on the other hand, the solutions are strongly acid, containing more than 200 grms. of hydrogen chloride or 500 grms. of sulphuric acid per litre, the reduction goes further, and the brown oxide is obtained. To this oxide the formula MoO_2 is usually assigned. From the author's analysis of the brown solution it appears, however, that this brown oxide has a composition corresponding to Mo_2O_5. The molybdenum was determined in the brown solution by evaporation to dryness and ignition of the residue to constant weight; the oxygen was determined by titration with permanganate in an atmosphere of hydrogen.—A. G. L.

Alkali carbonates; Causticising of —— *by lime.* M. Le Blanc and K. Novotny. Z. anorg. Chem., 1906, **51**, 181—201.

The authors have determined by direct as also by conductivity methods the solubility of calcium carbonate in water at 18° and 100° C. The actual amounts dissolved at these temperatures are 13 and 21 mgrms. per litre respectively; but as 65 and 72 per cent. of these amounts respectively are hydrolysed, the amounts actually existing in solution as carbonate are 4 mgrms. per litre at 18°, and nearly 6 mgrms. per litre at 100° C. With the aid of these data and those already existing for the solubility of calcium hydroxide, the authors have calculated the equilibrium constants for the reaction of calcium hydroxide on potassium or sodium carbonate; and they have also carried out direct experiments, starting both from alkali carbonate and lime and from alkali hydroxide and calcium carbonate. The results, given in very great detail in the paper, are summarised below:—

Temp. °C.	Solution used.	Percentage of total alkali converted into hydroxide.
100	$N/1$-Na_2CO_3	99·1
100	$2N$-Na_2CO_3	97·2
100	$3N$-Na_2CO_3	93·6
150	$2N$-Na_2CO_3	97·2
150	$3N$-Na_2CO_3	93·3
18	$N/1$-K_2CO_3	98·1
18	$3N$-K_2CO_3	92·1
100	$N/1$-K_2CO_3	98·8
100	$2N$-K_2CO_3	97·3
100	$3N$-K_2CO_3	92·8

Temperatures (and also pressure) are practically without influence on the final result; the speed of reaction is perhaps greater at higher temperatures, but the experiments show that equilibrium is in all cases rapidly reached. None of the various patents that have been taken out for working at high temperatures or increased pressures have therefore had any scientific foundation, except in so far as they all supplied the conditions for rapid work—high temperature, thorough agitation, considerable excess of lime. On the other hand, the universal industrial practice of not working with a too concentrated solution of alkali carbonate is justified both by the theory of the process and by the experimental results.—J. T. D.

Aluminium phosphate; Transformation of volcanic rocks into —— *under the influence of substances of physiological origin.* A. Lacroix. Compt. rend., 1906, **143**, 661—664.

Large deposits of aluminium phosphate are found on the island of St. Thomas and other islands in the gulf of Guinea. This results from the reaction on the trachytes and other volcanic rocks of the islands, of the dung of sea-fowl. Phosphates formed in a similar manner from limestone rocks are well known, but this decomposition of silicious rocks seems not to have been before observed. The alkalis contained in the rocks are not present in the phosphate, having no doubt been washed out by the copious rains to which the islands are subject.—J. T. D.

Potassium persulphate; Behaviour of —— *towards some saline solutions.* R. Pajetta. Gaz. chim. ital., 1906, **36** [2], 298—304.

The solubility of potassium persulphate in water and in saturated solutions of different salts at 12° C. was determined; the results are expressed in grms. per 100 c.c.: Water, 3·181; sodium sulphate, 5·987; sodium bisulphate, 8·72; disodium phosphate, 4·693; borax, 3·795; sodium nitrate, 19·143; sodium carbonate, 5·613; sodium bicarbonate, 4·947; potassium sulphate, 0·792; potassium bisulphate, 0·329; potassium nitrate, 0·896; potassium carbonate, 0·0118; potassium bicarbonate, 0·309; magnesium sulphate, 2·961, and calcium sulphate, 3·37. It will be seen that the solubility of potassium persulphate is greater in presence of sodium salts and less in presence of potassium salts than in pure water. The solubility in solutions of sodium salts is a function of the concentration of sodium in the solution, equal volumes of solutions containing equivalent quantities of different sodium salts dissolving equal amounts of persulphate. According to the author these results show that in presence of sodium salts double decomposition takes place according to the equation: $K_2S_2O_8 + Na_2SO_4 = Na_2S_2O_8 + K_2SO_4$. (See also this J., 1906, 1068.)—A. S.

Barium ferrate; Properties of ——. E. Baschieri. Gaz. chim. ital., 1906, **36** [2], 282—286.

Barium ferrate, $BaFeO_4.H_2O$, is scarcely acted upon by sulphuric acid at the ordinary temperature, but is attacked immediately by hydrochloric and nitric acids. With dilute hydrochloric acid, chlorine is evolved, and the solution is coloured red; after some days the evolution of chlorine ceases, and the red colour disappears; barium chloride and ferric chloride are found in the solution. A red coloration is also produced when the ferrate is decomposed by very dilute nitric (evolution of ozone), acetic (evolution of carbon dioxide), oxalic, formic, citric, and salicylic acids. No red coloration is produced when the ferrate is decomposed by carbonic acid or by hydrocyanic acid; in the latter case, metallic iron and barium ferricyanide are formed. It is probable that the red coloration is due to the presence of FeO_4'' anions in solution, the properties of barium ferrate resembling those of peroxides.—A. S.

Carbon monoxide; Action of —— *on steam at red heat, and action of hydrogen on carbon dioxide.* A. Gautier. Bull. Soc. Chim. 1906, **35**, 929—934.

Boudouard (Bull. Soc. Chim., 1901, **25**, 484) determined the ratio, CO/CO_2, in the equilibrium between carbon monoxide, steam, carbon dioxide, and hydrogen at different temperatures; and Hahn (Z. physik. Chem., 1903, **42**, 705; **44**, 513; 1904, **48**, 735; this J., 1903, 1038) determined the coefficient, $K = \frac{CO \times H_2O}{CO_2 \times H_2}$, at different temperatures. The author shows that when a current of carbon monoxide, mixed with a varying excess of steam is passed through a porcelain tube heated to 1200°—1250° C.,

at the rate of about 1 litre of the mixed gases per hour, or when a dry mixture of equal volumes of carbon dioxide and hydrogen is similarly treated at 1300°, the reaction proceeds until the volume of hydrogen is about double that of carbon monoxide. The reactions correspond with the equations:

$$3CO + 3H_2O = CO + H_2O + 2H_2 + 2CO_2.$$
$$3CO_2 + 3H_2 = CO + H_2O + 2H_2 + 2CO_2.$$

Under these conditions, any mixture of carbon monoxide, steam, hydrogen, and carbon dioxide tends towards the composition, $CO + H_2O + 2H_2 + 2CO_2$. Small quantities of formic acid, but no formaldehyde, are produced. These results are discussed with reference to the composition of volcanic gases, and attention is directed to the occurrence of formic acid in certain hot mineral springs.—A. T. L.

Hydrofluosilicic acid; Determination of ——. L. Schucht and W. Möller. XXIII., page 1176.

Dithionic acid and dithionates; Analysis of ——. R. H. Ashley. XXIII., page 1176.

Chlorine and bromine; Separation of —— in acid solution by hydrogen peroxide. P. Jannasch. XXIII., page 1176.

Borax; Production of ——. The United States Mineral Resources, 1905. [T.R.]

THE production of borax during 1905 was almost entirely confined to California. Only small quantities are ever taken from the marshes of Nevada during the summer months. The total output of crude borax in the United States for 1905 was 46,334 short tons, valued at $1,019,154, as against 45,647 tons, $698,810, in 1904, an increase of 687 tons, $320,334. From 2 to 4 tons of crude borax are required to make 1 ton of pure anhydrous boric acid. When the crude product, worth at the mines from $15 to $50 per ton, is refined, it is worth on the market from $120 to $140 per ton. No pure borax is shipped, about six-sevenths of the total product being only 25 per cent. ore. The crude material, as it comes from the ground, varies in boric acid content from about 5 per cent. to about 35 per cent.

Uranium sodium acetate; U.S. Customs Decision. Oil, Paint, and Drug Rep., Oct. 22, 1906. [T.R.]

THE protest of the importers was sustained regarding the duty on merchandise invoiced as "uranium and sodium acetate." The importation was assessed at the rate of 45 per cent. *ad valorem*, under paragraph 3 of the Tariff Act, as a chemical compound, and was claimed to be free, under paragraph 691 of the same Act. From the evidence presented, the merchandise was found to be a double salt of uranium, and therefore entitled to free entry, as claimed. The decision of the collector was accordingly reversed.

ENGLISH PATENTS.

Nitric acid and concentrated sulphuric acid; Production of concentrated —— from nitrosulphonic acid and nitrous sulphuric acid. Det Norske Aktieselskab f. Elektrokemisk Ind., and B. F. Halvorsen, Christiania. Eng. Pat. 3680, Feb. 14, 1906. Under Int. Conv., Feb. 15, 1905.

SEE Fr. Pat. 363,157 of 1906; this J., 1906, 847.—T.F.B.

Hypochlorite solutions; Manufacture of —— by electrolytic methods. W. P. Digby. Eng. Pat. 21,949, Oct. 28, 1905. XIA., page 1156.

Gases; Process and apparatus for separating —— [e.g., oxygen from the air]. A. A. Humphrey, London. Eng. Pat. 14,809, July 18, 1905.

THE process is based upon the different solubilities of gases in water, and is intended especially for separating oxygen from the air. Water flows from a reservoir into a funnel disposed above the open funnel-shaped top of a tall vertical pipe. The upper funnel has a piece of gauze stretched across the bottom in order to break up the stream of water. Air is drawn in by the water through the space between the funnels, and as the mixture of air and water descends, the nitrogen and oxygen are dissolved according to their respective solubilities, and to the pressure (height of the column of water). The lower end of the pipe opens into a closed tank, from the top of which a second pipe ascends for the escape of undissolved gases. The water containing the dissolved gases is withdrawn from near the bottom of the tank, and forced by a circulating pump up a third pipe to the water reservoir at a higher level than the top of the first vertical pipe. In the reservoir, owing to the low pressure, the dissolved gases (air enriched in oxygen) escape, and are withdrawn, and either utilised directly or passed through another similar apparatus, or through the same apparatus again. The water is used over again. Various modifications of the apparatus are described.—A. S.

Oxygen gas; Means for generating ——. R. von Foregger, New York. Eng. Pat. 11,979, May 22, 1906. Under Int. Conv., Feb. 8, 1906.

SEE Fr. Pat. 366,524 of 1906; this J., 1906, 1045. Reference is directed, under Section 1, Subsection 2, of the Patents Act, 1902, to Eng. Pats. 21,372 of 1897, and 20,430 of 1898.—T. F. B.

Oxygen; Preparation of —— by the decomposition of oxygenated salts. G. F. Jaubert, Paris. Eng. Pat. 12,246, May 25, 1906. Under Int. Conv., May 29, 1905.

SEE Addition to Fr. Pat. 350,377 of 1904; this J., 1906, 885.—T. F. B.

UNITED STATES PATENT.

Nitric acid; Apparatus for making ——. O. H. U. Brünler, Leipsic-Gohlis, Germany. U.S. Pat. 834,257, Oct. 30, 1906.

SEE Eng. Pat. 5852 of 1906; this J., 1906, 846.—T. F. B.

FRENCH PATENTS.

Sulphuric acid; Apparatus for the concentration of ——. A. Gaillard. Fr. Pat. 367,376, June 23, 1906.

THE acid to be concentrated is sprayed from an atomiser at the top of a cylindrical tower. In its passage down the tower it meets hot products of combustion from an auxiliary stove; these gases enter near the bottom of the tower and emerge by a pipe in the top, which leads them to the chimney, through a scrubbing tower filled with coke. Just below the inlet pipe for the hot gases is placed a perforated plate on which the acid collects, and through which it drops into a shallow trough at the base of the tower. This trough is cooled by a spiral cold water pipe inside it, and outside it another cold water pipe. The top of the tower, made of lead, meets the walls in a hydraulic seal; the walls are of stone, with or without an outer coating of lead.—A. G. L.

Alumina; Process for the preparation of pure ——. H. Arsandaux. Fr. Pat. 361,766, Sept. 13, 1905.

LYES of sodium aluminate, such as those occurring in the lixiviation of the product obtained by furnacing a mixture of bauxite with sodium carbonate, and containing silicates, are treated with sodium carbonate solution, and then with an equivalent quantity of milk of lime, or with finely divided or recently precipitated calcium carbonate, in order to form calcium silico-aluminate, which is separated by filtration. Aluminium hydroxide is then precipitated from the cleared solution by carbon dioxide in the usual manner.—E. S.

Aluminium hydroxide and aluminates; Process for the manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 367,728, July 4, 1906. Under Int. Conv., Nov. 24, 1905.

BAUXITE is heated to a temperature between 180° and 200° C. in an open vessel, and a strong boiling hot solution of potassium hydroxide (in the proportion indicated by $Al_2O_3:Na_2O$, or $K_2O = 1:1·3—1·5$) is gradually added. The heating is continued for half an hour or more, after which the potassium aluminate formed is extracted and

treated as usual. Sodium hydroxide may be substituted for the potassium hydroxide, but in this case a final heating to about 500° C. is necessary.—A. G. L.

Aluminium compounds; Process for the manufacture of ——. E. L. Rinman. Fr. Pat. 367,756, July 4, 1906.

Minerals containing aluminium, such as aluminium silicates, bauxite, kaolin, and felspar, are finely powdered and intimately mixed with an ammonium salt, preferably ammonium sulphate or chloride. The mineral may be used in the crude state or after a preliminary calcination. The mixture is then heated to a temperature at which the ammonium salt is dissociated, an aluminium salt and free ammonia being formed. The aluminium salt is leached out of the residue with water; aluminium hydroxide may be made from it by treating it with the ammonia evolved during the reaction, the ammonium salt being regenerated. If alkalis are present in the mineral, their salts will also be found in the solution. When ammonium chloride is employed as the decomposing agent, sublimed aluminium chloride may be obtained from the mixture by first heating under a pressure of 2 to 3 atmospheres at 350° C. until no more ammonia is evolved, and then lowering the pressure whilst maintaining the temperature.—A. G. L.

Hyposulphites [hydrosulphites]; Production of stable ——. Badische Anilin und Soda Fabrik. Fr. Pat. 367,524, June 5, 1906. Under Int. Conv., Nov. 8, 1905.

Calcium hyposulphite, precipitated by sodium hyposulphite from calcium chloride solution, is filtered off, washed with water, and with alcohol, and the alcoholic paste is incorporated with finely powdered quicklime. After removal of the bulk of the alcohol, the mass is dried in a vacuum, and preserved in hermetically closed vessels. Lime may be replaced in the process by the oxides of other alkaline-earth metals, or by the dry hydroxides of alkali metals. Reference is made to Fr. Pat. 300,735 of 1900. (Compare Eng. Pat. 18,852 of 1900; this J., 1901, 988.) —E. S.

Cyanogen compounds; Preparation of —— from vinasse. Chem. Fabr. Schlempe, G.m.b.H. Fr. Pat. 367,502, June 28, 1906. Under Int. Conv., Jan. 16, 1906.

The tar produced in the destructive distillation of vinasse, containing nitrogen, is, according to one process, partially burned with access of air, and the mixture of gases and vapour is passed through a highly heated tube to induce the formation of cyanogen. Another process consists in distilling the tar, without contact of air, direct into a carburetter used in the production of water-gas, the transformation into cyanogen being effected when these vapours and the water-gas traverse the superheater raised to a very high temperature. It is stated that thus the nitrogen in both the tar gases and in the water-gas is transformed into cyanogen, whilst the carbon compounds in the former serve to enrich the latter.—E. S.

Natural salts from mineral waters; Apparatus for extraction of —— by evaporation on a water-bath. J. J. Deprin. Fr. Pat. 367,762, July 4, 1906.

The mineral water, after undergoing a preliminary concentration in an ordinary steam boiler, is heated in a series of rectangular enamelled basins with concave bottoms, supported in a water-bath. The water-bath is heated by a furnace and is provided with a filling hole, a vapour-escape pipe, and an emptying pipe and tap. The contents of the basins are kept in movement by oscillating agitators suspended by hollow arms from a hollow shaft, and the solids are left as crystals in the basins.—W. H. C.

Glucina [Beryllia]; Process for separating —— from alumina and iron by acids and acid salts, especially by carbonic acid and alkali bicarbonates. F. Bran and G. van Oordt. Fr. Pat. 367,861, July 7, 1906. Under Int. Conv., July 15, 1905.

A mixture of the hydroxides of glucinum [beryllium] aluminium, and iron is treated with a solution of sodium carbonate and with carbon dioxide; or with sodium bicarbonate solution, the proportion being maintained of at least 1 mol. of the sodium salt to one of the glucinum hydroxide. Under these conditions, the glucina dissolves Or, the hydroxides may be treated with an alkaline lye, the solution being filtered from any undissolved iron hydroxide, and carbon dioxide passed through until the alkali is bicarbonated, when the glucina alone remains in solution.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 1096.)

English Patent.

Enamelling or glazing metallic and other surfaces; Process of ——. W. Atkinson, Shipley, Yorks, and J. Smith, Bradford. Eng. Pat. 12,554, May 30, 1906.

The metallic articles to be coated are first cleaned with sulphuric acid, after which a flux is applied. This consists of 130 parts of white opal cullet, 20 of sodium bicarbonate, and 12 of boric acid, for wrought-iron or steel articles; for cast iron, a flux consisting of 130 parts of white opal cullet, 25 of sodium bicarbonate, and 13 of boric acid, is used. In either case the flux is first melted, run into water, and powdered before it is applied. The coated article is then dried and fired. The cold article is covered with a second coat of white opal cullet, or flint glass, or soda glass, also previously melted, run into water, and powdered. The second coat is allowed to dry, after which the article is again fired, preferably to a temperature just below the melting point of the metal. Broken porcelain may be substituted for the glass, but in this case the porcelain is heated only to redness, not fused, before it is thrown into water and powdered. Pottery may be enamelled in the same way.—A. G. L.

United States Patent.

Glass plates; Manufacture of ——. B. C. White, Chicago, Ill. U.S. Pat. 835,148, Nov. 6, 1906.

The method described of manufacturing glass plates consists in depositing a mass of glass upon a table between two rollers, moving the rollers along the table to spread a portion of the glass into a sheet, and then reversing the direction of movement of the two rollers and introducing a fabric or web between the portion of glass spread into a sheet and the roller effecting the spreading operation, and by the action of the other roller, spreading the remaining portion of glass into a sheet over and upon the fabric or web, and the sheet previously spread. The axes of the two rollers are linked together so that the rollers move forwards and backwards as a single body over the table. (See also U.S. Pats. 805,609 and 805,610 of 1905; this J., 1906, 20.)—W. C. H.

French Patents.

Glass-melting furnaces; The "monolithic" tank and its application to ——. J. Lecomte-Falleur et Cie. First Addition, dated June 18, 1906, to Fr. Pat. 346,012, Sept. 2, 1904. (See Eng. Pat. 19,067 of 1904; this J., 1905, 91).

This addition to the principal patent is for an arrangement for the continuous supply of material to the "monolithic" tank to avoid the repeated cooling of the mass of molten glass by intermittent additions of cold material, to economise material, to protect the "siège" and the tanks, and prevent clogging of the regenerators by molten material dripping into them. The arrangement suggested is either a trough or boat to contain the materials, which is placed over the melting compartment of the tank, and provided with an opening for the molten material to fall into the compartment, or a shoot, on which the materials are gradually melted by the heat of the furnace, and slide into the melting compartment.—W. C. H.

Enamels; Process for the manufacture of vitrifiable ——. P. Wagret. Fr. Pat. 367,613, April 12, 1906. Under Int. Conv., March 17, 1906.

The vitrifiable enamels are produced by the employment of

the following materials:—For red: Minium, Paris red, grey earth ("Terre grise"), borax. For black: indigo blue. For white: fluorspar.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 1098.)

Wood; Effect of moisture on the strength and stiffness of ——. United States Forest Service Rep. Eng. and Min. J., Nov. 10, 1906, 865.

THE United States Forest Service has studied this subject, with the following results:—The relation of moisture to strength follows a definite law. Proper drying greatly increases the strength of all kinds of wood, the amount of increase depending upon the species and the degree of dryness. For example, the strength of a piece of unseasoned red spruce may be increased over 400 per cent. by a thorough drying at the temperature of boiling water. Strength decreases again, however, as the wood reabsorbs moisture. Air-dried wood, protected from the weather and containing 12 per cent. of moisture, is from 1·7 to 2·4 times stronger than when green, according to the species. Stiffness is also increased by drying. These conclusions, however, are drawn from small-sized pieces, not exceeding 4 by 4 in. cross-section. Large timbers require years of drying before the moisture is reduced to the point at which strength begins appreciably to increase. More or less "checking" always occurs when large timbers dry, and if this "checking" be excessive it may cause enough weakness to counter-balance the strength gained by the drying. Consequently it is not safe to assume that the average strength of large so-called seasoned timbers is much greater than that of green or wet ones. The fibre-saturation point of a number of species has been determined. This point, which varies with conditions and species of wood, designates the percentage of water which will saturate the fibres of the wood. It has been found that, under normal conditions, a given kind of wood fibre will absorb a definite amount of moisture; additional water simply fills the pores of the wood. Only that water which permeates the wood fibre has an influence upon strength. For the following species, the saturation point occurs at the given percentage of moisture based on the dry weight of the wood: Longleaf pine, 25; red spruce, 31; chestnut 25; loblolly pine sapwood, 24; red gum, 25; red fir, 23; white ash, 20·5; Norway pine, 30; Western tamarack, 30 per cent. Prolonged soaking in cold water does not reduce the strength of green wood below that at its fibre-saturation point, provided it remains in perfect condition. When wood has been dried and is resoaked, it becomes slightly weaker than when green. Wood soaked in heated water absorbs more moisture. This causes a reduction in strength and stiffness, as is seen in wood steamed for bending.

ENGLISH PATENTS.

Stone, artificial, from slag; Manufacture of ——. W. Schumacher, Osnabrück, Germany. Eng. Pat. 18,806, Sept. 18, 1905.

IN this process for the manufacture of artificial stone, slag is first subjected to a coarse disintegrating process, and after being heated by steam, and with or without a small admixture of lime, but without admixture of other silicious material, is pressed into blocks, which are ready for use within a short time after their production. The blocks so prepared may be subjected to a hardening process by means of steam under pressure.—W. C. H.

Stones, artificial, and other plastic articles; Manufacture of —— . W. J. Apperley and F. J. D. Hullinghorst, London. Eng. Pat. 17,569, Aug. 3, 1906.

Two parts by weight of a solution of lead acetate at 10°—20° B. are added to 1 part of ammonia (sp. gr., 0·880). The clear solution obtained on standing (10 to 30 per cent.) is added to magnesium chloride solution (300 parts) at 25°—35° B. Of the mixed solution, 1 part is added to ¼—1 part of burnt magnesite, various organic or inorganic substances being added as filling materials. Liquid oils, or fats, may be used for this purpose, after mixing them with a solution obtained by acting with caustic potash solution (at 15°—35° B.) on powdered resin. To produce a material resisting moisture, cold, and heat, bituminous materials or tar may be added to the solution obtained on dissolving barium dioxide in hydrochloric acid, and this mixture used as filling material.—A. G. L.

Drying; Apparatus for ——, *suitable for bricks, timber, and other purposes.* W. B. Hughes, London. Eng. Pat. 21,816, Oct. 26, 1905.

A DRYING chamber, provided with doors and shelves to support the materials to be dried, is built over a trench. In the upper part of the latter a number of horizontal pipes are arranged through which steam or some other heating medium can be passed. A blast of air is delivered by a fan into a perforated pipe placed below the heating pipes, the perforations being made progressively larger the further they are from the point at which the air enters. The air passes up, around and between the heating pipes, and then around and between the materials on the shelves of the drying chamber, and finally escapes along with the vapour given off through openings in the sides.—W. H. C.

Stucco; Manufacture of ——. J. Y. Johnson, London. From R. Koepp und Co., Oestrich on Rhine, Germany. Eng. Pat. 4503, Feb. 23, 1906.

SEE Fr. Pat. 363,564 of 1906; this J., 1906, 848.—T. F. B.

UNITED STATES PATENTS.

Clay products; Dryer for ——. R. W. Lyle, New York. U.S. Pat. 834,584, Oct. 30, 1906.

THE dryer consists of one or more drying tunnels or compartments. The products of combustion from a system of kilns are conveyed to a main flue chamber, which extends across one end of the drying compartments, and is contained entirely within the dryer, in which the radiating top of the flue is directly exposed. Longitudinal heat-radiating flues are arranged in the drying compartments, and are connected with the main flue chamber, from which they can be independently closed. The ends of the longitudinal flues that enter the main flue chamber are supported by the wall of the main flue and a second wall a little outside it, the space between the walls being filled with packing to form a loose-joint connection. Forced draught can be produced in the flue chamber, and in any of the longitudinal flues that are in open communication with it at the time. The flues are provided with openings, that can be closed with covers, when necessary, for the passage of products of combustion from the flues.—W. C. H.

[*Mortar*] *Composition of matter.* M. W. Beique, Colorado Springs, Colo. U.S. Pat. 834,252, Oct. 30, 1906.

THE composition described consists of unslaked lime (100 lb.), plaster of Paris (200 lb.), and tailings from ore that has been treated by a cyanide process (2000 lb.). These are mixed together with enough water to give the desired consistency to the mass, and common sand is added "to overcome excess of slimes" in the tailings; hair or fibre may also be added.—W. C. H.

Cement; Manufacture of hydraulic ——, *and apparatus therefor.* B. Enright, South Bethlehem, Pa. U.S. Pat. 834,374, Oct. 30, 1906.

THE process described consists in passing the highly heated gaseous products of combustion and decomposition issuing from a rotary cement kiln through a charge of cement-forming materials in a vertical kiln, to which the sensible heat of the gases is imparted. The whole or part of the carbon dioxide produced in the vertical kiln is reduced to carbon monoxide and returned to the vertical kiln, and there again burned to the dioxide while calcining the charge of material in the kiln. The apparatus comprises a rotary kiln connected at its upper end with the

treated as usual. Sodium hydroxide may be substituted for the potassium hydroxide, but in this case a final heating to about 500° C. is necessary.—A. G. L.

Aluminium compounds; Process for the manufacture of ——. E. L. Rinman. Fr. Pat. 367,756, July 4, 1906.

Minerals containing aluminium, such as aluminium silicates, bauxite, kaolin, and felspar, are finely powdered and intimately mixed with an ammonium salt, preferably ammonium sulphate or chloride. The mineral may be used in the crude state or after a preliminary calcination. The mixture is then heated to a temperature at which the ammonium salt is dissociated, an aluminium salt and free ammonia being formed. The aluminium salt is leached out of the residue with water; aluminium hydroxide may be made from it by treating it with the ammonia evolved during the reaction, the ammonium salt being regenerated. If alkalis are present in the mineral, their salts will also be found in the solution. When ammonium chloride is employed as the decomposing agent, sublimed aluminium chloride may be obtained from the mixture by first heating under a pressure of 2 to 3 atmospheres at 350° C. until no more ammonia is evolved, and then lowering the pressure whilst maintaining the temperature.—A. G. L.

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(*Continued from page* 1096.)

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United States Patent.

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The method described of manufacturing glass plates consists in depositing a mass of glass upon a table between two rollers, moving the rollers along the table to spread a portion of the glass into a sheet, and then reversing the direction of movement of the two rollers and introducing a fabric or web between the portion of glass spread into a sheet and the roller effecting the spreading operation, and by the action of the other roller, spreading the remaining portion of glass into a sheet over and upon the fabric or web, and the sheet previously spread. The axes of the two rollers are linked together so that the rollers move forwards and backwards as a single body over the table. (See also U.S. Pats. 805,609 and 805,610 of 1905; this J., 1906, 20.)—W. C. H.

French Patents.

Glass-melting furnaces; The "monolithic" tank and its application to ——. J. Lecomte-Falleur et Cie. First Addition, dated June 18, 1906, to Fr. Pat. 346,012, Sept. 2, 1904. (See Eng. Pat. 19,067 of 1904; this J., 1905, 91).

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Enamels; Process for the manufacture of vitrifiable ——. P. Wagret. Fr. Pat. 367,613, April 12, 1906. Under Int. Conv., March 17, 1906.

The vitrifiable enamels are produced by the employment of

greater as either the chromium or the carbon increases. The mechanical properties of these steels are in every case similar to those of the corresponding nickel steels, the effect of the chromium being, however, to raise the breaking stress and the elastic limit without sensibly lessening the elongation or the resistance to shock; but the chrome-nickel steels containing carbide (a structure not met with in nickel steels under the same conditions) are brittle, though having medium values for elongation. *Quenching* a pearlitic chrome-nickel steel increases the breaking stress and elastic limit to a greater extent than in the corresponding nickel steel or chromium steel; it produces little effect on a martensitic chrome-nickel steel, softens a γ-iron steel slightly whilst not sensibly changing its micrographic structure, and is without action on a carbide steel unless the initial temperature be above 1200° C. *Reheating* softens slightly all the chrome-nickel steels, without sensibly altering their structure. *Cementation* affects them as it does the nickel steels. The only chrome-nickel steels which seem capable of industrial application are the pearlitic and γ-iron steels; the former are much harder after quenching, and the latter have a much higher elastic limit than the corresponding nickel steels. By cementation, a pearlitic chrome-nickel steel yields a steel with an outer martensitic shell much harder than that yielded by a nickel steel under similar treatment.—J. T. D.

Ammonia-copper-cyanide process. [*Gold extraction.*] E. Le Gay Brereton. Inst. Min. and Met., Bulletin No. 26, 27—31.

THE author shows that when an ammoniacal copper solution is titrated with an alkali cyanide, a certain amount of free cyanide is indicated by silver nitrate, not only when the solution is decolorised, but at all stages of the titration. This is the case both with ammonium cyanide and potassium cyanide, and appears to be due to ordinary mass action, a greater excess of "ammonium hydrate" in the solution causing a greater excess of free cyanide. This free cyanide always increases, on standing, up to a certain point (two days), after which it remains constant, the increase possibly being due to the breaking-down of the last of the cupric cyanide. The addition of more ammonia to a decolorised solution does not cause a return of the blue colour even after prolonged standing (three months), unless the free cyanide is also removed. In extracting gold by means of the ammonia-copper-cyanide process, the best results with a 0·25 per cent. solution of potassium cyanide were obtained in the presence of only 0·11 per cent. of ammonia, from which it appears that the efficiency depends mainly upon the quantity of cyanogen liberated by the decomposition of the cupric cyanide to cuprous cyanide, and not merely upon the protection of the potassium cyanide by the ammonia.—A. G. L.

Copper-palladium alloys. R. Ruer. Z. anorg. Chem. 1906, **51**, 223—230.

COOLING-CURVES of alloys of palladium and copper have shown the authors that while the two metals may be melted together in all proportions, the alloys are simple mixtures, and there is no evidence of any compound of the two metals, or even of a eutectic. Alloys containing less than 20 per cent. of palladium show the colour of the copper they contain, but those containing more palladium are white. The alloys are harder than either of their constituents, the hardest alloy being that which contains equal proportions of the two metals.—J. T. D.

Sulphides; Action of steam on —— at red heat. Formation of native metals. A. Gautier. Bull. Soc. Chim., 1906, **35**, 934—939.

THE action of steam on iron sulphide at incipient red heat proceeds mainly in accordance with the reaction:—

$$3FeS + 4H_2O = Fe_3O_4 + 3H_2S + H_2.$$

With excess of steam and at a higher temperature, sulphur dioxide and free sulphur are formed (Gautier, Bull. Soc. Chim., 1901, **25**, 408). With the sulphides of metals which do not decompose steam at red heat, the action proceeds differently. When steam is passed through a tube in which is placed an earthenware boat containing galena, the latter commences to volatilise at incipient red heat and crystallises with a little lead sulphate in the cooler parts of the tube. After cooling, the boat contains metallic lead with about 2 per cent. of free sulphur. Some free sulphur sublimes, and the only gaseous product is a trace of sulphur dioxide. The reactions which occur are:—

$$3PbS + 2H_2O = 3Pb + 2H_2S + SO_2;$$
$$2H_2S + SO_2 = 2H_2O + 3S;$$
$$PbS + 2SO_2 = PbSO_4 + 2S.$$

These experiments show how a native metal may be formed from its sulphide by the action of steam under conditions similar to those which obtain in the depths of the earth, and indicate one of the sources of the free sulphur emitted from fissures in volcanic rocks. The action of steam on cuprous sulphide at bright red heat yields sulphur dioxide and hydrogen without hydrogen sulphide. The cuprous sulphide is partly reduced to copper. The principal reaction is:—

$$Cu_2S + 2H_2O = 2Cu + SO_2 + 2H_2.$$

A small quantity of free sulphur is produced. The sulphides of silver react even more readily and yield metallic silver, sulphur dioxide, and free sulphur. Native silver occurring with free sulphur, and in some cases with native copper, is probably formed in this manner. A mixture of steam and hydrogen sulphide passed through a tube at bright red heat yields free sulphur, condensed steam containing sulphurous and sulphuric acids with traces of thionic compounds, and a mixture of gases containing from 17 to 10 per cent. of sulphur dioxide and from 83 to 90 per cent. of hydrogen. Thus, steam oxidises metallic sulphides, hydrogen sulphide, and free sulphur at red heat, with the formation of sulphur dioxide and small quantities of sulphuric acid, and it is no longer necessary to assume that atmospheric oxygen penetrates deeply into the earth's crust in order to explain the presence of these compounds in volcanic gases and in springs of volcanic origin.—A. T. L.

Hydrogen sulphide; Action of —— on metallic and non-metallic oxides at high temperature. A. Gautier. Bull. Soc. Chim., 1906, **35**, 939—944.

THE action of excess of hydrogen sulphide at bright red heat on the oxides of iron yields iron sulphide, FeS, mixed with a lower sulphide. The resulting gases, after removal of hydrogen sulphide, contain about 11 per cent. of sulphur dioxide and 88 per cent. of hydrogen when ferric oxide is used, and about 83 per cent. of sulphur dioxide and 17 per cent. of hydrogen when the magnetic oxide is employed. The reaction with ferric oxide is represented by the equation:—

$$2Fe_2O_3 + 7H_2S = 4FeS + 3SO_2 + 7H_2.$$

The action of hydrogen sulphide on steam has been described in the preceding paper (see preceding abstract). The action on silica yields silicon sulphide, the oxysulphide $SiO_2.SiS_2$, sulphur dioxide, and hydrogen. With alumina the reaction is:—

$$4Al_2O_3 + 9H_2S = 2Al_2O_3,2Al_2S_3 + 3SO_2 + 9H_2.$$

Natural aluminium silicates react similarly, having part of their oxygen replaced by sulphur, and part of their silica separated as oxysulphide. A mixture of hydrogen sulphide and carbon dioxide at bright red heat yields carbon monoxide, carbon oxysulphide, free hydrogen, and a considerable quantity of water, but no sulphur dioxide. The reaction is:—

$$8CO_2 + 9H_2S = 3COS + 5CO + H_2 + 8H_2O + 6S.$$

The absence of sulphur dioxide is due to the reaction:—

$$2CO + SO_2 = 2CO_2 + S.$$

Carbon oxysulphide has been found from time to time in volcanic gases and in hot springs in volcanic districts. It has probably been frequently overlooked on account of its rapid conversion into hydrogen sulphide and carbon dioxide in the presence of moisture at ordinary temperatures. It is found that all the reactions in which sulphur dioxide is formed at red heat also yield small

quantities of sulphuric acid, which is thus produced without the presence of oxygen, in accordance with the equation:—

$$2SO_3 = SO_2 + O + S.$$

The steam formed by the action of hydrogen or of hydrogen sulphide on carbon dioxide is stated to be sufficient to account for the large quantities emitted by volcanoes, and it may also be the source of the hot springs in their vicinity.—A. T. L.

Power obtainable from metallurgical waste gases. C. Richter. Gasmotorentechnik, 1906, 6, 73—76. Science Abstracts, 1906, 9B, 426—427.

THE author gives a formula whereby the volume of waste gases from blast-furnaces and other metallurgical furnaces can be calculated. In most cases it is impossible to devise any accurate system of measuring the volume of these gases, and estimates of the power which is available are therefore not always trustworthy. The author's method depends upon taking some "critical" element, such as carbon, which is converted during the furnace process into gas, and from the amount of this charged into the furnace during a given time, and amount present in the solid materials discharged from the furnace, calculating the volume of gas which must have been produced. The percentage composition of the waste gases is of course required in the application of this method, as well as the chemical composition of the charge. The method can also be applied to the calculation of the heat and power value of the exit gases from blast-furnaces, and examples are given in the original article of all three applications. The method has proved itself reliable when applied to the gas production of three blast-furnaces, and should prove of considerable value in the designing and planning of gas-power installations in connection with large ironworks.

Molybdenum; Determination of ——. J. Darroch and C. A. Meiklejohn. XXIII., page 1176.

Mineral production of the United Kingdom in 1905. [T.R.]

THE following table, showing the quantity and value of the minerals produced in the United Kingdom in 1905, as compared with 1904, is taken from the General Report and Statistics on Mines and Quarries, 1905, Part III., recently issued by the Home Office.

The decrease in the total value of the minerals raised during the year is to be accounted for by a further fall in the average price of coal from 7s. 2·58d. per ton in 1904 to 6s. 11·38d. in 1905. The total output of coal was the highest hitherto recorded. The quantity of coal exported exclusive of coke and patent fuel and of coal shipped for the use of steamers engaged in foreign trade, was 47,476,707 tons, an increase of nearly 1½ million tons on the exports for 1904. Germany received over 7½ million tons, France and Italy each over six million tons, Sweden over three million tons, and Russia, Spain, Denmark, and Egypt each over two million tons. Adding the 2,287,792 tons exported in the form of coke and patent fuel, and the 17,396,146 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 67,160,645 tons. The amount of coal remaining for home consumption was 168,968,291 tons, or 3·91 tons per head of the population. 19,255,555 tons were used in the blast-furnaces for the manufacture of pig iron, as against 17,535,337 tons in the previous year. 33,452,943 tons were used in the manufacture of coke, and 1,109,797 tons in the manufacture of briquettes in 1905. Particulars relating to the manufacture of coke and briquettes are given for the first time, the quantity of coke obtained being 18,037,985 tons, valued at £10,625,799. The number of coke ovens in use during the year was 31,060. The quantity of briquettes produced was 1,219,586 tons, valued at £717,671. The output of iron ore shows an increase of 816,421 tons, and the value an increase of £356,370 on that of 1904. The ore yielded 4,760,187 tons of iron, or nearly one-half of the total quantity of pig iron made in the country. 7,344,786 tons of iron ore were imported during the year, over 78 per cent. of which came from Spain.

Mineral.	1904. Quantity.	1904. Value at the mines and quarries.	1905. Quantity.	1905. Value at the mines and quarries.
	Tons.	£	Tons.	£
Alum shale..	6,532	980	7,131	1,609
Arsenical pyrites	46	151	641	155†
Arsenic	976	5,719	1,528	7,498
Barytes	26,327	24,673	29,063	29,618
Bauxite	8,700	2,539	7,300	1,825
Bog ore	4,543	1,136	3,205	801
Chalk	4,488,728	181,057	4,535,584	196,480
Chert and flint	65,256	14,697	70,077	14,483
Clay and shale	15,948,915	1,772,020	15,134,754	1,763,008
Coal	232,428,272	83,851,784	236,128,936	82,038,553
Copper ore ..	5,276	14,172	6,903	21,796
Copper precipitate	189	3,780	250	10,900
Fluorspar ..	18,160	15,464	39,446	19,557
Gold ore	23,203	68,576	15,981	17,787
Gravel and sand	2,239,593	166,189	2,241,620	170,205
Gypsum	234,005	72,868	255,508	124,253
Igneous rocks	5,988,821	1,351,139	5,956,900	1,288,344
Iron ore	13,774,282*	3,125,814	14,590,703†§	3,482,184
Iron pyrites	10,287	5,300	12,186	4,789
Lead ore ..	26,374	206,238	27,649	244,752
Limestone (other than chalk)	12,043,135	1,369,610	12,501,780	1,410,526
Manganese ore	8,756	4,370	14,474	11,634
Mica	7,140	2,996	11,640	3,858
Natural gas..	c. ft. 774,800	155	—	—
Ochre, umber, &c.	16,050	18,242	16,237	15,462
Oil shale	2,333,062	554,346	2,496,785	593,384
Petroleum ..	—	—	46	69
Phosphate of lime	58	87	—	—
Salt	1,891,633	596,785	1,889,910	556,437
Sandstone ..	5,806,363	1,717,970	5,640,684§	1,634,357
Silver ore ..	35	1,782	14	806
Slate.....	563,170	1,678,726	514,524§	1,466,916
Sulphate of strontia ..	18,169	17,260	14,294	13,936
Tin ore (dressed) ..	6,742	479,633	7,201	574,183
Uranium ore	—	—	103	‖
Tungsten ore	161	14,369	172	11,357
Zinc ore	27,655	137,012	23,909	139,806
Total values	—	97,477,639	—	95,870,723

* Exclusive of 350 tons of micaceous iron ore, used for paint.

† Exclusive of 443 tons of micaceous iron ore, used for paint.

‡ Value of 141 tons only.

§ These figures differ slightly from those previously given, owing to correction of errors in certain returns, viz.: 1118 tons of slate corrected to 1118 tons of sandstone, and 28 tons of iron ore, which have been added to ochre, umber, &c.

‖ Value not yet ascertained.

Manganese in Mysore, India. Eng. and Min. J., Nov. 3, 1906. [T.R.]

A NEW deposit of manganese which promises to be an important source of supply is being opened up in Mysore State, India. It is situated 20 miles north-west of Shimoga Station on the Southern Mahratta Railway, 340 miles from Mormugoa. The distance from the deposit to the railway is covered partly by ordinary road, but the four miles nearest the mine are in dense jungle, through which a rough road has been cut. The ground is now being surveyed for a branch line from the railway. The deposit was discovered in August, 1905. By the end of 1905 mining was in full swing, and between March and August of the current year 20,000 tons were shipped to the coast and 25,000 tons additional made ready for immediate shipment. On the surface the ore occurs in nodules and boulders cemented together with a form of laterite clay. These vary in size from an inch in diameter to several tons in weight. This deposit extends over an area of several thousand square yards, as far as has yet been ascertained. At one point a well defined lode of high-grade ore has been opened up. The ore is very compact, crystalline, and hard, with a bright metallic fracture, and contains over 55 per cent. of manganese.

Uranium discovery in Canada. Mining World, Nov. 10, 1906. [T.R.]

An important discovery has been made in the Laurentian mountains not far from Labell, Que., and close to the Canadian Pacific Railway, of graphite and uranium. The minerals from which radium is extracted have been found in paying quantities.

ENGLISH PATENTS.

Iron and other metals; Manufacture of ——, and the utilisation of lignite or other fuel therein. H. T. Simpson, known as A. T. Simpson, Bilbao, Spain, and A. E. Bourcond, Gijon, Spain. Eng. Pat. 21,060, Oct. 17, 1905.

The iron ore is first reduced by hot carbon monoxide produced from the lignite, and the reduced metal is then smelted electrically. For this purpose, the ore and flux are fed into a closed blast-furnace, through the tuyères of which carbon monoxide at about 1000° to 1200° C. is blown; the carbon dioxide formed, together with unaltered carbon monoxide passes from the top of the furnace into a pipe leading to a circulating pump. From this the gases pass through a heater to the producer, which contains incandescent coke made from the lignite; here the carbon dioxide is reconverted into twice its volume of carbon monoxide. The gases then traverse a second heater, and afterwards pass again to the furnace. Suitable means are provided for removing the extra volume of carbon monoxide formed during the cycle; the gas so removed may serve to heat the two heaters through which the remaining gas passes. In order to keep the carbon monoxide as pure as possible, lime may be employed instead of limestone as a flux for the ore. The lower part of the blast-furnace forms the crucible or hearth of an electric furnace (preferably of the Kjellin or Gin types); the reduced metal, together with the gangue, drops into this crucible, and is there smelted.
—A. G. L.

Manganese steel rail; Cast ——. W. Brinton, High Bridge, U.S.A. Eng. Pat. 3900, Feb. 16, 1906.

See U.S. Pat. 812,811 of 1906; this J., 1906, 269.—T.F.B.

Steel; Manufacture or treatment of ——. R. A. Hadfield, Sheffield. Eng. Pat. 4107, Feb. 19, 1906.

See U.S. Pat. 834,904 of 1906; following these.—T. F. B.

Iron or steel; Case-hardening of ——. F. Grünewald, Berlin, Germany. Eng. Pat. 12,130, May 24, 1906.

The iron or steel plates to be treated are heated in a muffle furnace from which external air is entirely excluded, and into which air is passed from a carburetter. The quantity of carbon absorbed by the metal can be regulated by using hot or cold air, or by altering the duration of heating. Suitable carburetters are those described by the inventor in Eng. Pats. 12,127, 12,128 and 12,129 of 1906.—A. G. L.

Gold, silver, and other metals; Extraction of —— from metal-bearing matter. J. G. Slater, Toronto, Canada. Eng. Pat. 21,549, Oct. 23, 1905.

The metal-bearing matter—ores, sand, quartz, &c.—is first reduced to an impalpable powder, and treated by the usual amalgamation and cyanide processes. The residue (1 part) is then mixed with potassium nitrate (1 part), and sea salt (½ part), the whole ground together, and put into a crucible or retort, on the bottom of which has been placed one-sixth part of copper. The mixture is then boiled in a hard coke furnace at a temperature of 2000° C. for one hour. The button of copper obtained will then contain the metals from the residue. The furnace used is provided with a close-fitting cover connected to an "accumulator" in which any gaseous metallic sulphides condense and settle.—A. G. L.

Disintegrating, washing, and screening machines [for ores]. C. B. C. Storey, Lancaster. Eng. Pat. 14,418, July 12, 1905.

See Fr. Pat. 367,477 of 1906; following these.—T. F. B.

Ore separators; Centrifugal ——. W. H. Peck, Chicago, Illinois. Eng. Pat. 21,634, Oct. 24, 1905.

Essentially the invention consists in an ore separator in which the size of the passage between the deflector and the containing vessel can be increased or decreased. This lateral movement of the deflector is accomplished without destroying the continuity of the wall of the deflector, by providing the latter with movable sections which collectively form an approximately circular circumferential contour, and giving these sections a flexible watertight covering of rubber and canvas, which covering forms the wall of the deflector. The containing vessel and deflector are revolved at different speeds.—A. G. L.

Ore separators; Centrifugal ——. W. H. Peck, Chicago, Illinois. Eng. Pat. 21,635, Oct. 24, 1905.

The object of this invention is the same as that of the preceding. A differentially rotatable core or deflector is made capable of substantially uniform radial expansion or contraction by constructing it in a number of sections, which can be pushed further from, or nearer towards, the centre, and which are covered by a watertight material forming the outer wall of the deflector.—A. G. L.

Ore concentrators; Centrifugal ——. P. H. Adams, Chicago, Illinois. Eng. Pat. 21,639, Oct. 24, 1905.

The ore concentrator consists of a rotatable tapering treatment vessel and a rotatable tapering deflector or core. By raising or lowering the latter in the treatment vessel, the channel between the two can be diminished or enlarged. Means are provided by which material can be removed by means of a current of water from a desired portion of the separating apparatus near the discharge end without disturbing the richer material near the feed end. Automatic means are provided to prevent the water from flowing up into the channel beyond a desired distance during the removal; these means open when the deflector is rotating at a low speed and close when it is at a high speed.—A. G. L.

Ore separators; Centrifugal ——. W. H. Peck, Chicago, Illinois. Eng. Pat. 21,650, Oct. 24, 1905.

The invention relates to a brake which lowers the speed of rotation of the treatment vessel of an ore separator during the time that material is to be removed from its surface. The motive power which rotates the vessel being partly discontinued by any suitable means, a friction wheel is brought into contact with the treatment vessel; the consequent revolution of the friction wheel rotates a fly-wheel governor, which is regulated so that as long as the rotation of the vessel exceeds a certain speed, the governor opens a valve admitting water into a hydraulic cylinder, which then applies suitable brakes to the treatment vessel. The whole is regulated so that during the removal of material from the surface of the treatment vessel, the latter should revolve at the (low) speed best suited for this operation.—A. G. L.

Ore separators; Centrifugal ——. P. H. Adams, Chicago, Illinois. Eng. Pat. 21,663, Oct. 24, 1905.

The ore separator consists of a rotatable treatment vessel tapering towards one end, and a rotatable deflector of similar shape, horizontally movable within the treatment vessel so as to enlarge or decrease the channel between the two. Means are provided for feeding material and water into the vessel at a distance from its feed end substantially equal to the distance through which the deflector moves, and means for discharge are placed at a similar distance from the discharge end. The deflector is of sufficient length substantially to cover the points of feed and the discharge openings.—A. G. L.

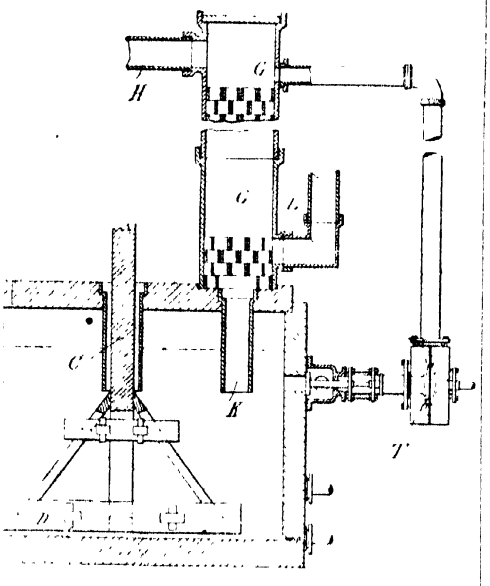
Ore concentration. Minerals Separation, Ltd., London. From G. A. Chapman, Broken Hill, N.S.W. Eng. Pat. 17,328, Aug. 1, 1906.

The process, consisting in agitating finely-divided ore suspended in acidulated water, described in Eng. Pat. 7803 of 1905 (this J., 1906, 184; also Fr. Pat. 354,960 of 1905; this J., 1905, 1177), is now modified by first introducing the ore, water, and acid into an agitating vessel,

terwards adding the necessary small proportion of oil the like in a second agitating vessel, and finally heating e pulp in a third agitating vessel, in which the acid is actically neutralised.—E. S.

lphide ores; Process and apparatus for the treatment of [complex or ferruginous] ——. H. Baker and A. T. Smith, Weston Point, Cheshire. Eng. Pat. 22,235, Oct. 31, 1905.

NELY-DIVIDED sulphide ores, while being agitated with ter, are treated, indirectly, with chlorine, in the m of ferric chloride preferably, ferric chloride rived from solutions taken from previous workings ntaining ferrous chloride, converted into ferric chloride direct treatment with chlorine. The large tank own in the drawing is constructed of stone, and the essories are of earthenware or the like, except the tator, D, suspended adjustably from the pipe, C, which itator is made of wood, tarred or otherwise protected.



ter and the finely-divided ore are introduced into the r, and the agitator being kept in motion, liquor from revious working in the column or tower, G, receives tream of chlorine through the valved pipe, H, for version of a portion of the ferrous chloride present ferric chloride. The liquor descends the tower ked with earthenware tubes or the like), and flows ugh the pipe, K, into the magma of ore and water. liquor is withdrawn, and forced to the top of the mn, G, by the centrifugal pump, T, and after being n treated with chlorine is returned to the tank through pipe, K, as before. Unabsorbed gases have outlet ugh the pipe, L. Steam is preferably injected. Towards end of the working, sulphur is set free, and floats he surface, whence it may be withdrawn through manhole, M, and is drained and pressed into cakes. n the sulphide ore contains metals precipitable ron or zinc, such as lead, copper, silver, &c., the slurry hlorides prepared as described, is treated with finely- ded sulphide ore, to convert most of the ferric into ous chloride. The solution is then digested with or zinc powder, or scrap, with constant agitation. tals of lead chloride suspended in the liquor are d to thus yield spongy lead, whilst copper also rates from cuprous chloride. The slurry containing e precipitates, drawn off from outlets at different s, so as to keep apart portions containing metals the lighter superincumbent layers with gangue, is filtered, and the metals collected are separated. In one form of apparatus, the reacting tank is caused to revolve on a horizontal axis, and provision is made for the withdrawal of the slurry. Chlorine may be supplied to the ore by the chloride of another metal, such as copper, capable of forming a higher chloride, instead of by ferric chloride.—E. S.

Flux or physic for the treatment of cast iron and other metals. J. Davies, Birmingham. Eng. Pat. 23,783, Nov. 18, 1905.

To the molten cast-iron or other metal is added a flux composed of charcoal, rock salt, limestone, plumbago, sodium carbonate, manganese, and nickel in suitable proportions. The metal obtained can be hardened and tempered like steel.—A. G. L.

Metals; Annealing of ——. D. Bates and G. W. Peard, Huyton, Lancs. Eng. Pat. 324, Jan. 5, 1906.

THE articles are annealed in a non-oxidising atmosphere by placing them on an endless conveyor which passes through an inclined chamber. Part of this chamber is heated in a furnace; the other part, which forms the discharge end, dips into a trough of water or other cooling liquid by which the articles are cooled below their oxidising point before they emerge into the atmosphere. The upper or feed end of the chamber is either open or else closed to such an extent as to admit only of the continuous entry of the articles. Steam or another non-oxidising gas is blown into the chamber, from a pipe entering near the discharge end, in such volume as to flow continuously out at the feed end, which latter may in addition be protected by means of a steam curtain, formed by steam under pressure emerging from a number of suitably placed jets.—A. G. L.

Lead and alloys of lead; Solvent for —— especially suitable for the removal of lead fouling from gun barrels. Kings Norton Metal Co., Ltd., T. A. Bayliss, and H. W. Brownsdon, London, and H. M. Smith, Abbey Wood, Kent. Eng. Pat. 2506, Feb. 1, 1906.

To a solution formed by dissolving 25 grms. of sodium hydroxide in 100 c.c. of water, 10 grms. of ammonium persulphate are added, immediately before applying the solution as a solvent for the deposits in gun barrels, &c. Or, tablets are formed, which may be stored, and dissolved in a solution of alkali hydroxide for application when needed, by mixing ammonium persulphate with from 5 to 20 per cent. of its weight of ammonium carbonate, and compressing in moulds. Other persulphates than that of ammonium, and other oxidising salts than persulphates, such as perborates or hypochlorites, may be employed. (Reference is made to Eng. Pat. 13,297 of 1905; this J., 1906, 378.)—E. S.

Aluminium alloys, and process for producing the same. J. O. O'Brien, Manchester. From A. Chambaud, Paris. Eng. Pat. 9750, April 26, 1906.

THE constituents of the alloy are:—Aluminium, 99·02; iron, 0·31; zinc, 0·01; magnesium, 0·041; and copper, 0·610 per cent. About one-fifth of the aluminium is first melted, the copper is then added, followed by the zinc and iron; the remainder of the aluminium is next added, and after withdrawal from the source of heat, the magnesium is introduced. The alloy is stated to be malleable and ductile, easily welded, and resistant to corrosion by sea-water and air.—E. S.

UNITED STATES PATENTS.

Steel armour-plates; Manufacture or treatment of ——. R. A. Hadfield, Sheffield. U.S. Pat. 834,904, Nov. 6, 1906.

THE castings are cooled slowly in a furnace, cleaned, heated for several days at 900°—1100° C. while in contact with carbonaceous material, allowed to cool gradually in the furnace, reheated to 700°—850° C., and cooled slowly. The castings are then again heated to 700°—850° C., cooled to 640°—690° C., quenched in water, reheated to 570°—640° C., cooled, heated again to

570°—640° C., quenched, and then taper-heated to 700°—770° C. at the face, tapering to 400°—600° C. at the back, and dipped in or sprayed with oil and water.—A. S.

Smelting; Process of ——. W. H. Adams and F. Powell, Portland, Oreg., Assignors to The Ladd Metals Co., Oregon. U.S. Pat. 834,240, Oct. 30, 1906.

The smelting process is carried out by means of gas. The gas is generated from a long horizontal body of fuel in a generator, so arranged that a horizontal zone of incandescence is maintained in it, and through this zone the products of combustion and volatile portions of the fuel must pass (see U.S. Pat. 834,238, page 1139). The gas generated is burned in a suitable flue, which leads to the base of a column of coarse ore, a blast of sufficient pressure to force the heat upward through the column of ore being maintained. Fine ore to be smelted, combined with fresh air, is fed into the flue, and added to the bath of molten ore at the base of the column.—W. C. H.

Metals and ores; Process and apparatus for separating ——. T. Groesbeck, Cincinnati, Ohio. U.S. Pat. 834,722, Oct. 30, 1906.

The apparatus consists of a receptacle mounted on a horizontal axis, and provided with a charging door near the periphery, and a discharge door at one side near the axis. The material containing metals or ores of high specific gravity is introduced into the receptacle, and the latter is slowly rotated one or more complete revolutions, whereby, it is stated, the material of high specific gravity concentrates about the axis of rotation, and is removed through the door provided for that purpose.—A. S.

Furnace; Smelting —. F. L. McGahan, St. Louis, Mo. U.S. Pat. 834,747, Oct. 30, 1906.

The apparatus comprises an ore-smelting chamber communicating with an "inclined inclosure," the latter being divided by a "water-grating" into a roasting chamber and a gas-flue. The roasted ore is discharged from the roasting chamber into the smelting chamber, which is separated from the former by a movable "water-grating." The smelting chamber is heated by a combustion chamber or chambers provided with fuel injectors with steam-pipe connections. The hot products of combustion and unconsumed gases from the ore-roasting and combustion chambers are passed to a carburetter supplied with suitable fuel, thence to superheating pipes surrounding the smelting chamber, and then back to the combustion chamber. Steam is supplied to the superheating pipes.—A. S.

Metals; Apparatus for recovering ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 834,803, Oct. 30, 1906.

The metal-bearing material and solvent solution are circulated and aërated in a tank, and a number of precipitating cells, each composed of a precipitating agent (metallic zinc in a divided form), covered by a filtering medium, are arranged in position to be submerged in the material contained in the tank. The metal-bearing solution is withdrawn from the tank through the precipitating cells, and afterwards returned to the tank.
—A. S.

Molybdenum and its alloys; Process of producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro-Metallurgical Co., W. Va. U.S. Pat 835,052, Nov. 6, 1906.

For the production of molybdenum, the process consists in smelting a mixture of molybdenum sulphide, carbon, and an oxygen compound of a metal with a relatively high affinity for sulphur, such as lime or other alkali or alkaline-earth compound. If it be desired to obtain alloys, a compound of the metal to be alloyed with the molybdenum is added to the charge.—A. S.

Ore concentration. H. L. Sulman, H. F. Kirkpatrick-Picard, and J. Ballot, London. U.S. Pats. 835,120 and 835,479, Nov. 6, 1906.

See Fr. Pats. 354,960 of 1905, and 363,418 of 1906; this J., 1905, 1177, and 1906, 890.—T. F. B.

Ore concentration. H. L. Sulman, London. U.S. Pat. 835,143, Nov. 6, 1906.

See Eng. Pat. 19,709 of 1905; this J., 1906, 850.—T. F. B.

Fine ores; Method of agglomerating ——. F. E. Bachman, Assignor to Northern Iron Co., Port Henry, N.Y. U.S. Pat. 835,232, Nov. 6, 1906.

Fine ores, flue dust, and the like are mixed with a suitable quantity of coke-breeze or other carbonaceous material, and the mixture is passed through a rotary kiln wherein it is heated, by a flame produced with blast-furnace gas, to a temperature below the fusing point of the ore, but sufficient to effect the combustion of the carbonaceous material, and the fusion of its ash. The fused ash effects the agglomeration of the fine ore.—A. S.

French Patents.

Manganese steel rail. W Brinton. Fr. Pat. 363,400, Feb. 19, 1906.

See U.S. Pat 812,811 of 1906; this J., 1906, 269.—T. F. B.

Smelting [steel, &c.]; Process and furnace for — —. A. Koch. Fr. Pat. 367,470, June 27, 1906. Under Int. Conv., June 27, 1905.

Two fusion chambers are built side by side with air- and oil-heating chambers between them; they are used alternately for preheating the charge and for melting it. The liquid fuel and air enter the working chamber and burn, and the waste gases pass through the preheating chamber and then to the oil heater, where they serve to liquefy and vaporise the oil residues used as fuel, and finally they pass through the air heater to warm the air. A modification is claimed, in which the goods as they pass from the melting to the heating chamber traverse a crucible chamber placed in front, where they serve to superheat the molten metal which collects in the crucible.—W. H. C.

Washing apparatus for all minerals; Mechanical — —. J. Nicholls. First Addition, dated March 5, 1906, to Fr. Pat. 364,771, Feb. 2, 1906 (this J., 1906, 990).

The present addition relates to a form of apparatus for treating, for example, cobalt ores containing finely-divided chromium minerals. It consists of an inclined trough, a short distance above the bottom of which is a metallic plate provided with a slot, or a perforated plate, extending nearly the whole length of the trough. The ore is introduced at the upper end of the trough, as also is a current of water, and a vibratory motion is imparted to the trough. The heavier and more finely divided chromium ore gradually passes to the bottom of the trough, below the plate, whilst the lighter and coarser cobalt ore is carried along above the plate. The two minerals are collected in separate receptacles at the lower end of the trough.—A. S.

Minerals and other substances; Process and apparatus for the treatment of —— by powdering, washing, and sifting. C. B. C. Storey. Fr. Pat. 367,477, June 27, 1906. Under Int. Conv., July 12, 1905.

The apparatus for the disintegration of the minerals, &c., consists essentially of a number of horizontal concentric rotating cylinders. Each cylinder or every second cylinder is provided at one end with a sieve of increasing fineness; in the second case the alternate cylinders serve merely to prolong the path of the mineral, being furnished with an opening at the ends remote from the sieves. The mineral is introduced into the innermost cylinder, together with water, air, or chemicals; as it is crushed, it gradually passes through the sieves to the outer cylinders, a number of residues being finally obtained in the different cylinders. The principle of the invention is that friable particles should be ground and crushed by harder particles of the same size.—A. G. L.

Cupola with fore-hearth heated by regeneration. J. M. Pignarre. Fr. Pat. 367,650, April 21, 1906.

The blast-furnace is provided with an adjacent fore-hearth at its bottom. By closing the top of the blast-furnace

entirely, the products of combustion from it are forced to pass through the fore-hearth on their way to a flue, half-way up the blast-furnace, which leads them to the chimney. The molten metal from the blast furnace can be run into the fore-hearth by means of a channel controlled by a valve. When the fore-hearth is hot enough, the flue leading from it to the chimney can be shut and the top of the blast-furnace opened, so that the latter then works in the normal way. A removable plate underneath the blast-furnace allows the latter to be entirely emptied after each run.—A. G. L.

Furnace for the extraction of zinc and its ores. P. Schmidt und Desgraz, G.m.b.H. Fr. Pat. 367,368, June 23, 1906.

THE claim is for a furnace heated by gas, with a continuous flame. The muffles are arranged along two sides of a heating chamber extending the length of the furnace. Several burners, arranged in pairs, are disposed in the hearth of the heating chamber, each pair communicating with the gas supply by a valve which can be operated by hand from outside the furnace. The air supply passes from a recuperator to a common conduit, wherein it is heated, and whence it passes to the burners through valved openings, which also can be regulated by hand from outside the furnace. It is stated that in this way a uniform degree of heating is attained in all parts of the furnace, and that the temperature can be easily controlled. —A. S.

Ores of iron and manganese, burnt pyrites, blast-furnace dust, and similar products; Process for the agglomeration of ——. F. Heberlein. Fr. Pat. 367,394, June 14, 1906.

THE finely-divided ore or other material is mixed with a suitable combustible, with or without addition of water. The mixture is ignited, and a current of air under pressure is blown through the mass, whereby sufficient heat is produced to cause the mineral to frit, whilst volatile matters are expelled.—A. S.

Copper; Metallurgical and electro-metallurgical process for obtaining pure ——. L. Jumau. Fr. Pat. 367,452, June 26, 1906.

THE process is based on the fact that if a copper salt be heated in a closed vessel under pressure with sulphurous acid, the latter is oxidised to sulphuric acid, and metallic copper is produced. Copper sulphate solution obtained by the usual method is treated with sulphurous acid or a sulphite, and heated in a lead-lined vessel, under pressure, to about 170° C. Metallic copper of 99·9 per cent. purity is, it is stated, thus obtained, and can be converted into bars by fusion or by pressure. If precious metals are present, they can be removed by electrolytically refining the precipitated copper, or they can be precipitated from the copper sulphate solution by a preliminary heating with calcium sulphite under atmospheric pressure.—A. S.

Cobalt and nickel; Process for the extraction and recovery of —— from ores and oxidised mattes. The Metals Extraction Corporation, Ltd. Fr. Pat. 367,717, July 4, 1906.

THE finely-ground ore or roasted matte is heated in an autoclave under steam pressure with a concentrated solution of magnesium chloride. It has been found that practically the whole of the cobalt is converted into chloride and dissolved before the nickel is attacked. After a suitable time the cobalt solution is drawn off, and the process then repeated until the nickel is dissolved. The cobalt and nickel are recovered from the solution by known methods.

In a modification of the process, the powdered ore is mixed with magnesium chloride and water to a paste, which is dried and then heated to about 300° C. The cobalt and nickel chlorides produced are removed by lixiviation with water, and the metals separated from the solution by known methods.—A. S.

Tinning and soldering; Process and powder for ——. F. Plathner and V. Dorn. Fr. Pat. 367,776, July 5, 1906. Under Int. Conv., March 20, 1906.

Two kilos. of powdered tin or lead, or of a mixture of the two metals, are mixed with 1 kilo. of powdered zinc chloride, ammonium chloride, or other deoxidising agent, and 500 c.c. of water, alcohol, or other inert solvent. The mixture is applied to the object to be coated, which is then heated in any usual way until the metal melts and adheres to the object.—A. G. L.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 1106.)

(*A.*)—ELECTRO-CHEMISTRY.

Carbon; Cathodic disintegration of —— in electrolyte of fused sodium chloride. G. J. Kemmerer. Trans. Amer. Electrochem. Soc., 1906, **9**, 117—119.

WHILST graphite is unattacked, and other forms of carbon are fairly durable, when used as anodes in the electrolysis of fused sodium chloride, they are readily attacked when used as cathodes. A quantity of sodium chloride was fused with the aid of a graphite cathode, which was afterwards replaced by a weighed rod of carbon (as used in arc lamps) or graphite, ½ in. square, dipping 1½ in. below the surface of the electrolyte. A current of 27 ampères was employed, the E.M.F. being 24 volts with the graphite and 27 volts with the carbon. After a definite period of time, the rods were withdrawn, well washed, dried at 100° C., and the loss of weight ascertained. In every experiment with the carbon rods, the portion dipping into the electrolyte was completely disintegrated in 1½—2 mins. A graphite rod weighing 29·792 grms. suffered a loss of 0·134 grm. in 10 mins., whilst a carbon rod weighing 39·215 grms. lost 6·735 grms. in 1½ mins.—A. S.

Ozone; Production of ——. C. Harries. Annalen, 1905, **343**, 341—344.

THE ozoniser used by the author consists essentially of a set of 10 Berthelot tubes arranged in parallel. One of the Berthelot tubes is shown in Fig. 1, and a plan of the apparatus is shown in Fig. 2. The tubes are disposed

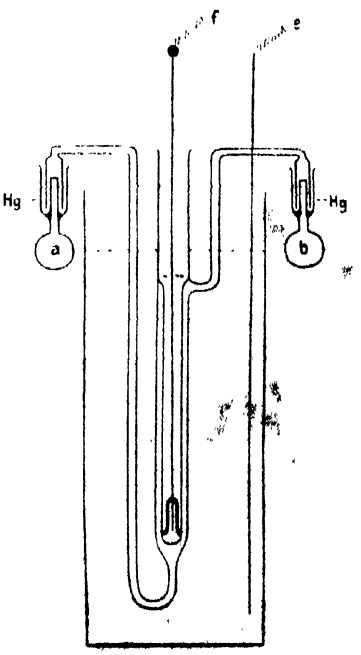


FIG. 1.

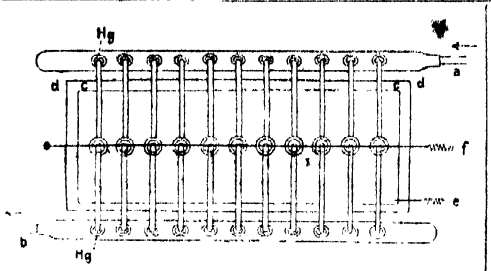


FIG. 2.

in a containing vessel, *c*, of glass, and both tubes and outer vessel are filled with water to a certain level. The whole is placed in a wooden box, *d*. Each tube has an electrode of aluminium wire, and these wires are joined, above the apparatus, by a long wire which forms one pole, *f*, for the current. Another aluminium wire dips into the water in the containing vessel, and forms the other pole, *e*. The ends of the Berthelot tubes dip into mercury seals. The oxygen enters at *a*, and, after ozonisation, leaves at *b*. With a current of about 2 ampères at 110 volts, transformed to about 10,000 volts, and with the oxygen led through at a rate of 5—6 litres in 12 mins., a yield of about 5·6 per cent. of ozone was obtained. It is advantageous to keep the water in the ozoniser cold, and to carefully dry the oxygen.—A. S.

Ozone; Preparation of ——. C. Harries. Ber., 1906, **39**, 3667—3670.

THE author had previously (see preceding abstract) obtained ozonised oxygen containing 5·6 per cent. of ozone. It is now found that by using 10 Berthelot tubes arranged in series instead of in parallel, a gas containing 11·2 per cent. of ozone is produced. The speed of the stream of oxygen is of great importance; with 10 Berthelot tubes arranged as above, and a stream of oxygen passing at the rate of 0·25—0·2 litre per minute, the resulting gas contained as much as 13 per cent. of ozone. This is the greatest amount which has hitherto been observed.—J. C. C.

ENGLISH PATENTS.

Incandescent electric lamp filaments; Manufacture of —— from thorium. British Thomson-Houston Co. From General Electric Co. Eng. Pat. 14,972A, July 20, 1905. II., page 1139.

Electric conductor; Method and means of hermetically sealing a wire or metallic —— or other substance through or into vitreous substance, such as lead, Jena, or quartz glass. C. O. Bastian and G. Calvert. London. Eng. Pat. 21,383, Oct. 20, 1905.

THE method described of hermetically sealing a wire or other suitable electrical conductor through, or into, or on to a hard vitreous substance, such as Jena or quartz glass, consists in utilising the difference between the coefficients of both expansion and contraction of the electrical conductor and of the glass. In order to utilise these physical properties, the conductor is provided at two or more points with heads or enlargements, at a suitable distance apart. These enlargements are arranged, relatively to the glass, in such a way that as the portion of the conductor between them contracts on cooling, they are pressed against the glass to form and maintain an air-tight joint. If, however, the glass and conductor are reheated sufficiently to cause any unsealing of the joint, due to the enlargements not pressing tightly against the glass, the (cubical) expansion of the conductor is so chosen that it still maintains the joint gas-tight by pressing against the glass surrounding it.—W. C. H.

Electrolytic apparatus. E. Hermite, Paris. Eng. Pat. 2465, Jan. 31, 1906.

THIS invention relates to an apparatus for the electrodecomposition of solutions, such as common salt and magnesium chloride. Several pairs of electrodes are connected in series in a single continuous electrolytic tank, the latter being divided by partitions into narrow compartments. The anode consists of a fine platinum wire threaded through holes in a slate slab, and on each side is bound a cathode zinc plate, the two plates being connected by metal bolts. Space is provided, between anode and cathode, for the circulation of the electrolyte, and the zinc plates are provided with shoulders, so that the electrodes may be supported on the walls or partitions of the electrolytic tank. The pairs of electrodes are so spaced that the resistance of the electrolyte between successive pairs is relatively great as compared with the resistance from one member to the other of any one pair. Leakage between successive pairs of electrodes is avoided, and high potentials may be used, without cutting down by interposed resistances or using a number of separate electrolytic tanks in series.—B. N.

Hypochlorite solutions; Manufacture of —— by electrolytic methods. W. P. Digby, London. Eng. Pat. 21,949, Oct. 28, 1905.

THE decomposition products at the anode and cathode are isolated from the main body of the electrolyte, one of the products being conveyed, either as an alkaline solution or as a gas, into a porous cell closely enclosing the electrode of opposite sign, in order to prevent combination of the products of decomposition in the main body of the electrolyte. The combination thus takes place in the compartment, where one of the products is liberated in a nascent condition. The porous cells, enclosing the anode and cathode, may be connected by conduits, and water or an alkaline solution may be supplied to the cathode cells, the resulting solution being led directly to the anode cells, or the gaseous products may be drawn off from the anode compartments, and passed into the cathode compartments. A mercury cathode may be employed, and the resulting amalgam washed with water in a separate compartment, the alkaline solution formed being led into the anode porous cells. The electrodes may, if necessary, be cooled by expanding ammonia or other compressed gas within them. The porous cells, surrounding the anode and cathode, consist of an asbestos sheet, bound between ebonite plates, the outer one being provided with vertical and the inner with horizontal slots.—B. N.

Fusion of materials by electricity; Effecting ——. G. F. Brindley, Niagara Falls. Eng. Pat. 11,675, May 18, 1906.

SEE Fr. Pat. 366,523 of 1906; this J., 1906, 1053.—T. F. B.

FRENCH PATENTS.

Electrolytic process. J. Tanne and E. Papenbruch. Fr. Pat. 367,440, June 26, 1906. Under Int. Conv., June 29, 1905.

THE materials to be submitted to electrolysis, either in the form of gases or finely-pulverised solids, are passed through the hollow electrodes under pressure, the orifices of the electrodes being opposite to each other in a reaction chamber, so that the materials differently charged with electricity are brought into mutual collision. The reaction chamber is connected to a cooling chamber, both being cooled by a continuous flow of cold water.—B. N.

Diaphragm; Electrolytic ——. I. L. Roberts, United States. Fr. Pat. 367,835, July 6, 1906.

THE invention relates to an electrolytic diaphragm, comprising a rigid element of porous material covered by a layer of non-porous material, the latter being maintained in position on the rigid element by means of linen cloth. The latter may also be covered by an open-work metallic support.—B. N.

GERMAN PATENT.

Mercury light; Apparatus for the illumination of liquids by —— for the purpose of producing chemical reaction. Schott und Gen. Ger. Pat. 172,681, March 3, 1905.

THE mercury lamp is placed in a glass tube, and the latter

immersed in the liquid which is to be exposed to the light from the lamp. This device is to avoid the necessity of constructing a special form of lamp which would be required if the lamp were placed directly in contact with the liquid, owing to the rapid withdrawal of heat by the latter from the lamp. If it be desired to work continuously, the tube containing the lamp is surrounded by several concentric tubes, opening alternately at top and bottom. The liquid is fed in at the top between the outermost tube and the containing vessel, flows through the annular spaces between the tubes, and is withdrawn at the bottom from the smallest tube.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Electro-deposits [Iron]; Structure of ——. C. F. Burgess and O. P. Watts. Trans. Amer. Electrochem. Soc., 1906, **9**, 229—237.

The authors describe, and show micro-photographs of, some peculiar variations in the physical structure of electro-deposited iron. It is stated that by electrolysing a solution of ferrous sulphate and ammonium chloride at 20°–30° C. with a current density of about 10 ampères per square foot, the electrolyte being circulated through the series of electrolytic tanks by means of a centrifugal pump, and care being taken to exclude dissolved gases from the solution, it is possible to obtain satisfactory deposits of iron of a thickness of at least 1 in., with almost the same ease and rapidity as is the case with copper.—A. S.

Copper ore; Electrolytic treatment of —— at Miedzianka, Russian Poland. W. Stoeger. Oesterr. Z. Berg. u. Hüttenwesen, 1906, **54**, 387—391. Electrochem. and Metall. Ind., 1906, **4**, 366.

The ore (chiefly copper glance, but occasionally containing azurite and malachite) is crushed, formed into briquettes with 5 per cent. of moist loam, and roasted in such a manner as to obtain a mixture of copper sulphate and copper oxide. This is lixiviated with dilute sulphuric acid, and the copper recovered from the solution by electrolysis. Sheet-lead anodes wrapped in a textile fabric are employed, with a current of 1000 ampères, corresponding to 1 ampère per sq. dm. of cathode surface, at 2·5 volts per vat. 1·1 grm. of copper is deposited per ampère-hour. It is stated that the deposited copper is purer than electrolytic copper from refineries. The sulphuric acid produced during electrolysis is used for treating fresh quantities of roasted ore.—A. S.

United States Patents.

Ores [zinc-lead]; Process of treating ——. F. T. Snyder, Oak Park, Ill. U.S. Pat. 834,644, Oct. 30, 1906.

Ores containing metallic constituents reducible at different temperatures are mixed with carbon and slag-forming materials, and introduced, in absence of air, at the deeper end of a bath of molten slag. An electric current is passed through the slag between the deeper and shallower ends, whereby a temperature is produced progressively increasing in intensity towards the shallower end of the slag-bath, and sufficient to reduce in succession the different constituents of the ore. The unreduced ore is gradually moved forward until it reaches the shallow end of the bath, where the heat is sufficient to volatilise the metal last reduced, and completely expel it from the molten slag. The metal first reduced is withdrawn from below the deeper portion of the slag-bath. The process is especially suitable for the treatment of zinc-lead ores, the zinc being volatilised at the shallow end of the bath, and subsequently recovered by condensation, whilst molten lead is withdrawn from the deep end of the bath.—A. S.

Metals; Metallurgical process for the extraction of —— from their ores, and the conversion of iron into steel. G. H. Benjamin, New York. U.S. Pat. 834,656, Oct. 30, 1906.

The ore is mixed with a flux, and subjected to a gradually increasing temperature, and to the action of reducing gases. The partially reduced ore is then caused to move by gravity into a zone of high temperature, wherein it is subjected to the action of successive electric arcs, in the presence of a carbon body which will combine with or react upon it under the influence of the electric arcs. The resulting metal is separated by gravity from accompanying substances, and is subjected to the action of an oxidising atmosphere and of air-blasts. The gases generated from the charge by the action of the electric arc are used for reducing the ore in the first stage of the process.—A. S.

Gold and silver; Means for [electrolytically] precipitating ——. J. Snodgrass, Johannesburg, Transvaal. U.S. Pat. 835,329, Nov. 6, 1906.

The apparatus consists of a receptacle in which cathodes and anodes are disposed alternately. The cathodes each consist of a metallic frame, on both sides of which are secured metallic screens of fine mesh, the whole being covered with a fabric provided with a conductive coating. They rest on a metal plate, contained in the receptacle, by which they are placed in electrical connection. The anodes are disposed in frames of non-conductive material, in the sides of which are slots or holes by means of which the solution takes a sinuous course through the receptacle without passing through the anodes.—A. S.

French Patent.

Ores; Treatment of —— by electrolysis N. H. M. Dekker. Fr. Pat. 367,495, June 28, 1906.

The electrodes are arranged alternately in the electrolytic cell, one electrode being formed of a simple carbon or metallic plate, and the other of a flat vessel, of plaited wood, lined with a fabric containing the material to be treated. The material is divided into two parts by a carbon or metallic plate, which is bound to one of the electric terminals.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 1106.)

Lipase; Action of ——. A. E. Taylor. J. of Biol. Chem., 1906, **2**, 87—104. Chem. Centr., 1906, **2**, 1344—1345.

The lipase was prepared from fresh, ripe castor beans by removing the husks, pounding the kernels, and exhausting the latter with anhydrous ether. The ferment is insoluble in ether, but completely soluble in ether containing dissolved fats. If it be mixed with water and ether, a portion is taken up by the water, but none by the ether; the greater part, however, remains as an intermediate layer. If, now, an ester soluble in ether but not in water be added, the lipase passes into the ether. If, on the other hand, an ester soluble in both ether and water be introduced, the lipase passes into both the ether and the water, and into the latter medium in greater quantity. Ground castor beans contain, besides lipase, amylase, invertase, maltase, and an endotrypain, but no peroxydase. Several protein substances—globulin, albumin, nucleoalbumin, and a glycoprotein—are also present. The greater the degree of purity of the lipase, the less stable it is, as the protein substances serve to protect it from the action of the endotrypain. If turbid aqueous suspensions of lipase be repeatedly filtered through paper, the ferment is retained completely by the paper. In the dry condition the ferment is not injured by heating above 100° C., but is decomposed by heating the aqueous suspension, more rapidly in presence of alkali than when the water is acid. In presence of fats, the ferment is more resistant against the action of heat. In experiments on the hydrolysis of triacetin, it was found that the reverse reaction—the synthesis of triacetin—takes place, but only with very low velocity. On hydrolysing solutions of triacetin of different concentration, by means of sulphuric acid and lipase respectively, till equilibrium was established, the results obtained in the two sets of experiments agreed fairly well (see table).

indicating that the ferment acts as a true catalyser, and does not cause a displacement of the equilibrium.

Concentration of triacetin solution, per cent.	0·5	1·0	2·0
Percentage of ester decomposed by—			
(1) Sulphuric acid	88	82	78
(2) Lipase	86	79	70

Experiments on the hydrolysis of triolein showed that the amount of hydrolysis is a linear function of the time, and the degree of acceleration of the hydrolysis is directly proportional to the amount of ferment present. It is stated that dry lipase from castor seeds is capable of effecting the synthesis of all higher fats from glycerol and fatty acids. The author has also succeeded in synthesising triolein from anhydrous glycerol and oleic acid by means of pancreas powder, but failed in similar attempts with palmitic and stearic acids. (See also this J., 1905, 977, 1242; 1906, 994, 1106.)—A. S.

Cod-liver oil; Separation of the fatty acids of ——. H. Bull. Ber. 1906, **39**, 3570—3576.

Fractional distillation of the fatty acids in a current of superheated steam having proved an ineffectual means of separation, the author tried distillation *in vacuo* of the methyl esters, which have a considerably lower boiling point than the fatty acids. It was found that about 80 per cent. of the fatty acid esters passed over below 240° C. at a pressure of 10 mm. Two kilos. of Lofoden cod-liver oil, almost devoid of free fatty acids, were converted into methyl esters of the fatty acids (yield 1960 grms.), and these were fractionated three times in a special vacuum distillation apparatus, the first time at intervals of about 10° C., and subsequently at smaller intervals. The three main fractions thus obtained boiled at 186° C., 206° C., and 224° C. respectively, and there were also considerable fractions boiling at 161·5 to 165° C. and 242° C. respectively. The fraction boiling at 161·5° to 165° C. was partially crystalline at the ordinary temperature, and when recrystallised from alcohol chilled with ice yielded the methyl ester of myristic acid melting at 19° C. The fraction 185° to 186° C., recrystallised from alcohol at about —15° C., gave considerable quantities of the methyl ester of palmitic acid melting at 29·5° C.

New acid of formula $C_{16}H_{30}O_2$:—This was separated from the alcoholic solution from which the palmitic acid ester had been crystallised. The fatty acids in this solution were first converted into barium salts and recrystallised from ether. The residual palmitic acid was then separated in the form of a lead salt insoluble in ether, and a final purification of the new acid effected by converting it into the zinc salt and treating the latter with hot ether. The portion that separated on cooling the solvent yielded a fatty acid melting at —1° C., and having a neutralisation value of 219 and an iodine value of 91·5. On oxidation with alkaline permanganate solution it yielded a dihydroxypalmitic acid crystallising from alcohol in flat plates (m. pt. 125° C.). This fatty acid is present to the extent of about 6 per cent. in cod-liver oil, and is also a constituent of herring and whale oils. It is not identical with the fatty acid of the same formula found by Ljubarsky (this J. 1898, 358) in seal oil, since the dihydroxy acid from the latter melted at 115° C. The fraction distilling at 205°—206° C. contained the methyl esters of stearic acid (in small proportion) and oleic acid.

Gadolinic acid:—The fraction 223° to 225° C. contained a new acid melting at 24·5° C., and having a composition corresponding to the formula $C_{20}H_{38}O_2$, a neutralisation value of 180·5, and iodine value of 80·3. It occurs in considerable quantity in cod-liver oil (whence its suggested name), and is also present in herring and whale oils. In the author's opinion Scharling's doeglic acid (Lewkowitsch, *Oils and Fats*, p. 110) must have consisted of a mixture of gadolinic and oleic acids. When oxidised with alkaline permanganate solution the new acid yielded a dihydroxy acid (which the author termed *dihydroxygadinic acid*), crystallising from alcohol in brilliant white crystals (m. pt. 127·5°—128° C.). From the distillation curve the author concluded that Heyerdahl's jecoleic acid (Lewkowitsch, *loc. cit.*) could not have been present in any considerable quantity, and that Heyerdahl's dihydroxy derivative was probably a mixture of the hydroxy derivatives of oleic and gadolinic acids. The fraction boiling at 239°—240° C. contained a fatty acid melting at 34° C., and having a neutralisation value of 165·4. It was identified as erucic acid, $C_{22}H_{42}O_2$. The lead salt, like that of gadolinic acid, was only slightly soluble in ether, and the potassium salt was nearly insoluble in cold alcohol. (See also this J., 1906, 818.)—C. A. M.

Oleic acid; Remarks on Molinari and Soncini's paper on the constitution of ——. C. Harries. Ber., 1906, **39**, 3728—3732. (See this J., 1906, 1055).

In reply to criticisms of Molinari and Soncini the author asserts that his critics must have failed to observe the formation of a perozonide, and only obtained the normal ozonide. He points out that their own analytical figures indicate that they were dealing with a mixture of the two ozonides, since the amounts of carbon found were half way between those calculated for the two compounds. Similar results have been obtained by himself, when sufficient care had not been given to the purification of the normal ozonide. In the author's opinion the following equation represents the decomposition of the ozonides by water:—

$$CH_3(CH_2)_7.CH \overset{O}{\underset{O}{<}} CH.(CH_2)_7CO_2H + H_2O =$$

$$H_2O_2 + CH_3(CH_2)_7.CHO + OCH(CH_2)_7.COOH$$

He further asserts that Molinari and Soncini overlooked the facts that hydrogen peroxide was formed on heating the ozonide with water; that the decomposition by water gave rise to no evolution of gas, which, however, was given off when sodium hydroxide solution was used, the hydrogen peroxide being then destroyed; and that by the action of hot water on the ozonide, aldehydes were formed in addition to acids. As regards the constitution of oleic acid, the position of the double bond was established long ago, *e.g.*, by the work of Baruch.—C. A. M.

Oleic acid ozonides; Decomposition products of ——. C. Harries and H. O. Türk. Ber., 1906, **39**, 3732—3737.

Oleic acid perozonide.—On heating 15 grms. of the heavy oil (this J., 1906, 1055) with 60 grms. of water for 30 minutes on the water-bath, decomposition took place, and the water gave a strong reaction of hydrogen peroxide. The resulting supernatant oil, which solidified on cooling, was dissolved in ether, and shaken with sodium bicarbonate solution, which separated it into two fractions. The portion taken up by the alkali solution consisted of the whole of the azelaic acid and the bulk of the semi-aldehyde of azelaic acid, whilst the part remaining dissolved in the ether consisted of pelargonic acid, nonylic aldehyde and the remainder of the semi-aldehyde of azelaic acid. These fractions were separated further by distillation under a pressure of 17 mm., and the products purified. The total yield amounted to 14·3 grms., and consisted of 2·0 grms. of nonylic aldehyde (b. pt. 80°—105° C. under a pressure of 17 mm.); 4·2 grms. of pelargonic acid (b. pt. 120°—150° C.); 3·7 grms. of distillation residue; and 4·4 grms. of azelaic acid and its semi-aldehyde.

Semi-aldehyde of azelaic acid.—This was insoluble in water, and solidified, on cooling, to a solid white mass, which began to melt at 57° C., and was completely fluid at 63° C. When heated it had a pleasant penetrating aldehydic odour recalling that of roses. It gave the usual reactions of aldehydes and formed a semicarbazone (m. pt. 164° C.). It was extremely unstable, and was readily attacked when heated with dilute mineral acids, being converted into a dark oil insoluble in hot petroleum spirit. The aldehyde itself was readily soluble in ethyl acetate and benzene, but was insoluble in cold petroleum spirit. When dried on a porous tile *in vacuo* its elementary composition corresponded with the formula $CHO(CH_2)_7COOH$. It darkened at about 140° C. and decomposed with evolution of gas

at 180° C. It formed a series of metallic salts, of which the sodium salt resembled soap and was only soluble in a large proportion of water, whilst the ammonium salt was readily soluble, the silver salt soluble with difficulty, and the calcium salt insoluble. In the authors' opinion the acid, $C_{18}H_{32}O_3$, found by Molinari and Soncini (this J., *loc. cit.*) among the decomposition products of oleic acid ozonide was a polymerisation derivative of this aldehydo-acid.

Normal oleic acid ozonide when decomposed by water in the same way as the perozonide gave the following yields from 16 grms. of the original substance:—Nonylic aldehyde, 2·8; pelargonic acid, 5·0; distillation residue, 4·2; and azelaic acids (m. pt. 80° C.), 3·5 grms. Total, 15·5 grms. The mixed azelaic acids were found to contain 3·5 grms. of the aldehydo-acid. The yield of this was reduced when the decomposition of the ozonide by water was continued for too long a time.—C. A. M.

Ozone; Gravimetric determination of ——, *and ozone numbers of oils.* P. Fenaroli. Gaz. chim. ital., 1906, **36**, [2], 292—298.

The author has obtained good results in numerous experiments with oleic acid and linseed oil for the determination of ozone by the method recommended by Molinari and Soncini (this J., 1906, 1055). The oil is contained in a 5-bulb apparatus as used in combustions, and the gas containing ozone is passed through at the rate of about 180 bubbles per minute; the temperature is maintained between 10° and 40° C. A calcium-chloride tube must be joined on to the absorption-bulbs, as even a carefully-dried oil will still give up a small quantity of moisture during the test. The increase of weight of the oil corresponds exactly to the addition of 1 mol. of ozone (O_3) for each double linking in the molecule of the fatty compound.

The ozone-numbers of some oils are given in the following table:—

	Iodine value.	Ozone number.	
		Calculated from iodine value.	Found.
Olive oil ..	83·8	15·9	15·8, 16·3
Maize oil ..	114·1	21·6	22·1, 21·1
Linseed oil .	176·8	33·5	33·4, 34·6
Castor oil .	86·4	16·3	16·3, 16·1

—A. S.

Cocoanut oil in butter fat; Determination of ——. F. W. Harris. Analyst, 1906, **31**, 353—360.

The utility and reliability of the different methods proposed for the detection and determination of cocoanut oil in butter are dealt with in this paper. Juckenack and Pasternack's line of reasoning (this J., 1904, 339), was found to be useless for indicating, with any degree of certainty, the presence of less than 15 per cent. of cocoanut oil. Methods based on the precipitation of certain of the fatty acids as silver salts (this J., 1905, 1025; 1906, 324) also gave unsatisfactory results, but the Polenske process (this J., 1904, 387) was found to be of considerable value in detecting this class of adulteration. The exact conditions of the method must, however, be adhered to, and particular attention paid to the condition of the pumice-stone added to the distillation flask. The most concordant figures are obtained by the addition of 0·1 grm. of finely-powdered pumice-stone, an equal weight in the form of small pieces giving lower results. Provided that a reliable basis of comparison has been obtained by the analysis of a large number of samples having varying Reichert-Meissl values, it is quite possible to detect the presence of 10 per cent. of cocoanut oil in butter, by the Polenske process; the admixture of 15 per cent. can not only be detected, but determined fairly accurately. If the proportion of cocoanut oil indicated be relatively small, confirmation by Bömer's phytosteryl acetate test (this J., 1902, 192) is essential, but it must be remembered that this test shows the presence of all, or any, vegetable oil, and not that of cocoanut oil alone.—W. P. S.

"Inoy" kernels [Poga oleosa]; Fixed oil from ——. Imp. Inst., 1906, **4**, 201.

"Inoy" kernels from the seeds of *Poga oleosa* exported from West Africa, yielded 60·8 per cent. of oil when extracted with light petroleum spirit. The oil was pale yellow, with an unpleasant taste and peculiar odour; it does not solidify or deposit on keeping. Sp. gr. at 15° C., 0·896; saponification value, 184·49; iodine value, 89·75; Hehner value, 93·00; Reichert-Meissl value, 1·45; acid value, 5·2 to 17·8; titer test (solidifying point of fatty acids), 22° C. The marc after extraction of oil gave 41·51 per cent. of proteids, 1·32 per cent. of reducing sugars, 2·5 per cent. of sucrose, 36·92 per cent. of other carbohydrates, 9·00 per cent. of crude fibre, and 8·75 per cent. of ash. The ash contained 49·1 per cent. of phosphoric anhydride present as phosphates. In general characters the oil approximates to cottonseed oil, but has a lower titer number, which renders it less valuable for soap-making.—J. O. B.

Olive leaves; New investigations of ——. F. Canzoneri. Gaz. chim. ital., 1906, **36** [2], 372—376.

The author has continued his study of olive leaves (Gaz. chim. ital., **27** [2], 1). On extracting dry olive leaves for several days with 95 per cent. alcohol, and allowing the solution to cool, small quantities of crystals were obtained, consisting apparently of two wax-like substances, melting at 85°—100° and 69°—70° C. respectively, and exhibiting different degrees of solubility in boiling alcohol. From the alcoholic solution there were isolated: (1) A white compound, $C_{25}H_{44}O_3$ or $C_{24}H_{42}O_3$, melting at 297°—298°C. with decomposition, soluble in ether, and insoluble in petroleum ether; (2) a white, crystalline, resin-like substance, m. pt. 253°—255°C., probably identical with the substance isolated by Peano (this J., 1903, 35) from the epicarp of olives; (3) a compound, crystallising in tetrahedra, m. pt. about 236° C.; (4) a crystalline acid, m. pt. 165°, insoluble in ether; (5) a compound, m. pt. 180° when crystallised from acetic acid, and 200°—235° after recrystallising from alcohol; (6) an acid of dough-like consistence, turning brown when exposed to the air; and (7) mannitol and gallic and tannic acids.—A. S.

Fatty substances; "Alcoholysis" of ——. A. Haller. Compt. rend., 1906, **143**, 657—661.

The author finds that different fats and oils react with very varying degrees of facility on methyl alcohol containing 1—2 per cent. of hydrochloric acid, to form glycerol and the methyl esters of the acids present. In the process, 100 grms. of the fat (freed from moisture) are boiled under a reflux condenser with 200 c.c. of the acidified methyl alcohol till the solution becomes homogeneous, and the liquid is then poured into water or brine, which dissolves the glycerol and excess of alcohol, whilst the esters rise to the top and can be separated. Should the whole mass form an emulsion, it is treated with ether, and the ethereal solution of esters treated with sodium carbonate, dried, and the ether distilled off. The esters are then separated by fractional distillation, at the ordinary or at reduced pressure according to circumstances. Volatile fatty esters are thus easily separated from methyl oleate; but the separation of the latter from palmitate or stearate can only be effected by drainage on a porous tile at 0° C., extracting the liquid from the tile by ether, distilling off the ether, and repeating the process as long as any solid ester is obtained. The process promises to be of use as a method of analysis.—J. T. D.

Carbon tetrachloride; Action of —— on cast iron. R. Bolis. Chem.-Zeit., 1906, **30**, 1117—1118.

The author finds that perfectly dry carbon tetrachloride may be boiled in cast-iron vessels, and will exert very slight action on them; moreover, the metal seems to become covered with a protective coating, so that the action becomes slighter in time, and ultimately ceases. If moisture be present, however, the iron is very sensibly attacked, and the rate of attack increases with the proportion of moisture. In this case, too, the last of successive boilings with carbon tetrachloride shows as strong an

attack as the first. When bones are boiled in cast-iron vessels with carbon tetrachloride to extract the fat, there is always some corrosion of the vessel, which is less with fresh and well-dried bones than with older and moister bones. Under ordinary working conditions this attack may be very serious in amount.—J. T. D.

Maize oil exports from the United States. [T.R.]

THE following figures have been compiled from the "Statistical Abstract of the United States," published by the Bureau of Statistics :—

Year.	Galls.	Value. $
1898	2,646,560	575,646
1899	2,360,623	565,293
1900	4,383,926	1,351,867
1901	4,808,545	1,831,980
1902	4,266,398	1,769,370
1903	3,778,035	1,467,493
1904	3,222,875	998,613
1905	3,108,917	890,937

Cotton-seed pitch; U.S. Customs Decision. Oil, Paint, and Drug Rep., Oct. 22, 1906. [T.R.]

ON Oct. 21, the Board of General Appraisers held that cotton-seed pitch used in connection with insulating cables for electrical purposes must pay duty at the rate of 20 per cent. The importing firm made several claims for exemption from duty and two claims for assessment at the rate of 10 per cent. The Board held that assessment as a non-enumerated manufactured article will stand.

Soap; U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T.R.]

IN 1900 soap and candles were shown as one industry without details and segregation is impracticable. The total cost of materials in 1900 was $33,143,230 and the value of the products $53,231,017. In 1905 the cost of materials used in the manufacture of soap and candles was $46,536,823 and the value of the products $72,164,062. The following table shows the materials used and the value of products for soap only in 1905 :—

Materials used, total cost	$43,625,608
Tallow, grease, and other fats—	
Pounds	475,618,277
Cost	$19,723,311
Cocoanut and palm-kernel oil—	
Gallons	6,833,132
Cost	$2,692,034
Cotton-seed oil—Galls.	13,276,006
Palm oil—Galls.	449,490
Olive oil—Galls.	602,909
Castor oil—Galls.	79,707
Turkey-red oil, distilled and saponified—	
Galls.	465,245
Other oils—	
Gallons	952,695
Cost	$233,434
Rosin—lb.	168,107,246
Foots—lb.	59,761,740
Petroleum products—	
Gallons	4,277,289
Cost	$218,798
Caustic soda—Tons	71,551
Soda ash—Tons	53,777
Potash—lb.	4,453,800
Lime—lb.	211,276
Common salt—lb.	44,103
Essential oils and perfumes—lb.	1,104,338
Alcohol (grain and wood)—	
Gallons	95,648
Glycerin—lb.	2,867,206
Sodium silicate—lb.	63,234,620
Borax—lb.	1,704,234
Mineral fillers—	
Pounds	31,075,233
Cost	$238,393
Sulphuric acid—lb.	6,954,425
Hydrochloric acid—lb.	393,246
All other materials	$6,081,276
Products,* total value	†$68,274,700
Hard soaps	$56,878,486
Tallow soap—	
Pounds	846,753,798
Value	$32,610,850
Olein soap—	
Pounds	29,363,376
Value	$1,363,636
Foots soap—	
Pounds	85,000,133
Value	$3,090,312
Toilet soaps, including medicated, shaving, and other special soaps—	
Pounds	130,225,417
Value	$9,607,276
Powdered soaps, sold as such—	
Pounds	120,624,968
Value	$4,358,682
All other—	
Pounds	143,390,957
Value	$6,097,670
Soft soap—	
Pounds	33,613,416
Value	$667,064
Special soap articles	$554,881
Glycerin—	
Pounds	27,660,661
Value	$2,958,105
All other products	$7,216,154

FRENCH PATENTS.

Fatty acids; Production of mono-iodo [and mono-bromo] substitution products from higher ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 21, 1906, to Fr. Pat. 362,370, Jan. 12, 1906. XX., page 1173.

Lubrication; Product suitable for ——. The Emery Pneumatic Lubricator Co. Fr. Pat. 367,320, June 21, 1906.

THE product consists of a mixture of soap or other saponaceous material, graphite, fluid extract of red elm bark (say, 2 parts of each), common salt or a suitable saline compound (1 part), to prevent solidification under the influence of compressed air, and water (4 parts). These ingredients are heated together to boiling point, well stirred until the mass becomes plastic, and then moulded into a convenient shape and wrapped in metal foil, or other impermeable material.—C. S.

Finishing soap [for textiles and paper]; Manufacture of a ——. E. Agostini. Fr. Pat. 361,772, Sept. 16, 1905.

INSOLUBLE soaps such as those of lime, alumina, zinc, &c., are mixed at a high temperature with fatty bodies or hydrocarbons so as to form a homogeneous mass. Weighting materials such as talc, kaolin, &c., can be added to this material. The insoluble soaps may be previously prepared or may be obtained in the fatty mixture by double decomposition between a fatty acid and a metallic hydroxide such as aluminium hydroxide. This material when applied to fabrics or paper yields a finish which is highly insoluble and also resistant to mechanical treatment. —A. B. S.

Candles or other illuminating bodies for nightlights, lamps, or other applications; Process for making —— by means of petroleum or other mineral oils. V. J. Kuess. Fr. Pat. 367,448, June 26, 1906. III., page 1141.

Petroleum or other mineral oils; Process of solidifying ——, and transforming them into a solid hydrocarbon soap. V. J. Kuess. Fr. Pat. 367,449, June 26, 1906. III., page 1141.

* Products consumed in establishments where produced were :—Turkey Red oil, 1,149,846 galls.; tallow, 10,613,271 lb.; cotton-seed oil, 920,410 galls.; causticlye, 30° B., 9,568,532 galls.; sodium silicate, 1,597,886 lb.; glycerin, 3,423,299 lb.; framed soap, 114,452,424 lb.

† In addition, soap products to the value of $1,487,113 were made in establishments engaged primarily in the manufacture of other products.

Glycerins of every description, including spent soap lyes and distillery by-products (vinasses); Process and apparatus for the purification of crude ——. L. Rivière. Fr. Pat. 367,752, July 4, 1906. Under Int. Conv., July 6, 1905.

Salts of sodium and potassium in the crude glycerin are precipitated by means of hydrofluosilicic acid, which is subsequently recovered from the fluosilicates. The free hydrochloric acid in the filtrate, resulting from the decomposition of the sodium chloride, is separated either by distillation with steam, and then saturated with lime; or it is converted into an ester by treatment with alcohol before distillation; or is precipitated as lead chloride by means of lead fluosilicate. The precipitated sodium and potassium fluosilicates may be converted into carbonates by treatment with sufficient lime to form the corresponding silicates and calcium fluoride, after which the silicates are decomposed by means of carbon dioxide and the resulting carbonates separated from the precipitated silica. The latter is dissolved in hydrofluoric acid to form hydrofluosilicic acid, or is converted into lead fluosilicate. All these different operations are carried out in autoclaves to which, when required, condensers and absorption vessels are attached.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 1107.)

(*A.*)—PIGMENTS, PAINTS.

English Patents.

Paint; Manufacture of ——. M. F. L. Colignon, Monte Carlo. Eng. Pat. 22,252, Oct. 31, 1905. Under Int. Conv., Nov. 26, 1904.

See Fr. Pat. 348,277 of 1904; this J., 1905, 506. Reference is directed under Section 1, Subsection 2, of the Patents Act, 1902, to Eng. Pats. 3623 of 1876 and 4415 of 1885. —T. F. B.

Basic lead salts [Pigments] insoluble in water; Process of producing ——. J. Kronen, Mulheim-on-the-Rhine, Germany. Eng. Pat. 19,732, Sept. 4, 1906.

The normal lead salt, insoluble in water, is made into a paste form, and then mixed with the calculated quantity of lead oxide or lead ochre.—B. N.

French Patent.

Luminosity; Method of imparting permanent —— to substances. [Luminous paint]. P. L. Despax. Fr. Pat. 367,309. June 20, 1906.

The object is treated with phosphorescent calcium sulphide incorporated with a special colourless varnish (dammar resin, wax and oil of turpentine) which is stated to preserve the luminosity by protecting the sulphide from the action of the air.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Turpentine and rosin; U.S. Census of ——. Oil, Paint, and Drug Rep. [T.R.]

In 1905 there were 1287 establishments engaged in the production of turpentine and rosin, the aggregate output being valued at $23,927,034. In 1900 there were 1503 establishments, but the output was only $20,344,888. Following is a statement of the products by kind, quantity, and value:—

	1905.	1900.
Products, total value	*$23,917,024	$20,344,888
Turpentine—		
Gallons	30,687,051	38,488,170
Value.....	$15,170,499	$14,960,235
Rosin—		
Barrels	†3,508,347	‡2,563,087
Value.....	$8,725,619	$5,129,268
All other products	$40,906	$255,385

* In addition, turpentine and rosin to the value of $26,750 were produced by establishments primarily engaged in the manufacture of other products.
† Barrels of 280 lb.
‡ Including some barrels of 500 lb.

English Patent.

Pitch oils [turpentines] and other ethereal oils obtained by destructive distillation of resinous substances; Purifying ——. A. Hesse, Wilmersdorf, Germany. Eng. Pat. 7934, April 2, 1906.

The malodorous constituents of oils obtained by the destructive distillation of resinous substances are stated to be completely and economically removed by treatment with an alkali metal or an alkaline-earth metal previous to distillation; a preliminary purification with alkali hydroxide or lime may be employed in addition. One thousand kilos. of Russian oil of turpentine are stirred with 3 kilos. of metallic sodium, and the oil is distilled under atmospheric pressure; if necessary, the distillate or any fraction of it may be again treated with sodium. —T. F. B.

United States Patents.

Turpentine; Apparatus for distilling ——. J. G. Saunders, Lake Park, Ga. U.S. Pat. 834,759, Oct. 30, 1906.

The worm of the still discharges into a closed receiver, provided near the top with an outlet for the turpentine, and with a cold-water inlet and outlet at lower levels, the water being admitted from an elevated tank, whilst the water-outlet pipe is bent upward above its connection with the receiver, in order to maintain the level of water therein, and is fitted with a tap for regulating the outflow. —C. S.

Turpentine; Method of distilling ——. J. T. Denny, Cromartie, N.C. U.S. Pat. 834,875, Oct. 30, 1906.

Wood, placed in a holder, is enclosed in a still, and subjected to non-destructive distillation, after which it is taken out of the still, and the holder, and subjected to destructive distillation in a retort, in the ordinary way. —C. S.

(*C.*)—INDIA-RUBBER, &c.

English Patent.

Fibrous agglomerates; Manufacture of [vulcanised] ——. C. A. C. de Caudemberg, Nice, France. Eng. Pat. 9710, April 25, 1906. Under Int. Conv., May 10, 1905.

See Fr. Pat. 354,801 of 1905; this J., 1905, 1118.—T.F.B.

United States Patents.

Rubber; Process of recovering —— from rubber waste. W. A. Koeneman, Chicago, Ill. U.S. Pat. 834,623, Oct. 30, 1906.

The finely-divided waste material is mixed with a "suitable proportion" of a miscible fixed hydrocarbon, such as tar, pitch, resin, or balsam, and boiled in a solution of a mineral acid containing a halogen salt of an alkali metal. The acid and dissolved matter are then separated, and the rubber is boiled in a solution of a salt of an alkali metal, washed, and dried.—C. S.

Gum; Rubber-like ——. R. F. Spencer, Denver, Col., Assignor to the Western Parent Crude Rubber Co., Santa Fé, N. Mex. U.S. Pat. 834,769, Oct. 30, 1906.

The gummy particles in the plant *Picradenia floribunda utilis* are separated from the fibrous portions, and agglomerated, being then converted into a plastic, rubber-like waterproof mass by dissolving them in a light hydrocarbon, such as gasolene.—C. S.

French Patents.

Rubber and rubber waste; Treatment of ——. W. A. Köneman. Fr. Pat. 368,144, June 2, 1906.

See U.S. Pat. 834,623 of 1906; preceding these.—T.F.B.

Compound (Rubber substitute) formed of the gums of certain Sapotaceæ, and method of producing same. M. M. Dessau. Fr. Pat. 367,472, June 27, 1906. Under Int. Conv., April 26, 1906.

The gums of certain Sapotaceæ—such as those of the

Mimusops and Chrysophyllum genera and the gum of Sap. Muelleri— are washed in water, then treated in a boiling 5 per cent. solution of potassium nitrate, and afterwards in a boiling 5 per cent. solution of sodium or potassium silicate, borax, or sodium tungstate, the gum being then drained and boiled in a bath containing 5 per cent. of quicklime. After washing, to remove any excess of alkali, the mass is kneaded and rolled.—C. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 1108.)

UNITED STATES PATENT.

Gelatin and glue from bones; Manufacture of ——. H. Hilbert, Heufeld, Germany. U.S. Pat. 834,806, Oct. 30, 1906.

SEE Eng. Pat. 13,682 of 1903; this J., 1903, 1007.—T. F. B.

FRENCH PATENTS.

Tanning; Rapid process of —— for producing sole leather. S. Boccardo and Co. Fr. Pat. 367,768, July 5, 1906.

THE hides are first subjected to the action of a bath containing sodium chloride, 22·5 per cent; sodium sulphate, 3·0 per cent.; and hydrochloric acid, 1·5 per cent. They are next immersed successively in baths containing:—First bath: tannin, 15·0 per cent.; sodium chloride, 12·0 per cent.; sodium sulphate, 1·5 per cent.; and hydrochloric acid, 0·75 per cent. Second bath: tannin, 30·0 per cent.; sodium chloride, 6·0 per cent. Third bath: tannin, 30·0 per cent. The tanned hides are then well washed to remove the salts and acid. The process takes from two to three days.—W. P. S.

Horn-like masses; Process for the manufacture of —— from casein or similar substances, or from other albuminoid or protein substances. G. W. Betz. Fr. Pat. 367,407, June 23, 1906.

THE solution of casein, after being rendered faintly acid, or after adding a small quantity of ammonia or other basic substance, is treated with formaldehyde. Or, casein is dissolved in acidulated water, and the solution treated with formaldehyde. Or, casein is dissolved in water, precipitated by addition of acid, and redissolved in presence of ammonia or other basic substance, and the solution treated with formaldehyde. The coagulated casein is separated, dried, and hardened, finally under the influence of pressure or heat. The product may also, during or after drying or hardening, be again subjected to the action of formaldehyde. Protein or albuminoid substances, such as albumin, glue, gelatin, gluten, &c., may be used in place of casein.—A. S.

XV.—MANURES, &c.

(*Continued from page* 1108.)

Denitrification process; Influence of carbohydrates and organic acids on the ——. J. Stoklasa and E. Vitek. Z. Zuckerind. Böhm., 1906, **31**, 67—119.

THE micro-organisms investigated were grown in a solution containing sodium nitrate, small quantities of potassium phosphate and sulphate, calcium and magnesium chlorides, sodium carbonate, and iron phosphate, along with the particular carbohydrate or neutralised acid. After a period the nitrogen present in the solution as ammonia, nitric or nitrous acid, and in organic form respectively was determined. The results are incorporated in a series of tables. *Clostridium gelatinosum* proved the best ammonia former in the case of dextrose, *Bacillus subtilis* the best from levulose and galactose. Arabinose is a better medium than xylose, whilst the neutralised organic acids offer less favourable conditions than do the carbohydrates. *Bacterium Hartlebi* gives rise to the formation of much organic nitrogen in arabinose solutions, whilst it decomposes 83 per cent. of the nitrate in xylose solution; for all the other bacteria the pentoses are shown to be an entirely unsuitable material. The acids all form excellent media for the decomposition of the nitrate to elementary nitrogen and the formation of organic nitrogen compounds, *Bact. Hartlebi* being again found to give the highest results. A more detailed investigation into its action showed that the first stage in the denitrification process is the reduction of nitrate to nitrite by hydrogen formed along with carbon dioxide in the decomposition of carbohydrate or organic acid by the enzymes of the micro-organism. It is pointed out that the carbohydrates in the soil are more adapted for the conversion of nitric acid into ammonia than as nutrients for denitrification bacteria.—E. F. A.

Fertilisers; U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T.R.]

THE fertiliser industry in 1905 followed the general tendency towards consolidation, the number of establishments reported being 400, as compared with 422 in 1900. The capital employed in the industry rose from $60,685,753 to $69,023,264, while the value of the products increased from $44,657,385 to $56,632,853. The following table shows the materials used by kind, quantity, and cost, and the products by kind, quantity, and value:—

	1905.	1900.
Materials used, total cost..	$39,343,914	$28,958,473
Fish	$880,142	$183,542
Kainite—		
Tons	190,493	54,700
Cost	$1,891,073	$520,833
Limestone—		
Tons	20,281	7,158
Cost	$10,731	$7,322
Phosphate rock—		
Tons	888,571	787,927
Cost	$4,244,554	$3,554,174
Pyrites—		
Tons	342,962	288,778
Cost	$2,020,759	$1,466,285
Sulphur—		
Tons	4,210	12,728
Cost	$92,234	$268,670
Lime—		
Bushels	22,131	13,130
Cost	$3,475	$887
Potash salts—		
Tons	122,107	*
Cost	$3,606,701	$3,098,400
Nitrate of potash—		
Tons	1,160	884
Cost	$39,039	$32,156
Nitrate of soda—		
Tons	42,213	19,518
Cost	$1,760,432	$709,841
Wood ashes—		
Bushels	17,083	*
Cost	$2,050	*
Sulphuric acid—		
Tons	197,865	231,527
Cost	$1,084,304	$1,355,382
Acid phosphate—		
Tons	320,559	286,898
Cost	$2,912,010	$2,176,245
Ammoniates—		
Tons	125,888	†
Cost	$2,445,051	†
Ammonium sulphate—		
Tons	10,540	4,120
Cost	$600,856	$186,609
Common salt—		
Tons	2,406	481
Cost	$13,245	$2,211
Cottonseed and meal ..	$2,376,448	$167,410
Bones, tankage, and offal	$5,094,149	$9,766,735
All other components of products	$5,591,236	$1,058,385
All other materials	$4,675,425	$4,403,388

* Not reported.
† Included with bones, tankage, and offal.

	1905.	1900.
Products, total value	$56,632,853	$44,657,385
Fertilisers :—		
Superphosphates—		
From minerals, bones, &c.—		
Tons	766,338	923,198
Value.....	$7,515,257	$8,471,943
Ammoniated—		
Tons	775,987	142,808
Value.....	$12,901,057	$2,449,388
Complete—		
Tons	1,329,149	1,436,682
Value.....	$25,673,511	$25,446,046
All other—		
Tons	396,303	291,927
Value.....	$4,416,469	$4,178,284
Sulphuric acid :—		
66° B.—Tons	337	2,816
Value....	$9,251	$50,004
50° B.—Tons	23,997	66,932
Value....	$185,327	$387,921
Other acids—		
Tons	45,689	*
Value.....	$241,506	$17,872
Epsom salts—		
Tons	764½	1,400,000
Value.....	$13,716	$10,500
Soda products—		
Tons	3,241	*
Value.....	$36,935	$1,522
All other products	$5,639,824	$3,643,905

* Not reported.

ENGLISH PATENT.

Manure [from sewage sludge]. J. T. Sidebotham, Stalybridge, Cheshire. Eng. Pat. 1970, Jan. 26, 1906.

SEWAGE or "slush cake," as taken from the presses of various sewage works, is mixed with about one-eighth of its weight each of lime and granulated peat moss, and the mass is ground, with the addition, if desired, of a small proportion of ammonium sulphate, sodium nitrate, or steamed bone flour.—E. S.

FRENCH PATENT.

Fœcal matters; Process and apparatus for the treatment of —— for the manufacture of manures. Ets. Charles et Cie. Fr. Pat. 367,670, June 19, 1906. XVIII*B.*, page 1169.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 1109.)

Sugar beets; Analysis of ——. D. L. Davoll, jun. J. Amer. Chem. Soc., 1906, **28**, 1606—1611.

FOR the analysis of sugar beets, the author recommends a modification of the warm aqueous digestion method, in which the solution is made up, not by volume, but by weight. It was found that the average weight of 52·096 grms. of pulp, 14 c.c. of basic lead acetate solution, and water, when mixed, digested, cooled to 20° C., and made up to 201·2 c.c., was 209·2 grms., and that the weights ranged between 207·67 grms. (for 11·9 per cent. beets) and 210·08 grms. (for 17·9 per cent. beets). Hence 209·2 grms. may be taken as the correct weight to which the digested pulp is to be adjusted. This method allows of the substitution of beakers for graduated flasks. The weights of a large number of 300 c.c. Jena beakers are ascertained. The heaviest of these is provided with a ⅛ in. glass tube, sealed at both ends and fitted with a rubber tip secured by copper wire, of suitable length, to act as a stirrer. The beaker and stirrer are then weighed together, and this weight is taken as the standard to which all the beakers and their respective stirring rods are to be brought. The weights of the other, lighter beakers, with stirring rods, are adjusted to the standard by introducing the requisite quantities of mercury into the hollow stirring rods before sealing. The beakers and corresponding stirring rods are then etched with consecutive numbers. The pulp is weighed out, rinsed into the beaker, treated with 10—16 c.c. of basic lead acetate solution and so much water from an overflow pipette, that only a few drops are required, after digestion and cooling, to make up the weight to 209·2 grms. The amount of water to be added is first determined by experiment, and allowance must be made for evaporation during digestion. The pulp is digested for 30 minutes at 80° C., and cooled in a cold water bath. The beaker is then dried on the outside, placed on a balance, and made up to weight with water. The analysis is completed as usual. The advantages of the method are :—1. The pulp is much more quickly and easily introduced into the beaker than into a flask. 2. Stirring may be done much more efficiently. 3. Addition of ether is unnecessary. The method is, of course, applicable to sugar-cane and bagasse, in which cases, weight being applied instead of volume, the quantities may be proportionally increased and the difficulty in sampling thereby overcome.—L. E.

Beetroot; Quantity of plus-sugar, calculated as anhydrous raffinose, present in ——. H. and L. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 454—460.

IT is now known that the raffinose which is found in beetroot molasses is not formed in the course of manufacture, but that it is pre-existent in the beetroot itself. A. Herzfeld has advanced the opinion that raffinose is present in exceptionally large quantity in beetroots which, after having been subjected to considerable cold, have continued to grow, and that this raffinose results from the transformation of pectin substances previously rendered soluble. This hypothesis has been confirmed by the researches of Wohl and Niessen. Moreover, it is well known that, during the germination of many plants, *e.g.*, potatoes and barley, starch is transformed into sucrose. The authors quote, from a paper by A. Herzfeld (Z. Ver. deut. Zuckerind., 1906, 751), results of analyses of raw beet sugar and molasses of the campaigns 1902—3, 1903—4, 1904—5, and 1905—6, which show that the amount of raffinose in this year's beetroot is exceptionally high. The authors have analysed a sample of German molasses which contained 2·04 per cent. of raffinose (calculated on dry matter), and have shown that a serious error is introduced in the determination of the purity coefficient, if the amount of raffinose is not taken into account. Hence, to obtain the real purity coefficient, the authors recommend the determination of the polarisation (before and after inversion) from which the amount of crystallisable sugar may be found by Herzfeld's formula, and the determination of the real content of water from the loss in weight on drying the sample.—L. E.

Purities, apparent and real; The different ——, which may be calculated for the same product. Variations in the ratio of organic matter to ash and in the saline coefficient, according to the method of analysis. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 460—465.

THE author has analysed a sample of Egyptian cane molasses by determining *sucrose* by means of direct polarisation either with or without treatment with basic lead acetate, and also by Clerget's method; *reducing sugars* by reduction of an alkaline-copper solution either with or without previous treatment with basic lead acetate; *dry solids*, by determining the density either by the Brix saccharometer, or by a pycnometer, or else by directly drying the molasses in presence of powdered pumice-stone. The results varied as follows :—Crystallisable sugar, 30·6—37 per cent.; reducing sugars, 13—16; water, 18—26; organic matter, 12—28; purity coefficient, 37·5—50; proportion of reducing sugars to 100 parts of sucrose, 39—50; ratio of organic matter to ash, 1·34—3·16. To ascertain the true composition of cane molasses, the author points out that the sucrose must be determined by Clerget's method, and the water, by drying the molasses. To prevent the molasses from undergoing any alteration during drying, one or two drops of ammonia should be added to the sample. The author has also analysed a sample of beetroot molasses containing a considerable proportion of raffinose, the *sucrose* being deter-

mined by Clerget's method, and by means of direct polarisation, and *dry solids* by density according to Brix, or with the pycnometer, or by direct drying. The results obtained by the various methods showed considerable differences. (For determining the true purity coefficient in such cases, see the preceding abstract.) In order to make an accurate determination of the dry matter in beetroot molasses, the latter should first be neutralised with the requisite quantity of sulphuric acid (determined by titration), a drop of ammonia being subsequently added to ensure absolute neutrality. The weight of acid retained by the alkali in the molasses, is deducted from the weight of dry matter.—L. E.

Saturation; Some remarks on ——. E. Bäck. Z. Zuckerind. Böhm., 1906, **31**, 119—124.

In the first saturation of sugar juice with carbon dioxide, subsequent to treatment with lime, it is commonly considered advisable that the degree of alkalinity should not be reduced below 0·1 per cent. of calcium oxide, since it is supposed that, if the saturation be carried beyond this point, a portion of the separated non-sugar is re-dissolved. The author considers that this supposition is ill-founded. During the last 15 years he has carried the first saturation to an alkalinity of 0·06—0·07 per cent. of lime (indicator phenolphthalein) with good results. Analyses of diffusion and thick juices during this period showed that the removal of non-sugar was very satisfactory. The author has confirmed his opinion by the following experiments:—The diffusion juice, heated to 85° C., was treated with 3 per cent. of lime in the form of milk of lime. The juice was then saturated to an alkalinity of 0·1 per cent. of lime (phenolphthalein), a portion of the juice and mud was removed, and the saturation of the remainder was carried to about 0·05 per cent. of lime, a second sample of juice and mud then being taken. Both samples were filtered, the filtrates being saturated to neutrality in order to eliminate the influence of the different amounts of lime in the samples on the analytical results. The saturated filtrates were again filtered, evaporated, and analysed. Three such analyses were made, and in one case, the mud also was analysed. The results showed that the thick juice from the diffusion juice saturated to 0·05 per cent. of lime, contained less non-sugar and nitrogen, and had a higher coefficient of purity than the thick juice from diffusion juice saturated to 0·1 per cent. of lime. Moreover, the mud from the juice saturated to 0·05 per cent. of lime contained less saccharate than that from the juice saturated to 0·1 per cent. The author concludes that the alkalinity may be reduced to 0·05—0·06 per cent. of lime in the first saturation without re-dissolving the non-sugar, and that the coefficient of purity of the juice is higher, and the desaccharification of the mud is easier than when the alkalinity is only reduced to 0·1 per cent.—L. E.

Sugars; Determination of —— by means of the refractometer. L. M. Tolman and W. B. Smith. J. Amer. Chem. Soc., 1906, **28**, 1476—1482.

Stolle (Z. Ver. deutsch. Zuckerind., 1901, 335, 469) has determined the index of refraction of sucrose, dextrose, lævulose, and lactose with the aid of the Pulfrich refractometer, and showed that the relation between the index of refraction and specific gravity as calculated by the Lorenz formula $\frac{N_2 - 1}{(N_2+2)D}$ was a constant, 0·206. The authors have made a series of determinations with the Abbé refractometer on the sugars mentioned and also on maltose, commercial glucose (a mixture of dextrose, maltose, and dextrin), and dextrin. It was found that, for the same concentration, the index of refraction is practically the same for sucrose, maltose, commercial glucose, lactose, dextrose, and lævulose, but is somewhat higher for dextrin. In the following table the values of the index of refraction for solutions of sucrose ranging from 1 per cent. to 90 per cent. strength are given, and for ordinary work this table may be used for all sugars in the same way as the Brix table is used in the case of specific gravity determinations:—

Sucrose, per cent.	Index of refraction at 20° C.	Sucrose, per cent.	Index of refraction at 20°.	Sucrose, per cent.	Index of refraction at 20°.
1	1·3343	31	1·3828	61	1·4442
2	1·3357	32	1·3847	62	1·4465
3	1·3372	33	1·3865	63	1·4488
4	1·3387	34	1·3883	64	1·4511
5	1·3402	35	1·3902	65	1·4534
6	1·3417	36	1·3921	66	1·4557
7	1·3432	37	1·3940	67	1·4581
8	1·3447	38	1·3959	68	1·4605
9	1·3462	39	1·3978	69	1·4629
10	1·3477	40	1·3997	70	1·4653
11	1·3492	41	1·4017	71	1·4677
12	1·3508	42	1·4036	72	1·4701
13	1·3524	43	1·4056	73	1·4726
14	1·3539	44	1·4076	74	1·4751
15	1·3555	45	1·4096	75	1·4776
16	1·3572	46	1·4117	76	1·4801
17	1·3588	47	1·4137	77	1·4826
18	1·3604	48	1·4158	78	1·4851
19	1·3621	49	1·4179	79	1·4877
20	1·3637	50	1·4200	80	1·4903
21	1·3654	51	1·4221	81	1·4929
22	1·3671	52	1·4242	82	1·4955
23	1·3688	53	1·4263	83	1·4981
24	1·3705	54	1·4284	84	1·5007
25	1·3722	55	1·4306	85	1·5034
26	1·3739	56	1·4328	86	1·5061
27	1·3756	57	1·4351	87	1·5088
28	1·3774	58	1·4373	88	1·5115
29	1·3792	59	1·4396	89	1·5142
30	1·3810	60	1·4419	90	1·5170

The temperature correction for index of refraction is practically the same as that for specific gravity. The determination of the index of refraction is stated to possess considerable advantages over that of the specific gravity with respect to speed, ease of manipulation, &c.—A. S.

Gum of Cochlospermum gossypium. H. H. Robinson. Chem. Soc. Trans., 1906, **89**, 1496—1505.

Cochlospermum Gossypium is a small deciduous tree growing abundantly in N.W. Himalaya, and also found in Central India. The gum has been examined by Lemeland (this J., 1904, 904). The gum examined by the author contained 15·5 per cent. of water (loss at 100° C.) and 5·2 per cent. of ash. It was investigated according to the method proposed by O'Sullivan (Chem. Soc. Trans., 1884, **45**, 41; this J., 1892, 48; 1901, 733). It probably consists of the tetra-acetyl derivative of a gummy acid to which the name *α-cochlosperminic acid* was given. This acid, probably $C_{34}H_{54}O_{30}$, was isolated by treating 100 grms. of the gum with 2 litres of 5 per cent. sodium hydroxide solution, and after standing for a long time, nearly neutralising the mucilage with dilute hydrochloric acid, again allowing to stand for a few days, and then adding excess of strong hydrochloric acid solution. The solution was purified by dialysis, and the free gum-acid precipitated by alcohol and a small quantity of hydrochloric acid, washed with alcohol, and dried. It is a white granular substance, having a rotatory power $[\alpha]_D = +57°$; it gelatinises with water, but does not dissolve. On hydrolysis with dilute sulphuric acid, the gum yields 14·4 per cent. of acetic acid, a gum-acid (*gondic acid*), and two sugars—xylose and a hexose, possibly galactose. Gondic acid, $C_{28}H_{46}O_{21}$, is soluble in water, and is precipitated from solution by alcohol as a white amorphous substance. It is an anhydride, and has the rotatory power $[\alpha]_D = +97·7$.—A. S.

Araban; Formation of —— by bacteria, and its relation to gums of the Amygdalæ. W. Ruhland. Ber. dtsch. botan. Ges., 1906, **24**, 393—401. Chem. Centr., 1906, **2**, 1348.

Aderhold and Ruhland have previously isolated from young shoots of diseased cherry trees, a fission fungus, *Bacillus spongiosus*, Aderh. and Ruhl., which when sown in various parts of a cherry tree causes the production of a gum consisting of a mixture of araban and galactan. The author has grown this bacillus on bouillon-agar with additions of pentoses, hexoses, disaccharides, raffinose, glycerol, ammonium lactate, and mannitol. In presence of sucrose, a slime was produced immediately, and also, after some time, in presence of raffinose. No slime was

produced on the media containing dextrose or a mixture of dextrose and levulose, and either none or a very small quantity on media containing levulose alone. Slime was produced on media containing mannitol, but only in small quantity. The best concentration of sugar for the production of slime is very high; much more slime is produced in presence of 30 per cent. than in presence of from 5 to 30 per cent. of sugar. The gum contained in the slime was pure araban, no galactan, hemicelluloses, or nitrogenous substances being present. It appears, therefore, that a bacillus producing a gum-flux in plants forms a different gum when grown in an artificial nutrient medium, and the author considers that Grieg Smith's view of the bacterial origin of gums is not proved. (See this J., 1904, 105, 972.)—A. S.

Charcoals; Adsorptive properties of various ——. L. Rosenthaler and F. Türk. XX., page 1172.

Molasses for fermentation; Observations on the preparation of ——. G. Garbarini. XVII., page 1166.

Sucroclastic action of acids as influenced by salts and non-electrolytes. R. J. Caldwell. XXIV., page 1177.

Levulinic acid; Iodometric determination of ——. B. Savarè. XX., page 1172.

Denitrification process; Influence of carbohydrates and organic acids on the ——. J. Stoklasa and E. Vitek. XV., page 1162.

Starch; U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T. R.]

In 1905 there were 131 establishments engaged in the manufacture of starch, but the product was valued at only $8,082,904, as compared with 124 establishments having an output valued at $9,232,984 in 1900. The reason for this apparent reduction in output is that starch to the value of $4,224,200 was produced in 1905 in glucose factories, as compared with $2,850,888 worth produced in the same factories in 1900. This exception should be borne in mind in connection with the statistics in the following table showing the materials by kind, quantity, and cost, and products by kind, quantity, and value:—

	1905.	1900.
Materials used, total cost..	$5,260,854	$5,806,422
Corn—		
Pounds	245,712,485	462,213,456
Cost	$2,142,998	$2,723,241
Potatoes—		
Pounds	209,572,349	237,141,445
Cost	563,651	$699,808
All other materials	$2,554,205	$2,383,373
Products, total value	$8,082,904	$9,232,984
Starch:—		
Pounds	196,074,530	297,803,139
Value.....	$6,751,397	$8,037,965
Corn—		
Pounds	150,520,009	247,051,744
Value.....	$4,702,309	$6,133,001
Potato—		
Pounds	27,709,400	33,941,826
Value.....	$924,476	$1,129,129
All other—		
Pounds	17,845,121	16,809,569
Value.....	$1,124,612	$775,835
Cattle food—		
Pounds	58,626,677	68,745,819
Value.....	$508,723	$258,023
All other products.....	$822,784	$936,996

United States Patent.

Grape-sugar [Dextrose]; Process of manufacturing anhydrous ——. T. B. Wagner, Chicago, Ill. U.S. Pat. 836,145, Nov. 6, 1906.

The process consists in preparing a solution of dextrose at a temperature of 110°—130° F., adding "seed" crystals, and agitating the solution at the said temperature until the dextrose has crystallised out. The mother-liquor is subsequently removed.—W. P. S.

French Patent.

Coal; New artificial —— composed of a mixture of beet-pulp, fine coal, wood charcoal, or coke, and a binding medium. J. P. Reneaux. Addition, dated June 19, 1906, to Fr. Pat. 366,141, April 28, 1906. II., page 1139.

German Patent.

Crystals; Apparatus for obtaining uniform —— from solutions, especially from sugar solutions. M. W. Verwer. Ger. Pat. 167,050, March 18, 1903.

The solution from which crystals are to be obtained is contained in a cylindrical drum, through which passes a central rotating shaft of octagonal cross-section. Alternate faces of the shaft carry arms, to which are fixed the strings, rods, &c., on which the crystals form. By rotating the shaft, the strings, &c., can be moved from the lower to the upper part of the containing vessel, as desired, and the obtainment of uniform crystals is thus rendered possible. —A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 1113.)

Malt rootlets. M. Bermann. Woch. f. Brau., 1906, 23, 602—603.

The careful observation and regulation of the rootlet growth is an important duty of the maltster, as the quality and modification of the malt may be affected by faulty growth, but owing to the fact that the dried roots (combs) are removed, the fault is not easily traced by the analyst. It is true that a determination of the coagulable and uncoagulable albuminoids may afford some indication, but this is too laborious for ordinary use. The natural tendency for the rootlet to grow towards the centre of the earth and the acrospire away from it exists in the malting process. But the direction of the acrospire is determined by its position in the husk, whereas that of the rootlet is changed every time the grain is turned, thus producing the well-known "curliness." This curliness is therefore a record of the frequency of the turning and the stages at which this is performed, and is an indication of all that the turning entails. Numerous and small spirals denote frequent turning of the couches, and are characteristic of the Bohemian malts, whilst longer spirals show that the couches have been allowed to lie more solid, as in the preparation of Bavarian malts. Long, straight rootlets always indicate faulty malt. In this case, if the malt shows a correct length of acrospire but inferior modification, it shows that the barley was steely and that the maltster was obliged to make what is called "felted malt." If the modification is correct, the fault is due either to carelessness or to a desire to curtail the time of malting by not turning the couches at an early stage. The growth of the rootlet is not uniformly rapid; it is slow at first, reaches a maximum intensity on the third or fourth day, and subsequently slackens. A good rootlet growth should be uniform and bushy; if two or three of the filaments are long and the others scarcely developed, the malt is inferior; this generally indicates either unmatured barley or overloading the floor out of harmony with the temperature. No rule can be laid down for the length of the rootlet; it generally varies between 1½ and 2 corn-lengths; the growth must be adjusted to the nature of the barley and the uses of the malt. Within certain limits the development of the rootlet and acrospire can be varied independently; the rootlet responds more to a full steep or early sprinkling, whilst the acrospire growth is favoured by incomplete steeping and repeated sprinkling at a later stage. Frequent turning over at first and only allowing the malt to lie after the fifth day has been reached, favour the development of the acrospire as compared with

that of the rootlet, whilst leaving the couches alone in the early stages has the opposite effect. Lastly, the rootlet growth should remain fresh and vigorous right up to the withering stage, and should have a characteristic "cucumber" odour. Premature withering with a bad odour is a sign of forced working or overloading of the floor.—J. F. B.

Malt; Rapid method for the determination of the colour of ——. M. Bermann. Woch. f. Brau., 1906, **23**, 584—585.

In making malt of a definite colour, a rapid, if not quite accurate, method for the determination of colour is desirable. The author proceeds in the following manner:—A certain weight of malt is ground in the Seck mill, and is at once mixed with 400 c.c. of water at a temperature of 75° C. The mash is stirred continuously for five minutes, and filtered at once without cooling, the colour being then determined in a colorimeter. As regards the weight of malt which should be taken, the author remarks that this method does not give the same results as the standard laboratory mashing method, since only the more friable portions of the corns are dissolved. The quantity of malt mashed in 400 c.c. of water must therefore be larger, and the increased weight must be adjusted according to the condition of the endosperm. The quantities empirically determined for various types of well-modified malt are about 55 grms. for Munich malt, 60 grms. for Vienna, and 67 grms. for Pilsener. With only moderately modified malts these quantities should be increased by 5 grms. This rapid method of colour determination is especially convenient in the preparation of Bavarian malts, the colour of which is largely subject to control during the curing process. One of the kilns is started half an hour before the others, all being worked in the same manner. The malt from the kiln in advance is then tested for colour at intervals of half an hour, and the other kilns are stopped according to the indications thus obtained.—J. F. B.

Extract in the mashing process; Simple method for increasing the yield of ——. R. Heerde. Woch. f. Brau., 1906, **23**, 628.

For breweries in which two mash tuns are worked continuously, and in which filter-presses are not used, the author recommends the employment of two filtering vats instead of one, in order to increase the filtering surface and reduce the depth of the layer of grain. The mashing processes in each tun are worked alternately, a fresh mash being started in each tun once in eight hours, so that the filtering vats receive a fresh charge every four hours. The wort from both vats is run into one copper. By using two vats, the speed and efficiency of filtration are increased, and a finer malt grist may be employed. Thus, the yield of extract is increased, and the rapid filtration has a favourable effect on the taste of the beer, and, in the case of pale beers, on the colour also.—L. E.

Molasses for fermentation; Observations on the preparation of ——. G. Garbarini. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 521—523.

It often happens that molasses are infected with organisms which are so resistant to heat that they are not destroyed during the sterilisation previous to fermentation. In such cases it is usual to increase the quantity of sulphuric acid added to the liquor. This involves, in addition to the extra consumption of acid, a reduction of the value of the saline residue. Moreover, the calcium sulphate, formed by the addition of sulphuric acid to the liquor, causes incrustation on the evaporating pans. To remedy these defects, the author proposes the following method:—After diluting the molasses to a gravity of 1·25—1·30, sulphuric acid is added to the extent of 2—2·5 grms. per litre, and the liquor is heated and treated with an agglutinating agent such as blood, or colophony dissolved in caustic soda. The liquor is then passed through a sand filter, the greater part of the calcium sulphate and a large number of organisms, being thus removed. A quarter of the filtered liquid is again treated with acid, so that when diluted to a gravity of about 1.060, its acidity will amount to 2·5—3 grms. of sulphuric acid per litre; it is then sterilised and afterwards used for growing the pure yeast employed for fermentation. The remainder of the liquor is diluted with the hot condenser water from the distillation column, and sterilised. Both liquors (gravities about 1.080) are run into the fermenting vat; three-fourths of the mixture will have an acidity of 0·5—0·6 grm. per litre, whilst that of the remainder will be 2·5—3·0 grms. per litre (expressed as sulphuric acid).—L. E.

Distillery and pressed yeasts; Influence of acids and other substances on infected ——. W. Henneberg. Woch. f. Brau., 1906, **22**, 527—529, 568—571, 580—584, 597—602.

The best means of cleansing the yeast in distilleries and pressed-yeast factories, which do not employ pure cultures, is by the use of suitable poisons which have a stronger action on the infecting organisms than on the culture yeast. The poisons may be applied either by steeping the yeast in a solution of the substance for a sufficient time to kill the infection, or by conducting fermentations in presence of small quantities of the poison sufficient to restrict the growth of the bacteria, and to allow the yeast to get the upper hand. The author has studied the conditions as to time and concentration under which these substances can be used to the best advantage, and their relative efficiencies for separating the culture yeast in the pure state. Hydrofluoric acid is of little use for cleansing the yeast by steeping, because the yeast is more sensitive than the bacteria; when fermentations are conducted in presence of hydrofluoric acid the yeast is slightly more resistant. Hydrochloric acid gives a good separation of yeast from bacteria by the steeping process; for cleansing by fermentation it is moderately good. Sulphuric acid gives an excellent separation both by the steeping and the fermentation processes. Nitric acid resembles hydrochloric acid in its action. Phosphoric acid is not of much use for purifying yeast by the steeping process, but in purifying by fermentations it can be used at concentrations of 0·2 per cent. Formic, acetic, and butyric acids afford no separation by either process. Lactic acid is only moderately good for cleansing by the steeping process, but, as is well known, it is one of the most valuable means for purifying by means of fermentation. The proportion used in practice for obtaining pure fermentations depends on the method of mashing and the nature of the raw material; in grain mashes the concentration may lie between 0·47 and 0·13 per cent. of lactic acid. Oxalic acid is suitable for cleansing by steeping, but quite unsuitable for fermentations. With tartaric acid successful treatment by steeping is only obtained by the prolonged action of solutions containing more than 2·5 per cent., but concentrations over 0·5 per cent. give good results by the fermentation process. Citric acid is weaker in its action than tartaric acid: cleansing is obtained by the action of 2·5—5·0 per cent. solutions in 24 hours; in fermentations, purification takes place in presence of 1 per cent. Alcohol cannot be used for purification by either process. Formaldehyde is very powerful in its action, but does not afford a good separation of yeast from bacteria. On the other hand, the addition of 0·005 per cent. of formaldehyde to the mashes is a most valuable means for preventing the flocculation of the yeast which takes place under the action of a species of lactic acid bacteria. Caustic soda is quite unsuitable for cleansing the yeast from infection.—J. F. B.

Beer; Method for the separation of mycoderma and acetifying bacteria in ——. C. Bergsten. Woch. f. Brau., 1906, **23**, 596—597.

When acetifying bacteria are present in beer they are nearly always accompanied by mycoderma yeasts. In an examination of such beers the liquid becomes covered with a film of mycoderma which grows more rapidly than the bacteria, and may suppress them. An analytical separation of the two is obtained by favouring the growth of the bacteria by the addition to the beer of dilute acetic acid, towards which mycoderma yeasts are very sensitive. The quantity of acid necessary to suppress the growth of mycoderma depends on the temperature employed,

since high temperatures are also inimical to the mycoderma. A temperature of 40° C. is sufficient to prevent the development of mycoderma without the addition of acid; at 25° C., 15 per cent. of *N*-acetic acid must be added; at 15° C., 25 per cent. Cultures should be made at various temperatures, since some species of acetifying bacteria are favoured by low temperatures and others by high temperatures. In the acidified cultures the beer becomes covered with a thin, delicate film of bacteria, whilst in the unacidified sample, incubated at 20° C., a thick, white, leathery film of mycoderma is formed. The films can be tested under the microscope with iodine solution. Most of the acetifying bacteria are stained yellow, *B. Pasteurianum* and *B. Kützingianum* are stained blue, whilst *B. xylinum* gives the blue cellulose reaction after treatment with sulphuric acid. Mycoderma yeasts are rich in glycogen, and the films therefore give a brown reaction with iodine.—J. F. B.

Sarcina; Detection of ——. H. Will and M. Rigaud. Z. ges. Brauw., 1906, **29**, 577—582 and 599—601.

The nutrient liquid recommended by Bettges and Heller (this J., 1906, 227) for the detection of sarcina in brewery yeast seems to be generally applicable. When this liquid is used for an object glass preparation sealed by means of vaseline in the manner recommended by Lindner, the sarcina can be detected earlier and more certainly than when yeast water is employed. Such sealed preparations are to be preferred to inoculations into Freudenreich flasks. A slight degree of acidity or alkalinity of the culture liquid does not interfere with the development of the sarcina under the above conditions. Schönfeld (this J., 1898, 781) showed that sarcina in beer could be detected by completely filling a bottle with the beer, closing the bottle with a paraffined cork, and keeping it at room temperature. Under these conditions, the sarcina develops rapidly both in the deposit and in the beer, and in some cases the beer becomes quite turbid. It was shown later by Luff (Z. ges. Brauw., 1902, **25**, 82) that, after a beer is forced, any sarcina originally present is found in abundance in the deposit. The authors find, however, that the time required for any considerable increase of the sarcina to occur in this way is at least two to three weeks, so that the method of Bettges and Heller (*loc. cit.*) is to be recommended.—T. H. P.

Fusel oil; Production of —— in fermentations with sterilised yeast preparations. H. Pringsheim. Ber., 1906, **39**, 3713—3715.

Buchner and Meisenheimer (this J., 1906, 998) had observed that in the fermentation of sugar by yeast cell-juice only minute traces of fusel oil are produced. The author has studied the same question in fermentations by "Aceton-dauerhefe," a preparation of dry yeast sterilised by treatment with acetone. The experiments were made both with pure sugar and with the addition of increasing quantities of leucine, which is regarded by Ehrlich (this J., 1905, 683) as the mother substance of amyl alcohol in fermentations. The fusel oil determinations were made by Beckmann's method, but in no case did the quantity of amyl alcohol found exceed the normal limit of error of the method. On the other hand, in fermentations by living yeast cells conducted in presence of leucine, considerable quantities of amyl alcohol were found.—J. F. B.

Wines containing a high percentage of alcohol. N. Passerini. Staz. sperim. agrar. ital., 1906, **39**, 350—354. Chem. Centr., 1906, **2**, 1514—1515.

In general it is accepted that if a wine contain more than 15—16 per cent. (by vol.) of alcohol, it has been fortified by addition of alcohol. According to the author, however, choice wines, named "vinsanti," prepared in Tuscany and other districts of Italy, chiefly from grapes of the Trebbiano variety, contain a higher proportion of alcohol than is customary in wines. For the preparation of "vinsanti," the dried grapes are pressed, usually in the early part of November, and the must allowed to ferment in wooden casks of ½—1 hectol. capacity. After three years the wine is bottled, generally in November. The author has examined samples of genuine "vinsanti" of the years 1868—1905. Of 30 samples, 17 contained more than 15 per cent. (by vol.) of alcohol, nine contained more than 17 per cent., and two contained over 20 per cent. The highest alcohol content was 21·4 per cent. in a wine of the year 1868. This wine had the following composition:—Percentage of alcohol by weight, 17·4; dry extract, 125·76 parts per 1000; ash, 2·57; total acid (as tartaric acid), 8·84; volatile acid (as acetic acid), 2·6; potassium bitartrate, 0·94; dextrose, 76·15, and glycerol, 11·22 parts per 1000. The ratio of glycerol to alcohol in the wine was thus 6·4:100; in two other wines the ratio had the values 7·4 and 6 respectively: 100.—A. S.

Œnocyanin, the colouring matter of red wine; Extraction and utilisation of ——. M. Cari-Mantrand. Bull. Soc. Chim., 1906, **35**, 1017—1022.

It has not been found possible to extract the colouring matter from grape mares and lees of wine with satisfactory results, but red wines destined for distillation serve as a convenient source of œnocyanin. The author proceeds in the following manner:—The wine is treated with sufficient basic lead acetate to precipitate the colouring matter; the precipitate is collected on a filter, and is washed until the filtrate contains only traces of lead. This operation takes place very slowly, requiring about 24 hours. The precipitate is weighed moist, and the dry substance and lead oxide are determined in an aliquot portion. The remainder is then treated with exactly the calculated equivalent of sulphuric acid, and the liquid is filtered hot. The colouring matter passes into the filtrate, and the lead sulphate is washed with hot water. During the concentration of the solution, the œnocyanin tends to resinify and to become converted into a tarry mass, insoluble in water and only partially soluble in alcohol. This tendency is entirely prevented by the addition of 10 grms. of glycerol to the extract from 1 litre of wine, and the liquid can be evaporated to the consistency of a fluid extract perfectly soluble in water or wine. This extract can be employed for increasing the colour of poor wines, also for colouring confectionery, liqueurs, &c. The determination of the œnocyanin should be included in the analysis of red wines, as it forms part of the solid extractive matter; proportions ranging from 9·2 to 18·7 grms. per litre have been recorded. Œnocyanin is not a uniform substance. In certain wines a portion of it separates from the hot filtrate from the lead sulphate after cooling. This insoluble portion should be filtered off, dissolved in strong alcohol, and evaporated in presence of glycerol, the product being then mixed with the rest of the extract.—J. F. B.

Whiskey; Methods for the determination of esters, aldehydes, and furfural in ——. L. M. Tolman and T. C. Trescot. J. Amer. Chem. Soc., 1906, **28**, 1619—1630.

Esters.—The following method is proposed: Add 25 c.c. of water to 200 c.c. of the sample, and distil off 200 c.c. into a receiver provided with a mercury seal. Neutralise 50—100 c.c. of the distillate in presence of phenolphthalein, and add excess of *N*/10 caustic soda. Allow to stand all night and heat for half an hour under a reflux condenser. Lastly, determine the excess of alkali by titration. No method is proposed for the separation of fixed esters, if any are present, from colouring or resinous matters which also react with caustic soda.

Aldehydes.—The temperature (15° C.) at which the solutions are mixed and compared is an essential factor. Comparisons should be made in a colorimeter. The determinations are carried out on the distillate prepared for the ester determination. It is not possible to effect the determination on the undistilled sample clarified by basic lead acetate (Schidrowitz; this J., 1902, 814), because spirits, coloured artificially by caramel, are not decolorised by the lead solution. Experiments have shown that the quantity of alhehyde is in no way altered by the distillation.

Furfural.—This determination is made on the distillate; the temperature of 15° C. is important. The authors prefer to employ hydrochloric acid instead of acetic acid for making the aniline reagent, since some samples of acetic acid give a coloration with aniline. In all colorimetric determinations the time allowed for comparison with standards should be 15 minutes. The proportion of furfural is not affected by distillation.—J. F. B.

Sucroclastic action of acids as influenced by salts and non-electrolytes. R. J. Caldwell. XXIV., page 1177.

Methyl and ethyl alcohols; Preparation of chemically pure ——, and their specific gravities. P. Klason and E. Norlin. XX., page 1172.

ENGLISH PATENTS.

Filters for beer and other sedimentary liquids. H. C. Russell, London. Eng. Pat. 15,046, July 2, 1906.

THIS specification describes a combined filter and press for the paper pulp or other filtering material, provided with inlet and outlet pipes for the liquid, a filter cover adapted to receive the press plate, and means for raising and lowering and putting final pressure on the press plate. The filter is made up of a series of filtering sections placed in juxtaposition and separated by metal gauze spacing discs, a metal gauze shell, and top and bottom gauze discs, a perforated base-plate, and a flanged cover-plate adapted to be closed tightly on the body of the filter casing by the press plate. A central core-tube is used to prevent the compressed material passing through the central rings to the liquid-outlet pipe. An interrupted screw-threaded spindle on the press plate engages at its upper part with a pinion above the press crosshead and at its lower part with the interrupted threaded interior of a sleeve which is provided with internal thrust keys or stops and is externally threaded and works through a threaded aperture in the crosshead of the press, this sleeve being provided with a wheel or lever whereby it can be rotated to cause the sleeve to engage with or be disengaged from the screwed spindle on the press cover, and to raise or lower the sleeve and the screwed spindle and press cover together.—T. H. P.

Whiskey; Treatment of —— for the purpose of removing the noxious elements from the higher alcohols. J. B. Hilliard, Glasgow. Eng. Pat. 6770, March 21, 1906.

IN this process, the higher alcohols, together with noxious materials and impurities, are collected separately from the main bulk of alcohol during the distillation, and are treated with pure oxygen gas, whereby, it is stated, the noxious substances are deposited at the bottom of the vessel, and can be run off; the purified higher alcohols are then added to the bulk of pure alcohol.—T. H. P.

Vinegar; Process and apparatus for manufacturing fermentation ——, employing stationary coatings of pure vinegar-generating bacteria. H. Frings, jun., Aachen, Germany. Eng. Pat. 13,178, June 7, 1906. Under Int. Conv., June 7, 1905.

SEE Fr. Pat. 359,115 of 1905; this J., 1906, 386.—T. F. B.

FRENCH PATENTS.

Desulphiting grape juice and apple and other musts that have been preserved by means of potassium bisulphite. C. Bonnard. Fr. Pat. 367,703, July 3, 1906.

THE juice or wort is sprayed in a vessel traversed by a current of ozone, which oxidises the bisulphite into sulphate.—C. S.

Cyanogen compounds; Preparation of —— from vinasse. Chem. Fabr. Schlempe, G.m.b.H. Fr. Pat. 367,502, June 28, 1906. VII., page 1147.

Glycerins of every description, including spent soap lyes and distillery by-products (vinasses); Process and apparatus for the purification of crude ——. L. Rivière. Fr. Pat. 367,752, July 4, 1906. XII., page 1161.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 1114.)

(*A.*)—FOODS.

Wheat proteins; Investigations on the properties of ——. J. S. Chamberlain. J. Amer. Chem. Soc., 1906, **28**, 1657—1667.

FOR the proper extraction of the proteins of wheat by alcohol, cold 70 per cent. alcohol should be used on the air-dry wheat or flour, either hot alcohol or dry flour giving abnormal results. The best results are obtained by using large amounts of solvent, *viz.*, 100 c.c. of alcohol to 2—4 grms. of flour. The same conditions of extraction apply to saline solutions, 4—6 grms. of flour being extracted with 100 c.c. of 5 per cent. potassium sulphate for 24 hours; the use of potassium sulphate is preferable to that of sodium chloride, as it avoids the evolution of hydrochloric acid in the Kjeldahl operation. Alcohol extracts a large proportion of the proteins soluble in salt solution, probably the albumin and proteose, as well as gliadin. The author considers the separation of wheat proteins into more than two groups,—*viz.*, (1) alcohol-soluble, and (2) alcohol-insoluble, to be unwarranted. Dry gluten, as procured by washing whole wheat or flour in a stream of water, is about 75 per cent. proteins and 25 per cent. non-proteins, whilst of the total proteins of wheat, from 60—65 per cent. are contained in the gluten, and 35—40 per cent. lost in the washings. The balance between the non-proteins present in the gluten and the loss of proteins in washing makes gluten determinations agree roughly with total proteins calculated from total nitrogen, but they will usually fall below with whole wheat and above with flours. The loss of proteins in the determination of gluten is at the expense of gliadin or glutenin.—E. F. A.

Colouring matters in pastry-ware; Use of carbon tetrachloride for the detection of —— which are forbidden by public health laws. A. Piutti and G. Bentivogolio. Gaz. chim. ital., 1906, **36** [2], 385—391.

SINCE 1888, the use of Martius' Yellow, Metanil Yellow, Victoria Yellow, and picric acid for colouring foodstuffs has been forbidden in Italy. The usual methods for the detection of these colouring matters are unreliable in the case of mixtures, such as are frequently used for the colouring of pastry-ware. The following method is recommended by the authors: 50 grms. of the material under examination are mixed with 500 c.c. of boiling water, made alkaline with 2 c.c. of concentrated ammonia solution, boiled for 40 minutes with 60—70 c.c. of alcohol, rapidly filtered through cotton-wool, and the solution acidified with 2—3 c.c. of dilute hydrochloric acid. Five or six pieces of wool, free from fat, each weighing 0·5 grm., are now dyed in the solution; the dyed pieces are washed repeatedly with water, and then boiled with ammoniacal water to extract the colour. The solution is next acidified in order to again deposit the colour on the wool, and the dyed pieces of wool are again boiled with ammoniacal water. The extract is now evaporated to dryness, and the residue treated with water to obtain a solution of the colouring matters, which solution is acidified with acetic acid and shaken vigorously with carbon tetrachloride. The detection of the different colouring matters follows according to the scheme:—

Acetic acid solution of colouring matters shaken with carbon tetrachloride.				
Colourless carbon tetrachloride solution shaken with ammoniacal water, and aqueous solution divided into two parts :—		Aqueous solution evaporated to dryness, residue dissolved in water, and divided into three portions :—		
I. Pink precipitate with stannous chloride and ammonia = Martius Yellow.	II. Pink coloration (solution) with zinc and hydrochloric acid = Victoria Yellow.	I. Violet coloration with hydrochloric acid = Metanil Yellow (Tropäolin G.)	II. Reddish-brown coloration with ammonium sulphide = picric acid.	III. Reduced with Zn + NH_3, then with Zn + HCl ; yellow coloration with KOH, and orange with $FeCl_3$ = Naphthol Yellow S.

—A. S.

Cocoa ; The carbohydrates occurring in ——. A. D. Maurenbrecher and B. Tollens. Ber., 1906, **39**, 3576—3581.

Cocoa nibs, after removal of husk and fat, were found to contain 5·51 per cent. of pentosans. A solution was obtained, on hydrolysis of the fat-free powder, in which *l*-arabinose, *d*-galactose, and dextrose were detected : xylose did not appear to be present. The thin husk surrounding the beans yielded 9·09 per cent. of pentosans, and the products of hydrolysis contained *l*-arabinose, *d*-galactose, dextrose, and probably xylose. These same sugars were also found in the fleshy part of the cocoa pod, after hydrolysis of the latter. Araban and galactan are, therefore, present in the nibs, husk, and fleshy part of the cocoa fruit. Only traces of water-soluble carbohydrates were obtained directly from the cocoa powder. The fat extracted from the cocoa nibs yielded a quantity of phytosterol, which, apparently, contained a little cholesterol.—W. P. S.

Tea ; The carbohydrates occurring in ——. A. D. Maurenbrecher and B. Tollens. Ber., 1906, **39**, 3581—3582.

A sample of Java tea (*Thea assamica*) examined by the authors contained 5·60 per cent. of pentosans, calculated on the dry substance. On extraction with water, the leaves yielded a trace of sugar which was proved to be dextrose. Further quantities of dextrose, together with arabinose and *d*-galactose, were obtained after submitting the leaves to hydrolysis. Araban, galactan, and a carbohydrate yielding dextrose, are consequently present in the leaves.—W. P. S.

Cocoanut oil in butter fat ; Determination of ——. F. W. Harris. XII., page 1159.

United States Patent.

Milk ; Process for reducing —— to a dry powder. L. Gathmann, Assignor to M. E. Dayton and H. Bartle, Washington, D.C. U.S. Pat. 834,516, Oct. 30, 1906.

A thin layer of milk is fed on to a continuously rotating conical drum which is heated by steam to a temperature of over 100° C. The drum forms the cone of a grinding machine. As the water is driven off, the solid constituents of the milk are first kneaded, and, as the drying continues, are submitted to a grinding action, and issue from the machine as a dry powder.—G. W. McD.

French Patent.

Milk ; Process of treating [concentrating] ——. A. Wurm. Fr. Pat. 367,646, July 7, 1906.

Milk, skimmed milk, or whey may be concentrated by allowing it to flow in a thin stream over inclined trays, or channels, which are suitably heated. The lowest tray delivers the partially concentrated fluid into a tank, from which it is conveyed by an elevator to the top tray, and again allowed to run over the successive trays until sufficiently concentrated. The trays, or channels, are contained in a closed chamber.—W. P. S.

(*B.*)—SANITATION ; WATER PURIFICATION.

English Patents.

Manure [from sewage sludge]. J. T. Sidebotham. Eng. Pat. 1970, Jan. 26, 1906. XV., page 1163.

Air ; Regenerating and purifying vitiated ——. G. F. Brindley, Niagara Falls, and R. von Foregger, New York. Eng. Pat. 11,980, May 22, 1906. Under Int. Conv., March 9, 1906.

See Fr. Pat. 366,525 of 1906 ; this J., 1906, 1063.—T. F. B.

French Patent.

Fæcal matters ; Process and apparatus for the treatment of —— for the manufacture of manures. Em. Charles et Cie. Fr. Pat. 367,670, June 19, 1906.

The plant described comprises a large central tank, at the four corners of which are other tanks for receiving the separated solid matters, whilst on three sides of the main tank are disposed filtering tanks. The sewage, &c., enters the main tank through a pipe in the cover, and flows through an inclined hearth or screen arranged centrally in the upper part of the tank. Any noxious gases evolved pass away, through a central outlet pipe in the cover, to a furnace wherein they are burnt. The coarse solid matters remaining on the hearth or screen are removed from time to time through manholes in the cover of the tank, which holes also serve for the introduction of chemical reagents for the treatment of the sewage. These reagents fall on to a distributing table below the screen, which table is divided into compartments by curved radial arms, and is caused to rotate by the inflowing current of sewage. After the solid matter has deposited on the bottom of the tank, the liquid flows into one or other of the filtering chambers, wherein it passes in succession through layers of coke of medium size, fine coke, coarse sand, fine sand, powdered coke, powdered wood-charcoal, and "wood wool." The solid matter collected on the bottom of the main tank is conveyed to the tanks mentioned above, and therein is mixed by suitable means with calcium sulphate, calcium phosphate, &c., for the production of manures. Provision is made for cleaning the filtering layers in any one of the filtering tanks, without interrupting the process.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 1115.)

Camphor [in celluloid] ; Determination of ——. A. Arnost. Z. Unters. Nahr. u. Genussm., 1906, **12**, 532—539.

In the method described by the author, the camphor is obtained in alcoholic solution, which is shaken out with petroleum spirit, and the increase in volume of the spirit read off in a special apparatus. This increase, subject to certain corrections, represents the volume of the camphor dissolved out by the petroleum spirit. The details of the process are as follows :—Ten grms. of the finely rasped celluloid are mixed in an Erlenmeyer flask with 100 grms. of 25 per cent. sodium hydroxide solution, and the mixture allowed to stand for one hour, with frequent agitation. The flask is now closed with a cork pierced with two holes, through which pass a delivery tube and a tapped funnel, respectively. After attaching the delivery tube to a condenser, the contents of the flask are heated to a temperature of about 80° C. until the celluloid is completely saponified ; this is seen by the mass becoming homogeneous. The heat is now increased, and the camphor volatilised into the delivery tube and condenser. A few c.c. of alcohol are then added to the contents of the flask by means of the tapped funnel, and distilled off. This

addition of alcohol is repeated several times, until the whole of the volatilised camphor has been carried over into the receiver, a 100 c.c. flask serving the latter purpose. The distillate is diluted to 100 c.c. with alcohol, and the quantity of camphor in it determined in the following manner. The piece of apparatus shown in the illustration is thoroughly dried and suspended vertically in a water-bath at a temperature of 15° C. By the aid of a long-stemmed funnel, the bulb B, is filled up to the 90 mark with acidulated water; 5 c.c. of dilute sulphuric acid to 100 c.c. of water is a suitable strength, and a trace of an aniline dyestuff may be added to facilitate the reading. Ten c.c. of the alcoholic camphor solution are now added and, finally, 50 c.c. of petroleum spirit. The apparatus is next closed with an india-rubber stopper, shaken for two minutes, and allowed to stand in the water-bath at 15° C. for 30 minutes, when the increase of the volume of the petroleum spirit is read off. As a certain amount of contraction takes place when the alcoholic solution mixes with the water, a correction must be applied, the amount to be subtracted from the increase in volume of the petroleum spirit depending on the actual quantity of alcohol present. To ascertain this, the contents of the apparatus are transferred to a separating funnel, 50 c.c. of the aqueous portion are measured off, placed in a distillation flask, rendered alkaline with sodium hydroxide, and distilled, the distillate being collected in a 50 c.c. flask. The specific gravity of the distillate will then give the quantity of alcohol present, and, from the quantity of alcohol, the contraction due to it is ascertained by reference to tables. (See below.) Results of analyses are given, which show that the method yields accurate results; although after four hours' distillation the contents of the flask have still a distinct odour of camphor, the experiments recorded show that at least 99·6 per cent. of the camphor distils



over in three hours. In calculating the weight of camphor present, it must be remembered that the reading gives the *volume*; the sp. gr. of camphor at 15° C. is 0·993. The above contractions are expressed in cubic millimetres. In the original tables the contraction is given for each 0·05 c.c. difference in the quantity of alcohol.—W. P. S.

Contraction Table.

Alcohol (c.c.).	Water (c.c.).										
	89	90	91	92	93	94	95	96	97	98	99
3·00	176	176	175	175	175	175	174	174	174	174	173
3·50	209	209	209	208	208	208	207	207	207	206	206
4·00	242	242	242	241	241	241	241	240	240	240	240
4·50	276	276	276	276	275	275	275	275	274	274	274
5·00	311	311	311	310	310	310	310	309	309	308	308
5·50	346	346	346	345	345	345	344	344	344	343	343
6·00	384	384	383	382	381	381	380	379	379	378	378
7·00	459	459	458	458	457	456	455	454	453	451	450
8·00	540	539	538	537	536	534	533	532	531	530	529
9·00	628	626	624	621	618	616	614	613	612	611	610
10·00	717	715	713	711	709	706	704	702	700	698	696

French Patent.

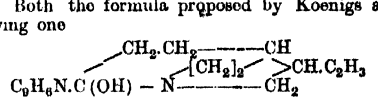
Finishing soap [for textiles and paper]; Manufacture of a ——. E. Agostini. Fr. Pat. 361,772, Sept. 16, 1905. XII., page 1160.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 1117.)

Cinchona alkaloids [*First communication*]. P. Rabe. Annalen, 1906, **350**, 180—203.

After discussing the work done by other investigators, the author gives two formulæ for cinchonine, the first of which has been put forward by Koenigs (see this J., 1906, 825). Both the formula proposed by Koenigs and the following one



put forward by the author are supported by the facts that on oxidation cinchonine yields cinchoninic acid and meroquinene, and that on boiling with acetic acid, cinchonine rearranges itself into cinchotoxine, :C(OH).N: → :CO HN:. The formula proposed by Koenigs explains the behaviour of cinchene on hydrolysis. But the second formula is a simple explanation of the two following facts: that cinchotoxine forms but one mono-isonitroso compound, and that isonitroso-cinchotoxine is decomposed into cinchoninic acid and the nitrite of meroquinene by the Beckmann reaction. At present it cannot be decided which of these two formulæ is correct. Methylcinchotoxine on treatment with amyl nitrite yields isonitrosomethylcinchotoxine melting at about 150° C. This was shaken with phosphorus pentachloride and chloroform, and the resulting liquid treated with ice-water and caustic soda solution. The *nitrile* of *N-methylmeroquinene*, $C_{10}H_{16}N_2$, was obtained on steam distillation. The nitrile is a clear liquid base with a characteristic smell resembling piperidine; it boils at 252°—255° C. at 741 mm., and 102° C. at 49 mm., it has sp. gr. 0·9505 at 20° C., and $[\alpha]_D^{20°} = +17·41°$. It was hydrolysed into N-methylmeroquinene, of which several salts and the ethyl ester are described. *Isonitrosoethylcinchotoxine*, $C_{21}H_{25}N_3O_2$, crystallises from alcohol in fine needles melting at 136° C. On decomposing, the *nitrile* of *N-ethylmeroquinene*, $C_{11}H_{18}N_2$, was obtained, boiling at 268° C. at 750 mm. It is a base with a piperidine-like smell. The salts of N-ethylmeroquinene ethyl ester are described. From isonitrosocinchotoxine, the *nitrile* of *meroquinene*, $C_9H_{14}N_2$, can be obtained. This resembles the two other nitriles and boils at 147°—150° C. at 12 mm. The three nitriles are miscible with water and volatile with steam.—F. Shdn.

Quinine acetylsalicylate; Basic —— L. Santi. Boll. chim. farm., 1906, **45**, 557. J. Pharm. Chim., 1906, **24**, 462.

Although theoretically both neutral and basic quinine acetylsalicylates can exist, it is found that, in practice, only the latter salt, $CH_3.CO_2.C_6H_4.CO_2H(C_{20}H_{24}N_2O_2)$, is obtained, in whatever proportions the constituents are

mixed. It is a white, bitter salt; m. pt., 157° C. Solubility in water, 3:1000; in alcohol, 2.5:100; in chloroform, 10:100; almost insoluble in ether. It is best obtained by mixing equimolecular proportions of acetylsalicylic acid and hydrated quinine, previously dissolved separately in ether. Basic quinine acetylsalicylate then separates as an oily liquid, which speedily assumes the form of a crystalline mass. The salt is useful as an antipyretic.—J. O. B.

Strychnine; A colloidal preparation of ——, *and its pharmacology.* O. H. Brown. J. of Biol. Chem., 1906, **2**, 149—157. Chem. Centr., 1906, 2, 1340.

If a mixture of hydrogen peroxide, albumin, and strychnine be allowed to stand, after about six weeks it is converted into a jelly, or a white flocculent precipitate separates. Adrenaline chloride behaves in a similar manner to strychnine. The strychnine is not oxidised by the hydrogen peroxide. The strychnine contained in the jelly has a much weaker toxic action than pure strychnine.—A. S.

Pareira root; The alkaloids of ——. M. Scholtz. Arch. Pharm., 1906, **244**, 555—560.

The author has previously shown (Arch. Pharm., 1898, 530, and 1899, 199) that the alkaloid bebeerine, isolated from Pareira root, exists in two forms, one amorphous, m. pt., 180° C., and the other crystallised from methyl alcohol, m. pt., 214° C. Further studies have confirmed the tertiary nature of the base by the preparation of quaternary derivatives with methyl iodide and benzyl iodide. The crude alkaloid extracted from the root by dilute sulphuric acid only yielded about 10 per cent. of bebeerine soluble in ether. The residual alkaloid was soluble only in pyridine, and, when purified, it melted at 300° C. Its composition and chemical properties were similar to those of bebeerine, but its physical properties and solubilities were entirely different. The bebeerine isolated some years ago was lævo-rotatory, $[\alpha]_D = -298°$, whereas that obtained in the present case was dextrorotatory to an equal extent, the melting points being identical. When equal quantities of these two antipodes are dissolved in chloroform and mixed together, a precipitate of the racemic alkaloid is obtained, m. pt. 300° C., identical in all respects with the sparingly soluble residual alkaloid mentioned above. The alkaloids of Pareira root, therefore, consist chiefly of *r*-bebeerine, together with an excess of either the *d*- or the *l*-modification according to circumstances. These modifications differ from each other in their physiological properties.—J. F. B.

Aconitine; A new reaction of ——. N. Monti. Gaz. chim. ital., 1906, **36** [2], 477—480.

Most of the reactions for aconitine, including the one proposed by Pinerua y Alvarez (this J., 1905, 562), are stated to be not characteristic of that alkaloid. The following test is recommended by the author:—From 0·0002 to 0·001 grm. of the alkaloid is treated in a porcelain capsule with 2—4 drops of sulphuric acid of sp. gr. 1·75—1·76, and the mixture is heated on the water-bath for 5—6 minutes. Aconitine is coloured by this treatment at the most only a faint yellow, but if a crystal of pure resorcinol be now added, and the heating continued, a yellowish-red coloration is produced, which gradually becomes stronger, being at its maximum intensity after heating for about 20 minutes. It is stated that no other alkaloid gives this reaction.—A. S.

Linaria vulgaris; Some chemical constituents of ——. Fandre. Rep. Pharm., 1906, **18**, 499.

The extract obtained from the plant with light petroleum spirit contains a saturated hydrocarbon, crystallising from the solvent, almost insoluble in alcohol, m. pt. 57° C. It also contains a phytosterol, crystallising in hexagonal plates, m. pt. 138° C. From the alcoholic extract, mannitol, several sugars (including dextrose), and linarein, have been isolated. The latter is identical with the linaric acid of Schlagdenhauffen and Reeb, but according to the author, it possesses no characters of an acid. It has the formula, $C_{14}H_{16}O_7$; m. pt., 255°—256° C. It is found only in the leaves and flowers. On oxidation, it yields linarodin, $C_9H_{10}O_3$; m. pt. 36·5° C., which is a soluble body with an agreeable odour recalling anise and coumarin. It can be distilled with steam, and has the characters neither of a phenol nor of an aldehyde.—J. O. B.

Terpenes and essential oils. (82*nd communication.*). *Terpinene.* O. Wallach. Annalen, 1906, **350**, 141—179.

Terpinene gives crystalline addition products with the halogen acids, which are liable to be mistaken for the corresponding dipentene derivatives. The hydrochloride, $C_{10}H_{16},2HCl$, melts at 51°—52° C. and boils at 108°—109° C. at 10 mm. The hydrobromide, $C_{10}H_{16},2HBr$, melts at 58°—59° C., and the hydriodide, $C_{10}H_{16},2HI$, at 76° C. These addition products are readily formed by treating sabinene or the terpineol of majoram oil dissolved in acetic acid with a halogen acid. Terpinene bihydrochloride appears to be 1,4-bichlorohexahydro-*p*-cymene. If terpinene bihydrochloride be warmed with aniline, pure terpinene results; this boils at 179°—181°, and has the sp. gr. 0·846 at 20° C., and $n_D = 1·4789$. It has a characteristic odour of lemons, and yields a nitrosite melting at 155° C., and the above-mentioned halogen acid addition products. The author discusses the boiling point and constitutional formula of dipentene. Terpinene bihydrobromide on treatment with silver acetate yields *a*-terpineol. The following substances were obtained by treating the respective halogen terpene compounds with aqueous alkali solution: limonene monohydrochloride gave active *a*-terpineol; dipentene bihydrochloride, m. pt. 50° C., gave dipentone and *a*-terpineol together with *cis*- and *trans*-terpine; *cis*-dipentone bihydrochloride, m. pt. 22° C., gave only *cis*-terpine; terpinene bihydrochloride, m. pt. 52° C., gave γ-terpineol, $C_{10}H_{18}O$, boiling at 212°—214° C., and with sp. gr. 0·0290, together with a new terpine, $C_{10}H_{18}(OH)_2$, which crystallised in leaflets melting at 136·5°—137·5° C. The author describes the behaviour of halogen acids towards *a*-terpineol, *β*-terpineol, γ-terpineol (which yields a mixture of dipentene and terpinene hydrochlorides), *cis*-terpine, and the active terpineols of Ceylon cardamom oil and majoram oil. Dipentene bihydrochloride and terpinene bihydrochloride can be separated from each other owing to the fact that the former is more rapidly acted upon by aqueous alkali. Sabinene yields on treatment with hydrochloric acid in glacial acetic acid, terpinene bihydrochloride with no trace of dipentene derivatives. Sabinene is converted into terpinene by boiling with dilute sulphuric acid. From the results of Kondakow (Chem.-Zeit., 1902, II., 722) it appears that *a*-thujene on treatment with hydrobromic acid yields terpinene bihydrobromide. Ceylon cardamom oil contains a hydrocarbon yielding terpinene bihydrochloride, m. pt. 52° C., terpinene, and a terpineol identical with that contained in majoram oil. The remainder of the paper is taken up with the discussion of this terpineol, terpinene nitrosite, and the constitution of terpinene.—F. Shdn.

Essential oils; Use of artificial esters as adulterants of ——. C. T. Bennett. Chem. and Drug., 1906, **69**, 691.

The author draws attention to the adulteration of French lavender and bergamot oils by ethyl citrate. This substance, when added in small quantities, has little effect on the physical characters of lavender and bergamot oils, but, owing to its high saponification value, will appreciably increase the apparent ester content of the oils. It can be readily detected by chemical analysis. Other esters which might be used for similar purposes of adulteration are alkyl oxalates, tartrates, benzoates, and cinnamates.

—A. S.

Pyramidone; Some microscopic reactions of ——. F. Weehuizen. Pharm. Weekblad, 1906, **43**, 1105—1106. Chem. Centr., 1906, 2, 1628—1629.

The following reactions are described:—

Dilution of pyramidone solution.	Reagent.	Reaction.	After stirring and shaking.	Appearance under microscope.
Faintly acid with sulphuric acid. 1:100	Iodine in potassium iodide	Reddish-brown ppt.	Dirty yellow ppt.	Yelow prisms, with many fine needles.
Faintly acid with sulphuric acid. —	Bromine in potassium bromide.	Green, changing to violet, red, and yellow.	Colour disappears; white ppt.	Colourless, irregular needles, longer and finer than with iodine and potassium iodide.
1:400	Mayer's reagent.	White ppt.	—	Triangular forms.
1:400	Potassium-cadmium iodide.	White ppt.	—	Rosettes of crystals, together with pentagonal and hexagonal leaflets
—	Mercuric chloride.	White ppt.	—	Feathery needles.
—	Sodium-palladium chloride	Yellow ppt.	—	Very fragile yellow needles, occasionally arranged in X- and Y- forms.

—A. S.

Levulinic acid; Iodometric determination of ——. B. Savarè. Gaz. chim. ital., 1906, **36**, [2], 344—348.

THE importance of levulinic acid as a product of the hydrolysis of hexoses, and of the oxidation of terpene alcohols, renders a satisfactory method for the determination of this acid necessary. The author recommends converting the acid into its calcium salt, $(C_5H_7O_3)_2Ca,2H_2O$, and determining this iodometrically by Messinger's method. A solution of the calcium salt is treated with known quantities of $N/10$ iodine solution (in potassium iodide) and $N/1$ potassium hydroxide (in excess). The following reactions occur :—

$$CH_3CO(CH_2)_2COOH + 3I_2 + 5KOH =$$
$$CHI_3 + COOK(CH_2)_2COOK + 3KI + 4H_2O.$$

The precipitated iodoform is filtered off into a Gooch crucible, the solution is treated with a quantity of $N/1$ hydrochloric acid equal to that of potassium hydroxide previously added, and the free iodine is titrated with $N/10$ thiosulphate solution. The iodine combined as calcium iodide and iodate remains unaltered. The number of c.c. of thiosulphate used subtracted from the volume of iodine solution added in the first place gives the number of c.c. of iodine solution consumed, of which each c.c. = 0·0019344 grm. of levulinic acid.—A. S.

Methyl and ethyl alcohols; Preparation of chemically pure ——, *and their specific gravities.* P. Klason and E. Norlin. Arkiv för Kemi, 1906, **2** [3], No. 24. Chem. Centr., 1906, **2**, 1480—1481.

METHYL alcohol was prepared in a purer condition than from methyl oxalate, by dissolving 500 grms. of pure potassium-methyl sulphate in water, adding a little more than the calculated quantity of pure sulphuric acid, making up the solution to about 2 litres, separating the free methyl-sulphuric acid, and distilling methyl alcohol therefrom. Nearly the theoretical amount of methyl alcohol was obtained in the first litre of distillate. The methyl alcohol was concentrated by repeated fractionation, finally after addition of recently ignited potassium carbonate. The last traces of water were removed by repeatedly heating with filings of metallic calcium and distilling. The pure methyl alcohol thus obtained was quite odourless, and was not coloured on heating with an equal volume of sulphuric acid on the water bath. Pure ethyl alcohol was prepared in a similar manner from potassium-ethyl sulphate; it, also, was odourless, and was not coloured on warming with sulphuric acid. The results of the specific gravity determinations were as follow :—For methyl alcohol: sp. gr. at 15°/15° C., 0·796742; referred to water at +4° and *in vacuo*: at 0°, 0·80999; at 10°, 0·80069; at 20°, 0·79134; at 30°C., 0·78184; at $t°$ (between 0° and 30° C.), $0·80999 - 0·00093t - 0·00000025t^2$. For ethyl alcohol: sp. gr. at 15°/15° C., 0·794130; referred to water at +4° and *in vacuo*: at 0°, 0·80628; at 10°, 0·79792; at 20°, 0·78938, and at 30°C., 0·78080. These figures are nearer to those of Winkler (this J., 1905, 1253) than to those of Mendelejeff.—A. S.

Charcoals; Adsorptive properties of various ——. L. Rosenthaler and F. Türk. Arch. Pharm., 1906, **244**, 517—536.

THE authors have studied the adsorption of various pharmaceutical substances from their solutions when treated under standard conditions with different kinds of charcoal. These charcoals may be divided, according to their adsorbent powers, into strongly adsorbent: bone, flesh, and "vegetable blood" charcoals, in the above order; and weakly adsorbent or non-adsorbent: blood, lime-wood, and sponge charcoals. For the same kind of charcoal, the adsorption of any substance varies with the solvent which is employed. The adsorption is by far the strongest in aqueous solutions; it is less with ethyl alcohol, methyl alcohol, ethyl acetate, acetone, and least of all with chloroform solutions. The speed of adsorption depends on the same factors as influence the amount of adsorption, being greatest in the case of bone charcoal and aqueous solutions. The quantity of substance adsorbed by a given quantity of charcoal is relatively less for concentrated solutions than for dilute solutions. All the circumstances which favour adsorption act in a similar degree in resisting the re-extraction of the adsorbed substance. The decolorising power of the charcoal is dependent on its adsorbing power. As regards the use of charcoal for decolorising purposes, the authors state that the charcoal must be carefully purified before use, either by repeated extraction with the solvent which is to be used, or by igniting gently and washing with acid. The quantity of charcoal employed should be as small as possible. It is not necessary to heat the liquid with the charcoal; several hours' contact at the ordinary temperature will suffice. The decolorisation should not, for preference, be effected on an aqueous solution, because the loss of substance by adsorption is at a maximum in that solvent; the solution should be as concentrated as possible. Easily oxidisable substances should not be decolorised by animal charcoal, because this charcoal has a powerful oxidising action; the oxidation of alkaloids is retarded by treating them in the form of salts. Blood charcoal has the strongest oxidising action, lime-wood charcoal has hardly any. Bone and flesh charcoals can be employed in the determination of caffeine without loss of alkaloid, but in the determination of sugars, &c., in wine and other liquids, charcoal should not be used unless it has been proved that no loss by adsorption takes place under the conditions of the experiment. The close interdependence of the decolorising and adsorbent properties of charcoals suggests that the decolorisation is due to adsorption of the colouring matters. The fact that successful results can be obtained in practice depends first on the circumstance that the amount of colouring matter is generally only a fraction of the total substance in solution, and secondly, on a selective adsorption, according to which the quantity adsorbed is generally proportional to the molecular weight, most colouring matters being substances of high molecular weight.

—J. F. B.

Camphor [in celluloid]; Determination of ——. A. Arnost. XIX., page 1169. C.

Essential oils: U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29. [T.R.]

IN 1905 there were 52 establishments engaged in the manufacture of essential oils, having a product of $1,464,652, as compared with 47 establishments having a product of $813,495 in 1900. The principal items of increase were in peppermint and witchhazel oils. The products of the industry by kind, quantity, and value are shown in the following table :—

	1905.	1900.
Products, total value	*$1,464,662	$813,495
Essential oils :—		
Natural oils—peppermint—		
Pounds	130,022	202,550
Value.....	$470,037	$188,559
Sassafras—		
Pounds	30,235	119,131
Value.....	$17,673	$38,165
Wintergreen—		
Pounds	4,737	2,166
Value.....	$15,579	$3,638
Other natural oils—		
Pounds	297,673	518,893
Value.....	$520,648	$470,347
Witchhazel—		
Gallons	797,700	110,260
Value.....	$367,873	$54,649
Artificial oils	$65,250	$52,050
All other products	$7,602	$6,087

* In addition, essential oils to the value of $14,500 were made by establishments engaged primarily in the manufacture of other products.

ENGLISH PATENTS.

Magnesium compounds ; Manufacture of organic ——. A. Zimmermann, London From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 21,757, Oct. 25, 1905.

ACCORDING to this invention organic magnesium compounds can be obtained in good yields, if a solution of a pinene hydrohalide be allowed to react on metallic magnesium in the presence of a catalytic agent such as iodine or an alkyl- or aryl-halide which renders magnesium active, such as methyl iodide, bromobenzene, benzyl chloride, &c. Ether, benzene, or toluene, or a mixture of ether with a suitable hydrocarbon, is used to dissolve pinene hydrochloride. The following is given as an example of the method of preparation :—To metallic magnesium (1·6 kilos.) a solution of iodobenzene (0·3 kilo.) in dry ether (0·7 kilo.) is gradually added. When the reaction is proceeding briskly, a solution of pinene hydrochloride (2·5 kilos.) in ether (1·8 kilos.) is added, the mixture being kept constantly stirred, and, further, a solution of pinene hydrochloride (7·5 kilos.) in benzene (5 kilos.) is also added. By regulating the supply of the solution, or by cooling the vessel in which the reaction takes place, the temperature is regulated so that it does not exceed 50°—60° C. When the whole solution is added and the product is cool, stirring is continued for one or two hours, during which operation, as during the whole process, moisture, oxygen, &c., must be prevented from reaching the product of the reaction.—G. W. McD.

Organic substances ; Process for the transformation of —— by partial combustion. J. Walter, Geneva, Switzerland. Eng. Pat. 21,941, Oct. 27, 1905. Under Int. Conv., Oct. 27, 1904.

SEE Fr. Pat. 360,785 of 1905 ; this J., 1906, 493.—T. F. B.

Formic acid ; Process for the manufacture of concentrated ——. Chem. Fabr. Grünau, Landshoff und Meyer Akt.-Ges., Grünau, Germany. Eng. Pat. 14,438, June 23, 1906. Under Int. Conv., July 1, 1905.

SEE Fr. Pat. 367,316 of 1906 ; following these.—T. F. B.

FRENCH PATENTS.

Fatty acids ; Production of mono-iodo [and mono-bromo] substitution products from higher ——. Farbenfabr. vorm. F. Bayer und Co., First Addition, dated June 21, 1906, to Fr. Pat. 362,370, Jan. 12, 1906. Under Int. Conv., July 29, 1905.

THE monobromo derivatives of the higher fatty acids form salts with magnesium and the alkaline-earth metals similar to those obtained with the iodo-acids described in the principal patent (this J., 1906, 714). For example, 25 parts of hydrated calcium chloride are dissolved in 120 parts of hot alcohol, ammonia is passed through the solution until precipitation of ammonium chloride ceases, and 130 parts of 92 per cent. alcohol are added. When cool, a solution of 40 parts of monobromobehenic acid (obtained by the action of hydrobromic acid on erucic acid) in 120 parts of alcohol, is added to the mixture ; the precipitated salt is filtered, washed with water until the washings are free from chlorine, and then with alcohol, and finally dried *in vacuo*.—T. F. B.

Formic acid from formates ; Manufacture of concentrated ——. Chem. Fabr. Grünau, Landshoff und Meyer Akt.-Ges. Fr. Pat. 367,316, June 21, 1906. Under Int. Conv., July 1, 1905.

FORMIC acid of a concentration of 97 to 98 per cent. is said to be produced in good yield by heating a formate with an acid salt of a polybasic acid. One part of sodium formate is intimately mixed with two parts of acid sodium sulphate (90 per cent.), and heated in a still, with or without an agitating device ; the residue consists of anhydrous sodium sulphate.—T. F. B.

Camphene ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 368,170, July 18, 1906. Under Int. Conv., July 20, 1905.

SEE Eng. Pat. 16,429 of 1906 ; this J., 1906, 909.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 1117.)

Plants ; Action of —— on a photographic plate in the dark. W. J. Russell. Roy. Soc. Proc., B, 1906, **78**, 385—390.

THE property possessed by wood of acting on a photographic plate (see this J., 1904, 988; also 1906, 1117), is possessed by leaves, and also by seeds, roots, bulbs, and most vegetable substances. To obtain this action, the leaves must be partially dried, *e.g.*, by pressing between blotting paper. The time necessary for exposure varies from a few minutes to 18 hours, according to the nature and condition of the leaf. The action may be accelerated by heat, but the temperature must not be above 55° C. Fresh leaves are more active than old dried ones, but the activity of the latter may be considerably increased by moistening slightly. It is found that the liquid expressed from leaves and absorbed by blotting paper is also capable of acting on a photographic plate.—T. F. B.

Selenium ; Studies on the sensitiveness of —— to light. P. von Schrott. Phot. Korr., 1906, **43**, 432. Chem.-Zeit., 1906, **30**, Rep. 384.

CRYSTALLINE selenium obtained from potassium selenide is not sensitive to light, nor does it conduct electricity. By warming, it is partially converted into metallic selenium, conductive, and sensitive to light. The red, crystalline variety of selenium, obtained from its solution in carbon bisulphide, is also converted into the metallic condition by heating. The modification obtained by allowing amorphous selenium to remain in contact with quinoline for fourteen days is also sensitive to light. This property disappears at temperatures near the melting point about 210° C.): when cool again, its resistance is found to be increased. The author considers that the increase or decrease of electric conductivity is probably due to ionisation or polymerisation respectively of the selenium.—T. F. B.

ENGLISH PATENTS.

Photographic prints on "self-toning" paper ; Treatment of ——. F. J. Shepherd, East Molesey, and J. J. Griffin and Sons, Ltd., London. Eng. Pat. 5276, March 5, 1906.

PRINTS on "self-toning" papers are immersed, before fixation, for about 10 minutes in a solution of aluminium chloride (about 2 per cent.), and then fixed as usual : the resulting prints are stated to be permanent, and of excellent tone.—T. F. B.

Photographic pigment paper. A. G. Bloxam, London. From Neue Photographische Ges., A.-G., Steglitz, Germany. Eng. Pat. 14,435, June 23, 1906.

See Fr. Pat. 367,461 of 1906; following these.—T. F. B.

French Patents.

Photographic pigment paper. Neue Photographische Ges., Akt.-Ges. Fr. Pat. 367,461, June 26, 1906. Under Int. Conv., Sept. 7, 1905.

Pigment papers have already been prepared with an intermediate film of gelatin or other colloid soluble in hot water, to facilitate the removal of the sensitive pigment film from the support; however, the bichromate solution used for sensitising penetrates into this intermediate film in places, and the latter, becoming partly insoluble, does not altogether fulfil its purpose. This defect is overcome by the present invention, in which the gelatin, &c., of the intermediate film is mixed with some substance which converts bichromates into normal chromates; sodium carbonate is stated to be very suitable, as also are other alkaline compounds, such as magnesium oxide, borax, sodium phosphate, &c. The intermediate film may be prepared, for example, by dissolving 100 grms. of gelatin and 20 grms. of crystallised sodium carbonate in 100 c.c. of hot water.—T. F. B.

Printing from relief plates with a liquid medium; Process of ——. Neue Photographische Ges., A.-G. First Addition, dated June 27, 1906, to Fr. Pat. 362,400, Jan. 13, 1906.

See Eng. Pat. 996 of 1906; this J., 1906, 952.—T. F. B.

Photographic printing; Imps. in ——. T. Manly. Fr. Pat. 368,260, July 21, 1906. Under Int. Conv., Aug. 22, 1905.

See Eng. Pat. 17,007 of 1905; this J., 1906, 655.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 1120.)

Camphor [in celluloid]; Determination of ——. A. Arnost. XIX., page 1169.

English Patents.

Nitrocellulose; Solvents for —— in the preparation of explosives. A. T. Cocking and Kynoch, Ltd., Birmingham. Eng. Pat. 25,081, Dec. 4, 1905.

In gelatinising soluble nitrocellulose with ether-alcohol, the sheets or cords are very liable to curl up or become distorted on leaving the machine, owing to the rapid evaporation of the ether. The use of acetone and amyl acetate for insoluble nitrocellulose and nitroglycerin compounds, is also attended with certain manufacturing difficulties, such as overheating during incorporation, in the case of acetone, and the difficulty of removing amyl acetate on drying, owing to its high boiling point. The invention consists in the use of suitable mixtures of acetone and alcohol as a solvent for nitrocellulose, the proportion of the two ingredients being chosen with regard to the degree of nitration of the nitrocellulose used. The manufacturing difficulties mentioned above are thus avoided. In the manufacture of cordite, Mark 1, a mixture of acetone (60 per cent.) and alcohol (40 per cent.) is used as the equivalent of 100 per cent. of acetone. Cordite MD can be gelatinised with acetone (70 per cent.) and alcohol (30 per cent.). The same proportions are also used for a guncotton containing 10 per cent. of soluble nitrocellulose, whilst a soluble nitrocellulose is gelatinised with a mixed solvent containing acetone (40 per cent.) and alcohol (60 per cent.) It is thus possible, by the use of suitable mixtures of acetone and alcohol, to produce a complete solvent, or partial solvent, for any form of nitrocellulose.

—G. W. McD.

Explosive or gunpowder; Machines for making grains or flakes of ——. C. Dobbs and J. R. Pitman, Haskell, N.J., U.S.A. Eng. Pat. 13,860, June 16, 1906. Under Int. Conv., June 29, 1905.

See Fr. Pat. 367,548 of 1906; following these.—T. F. B.

Powder; Manufacture of ——. C. Claessen, Berlin. Eng. Pat. 16,725, July 24, 1906.

Reduction of the temperature of explosion, and increase of the stability of nitrocellulose and nitroglycerin powders can be obtained by adding to them completely substituted ureas. Diethyldiphenylurea has been found to be particularly suitable for this purpose. These tetrasubstituted ureas present the advantage, as compared with such a substance as camphor, previously used, that they are non-volatile, and constitute advantageous gelatinising media for nitrocellulose.—G. W. McD.

Lead and alloys of lead; Solvent for —— especially suitable for the removal of lead fouling from gun-barrels. Kings Norton Metal Co., Ltd., T. A. Bayliss, H. W. Brownsdon, and H. M. Smith. Eng. Pat. 2506, Feb. 1, 1906. X., page 1153.

Explosives; U.S. Census of ——. Oil, Paint, and Drug Rep., Oct. 29, 1906. [T.R.]

In 1905, 124 establishments, having a product of $29,602,884, were engaged in the manufacture of explosives, as compared with 97, having an output of $17,125,41 in 1900, an increase of 73 per cent. in the value of products. The following table shows the principal materials used by kind, quantity, and value:—

	1905.	1900.
Materials used, total cost..	$17,203,667	$10,334,974
Pyrites—		
Tons	12,256	*
Cost	$67,261	*
Sulphur—		
Tons	19,574	12,742
Cost	$507,469	$317,383
Nitrate of soda—		
Tons	133,034	88,524
Cost	$5,608,557	$2,902,866
Nitrate of potash—		
Tons	2,336	1,847
Cost	$175,258	$150,544
Chloride of potassium—		
Tons	1,329	†
Cost	$51,831	†
Sulphuric acid—		
Tons	18,298	7,864
Cost	$247,301	$130,699
Nitric acid—		
Pounds	2,699,500	467,587
Cost	$122,047	$17,171
Mixed acids—		
Pounds	105,552,404	66,906,146
Cost	$3,093,429	$1,505,754
Glycerin—		
Pounds	24,561,527	16,983,918
Cost	$3,129,665	$2,016,557
Aqua ammonia—		
Pounds	997,830	649,703
Cost	$46,916	$11,303
Alcohol—		
Gallons	850,560	136,520
Cost	$231,353	$57,937
All other components of products	$1,516,859	$1,056,602
All other materials	$1,705,665	$2,163,358
Products, total value	$29,602,884	$17,125,417
Explosives	$27,695,963	$16,950,976
Gunpowder—		
Pounds	215,820,144	123,314,103
Value	$8,919,460	$5,310,351
Nitroglycerin—		
Pounds	7,935,936	3,618,692
Value	$1,620,117	$783,299

* Included in "all other materials."
† Included in "all other components of products."

	1905.	1906.
Dynamite—		
Pounds	130,920,829	85,846,456
Value	$12,900,193	$8,247,223
Gun cotton or pyroxylin—		
Pounds	293,970	228,342
Value	$167,322	$103,702
Smokeless powder—		
Pounds	6,009,855	2,973,126
Value	$3,938,073	$1,655,948
All other explosives ..	$150,798	$850,453
All other products ...	$1,906,921	$174,442

UNITED STATES PATENTS.

Guncotton blocks; Pressing of ——. G. W. Bell, Hayle. U.S. Pats. 835,296 and 835,297, Nov. 6, 1906.

SEE Eng. Pat. 17,415 of 1903; this J., 1904, 882.—T. F. B.

Guncotton blocks; Pressing of ——. G. W. Bell, Ipswich. U.S. Pat. 835,298, Nov. 6, 1906.

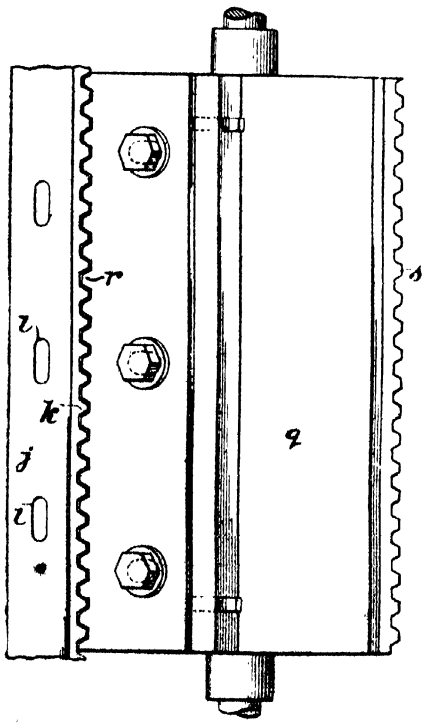
SEE Eng. Pat. 10,663 of 1904; this J., 1905, 690.—T. F. B.

FRENCH PATENTS.

Rockets; Process for the manufacture of ——. J. Stern and S. Molnár. Fr. Pat. 367,537, June 28, 1906.

To minimise the production of sparks in signalling rockets, and increase their luminosity, it is proposed to use coal in the composition, in place of the wood-charcoal usually employed. The following is given as a suitable composition:—Barium nitrate (2 parts), milk sugar (2 parts), coal (5 parts), and potassium chlorate (10 parts).
—G. W. McD.

Powder; Machine for the manufacture of polygonal grains of ——. C. Dobbs and J. R. Pitman. Fr. Pat. 367,548, June 28, 1906. Under Int. Conv., June 29, 1905.



BY means of two feeding cylinders a sheet of explosive is passed over a horizontal knife furnished with teeth of semipolygonal shape, and having a lateral movement backwards and forwards, the width of one tooth. Two rotating knives, with similar shaped teeth, mounted opposite to each other on a spindle, engage with the horizontal knife, and the sheet is thus cut completely into polygonal shaped grains. The accompanying figure represents the arrangement of knives looked at from above. The sheet passes over the horizontal knife, *j*, from left to right. The teeth, *r*, of the rotating knife cut the first half of the grain in contact with the teeth, *k*, of the horizontal knife. When this cut has been completed, the sheet is moved on by the feeding cylinders, the horizontal knife is moved by a crank through the slits, *l*, in the direction, *k*, *r*, the width of one tooth, and the second rotating knife, *q*, cuts the remaining part of the polygonal shaped grain by means of the teeth, *s*.
—G. W. McD.

Powders; Manufacture of smokeless ——. C. Claessen. Fr. Pat. 368,344, July 24, 1906.

SEE Eng. Pat. 16,725 of 1906; preceding these.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 1122.)

APPARATUS, &c.

Dialysis under sterile conditions; New method for ——. H. T. Brown, F. Escombe, A. McMullen, and J. H. Millar. I., page 1135.

ENGLISH PATENTS.

Gases; Apparatus for analysing ——. A. Bayer, Brünn, Austria. Eng. Pat. 20, Jan. 1, 1906.

SEE U.S. Pat. 834,040 of 1906; this J., 1906, 1120. Reference is directed under Section 1, Subsection 2, of the Patents Act, 1902, to Eng. Pats. 22,303 of 1895; 17,527 of 1900; 24,948 and 27,063 of 1902; and 20,770 of 1903.—T. F. B.

INORGANIC—QUANTITATIVE.

Copper; Determination of —— by titanium trichloride. E. L. Rhead. Chem. Soc. Trans., 1906, **89**, 1491—1495.

THE method proposed consists in reducing an acid solution of a cupric salt, to which potassium thiocyanate (10—20 c.c of a 10 per cent. solution) has been added, by means of titanium trichloride solution. It is best to preserve the titanium solution in an apparatus with a hydrogen generator attached (see Knecht, this J., 1903, 825). In order to obtain a sharp end reaction, the titration is carried out in presence of a ferrous salt, which may be added to the titanium solution or to the copper solution, preferably to the latter. The ferrous salt is oxidised to the ferric state by the cupric salt, and the end of the titration is indicated by the disappearance of the red colour due to ferric thiocyanate. The titanium chloride solution is prepared by boiling 50 c.c. of a strong solution (commercial 20 per cent.) with 50 c.c. of strong hydrochloric acid, and diluting to 2 litres. It is standardised by ferrous ammonium sulphate (compare Knecht, *loc. cit.*). The presence of ammonium chloride, sodium acetate, zinc sulphate or chloride, ferrous sulphate, and stannic chloride have no influence on the results. Nitric acid must not be present, and if ferric salts are contained in the solution they are determined with the copper, and a correction must be made. The titration should be carried out below 30° C. The results compare favourably with those obtained by the electrolytic and iodide methods.
—A. S.

Mercury; Volumetric determination of ——. E. Rupp. Ber., 1906, **39**, 3702—3704.

MERCURY is precipitated from an alkaline solution by means of formaldehyde, an excess of *N*/10 iodine solution is added to convert the mercury into mercuric iodide, and the excess of iodine is titrated with thiosulphate.

To the mercury solution (containing about 0·2 grm. in 25—50 c.c.) is added 1 grm. of potassium iodide, so that the mercuric iodide formed, goes into solution again. The liquid is made alkaline with caustic soda, and 2—3 c.c. of 40 per cent. pure formaldehyde diluted with 10 c.c. of water are added. After 30—60 secs., the mixture is acidified with acetic acid, and an excess of $N/10$ iodine solution (25 c.c.) introduced. Finally the free iodine is titrated with $N/10$ thiosulphate, using starch as indicator. Although the first stage of the reaction is somewhat modified by the presence of nitric acid, in the case of mercuric nitrate, yet the end product of the reaction is the same. Mercurous salts must first be converted into mercuric salts before treating with formaldehyde. In the case of mercuric cyanide it is advisable to acidify with sulphuric acid instead of acetic acid, when any cyanogen iodide formed decomposes again into cyanogen and free iodine.—B. J. S.

Molybdenum; Determination of ——. J. Darroch and C. A. Meiklejohn. Eng. and Min. J., 1906, **82**, 818.

This is an adaptation of the well-known molybdate method of estimating lead. From 0·5 to 1 grm. of the material, ground to pass a 100-mesh sieve, is fused with 4 grms. of sodium peroxide in a nickel crucible. The assay is kept in a fused state, not above a dull red heat, for three to five minutes, and is then allowed to cool, the crucible being gently rotated during the whole time. After extracting the mass with boiling water, the extract is boiled down to about 150 c.c., filtered, washed, and the filtrate acidified with acetic acid. This acid solution, which should be colourless, is then titrated, boiling, with lead acetate solution (25 grms. per litre), which has been standardised with ammonium molybdate solution, itself standardised in the usual way with lead sulphate. The titration is carried out as in the estimation of lead by the molybdate method, tannic acid being used as indicator. The end point is reached when the brown colour can no longer be obtained with a drop of the solution removed to a plate. If the ore contains much silica and iron, it is better to mix the weighed portion with 3 grms. of sodium peroxide, and add gradually to 10 grms. of fused caustic soda. When completely fused, another 3 grms. of sodium peroxide are cautiously added, and the fusion conducted as before. The method was found to give excellent results with ores and ferro-molybdenum, the complete assay occupying not more than an hour.
—F. Sodn.

Hydrofluosilicic acid; Determination of ——. L. Schucht and W. Möller. Ber., 1906, **39**, 3693—3696.

The method given by Sahlbom and Hinrichsen (this J., 1906, 1068) for the estimation of hydrofluosilicic acid, though accurate, is rather involved. The authors have been working for some years to obtain a method based on simple titration. Titration with alkali, using methyl orange or phenolphthalein as indicator, gave results which varied with the concentration of the solution, owing to hydrolytic decomposition caused by the hydroxyl ions. If an excess of neutral calcium chloride solution be added, however, titration can be carried out in the cold, using methyl orange, the following reaction taking place:—

$$H_2SiF_6 + 3CaCl_2 + 6NaOH = 3CaF_2 + 6NaCl + H_4SiO_4 + 2H_2O.$$

In practice a 4-N calcium chloride solution is used, consistent results being obtained with widely-varying dilutions.—B. J. S.

Dithionic acid and dithionates; Analysis of ——. R. H. Ashley. Amer. J. Science, Silliman, 1906, **22**, 259—262. Chem. Centr., 1906, **2**, 1356—1357.

The method of determination examined by the author consisted in decomposing the dithionate, by heating its solution with hydrochloric or sulphuric acid, driving over the sulphur dioxide into an iodine solution by means of carbon dioxide, and titrating the excess of iodine with thiosulphate. The method gives good results when sulphuric acid is employed, but unsatisfactory ones when hydrochloric acid is used. The author offers the explanation that with sulphuric acid, the liberation of the whole of the dithionic acid is soon complete, as the insoluble barium sulphate produced is removed from the system. Moreover, the solution can be concentrated until white fumes begin to appear, without any appreciable quantity of acid distilling into the iodine solution, whereas when hydrochloric acid is used, some of it passes over, and interferes with the sharpness of the starch reaction. The experiments were made with barium dithionate, prepared by acting with sulphur dioxide on manganese dioxide suspended in water in a vessel cooled by melting ice, adding excess of barium hydroxide solution, filtering, precipitating the excess of baryta from the solution as barium carbonate, and evaporating the filtered solution. The salt has the composition, $BaS_2O_6,2H_2O$. The author was unable to obtain the compound, $BaS_2O_6,4H_2O$, which has been previously described.—A. S.

Chlorine and bromine; Separation of —— in acid solution by hydrogen peroxide. P. Jannasch. Ber., 1906, **39**, 3655—3659.

A method for the quantitative separation of iodine from iodides in presence of bromides and chlorides, by heating with hydrogen peroxide in acetic acid solution, has been previously described (this J., 1906, 199). It is now found that an efficient separation of bromine from bromides in presence of chlorides can be effected in a similar manner by heating with hydrogen peroxide in a solution containing a considerable quantity of free sulphuric acid. The solution (25 c.c.) containing the halogens is heated with a mixture of 25 c.c. of concentrated sulphuric acid, 15 c.c. of water, and 30 c.c. of 6—8 per cent. hydrogen peroxide solution, and the liberated bromine is carried over by a current of carbon dioxide, and absorbed in ammoniacal hydrazine sulphate solution, from which it is subsequently precipitated as silver bromide.—A. S.

Molybdic acid; Reduction of —— in solution by molybdenum, and the titration of the reduced solution by means of permanganate. M Guichard. VII., page 1145.

Ozone; Gravimetric determination of ——, and ozone numbers of oils. P. Fenaroli. XII., page 1159.

ORGANIC—QUALITATIVE.

Aconitine; A new reaction of ——. N. Monti. XX., page 1171.

Pyramidone; Some microscopic reactions of ——. F. Weehuizen. XX., page 1171.

Colloids; Contribution to the chemistry of ——. K. Winkelblech. XXIV., page 1177.

ORGANIC—QUANTITATIVE.

Sugar beets; Analysis of ——. D. L. Davoll, jun. XVI., page 1163.

Sugars; Determination of —— by means of the refractometer. L. M. Tolman and W. B. Smith. XVI., page 1164.

Whiskey; Methods for the determination of esters, aldehydes, and furfural in ——. L. M. Tolman and T. C. Trescot. XVII., page 1167.

Camphor [in celluloid]; Determination of ——. A. Arnost. XIX., page 1169.

Levulinic acid; Iodometric determination of ——. B. Savaré. XX., page 1172.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 1123.)

Rare earths; Toxicity and action on fermentations of ——. A. Hébert. Comptes rend., 1906, **143**, 690—693.

Plants were not injured in water containing the sulphates of zirconium, thorium, cerium, and lanthanum, until the concentration reached 5 grms. per litre. Yeast,

diastase, and emulsin were "killed" by the salts of thorium and zirconium even at a concentration of 0·5 grm. per litre, whilst cerium and lanthanum salts appeared to have no action.—J. T. D.

Sucroclastic action of acids as influenced by salts and non-electrolytes. R. J. Caldwell. Proc. Roy. Soc., 1906, **78** A., 272—295. (Compare Armstrong and Caldwell, this J., 1904, 1165.)

STRESS is laid on the need of maintaining the proportions of water and acid as well as that of the hydrolyte, constant throughout experiments of this kind, so that the amount of the added substance is the only variable. The experiments described, the results of which are given in tabular form, show that cane sugar itself and several other carbohydrates have a relatively small though very distinct increasing effect on the rate of inversion of cane sugar by acids; alcohol has a marked inhibiting effect, probably because it enters into competition with the water and withdraws hydrogen chloride from it; glycerol—a non-electrolyte—occupies an intermediate position between alcohol and the carbohydrates, and the weak electrolyte, acetic acid, also has but little influence. Metallic salts accelerate the rate of change, the influence of those derived from monad metals being already considerable, and that of salts derived from dyads at least twice as great. This activity is due to their dehydrating influence. To ascertain the "degree of hydration" of the salt, the extent to which it was necessary to dilute the weight-normal solution in order to reduce the value of the constant K to 510—the standard value—was determined in each case. The values arrived at were as follows, the figures indicating mols. of water per mol. of the salt: ammonium chloride, 10; potassium chloride, 10; sodium chloride, 13; barium chloride, 19; and calcium chloride, 22. Tables are also given to show the influence of various carbohydrates on the electrolytic conductivity of solutions of hydrogen chloride and sulphuric acid.—E. F. A.

Colloids; Separation of —— by filtration. Bechhold. Z. Chem. und Ind. der Kolloide, 1906, **1**, 107—108.

THE now accepted fact that colloidal solutions are of the nature of suspensions rather than solutions proper, entails the supposition that colloidal particles can be separated from their "solvent" by means of suitable filters. The author has succeeded in preparing such filters by impregnating bases of vegetable fibre or wire gauze with gelatinous materials of varying concentration. Filtration is carried out in a specially designed apparatus at pressures of 0·2 to 4 atmospheres. In this way pure "solvent" may be withdrawn from colloidal solutions of arsenic sulphide, ferric hydroxide, egg-albumin, hæmoglobin, and globulin. Jellies of different concentration act as filters of different permeability; thus it was found possible to separate mixtures of colloidal silver and hæmoglobin, and to fractionate mixtures of peptone-albumoses. Enzymes and toxins have a tendency, not shared by ordinary albuminoids, to combine with, or "dye," the filtering material.—W. A. C.

Colloids; Contribution to the chemistry of ——. K. Winkelblech. Z. angew. Chem., 1906, **19**, 1953—1955.

WHEN a solution of gelatin is vigorously shaken with benzine (petroleum spirit), some of the colloid is precipitated as a stiff emulsion of gelatin, benzine, water, and air. With very dilute solutions the result is a permanent whitish ring of exceedingly small bubbles, settling around the walls of the vessel. This reaction is very delicate, serving to detect a few mgrms. of gelatin per litre. It is best carried out with quantities of 10 c.c. in a vessel of the diameter of an ordinary test-tube. Slight acidity of the solution is favourable, but in presence of much acid, alkali, or salt, the test must be performed on larger quantities. It is found that petroleum, melted paraffin, benzene, chloroform, and carbon bisulphide may also be used. Solutions of other colloids, both organic and inorganic, give the reaction. Tannin reacts, but gallic acid does not. Conversely, solutions of fats in hydrocarbons give similar permanent layers of emulsion with water or (better) dilute alkaline or acid liquids.—W. A. C.

Trade Report.

U.S. CUSTOMS DECISIONS; RECENT ——.

Bd. of Trade J.

Following is a *resumé* of some recent decisions given by the Board of General Appraisers:—

Articles.	Paragraph of the Tariff under which dutiable.	Rate of Duty.
Casein, as an albumen not specially provided for, or as lactarene	468 or 594	Free.
Semolino, a by-product in the manufacture of wheat flour, used as a farinaceous food, and for making puddings, &c., as an unenumerated manufactured article	Section 6	20 % *ad val.*
Printing paper.—A thin, flimsy coloured paper said to be used for "printing circulars and printing of all kinds," but not shown to be suitable for books or newspapers, dutiable as paper not specially provided for	402	25 % „
Zinc white paint, or enamel white paint, containing zinc, but not containing lead, ground in oil and reduced to liquid form by the addition of varnish and turpentine, and thus ready for use as a liquid paint, is not dutiable as "zinc, oxide of, and white paint or pigment, containing zinc, but not containing lead, . . . ground in oil;" but is dutiable as paint, not otherwise specially provided for	58	30 % „
Ripolins.—Paints or colours, known as ripolins are subject to the same rate of duty, under the same provision	do.	do.
Wood charcoal produced by a burning process by which every characteristic of wood is eliminated is not dutiable as a manufacture of wood, but as a non-enumerated manufactured article	Section 6	20 % „
Chemical glassware.—Articles composed exclusively of blown glassware in the form of flasks, &c., designed for use in chemical laboratories ..	100	60 % „
Articles designed for similar use but composed of moulded or pressed glass or of blown glass in combination with parts of moulded glass or other material	112	45 % „
Woulff bottles, or flasks (both terms interchangeably applying to the same article)	99	Various rates according to capacity.

German Chemical Industry.

Chem. Trade J., Nov. 17, 1906.

The report of the Association for the Protection of the Interests of the Chemical Industry of Germany refers to the development which took place during 1905, and to the profitable nature of the chemical undertakings as revealed by the reports of a number of companies. The Association has drawn upon the returns issued by 142 companies, with an ordinary share capital of £23,000,000, and bonds and mortgages totalling £4,200,000, while the reserve funds stand at £7,100,000. These companies paid, for 1905, £3,475,000 in dividends and as bond and mortgage interest, being an average of 10·12 per cent. as compared with 9·52 per cent. in 1904. If, however, only the average dividends distributed in recent years are compared with one another, and the most prosperous year hitherto (1899) be taken as a unit at 100, the ratios work out as follows for the past few years:—1899, 100; 1900, 91·1; 1901, 90·9; 1902, 87·8; 1903, 93·3; 1904, 97·7; and 1905, 106·2. It will thus be seen that the year 1905 has eclipsed 1899, which was the record year of the last period of prosperity. It is assumed that the present year will not exhibit any material change in the favourable development of the German chemical industry, notwithstanding the operation of commercial treaties disadvantageous to the export trade of the country.

New Books.

Savons et Bougies. Paul Puget, Ing. Chimiste E.C.P., Prof. à l'Ecole Superieure de Commerce de Nantes. Librairie J. B. Baillière et Fils, Rue Hautefeuille, 19. Paris. 1907. Price 5 frs.

Small 8vo volume, containing 382 pages of subject matter, and an alphabetical index. The text is illustrated with 79 engravings, and treats of the following subjects:—Soaps. I. Fatty Matters. II. Soaps and Candles. III. Decomposition of neutral fatty matters. IV. Glycerin. V. Hard Soaps. VI. Soft Soaps. VII. Toilet Soaps. VIII. Soaps for Industrial, Medicinal, and Veterinary application. IX. Soap Analysis. Candles. I. General considerations. II. Stearic and Palmitic Acids. III. Tallow Melting. IV. Separation of Solid from Liquid Fatty Acids. V. Manufacture and Analysis of Candles.

Contribution a l'Etude de la Saponification des Corps Gras. Par M. Maurice Nicloux, D.ès.Sc., M.D. Librairie Scient. A. Hermann, Rue de la Sorbonne, 6, Paris. 1906. Price 3 frs.

Pamphlet, 8vo size, containing 73 pages of subject matter, and a table of contents. The subject is treated under the following heads:—I. Introduction. II. Historical. III. Extraction of the active substance of the seed of the Castor Oil plant—the cytoplasm. IV. Dissociation of the Cellular Constituents. V. Cytoplasm and grains of Aleuron. VI. Measure of Activity. VII. Study of the Hydrolysing properties of the isolated Cytoplasm. VIII. Are the active powers, specially the Hydrolysing power of the Cytoplasm, not due to the presence of a soluble ferment? IX. Application of the preceding experimental results to the study of some points in Vegetable Physiology. XII. Detailed study of Saponification. XIII. General conclusions.

Outlines of Qualitative Chemical Analysis. By Frank Austin Gooch and Philip Embury Browning, Professor and Assistant Professor of Chemistry in Yale University. John Wiley & Sons, New York. 1906. Chapman & Hall, Ltd., London. Price 5*s.* 6*d.*

8vo volume, containing 139 pages of subject matter, and an alphabetical index. The subject matter is comprised under:—I. Introductory. II. The Basic Analysis. III. Acidic Analysis. IV. The Systematic Examination. V. Organic Compounds.

Ice Formation, with Special Reference to Anchor-Ice and Frazil. By Howard T. Barnes, M.A.Sc., D.Sc., &c., Associate Professor of Physics, McGill University, Montreal. John Wiley & Sons, New York. 1906. Chapman & Hall, Ltd., London. Price 12*s.* 6*d.*

8vo volume, contains 250 pages of subject matter with 39 illustrations and a chart with sectional plans. There is also an alphabetical index. The subject matter is treated under the following heads:—Introduction: I. Physical Laws governing the Transfer of Heat. II. Physical Constants of Ice. III. Formation and Structure of Ice. IV. Sheet, Frazil, and Anchor Ice. V. Precise Temperature Measurements. VI. River Temperatures. VII. Theories to account for Frazil and Anchor-Ice. VIII. Methods of overcoming the Ice Problem in Engineering Work.

Ferric and Heliographic Processes. A Handbook for Photographers, Draughtsmen, and Sun Printers. By George E. Brown. Dawbarn & Ward, Ltd., 6, Farringdon Avenue, London, E.C., 1906. Price 2*s.* net.

Small 8vo volume, containing 126 pages of subject matter, two pages of bibliography, and an alphabetical index. There are 17 illustrations. The subject matter treats of the following items:—I. The Ferroprussiate Process. II Toning Blue prints and their Uses. III. Ferroprussiate in Tri-colour Work. IV. Kallitype Process. V. Obernetter Process. VI. Uranotype Process. VII. Prints on Fabrics—Prints in Dyes. VIII. Heliographic Processes compared. IX. Preparation of Heliographic Papers. X. Marking Tracings for Sun Copying. XI. Outfit for Heliographic Printing. XII. Ferroprussiate, or White Line on Blue Ground. XIII. Pellet, or Blue line on White Ground. XIV. Ferrogallic, or Black Line on White Ground. XV. Brown Line on White Ground. XVI. Minor Heliographic Processes. XVII. Paper and Sizing. XVIII. Chemicals.

Practical Radiography. A Handbook of the Applications of the X-Rays, with many Illustrations. By A. W. Isenthal and H. Snowden Ward. Second Edition. Dawbarn & Ward, Ltd., 6, Farringdon Avenue, London, E.C. 1898. Price 2*s.* 6*d.* net.

8vo volume, with 157 pages of subject matter and 68 illustrations. The matter is classified under the following heads:—1. Practical Radiography.—Historical. II. Apparatus. III Electrical. IV. Photographical. V. Medical. VI. Diagnostical Applications. VIII. Therapeutic Value of the X-Rays. VIII. General Applications and Probabilities. IX. Theory of the X-Rays.

Paper Technology: An Elementary Manual on the Manufacture, Physical Qualities, and Chemical Constituents of Paper and of Paper-making Fibres. By R. W. Sindall, Technical Adviser to the Government of India. Chas. Griffin & Company, Ltd., Exeter Street, Strand, London. 1906. Price 12*s.* 6*d.* net.

8vo volume, containing 247 pages of subject matter, and an alphabetical index. The text is illustrated with a frontispiece, 13 plates, and 158 illustrations. The subject matter is classified under the following heads:—I. Introduction. II. Technical Difficulties relating to Paper. III. Rag papers. IV. Esparto; Straw; Notes on Beating. V. Wood Pulp. VI. Wood Pulp Papers. VII. Packing Paper. VIII. "Art" Papers. IX. The Physical Qualities of Paper. X. Chemical Constituents of Paper. XI. The Microscope. XII. Fibrous Materials used in Paper-making. XIII. Analysis of a Sheet of Paper XIV The C.B.S. Units. XV. Cellulose and its Derivatives. XVI. History, Chronology, and Statistics. XVII Dictionary of Technical Terms. XVIII. Glossary of various Papers, with brief notes as to origin of same, and use of the Papers. XIX. Questions on "Paper Manufacture" set by the City and Guilds of London Institute, 1902—1906.

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The Hon. Treasurer is prepared to receive subscriptions for the Decennial Index (1896—1905). The Authors' Names portion is now in the press and will be issued early in the new year; and the subject-matter portion will follow as soon as possible afterwards. The price is 10*s.* for the whole Index, or 11*s.* ($2.75) post free.

Copies of the Collective Index (1881—1895) may be had at the same price.

Cheques on members' own bankers, or money orders, payable at the G.P.O., London, should be made payable to Samuel Hall, and sent to the Hon. Treasurer, East London Soap Works, Bow, E., with the signed fly-leaf of a notice which will be sent out with the ordinary subscription notice, and to any others who make application for it.

SUBSCRIPTIONS OF MEMBERS ABROAD.

IMPORTANT NOTICE.

Members are reminded that the subscription of 25*s.* ($6.15) for 1907 should be sent so as to reach the Hon. Treasurer early in the New Year, so as to ensure continuity in the receipt of the Society's Journal.

For the greater convenience of members abroad, arrangements have been made whereby cheques on their own bankers, drawn in the usual way and in their own currency, will be accepted in payment of subscriptions. Cheques and money orders on G.P.O., London, should be made payable to Samuel Hall, and forwarded to him at Bow.

The return, whenever possible, of the fly-leaf attached to the subscription notice, is specially recommended as a means whereby the sender may be identified, and changes of address recorded, on which depends the safe receipt of the Journal.

"INDUSTRIAL DISEASES COMMITTEE."

With reference to a notice which appeared in the November 15th issue of the JOURNAL (p. 1062), announcing the appointment of a Departmental Committee "to inquire and report what diseases and injuries, other than injuries by accident, are due to industrial occupations, are distinguishable as such, and can properly be added to the diseases enumerated in the Third Schedule of the Workmen's Compensation Bill, 1906," members who desire to assist the Committee by tendering evidence are requested to communicate with the Society.

List of Members Elected.

Dec. 21, 1906.

Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.

Barbour, R. B., Eclipse Chemical Manufacturing Co., Chelmsford, Mass., U.S.A., Manager.

Blyth, M. Wynter, 36, Eastcheap, London, E.C., Analytical and Consulting Chemist.

Boutwell, Arthur T., Smith and Dove Manufacturing Co., Andover, Mass., U.S.A., Superintendent of Bleaching and Dyeing.

Casaburi, Dr. Vittorio, Ford Morocco Co., Wilmington, Del., U.S.A., Leather Chemist.

Davies, Harry R., 74, India Street, Boston, Mass., U.S.A., Chemist.
Dillon, Frederick N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.
Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
Dunford, J. H., Trent Side Bone Works, Nottingham, Assistant Manager.
Futers, Stephen H., Glenraven House, Heol-y-Fai, Maesteg, Glamorgan, Analyst.
Grasser, N. H., Argold Hall, Llangollen, North Wales, Manufacturing Chemist.
Grocnewoud, S. H., 36, Grosvenor Road, Highbury, London, N., Analytical Chemist.
Hoseason, J. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.
Huyett, M. C., 1203, Traders' Bank Building, Toronto, Canada, Mechanical Engineer.
Inglis, Dr. J. K. H., University College, Reading, Lecturer.
Johnson, Dr. Harold, 5 and 6, Fowkes Buildings, Great Tower Street, London, E.C., Chemist.
Kinnersley, H. W., 25, Bourne Hall Road, Bushey, Herts, Chemist and Manufacturer.
Lacell, H. G., Marlowes, Hendon Lane, Finchley, N., Chemist.
Lowe, James, City Chambers, 45, John Street, Glasgow, Assistant Engineer, Gas Department.
Lowe, Jos. A., Fitchburg, Mass., U.S.A., Paper Manufacturer.
Lowson, William, The University, Leeds, Assistant Chemical Lecturer.
Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
Mihalovitch, S. F., 514, E. Pearl Street, Cincinnati, Ohio, U.S.A., Chemist.
Morson, Thomas Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.
Neil, Dr. Archibald A., 82, Eccles Old Road, Manchester, Chemical Engineer.
Parker, Elias G., 238, Grafton Avenue, Newark, N.J., U.S.A., Chemist.
Peirce, Edwin H., American Telephone and Telegraph Co., 125, Milk Street, Boston, Mass., U.S.A., Chemist.
Perrow, Mosby G., Lynchburg, Va., U.S.A.
Pincott, E. S., 222, St. James' Street, Montreal, Canada, Manager, Nichols Chemical Co.
Potter, Dr. Henry Noel, c/o Sawyer Mann Co., 523, W. 23rd Street, New York City, U.S.A., Electrical Engineer.
Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.
Schramm, Quirin, Otto-Hilgenstock Coke Oven Co., Ltd., Tingley, near Wakefield, Chief Chemist.
Shankland, Geo. A., Millthorpe, Watson Avenue, Mansfield, Company Manager.
Shepard, Jas. H., Chemical Agricultural Experiment Station, Brookings, S. Dak., U.S.A., Chemist.
Slack, Edwin B., 39, Huron Street, Toronto, Canada, Chemist.
Smith, Dr. G. McP., Chemical Laboratory, University of Illinois, Urbana, Ill., U.S.A., Instructor in Chemistry.
Steers, Thornton, 229, Grand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
Tattersfield, Fredk., The Hollins, Dewsbury, Yorks, Analyst.
Travell, N. E., Wright's Finishing Co., Ltd., Great Freeman Street, Nottingham, Lace Dresser.
Wardlaw, Thos. D., c/o The Geigy Aniline and Extract Co., 60, Front Street West, Toronto, Canada, Canadian Manager.
Wenger, Francis E., Helvetia, Newcastle, Staffs., Ceramic Colour Manufacturer.
Williams, A. Ll. Griffith, Uzina Consanceõ de Sinimbu, S. Miguel dos Campos, Maceio, Brazil, Sugar Planter.
Wilson, J. Murray, c/o Hamilton Powder Co., Belœil Factory, near Montreal, Canada, Technical Chemist.
Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, Professor of Chemistry.
Yerkes, Leonard Augustus, c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Cotton Bleacher and Finisher.

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When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps to the verification of addresses, on which the safe delivery of the Journal depends.

Bayly, F. W., l/o Sydney, N.S.W.; retain Journals.
Beckers, Dr. W., l/o Stone Street; 128, Duane Street, New York City, U.S.A.
Brown, Walter B.; all communications to Victor Chemical Works, 89, Board of Trade Buildings, Chicago. Chemist and General Superintendent.
Diestel, Wm., l/o William Street; 128, Duane Street, New York City, U.S.A.
Dow, Allan W., l/o Washington; 73, Upper Mountain Avenue, Montclair, N.J., U.S.A.
Escher, Paul, l/o Chicago; c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A.
Forbes, Eli, l/o Lancaster Mills; Clinton, Mass., U.S.A.
Gref, A., l/o Stone Street; 128, Duane Street, New York City, U.S.A.
Hadfield, R. A.; Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W.; and (Journals) Parkhead House, Sheffield.
Hays, B. F., l/o Brooklyn; c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A.
Hibbeler, C., l/o Somerville; 1, Ellsworth Park, Cambridge, Mass., U.S.A.
Hinchley, J. W., l/o Bangkok; 15, Fawcett Street, London, S.W.
Hogben, Walter; Journals to 9, Duddingston Crescent, Portobello, Edinburgh.
Humel, E. J.; l/o Clark Avenue; 7912, Grace Avenue, S.W., Cleveland, Ohio, U.S.A.
Hyde, Austin T., l/o Box 365; P.O. Box 98, Rumford Falls, Maine, U.S.A.
Imrie, John, l/o Milton; 415, Shields Road, Glasgow.
Jenks, R. L.; Journals to Central Excise Laboratory, Kasauli, Punjab, India.
Keppelmann, A. J., l/o Box 1549; P.O. Box 1382, Philadelphia, Pa., U.S.A.
Kitamura, Y., l/o Tokyo; Kaigun Kōshō, Yokosuka, Japan.
Labonde, Dr. L.; All communications to 145, West Adams Street, Los Angeles, Cal., U.S.A.
Macmillan, A., l/o Sunderland; Seaforth House, Blackhall, Mid-Lothian.
McDowall, Wm., l/o Taltal; c/o Inglis, Lomax and Co., Antofogasta, Chili.
Miller, H. Harold, l/o McMasters Avenue; 303, Front Street East, Toronto, Canada.
Muckenfuss, A. M.; all communications to c/o University of Mississippi, University, Miss., U.S.A., State Chemist.
Muter, Dr. John; Journals to 325, Kennington Road, London, S.E.
Muurling, L. J. R., l/o Box 2160; P.O. Box 1935, New York City, U.S.A.
Nishigawa, T., l/o Osaka; 12, Yamamoto Dori, Nishome, Kobe, Japan.
Pease, F. N., l/o New York; P.O. Box 503, Altoona, Pa., U.S.A.
Persons, A. C., l/o Prospect Street; 74, Oak Street, Willimantic, Conn., U.S.A.
Propach, C., l/o North Clark Street; 224, Randolph Street, Chicago, Ill., U.S.A.
Ridsdale, C. H., l/o Ferndale; Ravenscroft, Roman Road, Linthorpe.
Smoot, Albert M., l/o Elizabeth; 99, John Street, New York City, U.S.A.
Spoor, J. L.; all communications to Rede Court, Rochester, Kent.

Stevens, T. R. B., l/o Merton: retain Journals.
Tsukiyama, S., l/o Osaka; 2nd of No. 2116, Fukiaichō, Kobe, Japan.
Tutton, H. R., l/o Gravesend; 12, Ivy Street, Penarth, South Wales.
Weiss, P., jun., l/o Wharton; Vulcanite Portland Cement Co., Phillipsburg, N.J., U.S.A.
Williams, Percy, l/o Clapton; (subscriptions) 75, Fairfax Road, London, N.W., and (Journals) c/o A. J. Simons, Pontianak, Dutch West Borneo, *via* Singapore.
Wilson, L. P., l/o Wallasey; Boston House, Stoney Stanton Road, Coventry.
Woodman, Dr. Durand, l/o Pearl Street; 80, Beaver Street, New York City, U.S.A.
Worstall, R. A., l/o Church Street; 726, Clinton Place, Evanston, Ill., U.S.A.

Change of Address Required.

Flammer, E., l/o Heilbronn a/Neckar, Germany.

Change of Style and Address.

King, Lieut. A. E.; all communications to King, Capt. A. E., R.A., Inspector of Explosives, Egyptian Army, Citadel, Cairo, Egypt.

Deaths.

Bernays, Joseph, l/o 96, Newgate Street, London, E.C. Dec. 24.
Blass, Edward, Essen (Ruhr), Germany.
Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A. Nov. 26.
Potts, Jos. T., Price's Patent Candle Co., Bromborough Pool, Dec. 11.

Patent List.

N.B.—In these lists [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 27,552. James. Method of making liquid air and other liquid gases. Dec. 4.
" 27,592. Crush. Filter frame and process of filtration.* Dec. 4.
" 27,621. Martin and Rideal. Apparatus for heating Dec. 4.
" 27,691. Hellström. Centrifugal liquid separators. [Swed. Appl., Dec. 9, 1905.]* Dec. 5.
" 27,776. Kunick (Kunick). Continuous removal or introduction of substances from or into chambers standing under vacuum. Dec. 6.
[A.] 27,807. Radcliffe. *See under* XVII.
" 27,824. Thom. *See under* XII
" 27,900. Guy. Kilns and ovens fired with producer and other gases. Dec. 8.
" 28,225. Chmelewski. Kilns.* Dec. 11.
" 28,555. Watel and Harper. Apparatus for mixing or diluting solutions. Dec. 14.
" 28,574. Thwaite and Defries. High temperature gas furnace. Dec. 14.
[C.S.] 25,404 (1905). Schröder. Manufacture of homogeneous products from liquids or liquefied substances. Dec. 19.
" 25,570 (1905). Trotman and Hackford. Apparatus for automatically recording the temperature of ovens, dyeing vats, &c., and for controlling the supply of fuel to a steam generator, or the steam supply therefrom. Dec. 19.
" 4547 (1906). Cartwright. Surface apparatus for condensing, evaporating, or the like. Dec. 12.
" 15,516 (1906). Siehert. Smoke consuming furnace. Dec. 19.
" 16,583 (1906). Prollius. Centrifugal drums or apparatus. Dec. 12.

II.—FUEL, GAS, AND LIGHT.

[A.] 27,459. Johnson and Willis. Permeated electric arc lamp carbons and incandescent lamp filaments. Dec. 3.
" 27,540. Douglas. Suction gas producers. Dec. 4.
" 27,842. Forbes. Preparing carbide of calcium for generators. Dec. 6.
" 27,908. Grafton. Removal of naphthalene from illuminating gas. Dec. 7.
" 27,943. Mallison. Production of methane or gases containing it Dec. 7.
" 27,967. Ickringill and Hellwell. Incandescent mantles. Dec. 8.
" 28,038. Lake (Cone). Generation of gas.* Dec. 8.
" 28,086. Sclater. Suction gas apparatus. Dec. 10.
" 28,148. Bachman. Apparatus for washing gases.* Dec. 10.
" 28,181. Crossley and Rigby. Manufacture of producer gas. Dec. 11.
" 28,269. Wilton. Recovery of sulphur from gases, and purification of coal gas. Dec. 11.
" 28,274. McKay. Compressed, cemented coke leavings. Dec. 12.
" 28,281. Hatfield. Arc lamp electrodes. Dec. 12.
" 28,475. Robertson and Graham. Production of fuel and coke. Dec. 13.
" 28,576. Buss and Fohr. Making briquettes of coal, peat, &c.* Dec. 14.
" 28,580. Woodall and Duckham. Vertical retorts for the destructive distillation of coal.* Dec. 14.
" 28,660. Kurzer. Drums for gasifying heavy carburetted oils. [Ger. Appl., Aug. 24, 1905.* Dec 15.
[C.S.] 24,940 (1905). Ladd. Gas furnaces. Dec. 12.
" 24,949 (1905). Lake (Deuts. Gasglühlicht A.-G.). Incandescing bodies or mantles for gas lighting. Dec. 12.
" 25,313 (1905). Atkinson. Suction gas producers. Dec. 12.
" 25,574 (1905). Simpson. Removal of sulphur and other impurities from coke. Dec. 19.
" 25,596 (1905). Lake (Selas Gas.). Manufacture of a mixture of gas and air for illuminating purposes. Dec. 19.
" 26,829 (1905). Fielding. Suction gas generators. Dec. 12.

[C.S.] 27,002 (1905). Bloxam (Lux). Manufacture of electric incandescent lamp filaments from tungsten or molybdenum or an alloy thereof. Dec. 19.

„ 753 (1906). Thompson (Wurts). *See under* III.

„ 1980 (1906). Morton. Producer gas plants. Dec. 14.

„ 4119 (1906). Ingrey, Bartlett and Maclure. Production of acetylene and other gases. Dec. 12.

„ 9020 (1906). Bloxam (Lux). Manufacture of filaments of tungsten or molybdenum for electric incandescence lamps. Dec. 19.

„ 18,485 (1906). Allgem. Elektricitäts Ges. Incandescing bodies for electric lighting and heating. Dec. 12.

„ 22,049 (1906). Weigel and Wolf. Steam and gas generators. Dec. 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 27,945. Cowper-Coles. Production of petroleum compounds with low flashing points. Dec. 7.

„ 28,014. Claussen. Enriching light mineral oils or hydrocarbons. [Belg. Appl., Dec. 13, 1905.]* Dec. 8.

„ 28,089. Soc. Anon. des Combustibles Industrielles. Distillation of hydrocarbons. [Fr. Appl., April 19, 1906.]* Dec. 15.

[C.S.] 753 (1906). Thompson (Wurts). Distilling coals and other hydrocarbonaceous substances. Dec. 12.

„ 9202 (1906). Carter and Newell. Oils for lubricating purposes. Dec. 19.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 28,139. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds or colouring matters of the anthracene series. Dec. 10.

„ 28,240. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters containing sulphur. Dec. 11.

„ 28,578. Badische Anilin und Soda Fabrik. Manufacture of vat colouring matters containing sulphur. [Ger. Appl., Jan. 22, 1906.]* Dec. 14.

[C.S.] 8490 (1906). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new monoazo dyestuffs. Dec. 19.

„ 9695 (1906). Newton (Bayer und Co.). Manufacture of new disazo dyestuffs and intermediate products. Dec. 12.

„ 10,866 (1906). Newton (Bayer und Co.). Manufacture of new derivatives of the anthracene series. Dec. 19.

„ 16,100 (1906). Kalle und Co. Manufacture of sulphur-containing red colouring matter. Dec. 19.

„ 16,101 (1906). Kalle und Co. Manufacture of sulphur-containing red colouring matter. Dec. 19.

„ 16,907 (1906). Kalle und Co. Manufacture of thioindoxylcarboxylic acid. Dec. 19.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 27,438. Sagar. Apparatus for mercerising and sizing fibrous material. Dec. 3.

27,447. Pickles and Pickles. Finishing textile fabrics. Dec. 3.

[A.] 27,527. Kunstfäden Ges.m.b.H. Manufacture of artificial silk filaments for nitrocellulose. [Ger. Appl., Dec. 4, 1905.]* Dec. 3.

„ 27,727. Friedrich. Manufacture of artificial threads, films, or the like. [Ger. Appl., Dec. 11, 1905.]* Dec. 5.

„ 27,904. Clare. Sizing yarns, warps, and cloth. Dec. 7.

„ 28,271. Diedrichs. Apparatus for washing, bleaching, and dyeing textile fibres, spun yarns and textile fabrics. Dec. 11.

„ 28,317. Pike and Hough. Rollers for calico printing, &c. Dec. 12.

„ 28,533. Knowles and Yates. Apparatus for use in bleaching, dyeing, mercerising, and like treatment of yarn or threads. Dec. 14.

„ 28,711. Védie. Dyeing. Dec. 15.

[C.S.] 25,537 (1905). British Algin Co., Ingham and Bunzl. Treatment of textiles, paper, &c., with compounds of alginic acid. Dec. 19.

„ 25,681 (1905). Baudot. Treatment of raw wool. Dec. 19.

„ 2083 (1906). Hey. Treating textile fibrous material with products of electrolysis of water solutions of acids, oxides, and salts. Dec. 19.

„ 7574 (1906). Haddan and Co., and Buxton. Finishing pile fabrics. Dec. 12.

„ 9432 (1906). Severen. Manufacture of horsehair filaments. Dec. 12.

„ 11,254 (1906). Hausdorf. Apparatus for treating fabrics with liquids. Dec. 19.

„ 11,351 (1906). Schäfer. Fireproof material. Dec. 12.

„ 13,752 (1906). Puchert and Puchert. Cleaning wool fibre. Dec. 19.

„ 16,088 (1906). Thiele and Linkmeyer. Production of artificial silk. Dec. 19.

„ 17,660 (1906) Schmitt and Handschin. Dyeing and bleaching apparatus. Dec. 19.

„ 20,519 (1906). Miller. Mercerising apparatus. Dec. 12.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 27,828. Roth. Utilising in an advantageous manner the nitrogen of the air in the form of nitride.* Dec. 6.

„ 28,269. Wilton. *See under* II.

„ 28,449. Wolffenstein and Boeters. Concentration of dilute nitric acid. [Ger. Appl., Dec. 18, 1905.]* Dec. 13.

„ 28,581. Strohbach. Manufacture of sodium alum, potassium alum, or ammonium alum free from iron and in small crystals.* Dec. 14.

„ 28,683. Grossmann. *See under* XVIII*B*.

[C.S.] 25,477 (1905). Muth. Production of aluminium oxide from bauxite. Dec. 19.

„ 5776 (1906). Johnson (Feld.). Production of nitrate of ammonia. Dec. 19.

„ 6329 (1906). Barnes, Spence, and Spence and Sons. Manufacture of titanium compounds. Dec. 19.

„ 14,586 (1906). Kintner. Ozone producers. Dec. 12.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 27,564. Desgraz and Schmidt. Method of working flame furnaces used in treating glass, steel, &c.* Dec. 4.

„ 27,619. Collins. Manufacture of refractory articles. Dec. 4.

„ 28,297. Meakin, Ltd., and Jackson. Kilns for firing or drying ceramic ware. Dec. 12.

[C.S.] 20,507 (1906). Menzel. Drawing window or plate glass. Dec. 12.

„ 22,850 (1906). Redl. Manufacture of glass ware. Dec. 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 27,747. Ozigler-Eotvös. Kilns for burning bricks, lime, &c.* Dec. 5.

„ 28,199. Kilburn (Isolatorenfabr. Pulvolit G. m.b.H.) Manufacture of artificial stone or the like.* Dec. 11.

[C.S.] 1981 (1906). Peters. Mixing concrete and the like. Dec. 19.

„ 6333 (1906). Barnett, Hadlington and Henton. Continuous brick kilns. Dec. 19.

X.—METALLURGY.

[A.] 27,515. Thwaites. Utilising pyrites cinder and other metallic sulphides low in sulphur. Dec. 3.

27,564. Desgraz and Schmidt. *See under* VIII.

„ 27,740. Cowper-Coles. *See under* XI.

„ 27,844. Fouilloud. Soldering and like materials. [Fr. Appl., Dec. 8, 1905.]* Dec. 6.

„ 27,914. Frith (Grist). Treatment of metals such as steel or steel alloys. Dec. 7.

„ 28,030. Reynolds. Manufacture of steel. Dec. 8.

„ 28,123. Sherardising Synd., and Cowper-Coles. Coating or alloying metals. Dec. 10.

„ 28,182. Churchward. Annealing and supercarburising steel and steel alloys.* Dec. 11.

„ 28,342. Thirot and Mage. *See under* XI.

„ 28,443. Jensen (Assmann). Metallic reductions. Dec. 13.

„ 28,498. Fraser and Blackie. Recovery of copper from ores and the like. Dec. 13.

„ 28,567. Fraser, Tundley and Blackie. Recovery of metals from ores. Dec. 14.

„ 28,573. Thwaite and Defries. Manufacture of certain molten metals. Dec. 14.

„ 28,575. Thompson (Mojana). Process and apparatus for obtaining zinc.* Dec. 14.

„ 28,587. Cowper-Coles. Production of alloys of silver.* Dec. 14.

[C.S.] 20,322 (1905). Wolf. Separation of metals from ores. Dec. 19.

„ 25,748 (1905). Simpkin and Ballantine. Magnetic separator. Dec. 12.

„ 26,073 (1905). Rawson. Cupels for assay purposes. Dec. 19.

„ 26,577 (1905). Frith and Grist. Treatment of steel and steel alloys. Dec. 19.

„ 26,790 (1905). Baker. Treatment of complex sulphide ores. Dec. 19.

„ 717 (1906). Hodgkinson, Hardcastle, and Coote. Removal of metal plating or coating from metallic or other surfaces. Dec. 19.

„ 4969 (1906). Huntsman and Huntsman. Demonstrating by colours the heats for hardening, tempering and annealing steel. Dec. 13.

„ 7757 (1906). Tatlock. Production of a protective coating on iron and steel. Dec. 12.

„ 13,189 (1906). Soc. Electrométall. Franç. Manufacture of decarburised cast iron. Dec. 12.

„ 15,626 (1906). Colburn. Manufacture or treatment of iron or steel. Dec. 19.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 27,740. Cowper-Coles. Electrolytic refining of copper. Dec. 5.

„ 28,275. Cowper-Coles. Plates for secondary batteries. Dec. 12.

„ 28,342. Thirot and Mage. Electrolytic production of pure tin. [Fr. Appl., March 26, 1906.]* Dec. 12.

„ 28,370. Hiorth. Electric furnaces.* Dec. 12.

„ 28,593. Bingham. Regulation of electric furnaces.* Dec. 14.

„ 28,638. Gin. New application of induction furnaces.* Dec. 15.

[C.S.] 26,813 (1905). Ashcroft. Electrolysis of metallic compounds or ores. Dec. 19.

„ 132 (1906). Pettit. Electric furnaces. Dec. 19.

„ 6089 (1906). British Thomson-Houston Co. (General Electric Co.). Electrical resistance material. Dec. 12.

„ 16,701 (1906). Edison. Process of making metallic films or flakes. Dec. 19.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[A.] 27,701. Bacon. Manufacture of soap powder. Dec. 5.

„ 27,824. Thom. Vacuum filtering apparatus for oils and other liquids. Dec. 6.

„ 28,022. Leistner. Manufacture of soap. Dec. 8.

„ 28,351. Immerwahr. Manufacture of albuminous soaps. Dec. 12.

„ 28,699. Stansfield. Emulsification of fatty substances. Dec. 15.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

[A.] 27,907. FitzGerald. Chemically prepared substance for the manufacture of paints and artificial india-rubber. Dec. 7.

[C.S.] 25,859 (1905). Fireman. Manufacture of printing ink pigments. Dec. 19.

„ 1732 (1906). Morris, Smith, and Bawtree. Manufacture of copying inks and of paper for use therewith. Dec. 12.

„ 2826 (1906). Flack, and Humidine, Ltd. Anti-fouling and non-corrosive paints or compositions. Dec. 12.

„ 7073 (1906). Clark (Standard Paint Co.). Manufacture of paint. Dec. 19.

(*C.*)—India-Rubber.

[A.] 27,616. Sauton. Plastic material applicable as a substitute for caoutchouc. [Fr. Appl., Aug. 10, 1906.]* Dec. 4.

„ 27,907. FitzGerald. *See under* XIII*A*.

„ 28,217. Radcliffe. Apparatus for recovering spirit and like fluids from rubber, guttapercha, and the like. Dec. 11.

[C.S.] 25,291 (1905). Bloxam (Bamber). Manufacture of india-rubber. Dec. 12.

XV.—MANURES, &c.

[A.] 28,510. Vasey. Treatment of phosphates for the preparation of manure. Dec. 14.

[C.S.] 26,886 (1905). Thompson (Schlutius). Manufacture of a material rich in nitrogen and phosphorus, and its application as manure. Dec. 12.

[C.S.] 26,888 (1905). Thompson (Schlutius). Manufacture of artificial manure. Dec. 12.

,, 26,889 (1905). Thompson (Schlutius). Manufacture of manure from waste material. Dec. 12.

XVI.—SUGAR, STARCH, GUM, &c.

[C.S.] 10,216 (1906). Kantorowicz. Manufacture of starch. Dec. 19.

XVII.—BREWING, WINES, SPIRITS, &c.

[A.] 27,807. Radcliffe. Moisture evaporating and drying machinery for desiccating yeast and other substances. Dec. 6.

,, 28,108. Effront. Method of utilising nitrogen contained in distillers' washes.* Dec. 10.

,, 28,261. Nathan. Process for treating brewing vessels. [Ger. Appl., Dec. 29, 1905.]* Dec. 11.

,, 28,695. Paul and Remington. Food or stimulant for yeast.* Dec. 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 27,514. Sefton-Jones (Meyer). Manufacture of food products.* Dec. 3.

,, 27,744. Bielschowsky. Converting cereal-meal gluten into a colloidal condition.* Dec. 5.

,, 28,424. Stahel. Preservation of food. [Swiss Appl., March 14, 1906.]* Dec. 13.

[C.S.] 715 (1906). Sichler. *See under* XXIII.

(*B.*)—Sanitation; Water Purification.

[A.] 28,047. Hird. Treatment of sewage sludge or other organic waste or refuse. Dec. 8.

,, 28,585. Boult (Bohon). Purification of sewage.* Dec. 14.

,, 28,653. Grossmann. Eliminating calcium sulphate from waters, trade effluents, and solutions. Dec. 15.

[C.S.] 6011 (1906). Breda. Apparatus for purifying water. Dec. 12.

,, 6373 (1906). Liebl. Preparing drinking water from sea water. Dec. 19.

XIX.—PAPER, PASTEBOARD, &c.

[A.] 27,586. Dickson and James. Manufacture of celluloid. Dec. 4.

,, 27,788. Bayer, and Passauer Mechan. Papierfabrik. Marbling paper.* Dec. 6.

,, 28,382. Sefton-Jones (Berti). Manufacture of paper and apparatus therefor.* Dec. 12.

[C.S.] 25,537 (1905). British Algin Co., Ingham and Bunzl. *See under* V.

,, 3013 (1906). De Briailles. Manufacture of artificial cork. Dec. 19.

,, 1732 (1906). Morris, Smith, and Bawtree. *See under* XIIIA.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

[A.] 27,458. Johnson. Manufacture of camphenes, camphor, and isoborneol. Dec. 3.

,, 28,147. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of tertiary butylxylene or tertiary butyltoluene. Dec. 10.

[C.S.] 12,630 (1906). Ellis (Chem. Fabr. von Heyden A.-G.). Manufacture of isobornyl esters. Dec. 19.

,, 19,961 (1906). Basler Chemischer Fabrik. Manufacture of isobornyl oxalates. Dec. 19.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 28,067. Browne. Printing and developing photographs on silver chloride paper. Dec. 10.

XXII.—EXPLOSIVES, MATCHES, &c.

[A.] 28,053. King's Norton Metal Co., Bayliss, Smith, and Brownsdon. Preparation of explosives. Dec. 10.

XXIII. GENERAL ANALYTICAL CHEMISTRY.

[A.] 28,187. Ward. Automatic apparatus for determining and recording the percentage of carbon dioxide in combustion gases of boiler flues, &c. Dec. 11.

[C.S.] 26,073 (1905). Rawson. *See under* X.

,, 715 (1906). Sichler. Alkali butyrometric process for determining the percentage of fat in milk and other dairy produce. Dec. 12.

Official Notices.

JAMESTOWN EXPOSITION: SPECIAL ALCOHOL EXHIBIT.

An exposition is to be held at Jamestown, Va., U.S.A., from April 26th to Nov. 30th, 1907, to celebrate the 300th anniversary of the first English settlement on North American soil. A special feature will be an exhibit of the various apparatuses, machines, and appliances by which the heat, light, and power which can be obtained from alcohol may be utilised for domestic, agricultural, and manufacturing purposes, and also of the articles of manufacture into which alcohol enters as a component or factor. The exhibit will be under the superintendence of Prof. Charles E. Munroe, of George Washington University, to whom all applications for space should be addressed.

SECRET COMMISSIONS AND BRIBERY PREVENTION LEAGUE.

A league for the prevention of secret commissions and bribery has been formed under the auspices of the London Chamber of Commerce. Among the objects of the League are to expose flagrant cases of bribery, corruption, and blackmail, and, if necessary, to take steps to prosecute; and also to assist its members and subscribers in any action which may be considered by the Council necessary to recover secret commissions paid or received. All communications should be addressed to the Secretary, Mr. A. E. W. Gwyn, 58, Coleman Street, London, E.C.

Deaths.

Bernays, Joseph, 1/o 96, Newgate Street, London, E.C. Dec. 24.

Blass, Edward, Essen (Ruhr), Germany.

Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A. Nov. 26.

Potts, Jos. T., Price's Patent Candle Co., Bromborough Pool, Dec. 11.

Canadian Section.

Meeting held at Toronto, on Thursday, October 25, 1906.

PROF. W. H. ELLIS IN THE CHAIR.

A PAPER on "Industrial Alcohol and its Uses" was read by Dr. W. P. COHOE, and a number of the members took part in the discussion thereon.

Sir WILLIAM PERKIN, who was the guest of the evening, was then introduced by the Chairman, and gave the meeting an account of his discovery of mauve in 1856, and of the obstacles which had to be overcome before it could be produced on a manufacturing scale (see this J., 1906, 759). (See also pages 1207–8.)

THE DETERIORATING EFFECT OF "ACID PICKLE" ON STEEL RODS, AND THEIR PARTIAL RESTORATION ON "BAKING."

BY HERBERT A. BAKER AND W. B. LANG.

IT is the universal practice in wire manufacture to "pickle" the steel rods in order to remove the black scale of oxide before drawing them into wire. This has long been known to deteriorate the quality of the rods, but it has been found that, if the rods are "baked" at 250° F. for some hours after this treatment, they are in a great measure restored, and can then be drawn into wire. The following physical tests were made in order to find out quantitatively the amount of such deterioration and subsequent restoration of the rods. The work was done on samples taken in the different stages of the process of manufacture at the Imperial Steel and Wire Company's plant at Collingwood, Ontario, at the suggestion of the manager, Mr. J. A. Currie. Samples of three different coils of rods were taken in the following stages:—(1) Before treatment with acid; (2) after acid cleaning; (3) after rusting; (4) after lime coating; (5) after baking. Table I. shows the tensile strength, percentage elongation over 8 ins., and percentage contraction of the rods; the strength of the bath, time immersed, and time of baking are also given:—

TABLE I.

	Strength in lb. per sq. in.			Elongation over 8 ins			Percentage contraction.		
Rod	A	B	C	A	B	C	A	B	C
				per cent	per cent	per cent.	per cent.	per cent.	per cent.
Before treatment	65,700	59,700	69,100	16	13	12	63	66	67
After acid cleaning	61,400	59,700	64,200	16	13	13	38	44	47
„ rusting	62,800	57,000	64,700	17	14	11	38	47	44
„ lime coating	65,700	59,700	67,000	16	14	—	37	47	41
„ baking	65,700	58,000	67,600	16	13	—	57	66	56

The strengths of acid used, at 100° C., were: A, 38 per cent; B, 11 per cent.; and C, 10 per cent.; and the times of immersion in the baths: A, 1 hr.; B, 45 mins.; C, 1 hr 10 mins. All the rods remained in the "baker" for about 4 hours.

The tests were made with a Riehlé machine, by the kind permission and with the assistance of the staff in the Engineering Department, University of Toronto. It may be observed that the ultimate strength remains throughout the process as constant as can be expected of that kind of test. The percentage elongation over 8 ins. rather unexpectedly remains constant, but the sudden drop in the ability to contract to a small "neck," before breaking, occurs immediately after acid treatment, and remains practically constant until after "baking," when a marked recovery in this property occurs, the three rods agreeing well in this behaviour. It is important to note that on this property of "necking in," or contracting in area on stretching, depends the property of drawing well through the die, which is a conical hole in a block of tungsten steel.

This deterioration and recovery at the same stages in the process is also well shown in the following bending tests, which corroborate the contraction tests:—

TABLE II.

Bending tests on the rods.

	Before treatment.	After acid cleaning.	After rusting.	After lime coating.	After baking.
Rod A.	100	70	64	64	100
„ B.	100	60	56	57	99
„ C.	100	71	55	53	100

These figures are relative, of course, and express the ability to bend a certain number of times through a definite angle before breaking. They are the result of averaging eight or ten tests in each case. The highest

number was taken as 100, and the rest calculated proportionately. The results show a break in the bending properties of the rod immediately after acid treatment, and a recovery after "baking," thus corresponding to the effect on the rods as indicated by the contraction tests.

Shearing tests were also made, but the differences were so small that no conclusions could be drawn from them.

An examination of the wires of different diameters drawn from these rods (correspondingly marked A, B, C) was also made in the same manner:—

TABLE III.

Tensile strength and percentage contraction of wires.

1. *Tensile strength.*

		Wires A.	Wires B.	Wires C.
	Diam. in.	lb. per sq. in.	lb. per sq. in	lb. per sq. in
(*a*)	0·175	72,900	93,700	93,700
(*b*)	0·142	112,600	113,600	113,900
(*c*)	0·112	117,300	122,400	122,400
(*d*)	0·091	—	138,400	131,000
(*e*)	0·072	137,000	150,000	150,000

2. *Percentage contraction.*

		per cent.	per cent.	per cent.
(*a*)	0·175	52·0	54	47
(*b*)	0·142	45·0	38	36
(*c*)	0·112	28·5	31	32
(*d*)	0·091	—	36	33
(*e*)	0·072	20·0	37	30

It will be observed that wires B and C have a higher tensile strength than wire A. Incidentally the increase of tensile strength on drawing out will be observed. The fall in contraction area percentage, as the diameter of the wires tested decreases, is not so great in B and C as it is in A. This means that these wires could probably be drawn through two more dies before annealing would be necessary, while wire A would, in all likelihood, stand no more drawing. Thus B and C appear to be the better wires. The only difference in the treatment of the rods was that rod A was cleaned in 38 per cent. sulphuric acid, while rods B and C were cleaned in 10 per cent. acid. They were all "baked" about four hours—longer than usual—and are probably restored as much as possible. The results indicate that strong acid causes an unnecessary amount of deterioration in the rod, and that only weaker acid should be employed.

Table IV. gives the comparative bending abilities of the wires: this also would indicate that wires B and C are the better.

TABLE IV.

Bending tests on the wires.

		Wire A.	Wire B.	Wire C.
	Diam. in.			
(*a*)	0·175	91	100	100
(*b*)	0·142	90	97	100
(*c*)	0·112	89	100	83
(*d*)	0·091	—	100	80
(*e*)	0·072	86	100	94

Many superintendents of plants have attributed the deterioration to the presence of sulphur, knowing that sulphur renders steel "cold short." This appears to the authors to be highly improbable, as careful analyses show no difference in the sulphur content, which was 0·051 per cent. both before and after treatment. It seems much more probable that a "hydride" of iron is formed, as has often been suggested. Several tests confirmatory of this idea were obtained, but not sufficiently conclusive for present publication. The investigation is being continued.

London Section.

Meeting held at Burlington House, on Monday, November 5, 1906.

MR. R. J. FRISWELL IN THE CHAIR.

The CHAIRMAN announced that the Committee had elected Dr. Lewkowitsch to the position of Vice-Chairman.

Before calling on Sir William Ramsay to give his discourse he had, at the request of the Committee, to appeal to the members to endeavour to increase the membership of the London Section.

THE ADVANTAGES OF INVESTIGATING THE UNLIKELY.

BY SIR WILLIAM RAMSAY, K.C.B., F.R.S.

I have been asked to give an address to the members of the London Section to-night—I will not call it a paper. One of the luxuries in which I can only too seldom indulge is to say something not for publication, and you have gratified my wish in this. But you have laid on me the injunction to talk to the members of the Section from my personal experience; and this must excuse my egotism. For you will have noticed, gentlemen, the already too frequent use of the first personal pronoun singular.

"De minimis non curat—lex." I suppose this is true: lawyers say so. What I am here to do is to try to convince you that science and industry *should* attend to trifles. It is possible, I suppose, in real life to judge what are trifles and what are not; I am not convinced that it always is. But in science it is not so easy. And yet—a man who studies the markings on a butterfly's wing, or counts the bristles on the antennæ of a bee surely cannot be doing anything very important; but I am judging of a science not ours, and of one of which I know next to nothing. Such markings, however, may have led a Darwin or a Wallace to propound the theory of natural selection; and the bristles may be the organs of a sense unknown to us by means of which the bee gains impressions from some form of radiant energy incapable of impressing our grosser or differing sense-organs. No, I fancy there are no negligibles in Nature.

> "Flower in the crannied wall,
> I pluck you out of the crannies,
> Hold you here, root and all in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is."

It would be easy to illustrate this theme by instances taken from the work of others: work which in its final form has revolutionised science and industry. I should like to quote the much-quoted instance of Faraday, when he withdrew a magnet out of a coil of wire, and observed that a current flowed during the withdrawal. Think what that simple experiment has taught us of the nature and method of the action of electricity, and of its relationship to magnetic strain; and think too of the wonderful development of this simple deed: how myriads of dynamos are transmitting energy over thousands of miles of wire—energy which furnishes us with light, with power, and which may some day be utilised for distributing heat over our cities!

No tale about my own attempts can compare in interest with such a fairy tale of science; but I shall obey the Chairman's behest and tell you what there is to tell.

(The author then gave a sketch of the discovery of argon, helium, neon, krypton, and xenon, and of the spontaneous change of the emanation from radium into helium; these subjects are treated in full in "Gases of the Atmosphere," 2nd Ed., Macmillan & Co., 1905.)

The lecturer concluded as follows:

These, gentlemen, are the results of some of my investi-

gations of the "unlikely." It was improbable that air should be found to contain five overlooked elements; and perhaps still more improbable that a new gas should be evolved in quantity on heating certain well-known minerals. The acme of unlikeliness was, however, reached when it was proved that a gas, continuously being evolved from compounds of radium, itself spontaneously changed partially into helium. It suggests that it is worth while looking for similar changes in other forms of matter, and points towards universal "degradation" of the elements to the lowest members of their periodic columns. I have been engaged in that research for about two years.

As to the advantages of such investigations, it is hardly necessary to expound them to an audience such as this. First of all, it satisfies the curiosity which all members of the human race possess, or at least should possess—the curiosity to taste of the tree of knowledge. Next, it correlates knowledge; by supplying missing links, it increases the value of what is known; and lastly, it shows that more is sometimes gained by speculative chemistry—trying for results against long odds than in slowly and laboriously accumulating results which could have been foretold.

Dr. DIVERS expressed the opinion that Sir William Ramsay's lecture would be valuable in print in order to place it in the hands of those aspiring to success in chemical research, as an illustration of its methods.

Following some general remarks, Mr. TYRER said, "If we cannot believe a little bit in what we do not see, it is perfectly certain we shall not get very much out of what we may see."

Mr. LEON GASTER pointed out that the neon vacuum tube shown had been made use of by Prof. Fleming in his Cantor Lectures. It could be used as a very sensitive detector of the distribution of potential of stationary waves, by the variation of its glow. When moved in space and brought next to anode of potential, it did not glow, but when held near a loop of potential it glowed brightly. With the aid of the neon tube, the practical application of the cymometer (wave meter) for measurement of long electric waves was demonstrated. This was an instance to show how the unexpected might turn out to be very useful.

Mr. J. C. RICHARDSON asked if Sir William Ramsay could say anything about the later discoveries of Professor Rutherford's with regard to the absorption of the rarer gases by means of cocoa-nut charcoal. There was a letter from Sir James Dewar in "Nature" recently, and the previous week from Professor Rutherford, from which it appeared that the radio-active material from radium was absorbed by cocoanut charcoal.

The CHAIRMAN said some 30 years ago he was assistant to Sir Norman Lockyer, and had many times observed the D 3 line in the chromosphere of the sun. For a long time they were unsuccessfully engaged in endeavouring to discover helium in various minerals, amongst others in the Lenarto meteorite which fell in Sicily about the year 1860. This lecture has shown how the unsuccessful attempts of older workers are gradually corrected, and presently out of apparent chaos order ensues. With regard to the question of the investigation of the unlikely technologists may learn a great deal, because they are continually meeting with small difficulties which, in the hurry of manufacturing operations, are put aside, but all of which more or less deserve investigation. Sometimes, of course, these matters are investigated. The successful working of Lightfoot's black was traced to the aniline salts used on copper rollers for printing on the cloth, entering into the reaction and causing the production of that colouring matter, the most permanent cotton black known until the last few years. Again, within recent years there was the dispute about the preparation of rhodamine, when it turned out that one of the reasons for the success of a particular patented process was because the material of the autoclave neutralised the hydrochloric acid of the so-called anisoline hydrochloride and allowed the methylation to take place. When an enamelled autoclave was used the reaction failed. That explained a direct conflict of evidence on the part of distinguished investigators before a court of justice.

Sir WILLIAM RAMSAY said if it had not been for Dr. Travers and his efficient aid, he thought the last part of the work would not have been done so satisfactorily as it was. After all, the most important discovery—scientific or technical—is to discover an efficient assistant.

All the gases of the atmosphere are absorbed in charcoal, helium least and xenon most. Of course the emanation will also be absorbed, being an easily condensible gas; as Sir James Dewar had pointed out, it ought to be as absorbable as carbon dioxide. Their boiling points do not differ very much. It is curious that Professor Rutherford should have written what he did; it was obviously an oversight. There was no reason why these gases should not condense, and as a matter of fact they all did do so; helium less easily than hydrogen, being more volatile. The condensation of helium is very slight, but neon is fairly easily condensed; indeed this gas remains in the charcoal at atmospheric temperature to a considerable extent, and requires a high temperature before it can all be pumped out. Of course with increase of atomic weight, and consequent increase of density, the absorption by charcoal becomes greater and greater. He should be quite prepared to hear that the emanation could be easily absorbed and retained by charcoal, so that by leaving air containing the emanation over charcoal, it is as certain that the emanation would be absorbed as it is that carbon dioxide would be absorbed under similar circumstances.

In conclusion he should like to elaborate his last sentence a little. "We are a sporting race. There are two ways of working. You can either do what is already done—you can earn your daily bread, get in your money, save it and do a day's work in a day, and so be content. Or you can speculate. These two courses have their analogies in chemistry. You can either follow the regular routine and prepare organic compounds, each new one of which is so like the last that its properties and behaviour can be predicted. Occasionally an interesting compound turns up; interesting because it differs from what might have been expected. Though there are some giants, for example, Prof. Emil Fischer of Berlin, the average man is content to do little bits of work of this nature and is quite happy. On the other hand, it is possible to give a hostage to fortune, as it were—to try something that is not very probable. Some people like to do ordinary routine work: some, on the contrary, like to tempt Providence. I am one of those who prefer the latter course, and I venture to think that Providence has recompensed me to some extent."

Meeting held at Burlington House, on Monday, Dec. 3, 1906.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE DIRECT ESTIMATION OF ANTIMONY.

BY HERBERT W. ROWELL.

The extensive use of antimony alloys makes their analysis a matter of importance to the chemist and metallurgist, and any improvement upon the tedious separation of antimony by the gravimetric process is worthy of consideration. The method to be described, which depends upon the oxidation of antimonious to antimonic chloride by potassium bromate in hydrochloric acid solution, according to the equation

$$KBrO_3 + 3SbCl_3 + 6HCl = 3SbCl_5 + KBr + 3H_2O$$

was first suggested by Győry and modified by Nissenson and Siedler (Chem.-Zeit., 1903, **27**, 749; this J., 1903, 967) for testing hard leads. After many trials their process was modified to the method following:—

The sample to be tested should be in as fine a state of division as possible. Samples of alloys should, if possible, first be cast into thin, narrow bars, so that they may solidify with a minimum amount of "piping," for large ingots, slowly solidified, give a "piping" which often differs considerably from the rest of the ingot. Alloys

are conveniently sampled with a fine hack-saw, and the sawings rejected which do not pass a 30-mesh sieve.

Samples of antimonial lead.	Taken from	Antimony.
		per cent.
Small bar quickly solidified	Outside of bar	10·80
" " " "	"Piping" (very slight)	10·80
1 cwt. bar slowly solidified	Outside of bar	7·50
" " " "	"Piping"	7·79
Small bar filed completely	Filings through 60 mesh sieve	7·89
" " " "	Filings through 30 and on 60 mesh	7·89
" " " "	Filings left on 30 mesh	7·89
Alloy Z in sawings from thin bar	Sawings through 30 mesh	9·42
Alloy Z in sawings from thin bar	Sawings left on 30 mesh	9·42

Standard arsenious chloride solution.—0·8236 grm. of pure powdered arsenious oxide, dried carefully at 100° C., is weighed into a 500 c.c. graduated flask. About 5 c.c. of 10 per cent. sodium hydroxide solution are added, and the flask shaken and gently warmed until the arsenic is completely dissolved; 5 c.c. of strong hydrochloric acid are added and the solution made up to the mark with water. Fifty c.c. of this solution, equivalent to 0·10 grm. of antimony, are measured off with a pipette, the delivery of which has been checked against the 500 c.c. flask. A solution made in this way and kept in a well-stoppered bottle remains unchanged for a fortnight without oxidation.

The indicator.—0·1 grm. of pure methyl orange is dissolved in 100 c.c. of hot water. Drops of this indicator should be taken out with a tube to avoid the stain left about the neck of the bottle, as this or an old solution is liable to leave a stain and spoil the sharp finish. Methyl Blue and other methyl colours stable in hydrochloric acid generally stain the solution, while indigo turns green toward the finish, and the end is not so easily distinguished as with methyl orange. More of a solution of indigo is also required to produce a sufficient colour, which makes the test a trifle higher.

The standard potassium bromate solution is approximately *N*/20, and is made by dissolving 1·41 grms. of the "pure" salt in 1 litre of water. The theoretical quantity is 1·3926 grms. per litre, but the "pure" salt always contains bromide, which, however, makes no difference to the test. To standardise the solution, 20 c.c. of strong hydrochloride acid are added to 50 c.c. of the standard arsenic solution, and the mixture just brought to the boil. Thirty c.c. of the bromate solution are then added, and the titration is finished in exactly the same way as in the method below, observing all the precautions. The solution should be standardised every week, as it loses value at the rate of about 2·5 c.c. per litre per week.

A one-fifth normal solution may be used for titrating larger quantities of antimony.

Bromine solution.—Thirty-five c.c. of pure bromine, thoroughly shaken up with 250 c.c. of strong hydrochloric acid, makes a saturated solution, and leaves excess of bromine. The required quantity is conveniently measured by dipping in a pipette without any stem below the bulb and so allowing it to fill.

Method of analysis.—One grm. of ore or alloy, containing not more than 0·15 grm. of antimony, is weighed off into a 500 c.c. Bohemian beaker. These quantities may be varied, providing that more of the substance can be conveniently dissolved, and that the amount of standard bromate solution required is within the compass of the burette used. To the sample, 25 c.c. of concentrated hydrochloric acid and 5 c.c. of the saturated solution of bromine in hydrochloric acid are added; the covered beaker is then placed on a warm iron plate, so that the temperature is not high enough to drive off the bromine before complete solution is effected, and occasionally shaken until complete solution takes place.

Antimony oxides, and precipitates of mixed oxides of antimony and tin which do not dissolve readily in this way, may be fused with eight times their weight of caustic soda in a silver crucible at a dull red heat, till the mass turns yellowish-green. The fused mass is dissolved in as little water as possible, and transferred to a 500 c.c. beaker, and the solution acidified with hydrochloric acid and evaporated down to 10 c.c., when 20 c.c. of hydrochloric acid are added. To reduce the antimony, 3 or 4 grms. of fresh sodium sulphite crystals are added, the cover and sides of the beaker lightly rinsed down with water, and the liquid evaporated, with the cover on, to 10 c.c., or a little less if possible. Although there seems to be little risk of the antimony oxidising during the evaporation, the cover is better kept on, as it retards the evaporation very little, and often saves a test when it, or one near to it, spirts through evaporating too far.

Sodium sulphite is better than sulphurous acid for effecting the reduction, as it raises the boiling point considerably towards the finish, and ensures complete volatilisation of the arsenic. If more than 2 or 3 per cent. of arsenic is present, 20 c.c. of strong hydrochloric acid and 5 c.c. of saturated sulphurous acid are added, and the liquid boiled down again.

To the concentrated solution, 20 c.c. of strong hydrochloric acid and 40 c.c. of hot water are added, the cover and sides of the beaker are rinsed, and the whole is boiled for one minute to remove traces of sulphurous acid. The standard solution of potassium bromate is now run in to within a few c.c. of the necessary amount, with constant and thorough stirring, and at the rate of 30 c.c. at most every 50 seconds. If lead chloride begins to crystallise, the solution must be boiled again, but otherwise two drops of Methyl Orange solution are added, and bromate run in drop by drop till the colour of the indicator is destroyed. The solution should be at a minimum temperature of 60°C., and should be kept thoroughly stirred during the titration so that a local excess of bromate never forms, otherwise some of its value is lost before attacking the antimony. The result is calculated from the equation

$$\frac{(\text{c.c. of bromate required by 1 grm. sample—blank})\,10}{\text{c.c. of bromate required by 50 c.c. of arsenic solution.}} = \%\ \text{Sb}$$

A blank test should be made occasionally in exactly the same way as above, omitting the sample, and the result—which should not exceed 0·2 c.c.—subtracted from each test.

Possible sources of error.—The most probable sources of error are the incomplete removal of arsenic or sulphur dioxide.

Oxidation need not be feared if the cover is kept on. The liquid must not be allowed to evaporate to dryness, as antimonious chloride begins to volatilise at about 195°C., and boils at 220°C.

Lead, zinc, tin, silver, chromium, and sulphuric acid have no effect upon the test, but large quantities of calcium and ammonium salts tend to make the result too high.

Iron tends to make the results high, but not in as great a ratio as copper. Iron is very slightly reduced by sulphurous acid in a strong hydrochloric acid solution, and if, before adding the sodium sulphite to a test, it is boiled down to as small a volume as possible and made up again with cold, strong hydrochloric acid, the effect of iron is almost destroyed. With this precaution, 1 per cent. of iron raises the test about 0·02 per cent., while 5 per cent. has very little more effect.

The effect of copper.—Copper is partially reduced by sulphurous acid in a strong hydrochloric acid solution, and, under the conditions of the method given, raises the test in a fairly constant ratio as shown by the following figures:—

	Grm. Sb
0·001 grm. copper as cupric chloride in a blank test	= 0·0001
0·005 " " " " "	= 0·0005
0·010 " " " " "	= 0·0012

Alloy Z	9·42	% Sb.
+0·1 % of copper as cupric chloride	9·45	"
+0·3 " " " "	9·48	"
+0·5 " " " "	9·51	"
+0·8 " " " "	9·51	"
+0·9 " " " "	9·55	"
+1·0 " " " "	9·55	"
+2·0 " " " "	9·75	"
+5·0 " " " "	10·37	"

The quickest and most satisfactory method of obviating the effect of copper is to dissolve the substance in 15 c.c. of nitric acid 1:2, evaporate just to dryness, and boil for a few minutes with 50 c.c. of 1 per cent. nitric acid; allow to settle and pour off the liquid through a fine filter. Add 30 c.c. of 5 per cent. solution of ammonium nitrate, boil again, and transfer all the precipitate to the filter, wash two or three times with a hot 5 per cent. solution of ammonium nitrate, and dry the filter and precipitate. Separate the latter from the filter and fuse it and the filter ash together as directed above. Alloy Z contained 9·42 per cent. of antimony; when 5 per cent. of copper was added and separated as above two determinations gave percentages of 9·40 and 9·37.

Perhaps as exact a way when the copper amounts to about 1 per cent. is to subtract 0·012 per cent. of antimony for every 0·1 per cent. of copper, the copper being estimated by a separate colorimetric test.

The efficiency of the method.—An estimation of antimony in an antimonial lead can be carried out in one hour from the time of weighing. Over 200 estimations have been made in connection with this paper, and the following typical examples show the accuracy of the method:—

	Per cent.
Alloy Z—	
(Commercial lead and antimony), highest test (one)	9·45
(Commercial lead and antimony), lowest test (two)	9·39
(Commercial lead and antimony), average of 22 tests	9·42
Average of four tests, gravimetric, weighed as Sb_2S_3	9·37
Alloy A—	
(Lead, arsenic, antimony), four tests, bromate method	8·65
(Lead, arsenic, antimony), two tests, gravimetric as Sb_2S_3	8·70
Specimen of well-formed stibnite (traces Fe and As)	71·20, 71·35
,, prepared Sb_2S_3	71·40, 71·35
Theoretical value of Sb_2S_3	71·42

Discussion.

Mr. Benedict Kitto said most people had experienced difficulty in getting exact results in the analysis of antimony alloys and ores, further, most of the processes in use were long and tedious, and required great care. He should have much interest in trying the author's process. If it was possible to carry out an antimony assay in an hour or an hour and a half with accuracy, it would be a great advantage.

Mr. T. C. Cloud said this paper was of value, inasmuch as a rapid method of determining antimony in lead was described, which, to mineralogists interested in lead, was a great consideration. If it was possible to make an estimation in one and a half hours or even two hours, lead chemists would be extremely gratified. He was sure many of them would try the process and see if it was really all the author claimed for it.

Mr. A. Philip said that since 1889 he had used the process first devised by Herroun in 1885 for the volumetric determination of antimony. This consisted in dissolving the alloy in hydrochloric acid with potassium chlorate, and, after removing all free chlorine, adding potassium iodide and titrating with thiosulphate as in the iodide process for copper. An allowance for any copper present was made by determining that metal colorimetrically. The presence of iron, however, seriously interfered. The method adopted for sampling the alloy was similar to that described by the author, a hack saw being used to obtain finely divided particles, but in order to obtain homogeneous samples, the alloy as received was melted under paraffin wax or heavy petroleum oil, and then cooled suddenly by pouring on to a large slab of iron. In ordinary work the time taken for making a determination by Herroun's process was longer than that which the author claimed for the process he described, but, including the correction for copper, it was certainly under two hours. It was not clear whether the time of one hour stated to be necessary for the new process included the time required for the removal of the copper and iron. The limits of accuracy in the new process also appeared to be higher than in the Herroun's process, in which, under usual laboratory conditions, an accuracy of about 0·2 to 0·3 per cent. on an alloy of about 10 to 12 per cent. antimony was readily obtainable. This lower degree of accuracy was, however, quite satisfactory for practical purposes when dealing with commercial white metals and anti-friction alloys.

Mr. T. B. McGhie referred to the iodine process recently devised by Dr. John Clark. There was no doubt that method was susceptible of great accuracy, and at the same time was very speedy. The ordinary impurities which occurred in type-metal alloys and anti-friction metals appeared to exercise very little prejudicial effect on the author's process, and he thought it very remarkable that copper should have so slight an influence.

Mr. W. F. Reid said he did not understand why the samples were sifted. He would have thought that the finer and coarse portions had different compositions. He had met that difficulty himself, and found a good way was to use a number of fret saws fixed side by side. The filings so obtained were practically identical in size and of similar composition.

Mr. A. C. Chapman referred to a method recently described for the separation of arsenic from antimony and some other metals by driving it off as methyl arsenious ester; good results were said to be obtained. He would suggest that the author should try if it would suffice to remove 1 to 3 per cent. of arsenic from antimony and tin, as, if so, it might shorten his process to some extent.

Mr. Rowell, in reply, said the samples should be in a fine state of division so as to rapidly effect solution; if the particles were large, considerable time was occupied in dissolving them, which had to be done at a low temperature. He had found the same fault as Mr. Reid with some alloys. On the average, the sawings through a 30-inch sieve never varied from those left on the sieve, but those through a 60-inch mesh might vary if there was a "piping" in the sample. That was why the 30-inch sieve was used, which was as large as was compatible with speed. The effect of the iron was greater when reduction took place in more dilute solutions. If 2 to 3 per cent. of arsenic were present, it was necessary to boil down with a little more sulphurous acid, which might take another 15 or 20 minutes. He tried every other method before settling on this process, including modifications of the iodine process, and could never get satisfactory results. The extreme difficulty of estimating antimony gravimetrically was generally admitted. There were many chances of losing antimony and for including other elements in the final precipitate. There was possible loss of antimony oxide soluble in the nitric acid solutions, and antimony sulphide soluble in sulphuretted hydrogen solutions; there was possible incomplete separation of tin and arsenic and incomplete separation of lead and copper soluble in alkaline sulphantimonate solutions, and in cases where the sulphide was converted into the trioxide, sulphur was invariably included. He frequently met with differences of 1 to 1½ per cent. on the same sample tested by several different chemists. The method he had described was not free from difficulty, but he believed it would be found to be a great deal better than any other in use. In the hands of an ordinary laboratory assistant the analyses ought to be within 0·1 per cent. of the correct result.

THE STANDARDISATION OF DISINFECTANTS.

BY M. WYNTER BLYTH, B.A. (CANTAB.), B.SC. (LOND.), F.I.C.

It is difficult to arrive at any just or even approximate estimate of the amount of chemical disinfectants used in this or any other country. Some slight idea of what vast

quantities must be consumed in the course of each year may be gathered from the fact that, as calculated from statistics kindly supplied to me by medical officers of health, a low estimate would place the amount used for municipal work in English towns in the engineers' departments alone at 10 galls. of liquid disinfectants and 300 lb. of solid disinfectants per 1,000 people; by adding to this the quantities used by Government Departments, hospitals, public and private institutions and by private individuals, one can readily realise that the production, distribution, and application of disinfectants must concern a large industry.

Whether the free use of disinfectants could largely and with advantage be dispensed with, is a question which does not come into the scope of this paper. There is, however, no doubt that the judicious use of good chemical disinfectants is a great and valuable means of fighting disease, while on the other hand the use of worthless disinfectants is a public danger. On this account it is essential that we should have a reliable method for estimating the value of all substances used as germicides.

In the course of time the substances used as disinfectants have tended to become more and more complicated. Chemists have vied with one another in attempting to mix the most varied substances in the hope of producing the perfect disinfectant, until a point has been reached where the analytical chemist finds himself practically defeated and unable to determine, in many cases, the constituent parts of the mixture—and it avails him little in those cases where he is successful, for the germicidal properties of a mixed disinfectant depend quite as much on the method of mixing as on the substances mixed. Chemical analysis is, therefore, in the majority of cases out of the question, and is in no way necessary, since as disinfectants are intended for the destruction of the germs of specific diseases, it has long been recognised that the only satisfactory method of judging the value of a substance which is to be used for this purpose is by measuring the actual quantity that is required to kill some given organism under certain fixed conditions. It must be clearly understood that in this paper I am only dealing with disinfectants as germicides, and that the question of the standardisation of disinfectants as germicides has nothing whatever to do with poisonous, oxidising, deodorising or any other property.

Bacteriologists have in the past determined the actions of a variety of disinfectants on a great variety of micro-organisms, but owing to the use by different observers of different methods, different organisms, and different standards of comparison, the most extraordinary discrepancies as to the relative values of disinfectants may be found in the literature on the subject. To take a concrete example of the different estimates which may be formed of a disinfectant by competent observers, let me quote the case of the disinfectant I will call "A." One observer says "a dilution of 1:150 acting for five minutes on *B. coli* kills the organisms, while 1:20 carbolic is required to kill the same *B. coli* with certainty." These results indicate that "A" is about 7·5 times more efficient than is phenol, or, to put the matter in the modern form, "A" has a carbolic acid coefficient of 7·5. Another observer finds that a dilution of 1:1000 of the same disinfectant, "A," kills *B. typhosus* in 10 minutes, while 1:200 phenol is required to kill the same organism in the same time. These results are equivalent to a co-efficient of about 40. Yet another observer, experimenting with typhoid excreta, gives results which would appear to place the coefficient of this disinfectant at from 60 to 30, according to the time of contact. More recently the coefficient of "A," as determined by the drop method using *B. prodigiosus*, has been placed at only 0·2. I myself have found working by the drop method with *B. coli*, a coefficient of 0·25. So there is a choice of from 0·2 to 60 for the value of a disinfectant, and these discrepancies cannot be wholly explained by the fact that *B. typhosus*, *coli*, and *prodigiosus* were used, since the resistance of these organisms to disinfectants, although not identical, is somewhat similar. They can, however, possibly be explained by the fact that the organisms were grown in different ways, and the methods of working were different in each case. Similar cases of widely different results may be found recorded for almost every well-known disinfectant. These discrepancies had long been apparent, and several suggestions were made from time to time as to more uniform methods of working; but it was left to Dr. S. Rideal and Mr. Ainslie Walker to make the first definite practical proposal as to a standard method of determining the efficiency of disinfectants.

Their method of working is as follows (J. Roy. San. Inst., **24** [111] Oct. 1903). "To 5 c.c. of a particular dilution of the disinfectant in sterilised water add five drops of a 24-hour blood-heat culture of the organism in broth; shake and take sub-cultures every 2½ minutes up to 15 minutes. Incubate these sub-cultures for at least 48 hours at 38° C." "The strength or efficiency of the disinfectant is expressed in multiples of carbolic acid performing the same work—*i.e.*, when we have obtained a dilution of the disfectant which does the same work as the standard carbolic acid dilution, we divide the former by the latter and so obtain a ratio which we call the carbolic acid coefficient." They further recommended a temperature during medication of from 15° to 18° C., and a reaction of + 15 for the standard broth

This method, as may be seen, is the familiar drop method used, I believe, first by Mr. A. Wynter Blyth for the examination of disinfectants (Roy. Soc. Proc., 1886, No. 240), with certain stringent and necessary precautions. Whatever may be thought of Rideal and Walker's method as a guide to the strength or efficiency of a disinfectant, they have undoubtedly given us a standard method of working which has been of the greatest value in the study of germicidal values.

As a result of Rideal and Walker's suggestion, the Council of the Royal Sanitary Institute appointed a committee to consider the desirability of establishing a standard bacteriological method for determining the efficiency of disinfectants. This committee, which consisted of a number of eminent men—but unfortunately no representative of the commercial side of the question—after having some experiments carried out, and considering the question, no doubt with great care, presented in April, 1906, the following report to the Council of that body.

1. "The Committee are of opinion that no one method of testing disinfectants can indicate their relative values under every possible condition. These must be specially determined for the given case required, and where penetration is important a 'Thread method' is indicated."

2. "For general purposes, on account of its simplicity of working, the Committee recommend the 'Drop method,' as described in the J. of the Roy. San. Inst., Vol. XXIV. (1903), page 424."

"The test to be carried out with pure broth cultures of the *B. typhosus*, using sterilised distilled water as the diluent of the disinfectant."

"All nutrient broth to have a constant reaction of +15."

"Where special conditions exist, which may intertere with the activity of the disinfectant, the consumer should be advised to call for the same conditions to be embodied in the test."

This report was adopted by the Council of the Royal Sanitary Institute, but almost immediately withdrawn, and the Committee have since then been silent. I should have passed over this abortive report, but that it has had an important effect on the question of the standardisation of disinfectants. Whether the report should ever have appeared in the public press is not a question I am prepared to answer, but as a fact it was published in the "Lancet" and other journals, and has given more or less an official sanction to the Rideal-Walker method of testing and expressing the efficiency of disinfectants. This report, and the publicity which has been given to the question by papers in scientific journals, and the free advertisement of carbolic acid coefficients, combined with the real need which is felt for some guarantee of the germicidal value of disinfectants, has resulted in the Rideal-Walker method being more or less generally accepted. The position to-day being that Government departments, municipal councils, and other large bodies are contracting for disinfectants on the Rideal-Walker coefficient, while manufacturers are vieing with one

another in their endeavours to raise their coefficients to the highest possible limits.

It must not be forgotten that a standard test should be one which will discriminate fairly not only between worthless articles and the moderately good and very good ones, but also between the many very good disinfectants at present on the market. Practically any bacteriological test carried out under similar conditions will distinguish between, for instance, the worthless mixtures so often sold as carbolic powder, and a really genuine carbolic powder; but it takes a method of great accuracy to distinguish between such high-class disinfectants, as, for instance, Izal, Cyllin, Kerol, Lysol, and similar substances. Messrs. Rideal and Walker, in proposing their standard test, evidently thought that they had at least the essentials of a method sufficiently reliable to distinguish between high-class disinfectants.

I propose in this paper first to consider a few factors which influence the germicidal value of a disinfectant as determined by the drop method, and then to criticise the Rideal-Walker method, and to make a few suggestions as to the direction in which I consider tests as to the germicidal value of disinfectants might be improved

Influence of organic matter.—It is a matter beyond dispute that in anything requiring disinfection, organic matter is always present, and in the vast majority of cases the quantity of organic matter is large, and, compared with the volume of the disinfectant, enormous. In considering the real efficiency of a disinfectant, the possible influence of organic matter cannot be neglected. The difficulty is to know what organic matters to select. In the experiments recorded here I have taken as typical organic matter to which disinfectants are likely to come in contact in practice: fæces, urine, and blood. I have also taken milk in order to compare the effects of this substance with that of the others. The possible number of organic substances with which a disinfectant may come in contact is very large, but I submit that fæces, urine, blood, and milk will at least give an idea as to whether organic matter is of sufficient importance to be taken into account when considering the efficiency of disinfectants. But little work has been done in the past on the influence of the presence of organic matter upon coal tar disinfectants, although the oxidising disinfectants have lately received considerable attention. Kenwood and Hewlett (J. Roy. San. Inst., Vol. 27, No. 1) took disinfectants of a uniform strength of 5 per cent., which were added directly to and thoroughly mixed with 25 c.c. of typhoid fæces and of urine, and, after half an hour's exposure, inoculations were made into a suitable medium (McConkey's bile salts medium in Durham's tubes, and Conradi plates). These were incubated up to three days at 40° to 42° C., and the carbolic acid coefficients obtained by treating standard phenol in the same manner. Carbolic acid coefficients of the disinfectants in tap water and in distilled water, without the organic matter, were also obtained. (See Table I.)

There are one or two important points which must be taken into consideration in comparing these results. 1st, the amount of organic matter is variable, more being present in the disinfectant solutions than in the control; this, as I shall show, would tend to make the real coefficients too low. Secondly, the use of tap water, as shown by Mr. T. H. Lloyd (this J., 1906, 405 *et seq.*) tends to make the co-efficients low, but the conditions being the same in the organic and water solution, this factor may be disregarded. The fact that in one case naturally occurring *B. coli* was used, and in the case of the tap water, *B. coli* incubated in broth for 24 hours, is a factor which cannot be neglected, for not only is the dosage different in the two cases, but my experience is that the varieties of *B. coli* as they exist in fæces vary somewhat widely as to their resistance to disinfectants. It is probable that this difference in resistance has an influence on the coefficient obtained; this is a point to which I wish to refer later The broad fact remains from these experiments, since these factors are not sufficiently serious to effect this conclusion, that fæces have the effect of enormously reducing the carbolic acid coefficient of the disinfectants examined. The objects of Kenwood and Hewlett's experiments, it should be mentioned, were in no way connected with the influence of organic matter as such, but were intended to demonstrate the values that are obtained for disinfectants when used under practical conditions.

Turning to the experiments carried out by Major Fowler (J. Roy. San. Inst., **27**, No. 1), working under the direction of Lieut.-Col. Firth and Prof. Macfadyean, we find five recorded as the coefficient of "Disinfectant No. 1" at 65° C. (one experiment only), and 8·55 as the coefficient of "Disinfectant No. 2" (one experiment only). These coefficients were obtained by adding various dilutions of the disinfectant to tubes which contained when diluted half their volume of a filtered mixture of 1 grm. of fresh human fæces and 100 c.c. of fresh human urine. The solid fæcal matter present in such a mixture would be extremely small, and the experiments are too few in number to deduce any definite conclusions; but as far as they go they confirm the fact that the presence of urine has not a great influence on the coefficient of the disinfectants examined.

TABLE I.—*Carbolic acid coefficients in unknown quantities of organic matter.* (*B. coli communis*)

	Kenwood and Hewlett.							Fowler.		Blyth.	
	Natural Coll.			Broth Coll.				Natural Coll		Broth Coll.	
	Temp. °C.	Fæces.	Urine	Temp. °C.	Tap water.	Temp. °C.	Distilled water.	Temp. °C.	Urine and a little fæces.	Temp. °C.	Distilled water.
Disinfectant No. 1	17	2·4	4·0	17	6·0	17	5·7	18	5·0	20	7·0
" No. 2	17	2·4	4·0	17	4·0	17	5·3	20	8·55	20	8·0

Somerville and Walker (The Sanitary Record, Vol. 38, No. 887, p. 485) record some experiments in which, in addition to urine, 1 per cent solutions of serum, mucin, peptone, casein and gelatin, were taken as types of different forms of organic matter, and it is suggested that the method can be utilised to classify disinfectants and to compare their germicidal value when encountering different forms of organic matter. With regard to the solutions of peptone and casein, they give us no clue to the influence that these substances *in their natural state* would have upon the germicidal value of disinfectants, as the authors have dissolved the substances in sodium carbonate. The experiments on serum and blood, in more or less their natural state, demonstrate admirably the uselessness of drawing any conclusions from the use of very small quantities of organic matter with disinfectants of Class D, since it could be inferred that 50 per cent. of serum or blood would render them absolutely useless as germicides—an inference which would be most unfair to the coal tar disinfectants.

In the experiments recorded here I have adopted a slightly different method from that recommended by Messrs. Rideal and Walker, the modification being 10 c.c. of the diluted disinfectant in distilled water, and six drops of standard broth culture incubated for 24 hours at blood heat. My only reason for using this modification being that I have results obtained by the method recommended

over several years. It gives results in distilled water almost identical with the Rideal-Walker values.

Germicidal values in water.—These were taken in distilled water at temperatures varying from 14° C. to 18° C., and were obtained with typical *B. coli communis* (Houston's "Flaginac"). The numbers recorded in the tables are the mean values of a large number of experiments, and indicate the volume to which the disinfectant has to be diluted with distilled water (or with the particular organic fluid) in order to kill the organism in 12½ minutes' contact, but not in 10 minutes.

Fæces.—A little water was added to normal fæces and the mixture ground up in a mortar to as homogeneous an emulsion as possible. Five grms. of this mixture (fæces-emulsion), or definite dilutions, were weighed into several corked test tubes. The total solids in five grms. of the emulsion were determined by drying at 100° C. The nitrogen was determined by Kjeldahl's method, and fat by extracting with ether. To the test tubes containing 5 grms. each of fæces emulsion or the diluted emulsion was added 5 c.c. of various dilutions of the disinfectant; the volume so obtained was considered to be equal to 10 c.c., and the dilutions have been calculated on this assumption. The mixture of the disinfectant and fæces, after thoroughly shaking, was allowed to stand at least one hour. Inoculations were then taken into nutrient broth, the tubes incubated in the usual way, and later subcultured to detect organisms of the *coli* group; if any positive results were obtained, all further experiments with these tubes were rejected. Six drops of a 24-hour culture of typical *B. coli communis* were then added and the tubes shaken, and inoculation made into broth at intervals of 2½ minutes, three platinum loopfulls of the fæces-disinfectant mixture being taken for each inoculation. The experiments were made at temperatures between 14° C. and 18° C. By diluting the original fæces emulsion with distilled water, the 5 grms. of fæces were made to contain less and less organic matter as required. The total solids of each dilution of the emulsion were always checked by drying at 100° C.

It was not found possible to work, or to get a satisfactory mixture with a disinfectant, with an original fæces emulsion containing more than 14 to 15 per cent. of dry solids (7—7·5 in the fæces disinfectant). Experiments by this method were made on mixtures containing about 2·0 per cent., 4·8 per cent., 6·1 per cent., and 7·2 per cent. of total solid matter. Where the solid matter was slightly different from these figures, a slight correction has been made for the purpose of comparing the figures recorded in the table.

In illustration of the method the following results of one series of experiments may be given. The results given in the tables are, however, the mean results of many such experiments, and this plan has been followed throughout the experiments with urine, blood, and milk.

the broth culture. The specific gravity and nitrogen of the urine was determined in every case.

Blood.—A few experiments were made with fresh human blood, 5 c.c. of the blood being mixed with 5 c.c. of the diluted disinfectant.

Milk.—Experiments were made with (1) fresh milk with all its fat; (2) condensed milk with all its fat (Anglo-Swiss brand); (3) separated milk; (4) condensed sweetened separated milk.

It was found possible in the case of the condensed milks to work with 40 per cent. milk solids (20 per cent. in the dilution) in the sweetened milk, and 30 per cent. of milk solids (15 per cent. in the dilution) in the sweetened milks. Dealing only with the coal tar disinfectants, it was found that results similar to those obtained with diluted unsweetened condensed milk were obtained with fresh milk, provided the solids were the same, and they contained the same percentage of the fat, and results similar to those obtained with diluted sweetened milk were obtained with separated milk containing the same fat and solids; in other words, the influence of cane sugar upon these disinfectants is very small. Experiments previously recorded ("Analyst," **31**, No. 362) show the influence of milk sugar to be also very small, and, further, from my experiments with fæces, I think it is not too much to say that the whole class of carbohydrates has little if any influence on the germicidal efficiency of coal tar disinfectants. The following table gives the average composition of the organic substances used in these experiments:—

TABLE III.—*Fæces-emulsion:—Total solids, 12·4 per cent.; ether extract, 2·6 per cent.; nitrogen, 0·9 per cent.; carbohydrates, about 3·0 per cent.; ash, 1·2 per cent. Blood, human, not analysed. 50 per cent. used in experiments. Urine, sp. gr. 1·020; nitrogen, 1·5 per cent.*

	Total solids.	Fat per cent	Nitrogen per cent	Milk sugar.	Cane sugar.	Ash.
Milk	13·0	4·0	0·6	4·7	—	0·7
Separated milk .	9·6	0·3	0·6	4·9	—	0·8
Condensed ,, 1	68·90	1·00	1·7	15·2	39·80	2·3
Condensed ,, 2	39·01	11·14	1·80	14·04	—	2·4

For the purpose of reference the disinfectants examined have been roughly divided into the following classes:—

Class A., Phenol. Class B., Cresylic acid (Trioresol). Class C., Disinfectants containing carbolic or cresylic acids, and giving a clear solution with distilled water. Examples: Lysol, Cooper's fluid, cresylic acid and soft soap, &c. Class D., Division (α) disinfectants containing little or no carbolic or cresylic acids and giving an emulsion with distilled water. Examples: Kerol, Cyllin, Izal, Bactox, &c. Division (β) disinfectants containing carbolic or cresylic acids, and giving an emulsion with distilled water. Examples: Emulsified cresylic acid and many commercial disinfectants. Class E., Disinfectants giving a clear solution both in distilled water and tap water. Examples: Formalin, Chinosol, pyrogallic acid, &c. Class F. Oxidising or semi-oxidising disinfectants.

TABLE II.

Experiments with fæces.

Six drops 24-hour culture of the B. coli communis in broth + 15, incubated at 38° C.

Dilution.	2 per cent. solids, temp. 15° C.			4·1 per cent. solids, temp. 15° C.			6 per cent. solids. temp. 16° C.		
	7½ m.	10 m.	12½ m.	7½ m.	10 m.	12½ m.	7½ m.	10 m.	12½ m.
Phenol 1:85	+	+	+	+	+	+	+	+	+
,, 1:80	+	+	+	+	+	+	+	+	+
,, 1:75	+	+	—	+	+	—	+	+	+
,, 1:70	—	—	—	+	—	—	+	+	—
Results	75			75			70		

Urine.—The experiments were carried out in the same manner, except that fresh urine or urine and distilled water were substituted for distilled water in making up the various dilutions of the disinfectants; the urine was not sterilised, but the disinfectant and urine were allowed to stand in contact for one hour before adding

In the following tables the numbers show the average volume to which 1 vol. of the disinfectant must be diluted in order to kill the organisms (*B. coli communis*), under the conditions of the experiments, during a contact of exactly 12½ minutes. Temperature, 14° to 18° C.; average temperature, 15° C.

TABLE IV.—*Experiments with fæces.*

Disinfectant.	Solid matter, per cent.				
	0·0	2·0	4·8	6·1	7·2
Class A. Phenol	80	70	70	70	70
Class C. I.	160	130	100	90	85
Class D.αI.	480	200	150	120	90
„ αII.	480	200	130	110	100
„ βII.	140	110	80	75	75
Class E. I.	30	30	30	30	30
„ II.	20	20	20	20	20

TABLE V.—*Experiments with whole milk.*

Disinfectant.	Milk solids, per cent.						
	0·0	2·4	3·6	6·3	10	15	20
Class A. Phenol	80	75	70	70	65	50	50
Class B. Cresylic acid	175	140	125	100	—	—	—
Class C.I.	160	120	110	70	—	—	—
Class D.αI.	480	150	110	65	—	—	—
„ αII.	480	160	120	90	70	50	50
Class E. I	30	30	30	30	—	—	—
„ II.	20	20	20	20	—	—	—
Class F†. I.	350	120	100	40	—	—	—
Potassium permanganate	2000	800	700	400	—	—	—

TABLE VI.—*Experiments in separated milk, and in sweetened separated milk; the solids express the quantities of actual milk solids present.*

Disinfectant.	Milk solids, per cent.						
	0	2	4	6	8	10	15
Class A. Phenol	80	75	70	70	65	60	60
„ B. Cresylic acid	175	150	130	110	100	90	80
„ C. I.	160	130	110	95	85	75	65
„ C. II	120	100	90	80	75	70	55
„ D. αI	480	200	150	120	100	80	60
„ αII	480	210	180	150	130	115	100
„ Emulsified Cresylic acid	260*	—	—	—	—	—	80*
„ E. I.	30	30	30	30	30	30	30
„ E II	20	20	20	20	20	20	20
„ F. 1†	350	170	140	120	—	100	—

* Calculated on the real cresylic acid present in the emulsion.
† These disinfectants were tested by a slightly different method, see page 1188.

TABLE VII.—*Experiments with blood, 50 per cent. human blood used in each case.*

Disinfectant of Class D. (*a* I.) required, 1:100, and phenol, 1:80.

TABLE VIII.—*Experiments with urine.*

Disinfectant.	Per cent. of urine.			
	0.	10.	20.	50.
Phenol	80	80	80	80
C I.	160	150	140	140
C II.	120	110	110	110
DαII.	480	410	400	400

If we examine these tables, it at once becomes apparent that with the disinfectants of Class A to D, the introduction of fæces or milk or blood has the effect of reducing their germicidal efficiency as judged by the drop method. It will further be noticed that while the drop is at first sharp, it tends to become less and less as we introduce more and more matter, until it tends to cease altogether. We may, in fact, by taking as abscissæ the amount of organic matter present in each experiment, and as ordinates the effective dilution in each experiment, determine the position of a number of points. These, when joined up by lines, form rough curves, which if the intermediate points had been determined, and if no error of experiment existed, would probably be perfect curves, which all tend to become straight lines; in other words, a point is reached, its position depending on the nature of the organic matter and the particular disinfectant, where the introduction of more organic matter into the test would have no further influence on the efficiency of the disinfectant. This is, I think, a most important point to keep in mind when considering disinfectants of this class, for it shows that although a disinfectant may lose a certain amount of efficiency in the presence of organic matter, yet it may be a most excellent and certain germicide even in the presence of an enormous quantity of this organic matter.

The milk curve for a particular disinfectant was in each case found to be lower than the separated milk curve. This difference is undoubtedly due to the fat, which is one of the chief factors in lowering the germicidal efficiency, nitrogenous bodies of the albumin class being the other. ("Analyst," 31, No. 362.) The influence of albumin is well illustrated by the effect of 50 per cent. blood on disinfectant Dα1. In every case the curve for each disinfectant in fæces lies somewhere between the curves for the disinfectant in separated milk and milk, and follows the same course.

The fat (ether extract) in the fæces experimented on has an average value of 2·6 per cent., and the fat in the milk an average value of 4·0 for more or less the same amount of solid matter; so that if we only had to consider the fat, we might expect the curves to lie almost exactly as they do. The nitrogen in the fæces is higher than that in the milk, and its influence cannot be neglected; however, all the nitrogen of the fæces does not exist as proteids, and if these substances or closely allied ones are the only ones in addition to fat which influence the germicidal efficiency of the disinfectants, we cannot speculate on the probable influence of the nitrogen, unless we actually estimate the amount of proteid nitrogen present. Fæces is, however, such a complicated and variable mixture that it is a profitless task to consider all the possible influences which may come into play. I think, however, that carbohydrates may be neglected (with disinfectants of classes A to D); and the influence of bile salts is practically *nil*. The broad fact remains that the curves in fæces follow those in milk and separated milk, and it is obvious that by making a mixture of milk and separated milk, the influence of fæces of any given composition can be, if not be exactly imitated, at least very closely indicated.

Oxidising disinfectants.—With oxidising or semi-

oxidising disinfectants there are, I think, two things to be ascertained with regard to their action in organic matter. (1) What is their value when added to substances already containing the germs? (2) What is their value when the germs are added to the organic matter containing the disinfectant?

With regard to (2), the value obtained will depend in the presence of a large amount of almost any organic matter almost entirely on the time which is allowed to elapse before adding to the disinfectant—in other words, if the germs are not added fairly quickly they will not be killed at all. And this is one of the main advantages of the coal tar disinfectants over the oxidising disinfectants. With the coal tar disinfectants, whatever may be the influence of organic matter on the initial efficiency, it does not destroy the disinfectant. The disinfectant will, if given sufficient time, exert its influence even in the presence of large amounts of organic matter.

Experiments were made with potassium permanganate and F.I. in milk, six drops of the *coli* broth culture being added to sterilised milk before adding the disinfectant, the time being taken from the time of emptying the pipette. It may be said at once with regard to F I., that it apparently had no oxidising effects, the values and curves obtained corresponding very closely to the coal tar disinfectants, except that it is influenced very much by the presence of fat.

With potassium permanganate no curve was obtained, the fall in efficiency being a straight line. Unfortunately want of time has prevented me making experiments in fæces and in separated milk; but it is obvious that, providing it is proved that carbohydrates influence this disinfectant, as it is certain they will, the fall of efficiency in fæces would be greater than that in unsweetened milk.

The point I wish to emphasise here is that the fall in efficiency in organic matter of a real oxidising disinfectant is proportionate to the organic matter, and may be represented not by a curve but by a straight line, and that these disinfectants will be influenced by any oxidisable organic matter whatever.

The micro-organism used and the strain of micro-organism.—The particular micro-organism which is to be used in a standard test is of considerable importance, especially when we remember that it is suggested that the quantity of any given disinfectant which may be used in higher resistance than *B. typhosus*, and that then, even if the drop method on naked organisms did represent a real difference between any two different disinfectants, the difference would not be the same when the disinfectants were required to kill a more resistant organism.

The influence of variation in strain of the micro-organism used has been referred to by Lieut.-Col. Firth and Prof. Macfadyean (J. Roy. San. Inst., **27**, No. 1). "Too much importance," they say, "must not be attached to it, as the experiments show that the behaviour of several strains of *B. typhosus* in the presence of various disinfectants in corresponding solutions is remarkably similar. We are impressed with the fact that different strains of *B. typhosus* present certain differences as to tendency to clump, and for this reason admit some predilection for the employment of filtered cultures of this micro-organism, but the error from this source we think is small, provided that due care be taken to see that the particular strain employed is normal in all its cultural features. If we now turn to the record of the experiments carried out by Major Fowler, and upon which, presumably, the above remarks were based, we find that for one disinfectant the carbolic acid coefficient determined on broth cultures of *B. typhosus* varies from less than 6 to more than 11 as the result of eight recorded experiments—it is true that these observers say that "before stating that any given disinfectant has a definite coefficient as against a particular micro-organism by this or any other method, the same result should be obtained in not less than three out of five observations." I suggest, however, that the influence of different strains of organisms might account in part for these different results, and that before any organism is adopted as a standard organism, especially if the organism is liable to clump, and has such apparently widely different powers of resistance as judged by the experiments of Major Fowler, sufficient experiments should be carried out to settle the question decisively if possible. As the work recorded here was performed with typical *B. coli*, the question of strain of organism naturally arose—although in this case it is not so important, as my figures are based on average results. Dr A. C. Houston kindly supplied me with a series of typical and *a*-typical *coli* organisms; time has not yet permitted me to make a complete examination of the whole of these organisms. Of those examined the following results were obtained:—

TABLE IX.

Organism Coli No	Gas in gelatin shake culture.	Cane sugar peptone-culture acid and gas.	Fl = Fluorescence in neutral red broth.	Ag = acid and gas in lactose peptone cultures	In = indol in broth cultures.	Ac = acid and clot in litmus milk cultures	Dilution of phenol which kills in 12½ m. and not in 10 m. at 15° C.	Dr. Houston's classification.
1	+	+	+	+	+	+	1:80	Flaginac
2	+	+	+	+	+	+	1:80	Flaginac
3	+	+	+	+	+	+	1:80	Flaginac
4H	+	—	+	+	+	+	1:70	Flaginac
5	+	—	+	+	weak	+	1:80	Flag(in)ac
6	+	—	+	+	+	+	1:70	aginac
7	+	—	+	weak	—	—	1:100	Fl(ag)
8	+	—	+	—	—	—	1:110	Fl.

the practical work should be governed by the experimental coefficient. It has been proved by several workers that the carbolic acid coefficient of a disinfectant which, tested by the Rideal-Walker method against *B.* gives a value of 11, gives with typical *B. coli communis* a value of from 6 to 8. From a number of observations made on organisms of varying resistance to phenol, and from an examination of the figures given by other workers, I do not think it is too much to say that in the majority of cases, if not in every case, if carried out under exactly the same conditions, the higher the resistance of the organism to phenol the lower will be the coefficient obtained. *B. typhosus* is no doubt the best representative of the fæcal pathogenic organism, but the fact must not be lost sight of that disinfectants will often be required to kill organisms of a

The four strains of typical *coli* examined gave as the average of six experiments on each a value of 80. One typical in every one of the above characteristics except that it did not ferment cane sugar peptone, gave a value of 70. It would appear, as far as these limited experiments go, that when working with *B. coli* it is sufficient to determine its "flaginac" character and its power to ferment cane sugar.

These cultural features must, however, be determined, as *a*-typical *coli* (some at least) have very different resistances and give quite different carbolic acid coefficients. For instance, *Coli* No. 8 with disinfectant DaII. gave a coefficient (one experiment only) which was nearly as high as that which *B. typhosus* gives.

The thread method.—A number of experiments were

made with the thread method, using 24-hour old cultures of *B. coli communis* grown on agar, with the general result that coefficients conspicuously lower than those given by the drop method were obtained. This is quite in accordance with the work of other observers. A modification of the thread method was tried in order to ascertain, if possible, if the disinfectants containing soaps had any power of removing and penetrating the dried organic medium in which organisms might be embedded. The modified method was as follows: Standard sterile silk threads were placed in standard broth, which was then inoculated with the organism and incubated for 24 hours at blood heat. The threads were then removed and hung singly over a sterile wire suspended inside a sterile beaker and covered with a sterile Petri dish. They were then placed in the incubator and dried at blood heat for 24 hours—the subsequent proceedings were as in the ordinary thread method with naked organisms. The method of working gave with the majority of the emulsion-forming saponaceous disinfectants a conspicuously higher coefficient than does the ordinary thread method, and gave far more uniform results. It is, I think, also a little more analagous to the conditions which might be met with in practical disinfection, when the organisms are always imbedded in a more or less resistant organic medium.

The following results were obtained by the two methods, the figures representing dilutions effective in 12½ minutes as before.

TABLE X.—*Thread method.*

Disinfectant.	Dilution.		Carbolic acid coefficients.	
	Agar.	Broth.	Agar.	Broth.
Phenol	70	40	—	—
C II.	120	100	1·7	2·5
D—I.	145	130	2·0	3·2
D—II.	70	60	1.	1·5
E II.	1 not effective in the time.	—	—	—

In the light of these experiments, let us consider whether the Rideal-Walker method or any other modification of the drop method carried out on naked organisms is a reliable guide to the germicidal efficiency of a disinfectant when used for practical purposes. The answer to this has been—No, but it is the best test we have at present, and it gives a very good idea of the relative value of disinfectants. Further it has been stated that it can be modified to meet the requirements of special cases. I would ask those who say this to give any instance where disinfection was required which was not a "special case," or any instance of bacteria living without organic matter to live on. What modification would a borough engineer call for, when ordering disinfectants in bulk for putting on the roads, pouring down gullies, flushing urinals, or treating refuse heaps? This plea for modification for special cases is, I am quite convinced, absolutely impracticable, it would lead to endless trouble and discrepancies, and be desirable neither from the consumer's nor from the manufacturer's point of view. Let us first consider the question as to the utility of the Rideal-Walker coefficients from the commercial point of view. Disinfectants are being bought and sold at present on this coefficient. Is this always fair to all disinfectants? The tendency of the germicidal values of the high-class coal-tar disinfectants in the presence of some forms of organic matter, is to approach one another, and even in some cases to actually change places in order of merit as shown by the tables. The points of greatest difference coincide with the value obtained in distilled water.

To take a concrete instance, a disinfectant A costing 2s. per gall., has a Rideal-Walker value of 7, and another, B, at 1s. per gall, has a coefficient of 2. In the one case seven units are obtained for 2s., in the other four units for 2s. A is better than B. Now introduce 4·8 per cent. of solid fæcal matter into the test, and let us suppose we get coefficients of 2 and 1·5 respectively, *i.e.*, in A one obtains two units for 2s., and in B, three units for 2s., or B is better than A. Is it fair to B to sell or buy on the Rideal-Walker coefficient? Another instance of the impossibility of relying upon the drop method in water, is a common form of specification for the supply of disinfectants for use in the county borough. For instance, at Brighton, the schedule for the supply of disinfectants runs—"Carbolic acid—To contain at least 95 per cent. of tar acids, to be of the quality commercially known as No. 5, free from tar oils, containing at least 10 per cent. of an available crystallised phenol, and to be wholly soluble in twice its volume of a solution of caustic soda of sp. gr. of 1·070."

Contractors supplying disinfectants to meet these conditions, could, and I have no doubt do, supply articles of widely different germicidal value, and the introduction of a guarantee of germicidal efficiency is not only desirable, but in view of the importance of municipal disinfection, absolutely essential. Let us for the sake of argument introduce the words "shall have a carbolic acid coefficient as determined by the Rideal-Walker method of 0·95." In other words, what is required is an acid or mixture of acids equal in efficiency to 95 per cent. carbolic acid. Now the carbolic acid coefficient of cresylic acid is about 2, so that one contractor might supply an article containing 95 per cent. of real carbolic acid, another 10 per cent. of carbolic acid, and some 50 per cent. of cresylic acid, both would have about the same apparent efficiency. Introduce a fæces emulsion, however, into the test, and the cresylic acid mixture at once falls below the 95 per cent. phenol. It is obvious that the two substances cannot be compared as to their real value by their action on naked organisms. Incidentally it may be mentioned that I have under investigation at present a method for determining the proportions of carbolic acid to cresylic in a mixture of these two substances by observing the difference in germicidal value in organic matter (milk). If we disregard the commercial side of the question and look upon the carbolic acid coefficient as a guide to the quantity of disinfectant we should use for any practical disinfection, it can be clearly seen that, if we disregard the possible influence of organic matter, we run a grave risk of not using sufficient disinfectant, and this is true even when we allow a very large margin of safety. Nobody will deny that it is desirable to introduce organic matter in some form into the drop method test—the question is what organic matter, and what quantity. Fæces is to my mind the type of all organic matter that requires disinfection. If a disinfectant will disinfect fæces, I think we may safely infer that it will disinfect blood, pus, urine, or any other common organic fluid.

If various dilutions of a disinfectant, mixed with various definite qualities of a perfect emulsion of fæces, had consistently a carbolic acid coefficient of at least 10, whatever quantity of fæcal solids was present, provided the same quantity of fæcal solids was present in the control, then I should have no hesitation in saying that the disinfectant had an efficiency coefficient of *at least* 10. But fæces vary very greatly in composition, especially as regards the fat. We might take the average composition of fæces, and decide that a certain quantity of such fæces should be our standard organic matter. But it would be impossible to insure a supply of such average fæces, and further, apart from the disagreeableness of working with such a medium, consistent results cannot be got even with careful grinding and mixing, unless we average up a considerable number of experiments. If fæces cannot be used, can we use a substance in the place of fæces that will give the same result? I have already shown that with certain disiufectants the curve obtained from fæces of a given composition lies between the curves obtained from separated milk and whole milk. Milk can be obtained practically anywhere; it contains no lumps, it gives consistent results, and by the use of separated, rich or poor, condensed, skimmed, or condensed whole milk, its composition can be varied at will. Its analysis is probably simpler and more accurate than any other natural organic fluid. I believe it is possible to decide on a composition of milk which will exactly represent, with regard to its influence on germicidal action, an equal weight of solid acreage fæcal matter. What the composition of the

milk should be, or what is average fæces, or what quantity of solid matter should be taken, I do not at present feel in a position to suggest. My present feeling is that we should, if we can imitate fæces, find out the lowest limit to which the coefficient of each disinfectant can be driven down by the addition of our artificial fæces, and that we should then give the disinfectant credit for this value and for every value above this right up to the value in distilled water. This, I think, would be fair to those coal-tar disinfectants with a high Rideal-Walker value, and which are so very effective in the presence of small quantities of organic matter, and would give us some idea of a relative efficiency of disinfectants as judged by the drop method.

Even if we introduce some organic matter into the drop method, the question arises as to whether it is safe or expedient to judge disinfectants upon the results of one particular method of working. In other words, can the efficiency of a disinfectant be expressed by one figure. Desirable as this may appear, at least from a commercial point of view, I personally do not think it possible. For instance, I do not think we can entirely ignore the results obtained by the thread method, or a modification of this method. This method, whatever its failings may be, at least indicates that there are certain conditions under which certain disinfectants more nearly approach the germicidal value of carbolic acid. And these conditions in the case of more or less naked dried organisms on animal and vegetable tissues are likely to be met with very frequently in practical disinfection.

Can the efficiency of a disinfectant be expressed by more than one figure? Here I see no insurmountable difficulty. Analytical chemists are in the habit of judging the value of articles by not one figure, but by a whole series of figures—in fact few, if any, articles are judged by the result of one test: why then should bacteriologists be bound down to one test if that test be shown to be inadequate? I submit that it is impossible to assign to disinfectants on figure which will represent their relative or absolute efficiencies, but that we may by, a combination of the drop method in water and in organic matter with thread methods, assign to disinfectants a series of figures which will more or less indicate their relative efficiencies as tested against the particular organism used.

In conclusion I must tender my best thanks to those medical officers of health who have supplied me with information as to the quantity and nature of the disinfectants used in their districts, and the purposes to which they are applied; to Dr. A. C. Houston for supplying me with a series of cultures; to Mr. L. Goodban for making some of the analyses in connection with this work; and to various manufacturers for sending me samples of disinfectants.

Discussion.

The Chairman said that these different disinfectants most probably consisted of varying quantities of soft soap, hard soap, more or less water, and a little cresylic or carbolic acid. He should like to know whether the organic matter was determined by drying at 100°; under such conditions carbolic acid would volatilise to some extent, and the soap and other solids would remain behind. He did not think it right to replace fæces, which was the ultimate substance they wished to disinfect, by milk—a substance of very different composition.

Dr. A. Wynter Blyth thought it was very creditable to the Royal Sanitary Institute that, when a report was put forward somewhat prematurely, they had the courage to withdraw it. This was done because the Disinfectant Committee believed certain points required further consideration. One of the chief points of the paper seemed to be that a considerable amount of organic matter altered the relative values of various disinfectants. Those engaged in the manufacture of tar acids and other disinfectants knew that it was of very great importance to get some standard test. He was sure that Messrs. Rideal and Walker would be the last to consider their proposal as final. No doubt, like all tests when first proposed, it was susceptible of improvement.

Dr. Martin pointed out that the credit of finding a rational standard method of comparing disinfectants was due to Messrs. Rideal and Walker. Most workers agreed that the same organism must be employed for the comparison. The same temperature was essential, for Miss Chick's researches had shown that different disinfectants had varying temperature coefficients. Again, the number of organisms must be constant in a series of experiments, and a standard time must be agreed to, because the influence of dilution upon the time taken to kill bacteria varied with different germicides. Mr. Blyth had put it at 12½ minutes. It was necessary, therefore, to have the same organism, the same number, the same temperature, and the same time. He was in complete agreement with Mr. Blyth on the question of organic matter. They did not want to disinfect drinking water, but masses containing much organic matter. From experiments which had taken place under his inspection he could confirm the results represented on the curves for such substances as milk. One of the test conditions they would have to consider would be stools from infectious diseases such as typhus. Every chemist would realise that the effect of an oxidising disinfectant or of one forming precipitates in presence of organic matter would be greatly diminished. Disinfectants were readily absorbed by porous matter such as animal charcoal. All the emulsified disinfectants were made of the higher cresols, together with soap or glue, or something of that nature, to keep them in suspension. He did not wish to depreciate them; they were very useful disinfectants, but it was necessary to find out what their real value was. Twenty years ago both Behring and Esmarck experimented with Pearson's creolin, in presence of fæces and of blood serum, and obtained the same results as Mr. Blyth did. As regards the suggested standard, he had, personally, an objection to using milk instead of fæces, because for some purposes, *e.g.*, a sporing organism, he would have to standardise against mercuric chloride and not carbolic acid. With fæces it was possible to approximate towards accuracy by utilising emulsions made with constant amounts of dry sterile fæces. Dry fæces were unobjectionable and gave consistent results, and possessed the advantage of being one of the types of organic matter to be dealt with in practice.

Prof. Kenwood said that Prof. Hewlett and himself, almost immediately after Dr. Rideal and Walker's suggestion was made, criticised it adversely on the score that it did not include organic matter, and he thought now that the authors themselves were convinced of the necessity of including organic matter in a test of the germicidal powers of a disinfectant. It might be of academic interest to learn that certain naked organisms were killed by disinfectants of certain strengths, but when those strengths were advertised and used for trade purposes, they gave a terribly misleading conception to the general public and to purchasers of how these disinfectants should be employed in practice. The author asked whether it was fair that disinfectants should be bought and sold under the Rideal-Walker test, and conclusively showed by his experiments that it was not fair, and that, until it included organic matter, the method was not of real value. If disinfectants were to be purchased on the Rideal-Walker basis, there was one which far surpassed all others, and was much cheaper. He meant permanganate of potassium, which was the disinfectant *par excellence* by the Rideal-Walker method upon a naked germ, whereas in the presence of a little organic matter it figured very badly. Mr. Blyth first of all pointed out the marked effect which fat had on all these disinfectants, and he had confirmed his results upon milk. He agreed with Dr. Martin that fæces was undoubtedly the best medium to work with. The author had shown that with even 7 per cent., which in his opinion was not an excessive amount of solid matter, all the disinfectants in the first two groups were practically equal. If he had carried the experiments on with a little more organic matter, doubtless they would have been almost, if not quite, identical. In an endeavour to ascertain what material other than fæces could be used for standardising disinfectants, he had experimented with flour and found that that had too little disturbing effect, no doubt due to

its freedom from fat. On the other hand, Hewlett and himself had been recently conducting experiments on pus, and with this the disinfectants in the first two groups had coefficients of about 2. The great levelling effect of pus was explained by the fact that it contained a large percentage of fatty matter. It was perfectly obvious to him that it was not right to demand that disinfectants should always be used at the strength found necessary to disinfect fæces. Considerable waste would result, and therefore he agreed with Mr. Blyth's suggestion that for each disinfectant a series of factors was necessary to determine what was its real value under varying conditions and circumstances.

Mr. C. T. KINGZETT said with respect to fat it must be borne in mind that most disinfectants with which the author experimented were those of an emulsified character, which, when diluted with water, immediately split up into their aqueous portion, and the oily portion constituting the active principles. These would vary with each preparation. The interference of the fat was brought about doubtless by assimilation of these oily particles with those of the fat present in the mixture, and this was one of the most disturbing factors in ascertaining the germicidal value of such preparations. Fæces, apart from the disinfection of stools in infectious cases, was not a matter of much difficulty, and could be done quite well by the use of common lime. All that had to be done with the fæces of town and country was to collect it, remove it, and dispose of it. The question of disinfection did not arise on so large a scale. The bacterial method of testing disinfectants was open to the cardinal objection that it did not test the real disinfectant value, but only the relative germicidal values under the particular set of conditions observed, and those did not simulate the conditions under which disinfectants were used in practice. There was no absolute scientific test for ascertaining the relative values of disinfectants, and could not be until they had greater knowledge of their nature and constitution. Bacteria were not themselves infectants, only the agents of their production, and nothing was known with certainty of the precise conditions under which they were produced, or of their constitution. The relative values of disinfectants could not be measured by germicidal power under an artificial set of conditions, but only by the determination of all contributory chemical and physical qualifications and disqualifications. The germicidal value was of importance, but the antiseptic value was equally important, and more important still was what might be called the "oxidative value." All these properties, however, were of mere temporary value, because in the end the organic matter containing the infectant must be disposed of by oxidation, either rapidly, as by combustion, or, more generally, in the natural manner by the action of the very micro-organisms to which germicides were fatal. To that extent, therefore, the use of strong germicides was objectionable, because they prevented the natural operation by which ultimate purity and freedom from infection would be secured. The relative values of disinfectants primarily depended upon their adaptility to the required purpose, and no bacterial test afforded an acceptable basis for comparison. One strong objection to the bacterial test was the impossibility of standardising the culture, upon which subsequently everything depended. The most expert bacteriologist could not guarantee the purity and unmixed nature of the organisms. Another difficulty was the varying chemical and physical actions of the disinfectant, not merely on the organisms themselves, but also in respect of the culture medium. Combination, coagulation, precipitation, obscuration were all experienced in practice, and the results were only of value as regarded the one preparation in question. For the last twelve months Mr. R. C. Woodcock and he had subjected the Rideal-Walker test to considerable study, and they found that while fairly uniform results might be obtained, using the same preparation and the same culture, by the same experimenter, varying results were obtained by other experimenters, using the same materials. For example, a certain disinfectant which exhibited a relative efficiency of 12·6 and 13 respectively as determined by A., only gave 8·6 as determined by B., using the *B. typhosus* test. The efficiency was known to vary according as the broth was neutral or acid. In this case the high results were obtained using plus 15 broth, whilst only an efficiency of 8·5 was obtained by the same experimenter using neutral broth. When tested against *B. coli* by the same experimenter, the relative efficiency came out at 6·7. With certain other disinfectants identical results were obtained whether the broth was neutral or acid—a very important consideration. It was further to be noted that one disinfectant would show a superiority as compared with one organism, but an inferiority when tested against another organism. Finally he would call attention to a remarkable experience. A certain liquid of strong germicidal value was determined to have a relative efficiency of 9·5. It was then split up by chemical extraction into two parts, constituting 27 and 73 per cent. respectively; the smaller portion, when tested in precisely the same way, showed an efficiency of only 1·8, whilst the 73 per cent. gave a figure of 3·5 only. Another liquid with an original relative efficiency of 10 was similarly split up, when 15 per cent. showed a relative efficiency of 3, whilst the other 85 per cent. showed a relative efficiency of 8·5. He felt quite sure they would never arrive at any chemical or other standard for determining the relative value of all disinfectants.

Dr. S. RIDEAL said the paper resolved itself practically into (1) a recommendation of carbolic acid as a standard, and (2) of expressing the efficiency of a disinfectant as a coefficient of such standard, in the way originally introduced by Mr. Walker and himself. Mr. Blyth had brought forward a certain amount of destructive criticism as to the incompleteness of this test alone, but he had suggested no alternative, but contended that, in addition to this test, another should be simultaneously carried out, in which organic matter was purposely added. Instead of fæces, a mixture of separated and whole milk was used, and the author contended that this mixture would give a result which was similar to that of fæces. He had not, however, produced this mixture or shown that the curve was identical with that of fæces, but had relied on a diagram of his tests indicating that fæces influenced the coefficient in an intermediate way between whole and separated milk. The expression "average fæces" was somewhat startling, and he could not understand what was meant by such a mixture. He differed from Dr. Martin in considering that fæces was a material which could be used as a standard in any test. He thought Mr. Kingzett was correct in saying that it was not the disinfection of typhoid stools that all these tons of disinfectants were sold for, and, moreover, a typhoid stool was not normal or average fæces. They got from the papor the idea that the Rideal-Walker test was necessary; and, secondly, that this substitution of a mixture of milk to imitate average fæces was a corollary to the first test. But why should this be? It could only be in the limited number of cases in which the disinfectants were to be used in contact with fæces; the result of introducing organic matter, whether milk or fæces, into a test was to bring closer together the carbolic acid coefficients for the different disinfectants. No one had put forward any medium which would separate the different classes of disinfectant to a greater extent from another than when the test was carried out as originally suggested by himself and Mr. Walker, *viz.*, in the presence of distilled water. The modified test, therefore, had the effect of bringing the disinfectants closer together in numerical value instead of separating them; but surely if the Rideal-Walker method did not separate the various disinfectants sufficiently, they ought to supplement that test by one which would separate them still further from one another. It must be obvious that if the "naked bacteria" are sufficiently enveloped in fats and other organic matter, they are more difficult to kill by all disinfectants. By pushing Mr. Blyth's argument far enough, one gets to a condition when the bacteria are so protected that the carbolic coefficients for all the disinfectants are identical. He agreed with Dr. Martin that there should be uniformity, whatever test was adopted, but it seemed a pity that a test which had been adopted by the War Office, the Navy, several of the Colonies, and Municipal authorities in this country, even if it was not perfect,

should be displaced by some other test based on slender evidence and of which they knew comparatively nothing.

Dr. SOMERVILLE said he was glad to find so many agreed that some such standard test was necessary, and also that there should be an addition of organic matter, so as to meet, as far as possible, the conditions which obtained in practice. It was required to compare various disinfectants on the market with regard to their germicidal efficiency; to his mind that was the only point of importance. There were other qualities in disinfectants, but he held that the destruction of pathogenic germs in all cases assumed the premier position. If they were going to standardise disinfectants, chemists would agree that one of the first requisites was that they should deal with standard reagents, and standard substances. Mr. Walker and he had found that it was possible to obtain a substantially standard organism by adopting a standard broth and growing *B. typhosus* under uniform conditions—an organism which constantly produced fairly uniform results. With regard to the addition of organic matter, he had listened with interest to Mr. Blyth's experiments on milk, and had considered the question of fat. No doubt fat in milk did diminish the coefficients of a number of coal tar products, but he did not know that milk would ever come before them for disinfection. Moreover, the fat in milk differed so much chemically, physically, and biologically, from fæcal fat, that he was not prepared to accept milk as a substitute for fæces. He did not think it possible to get any form of fæcal material of even an approximately uniform composition. Until something definite was known about the effects of such bodies as mucin, gelatin, blood, and any other substances which could be obtained in the simplest form possible by experiments of the type Mr. Blyth had described upon the coefficients of the coal tar products, they were not in a position to adopt a standard material. Mr. Walker himself, and Dr. Kenwood had protested against the employment of fæces. In a particular typhoid stool there were often sloughs and portions of intestinal mucous membrane, and in another there might be a large hæmorrhage resulting in coagulated blood, but nothing in milk would represent such conditions. The same must be said of certain dysentery stools containing 90 per cent. of mucin. To apply principles of disinfection, based on experiments with milk, to such conditions as these, he could not accept.

Mr. A. R. LING said the author had left the matter quite open as to the selection of a method, giving data on which work could be continued and a method elaborated. Many of the preparations on the market were more or less of equal merit as disinfectants, consisting as they did of tar acids and bases, and the fact that they were brought closer together when organic matter was introduced into the bacteriological test, appeared to him to indicate that the author was proceeding on the right lines, and he certainly deserved the thanks of manufacturers.

Mr. AINSLIE WALKER said he was afraid that the procedure advocated by the author was scarcely calculated to advance the movement in favour of standardisation; this procedure, quite apart from the impossible material used as a source of organic matter, was one which, in his opinion, could yield no uniformity of result from day to day, even in the hands of the same investigator. Then as regards the use of milk, if the introduction of organic matter was designed to make the conditions of the test resemble more closely those known to exist in practice, why suggest milk? Any attempt to reintroduce the now universally discredited "thread" method was to be deprecated. Von Gerlach referring to results obtained on transferring the medicated threads to sub-culture tubes had admitted that "he had to ascribe the absence of growth to insufficient washing of the threads, as subsequent inoculation with vigorous cultures proved": and anyone familiar with the structure of the silk cell would appreciate the difficulty of attempting to eliminate the inhibiting action of the disinfectant absorbed by capillarity, without washing away the coating of bacterial emulsion.

Mr. G. C. JONES asked the author to accentuate one sentence in the paper. He had made the astonishing assertion that this question of the standardisation of products which were sold in this country to the value of many thousands of pounds annually had been referred to a committee on which there was no representative of the commercial side.

Mr. R. ORCHARD wrote:—"The employment of such objectionable substances as normal fæces would militate against the general adoption of any standard method involving their use—fæces requiring disinfection are usually abnormal; but Mr. Blyth's suggestion that they can be replaced by a mixture of whole and separated milk is very valuable for experimental purposes It does not appear easy, however to obtain a standard sterile milk, and the fat, which the author considers a most important factor, is its most variable constituent. In so far as bacteria are protected by the presence of fat, it is obvious that phenol and tar disinfectants are more valuable, as they are able to penetrate a fat envelope. The Rideal-Walker method was devised, I believe, as a primary sorting test, to include all classes of disinfectants, and as the possible basis of some legal control over their sale. The introduction of large quantities of organic matter into the test at once defeats this object by eliminating a number of valuable germicides, including some capable of destroying spores which resist most of the 'coal-tar' disinfectants. It is difficult to agree with Dr. Kenwood that permanganate is the disinfectant *par excellence* by the Rideal-Walker test, as the amount of organic matter present in this method (1 drop of broth per c.c. of diluted disinfectant) is sufficient to render inert very dilute permanganate solutions. From Mr. Blyth's results with *B. coli* and potassium permanganate (Table V.) the coefficient would appear to be about 25; many substances give far higher coefficients, as, for example, chlorine—220. It should not require any elaborate bacterial test to demonstrate that permanganate will not sterilise large quantities of organic matter. If disinfectants were solely prepared to be thrown down the drains, there might be an advantage in testing them in presence of large quantities of sewage matter."

Major C. G. FOWLER wrote that he was in agreement with the general tenor of Mr. Blyth's views regarding the importance of introducing organic matter in the standardisation of disinfectants, and such a procedure had been carried out in the Army Hygiene Laboratory during the past two years in the routine examination of disinfectants. The phenol coefficient was first obtained with a stock laboratory culture, such as the *B. coli communis*, and the result was then checked by standardising against natural bacteria, such as the *B. coli communis* in fæces. He thought, however, that the author was adding too much organic matter, and, by so doing, was losing the real relative value of the various disinfectants. By making use of such strong emulsions of fæces and whole milk, the method put forward practically brought all disinfectants into one line, and surely this was not the object to be aimed for. Mr. Blyth criticised the method used by the writer when working with an emulsion of fæces (5 per cent.) in urine, and coarsely filtering, by saying that the filtrate was little better than simple urine. But the emulsion of fæces, as used by Mr. Blyth, was little better than lumps of fæces. However carefully the emulsion was ground, it was quite impossible to get rid of lumps, perhaps not perceptible to the naked eye, but most obviously present on a coarse microscopic examination. Imagine each or any of these lumps to contain several hundred bacteria within and without their substance, and the certainty of action of any disinfectant upon them was altogether obscured; and, again, what an element of chance must enter into the fishing out of the mixture with the platinum loop. The method of coarsely filtering was crude enough, but surely the use of such unfiltered and richer material was open to more serious error. Again, when employing whole sterilised milk, was it possible to use it without encountering lumps, unless homogenised? The figures brought forward with regard to the action of separated and whole milk in reducing the

coefficient figure were in agreement with his own experiments, but those obtained when dealing with a fæcal emulsion were widely different. Moreover, a 5 per cent. filtered emulsion of fæces was amply sufficient to bring down the false figures, obtained with a pure culture in distilled water, of such disinfectants as mercuric chloride, permanganate, iodine and chlorine compounds. The presence of organic matter was not by itself the only reason why the coefficient of a disinfectant might show variation. The greatest claim for the use of such material as fresh fæces was the fact that it contained organisms in their natural condition and environment. The action of a disinfectant might be quite different on an artificial laboratory culture to that on bacteria in their state of nature, this being the condition under which practical disinfection was required. The constitution and covering of the natural bacteria might so vary from that of the laboratory culture, as to offer a very different task for the action of a disinfectant, putting aside the presence of organic matter. To the question, which the author pertinently asked at the conclusion of his paper, on the practical utility of the "drop" method as a means of standardising disinfectants, he would most emphatically answer in the affirmative. After several years' trial, it was his opinion that, used in a common-sense manner and by an expert, the "drop" method of standardising disinfectants was thoroughly trustworthy, but reliance must not be placed on one kind of examination only. Firstly, the pure culture coefficient must be ascertained, followed by its trial of constancy against natural bacteria in the presence of organic matter, but the amount of this latter must certainly be limited. He was interested to observe that the figure obtained by the "thread" method was in exact accordance with that found in his own experiments working on entirely different lines.

Mr. M. WYNTER BLYTH, in reply, said he quite agreed with Dr. Martin that fæces was far better than milk, if they could get it to give good results. In standardising disinfectants with organic matter the fat must be taken into account. Plenty of substances contained fat, but if the observer avoided fat, standardising with organic matter would not be worth more than the Rideal-Walker method in water. The fact that these disinfectants were separated by the Rideal-Walker method was the great objection to it, because it was a false separation; further, its use as a commercial standard was cutting out of the market, he believed wrongly, old-fashioned disinfectants containing large quantities of carbolic acid or cresylic acid, which gave in organic matter, or matter containing abnormal or normal fæces, the same or nearly the same efficiency value as in water. It was not always required to disinfect fæces, but many varied matters. He quite agreed that it would be as well to start this problem at the other end, and, instead of taking complicated bodies like milk or fæces, to take simple bodies and work them out; but in the meanwhile the Rideal-Walker values were being used commercially, and one of his main objects was to call the attention of buyers of disinfectants on the Rideal-Walker figures to the fact that the presence of organic matter caused the values to drop enormously. He wished to reiterate the fact that this was not in any way an attack on the work of Messrs. Rideal and Walker, but only on the uses to which it had been put. He quite agreed with other speakers that theirs was a most admirable method, and hoped they would make further experiments, in which they would introduce large quantities of organic matter and fat.

Mr. WYNTER BLYTH wrote, in reply to Mr. Orchard:—"The variations in the composition of normal and abnormal fæces, as well as in the other organic mixtures requiring disinfection makes it essential that the bottom limit to which we can force the germicidal value of a disinfectant by the introduction of fæces or artificial faces should be known. It is easy to get a standard milk; all that is necessary is to get a normal milk rich in fat and break it down by the addition of separated milk. I quite agree that the coal tar disinfectants are valuable, but their value is not indicated by the Rideal-Walker figures."

"In reply to Major Fowler, the introduction of a large amount of organic matter does not by any means bring all disinfectants into one level line, and if it did it would not matter, for if two things are equal why call them unequal? On reading my paper Major Fowler will see that his remarks as to lumps and embedded bacteria are not applicable.

"The portion of my paper which dealt with organic matter is an attempt to study the influence of organic matter upon germicidal value, apart from any variations in the organism used. On this account a pure culture of a definite organism was taken. I fully recognise that natural bacteria have not the same resistances as laboratory cultures; unfortunately in a standard test the first necessity is a standard organism, which, it requires no argument to prove, cannot be a natural fæcal organism."

THE DETANNISATION OF SOLUTIONS IN THE ANALYSIS OF TANNING MATERIALS.*

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(Contribution from the London Leather Industries Laboratories, Herold's Institute, London.)

If there is any point upon which the members of the International Association of Leather Trades' Chemists are perfectly agreed, it is that the present official method of detannising solutions for analysis (*i.e.*, the use of unchromed hide-powder in the filter bell) is extremely unsatisfactory. In order to meet with these difficulties, various proposals have recently been made to modify the present system of analysis, but notably by Dr. J. Paessler (Collegium, 1906, 234—236) and by Mr. F. Kopecky (Collegium, 1906, 199—203). The former proposes the use of a lightly chromed hide-powder of his own manufacture in the filter bell, whilst the latter advocates a heavily chromed and neutralised powder of his own preparation, used with a definite quantity of acetic acid, and with a maceration method. It seemed desirable that the claims of these two powders should be investigated by others than the makers of them, and hence the authors proceeded to do a series of comparative analyses, the same extracts being analysed by the official method and by the methods of Paessler and Kopecky, using powders prepared by them. The results of these analyses are shown in the tables below.

It has long been recognised that hide-powder is capable of absorbing many non-tannin substances, and hence it is clear that as long as tannin is estimated gravimetrically by the difference between the amounts of "soluble solids" and "soluble non-tannin matters," the most correct result will be that which yields the highest percentage of "non-tannins," so long as the residue is proved free from tannin and soluble hide substance. With the various chestnut and oakwood extracts first used, the method of Kopecky appeared to be very promising, being convenient to work, and giving, as the figures show, distinctly higher results in non-tans. When, however, tried upon a hemlock extract, even with the increased amount of hide-powder recommended by Kopecky (40 grms. wet), the non-tannin filtrates clearly contained tannins, and this tannin was not removed even by extending the time of maceration for another hour. This is also evident in the results obtained.

The same difficulty occurred later in the analysis of quebracho extracts by this method, the non-tannin filtrates when tested with a 1 per cent. gelatine, 10 per cent. salt solution, showing at once the presence of a considerable amount of tannin.

Further, in the analysis of various sulphited extracts by Kopecky's method, it was clear that something was wrong. As Kopecky's powder is neutralised, it is necessary to add acid to the solutions for analysis, and its maker recommends the use of 5 grms. of acetic acid per litre. This acid causes complications which are very obvious in the detannised solutions. As soon as the solutions are pipetted off and the evaporation commenced, the

* Taken as read.

liquids begin to show a darkening of colour, first deep orange, then brown, and finally black. After adding 50 c.c. of distilled water and evaporating again to dryness (as Kopecky suggests for driving off the last traces of acetic acid), this colour was intensified. This blackening also occurred with the undetannised solutions, though their first colour made the change less obvious. What is the exact cause of this phenomenon is a little difficult to state. Kopecky, in writing to one of the authors upon inquiry, suggested that the blackening was due to "traces of iron which oxidises and forms blacks with the traces of gallic acid always present in non-tan filtrates," the oxidation becoming possible when the sulphur dioxide is driven off by the action of acetic acid, or that some "sulphuric acid or bisulphates might be present in the extract which would cause the residues to char." Both these suggestions seem rather improbable. Other suggestions to account for this are that the acetic acid acts upon the sulphite compound in the extract, driving off sulphur dioxide, and forming sodium acetate, which, acting upon the tannin and phenolic non-tannin bodies, caused oxidation and blackening; or, that the acetic acid dissolves out chromium from the powder (see below), partly, at any rate, as chromium acetate, which acts upon the tannin and phenolic non-tannin matters, producing readily oxidisable compounds. It is quite possible, of course, that both these, and other causes not suggested, might combine to produce the effect noted. Whatever the cause, however, it is clearly undesirable to use solutions acidulated with acetic acid for the analysis of sulphited extracts. It should be mentioned, perhaps, that even the sulphited extracts were not completely detannised by Kopecky's powder

1. *Various Chestnut Extracts.*

	Method of Detannising.	Non-tannins per cent.
1.	Kopecky	11·9
	I.A.L.T.C.	11·9
	Paessler	9·9
2.	Kopecky	11·3
	I.A.L.T.C.	8·1
	Paessler	7·3
3.	Kopecky	8·36
	I.A.L.T.C.	7·0
4.	Kopecky	8·7
	I.A.L.T.C.	7·3

2. *Various Oakwood Extracts.*

1.	I.A.L.T.C.	14·8
	Kopecky	13·3
	Paessler	12·3
2.	I.A.L.T.C.	14·7
	Kopecky	14·4
	Paessler	12·2
3.	Kopecky	16·9
	I.A.L.T.C.	13·3

3. *Valonia Liquor.*

I.A.L.T.C.	7·2
Paessler	6·8
Kopecky	6·3

4. *Gambier.*

Kopecky	18·4
I.A.L.T.C.	13·3

5. *Spent Tan.*

Kopecky	5·1
I.A.L.T.C.	1·7

6. *Mangrove Extract.*

Kopecky	21·3
I.A.L.T.C.	20·6
Paessler	20·6

7. *Hemlock Extract.*

Kopecky	24·2
I.A.L.T.C.	16·7
Paessler	16·1

8. *Quebracho Extracts.*

1. (Solid)	Kopecky	11·3
	I.A.L.T.C.	9·3
2. „	Kopecky	8·5
	I.A.L.T.C.	6·5
	Paessler	6·0

9. *Various samples of Mimosa D., containing bisulphites of soda.*

1.	Kopecky	13·9
	I.A.L.T.C.	10·0
	Paessler	9·8
2.	Kopecky	14·0
	I.A.L.T.C.	9·7
	Paessler	9·2
3.	Kopecky	13·2
	I.A.L.T.C.	9·8
	Paessler	8·9

As the experiences of the authors with Kopecky's method were so very disappointing, they concentrated their attention for the time being upon comparative detannisations with the official unchromed powder and with Paessler's powder. These results are given below, and are the mean of duplicate analyses.

		I.A.L.T.C.	Paessler.
Mangrove extract	1.	19·8	19·2
„ „	2.	20·7	20·0
„ „	3.	20·6	19·6
Chestnut extract	1.	10·2	10·0
„ „	2.	10·6	10·0
„ „	3.	10·2	10·1
„ „	4.	9·8	9·4
Sumach samples	1.	16·2	15·0
„ „	2.	16·2	15·6
„ „	3.	17·2	16·0
„ „	4.	16·9	15·6
Solid Extract (Myrabs)	1.	26·8	20·0
„ „ „	2.	27·9	26·2
„ „ „	3.	24·9	23·2
Sumach Extract	1.	20·2	18·2
„ „	2.	22·0	20·0
„ „	3.	24·4	22·2
Undescribed extracts	1.	16·2	12·8
„ „	2.	15·3	12·1
„ „	3.	16·5	15·1
„ „	4.	14·6	13·4

It will be noticed at once that in all these cases, and in all the previous work, the results given by Paessler's powder are lower in the percentage of non-tannins, the usual difference being about 1½ per cent., though sometimes as great as 4 per cent. They are, therefore, even further divergent from the real truth than the analyses by the official method with the use of unchromed powder. This is extremely unfortunate, for Paessler's powder is a distinct improvement upon the unchromed, in both the packing of the filter-bell and in the rapidity with which the tannin solution soaks up the hide-powder. Such minor improvements, however, are quite overshadowed by the unfortunate readiness with which this chromed powder absorbs the non-tannin matters, which causes the percentage of tannin to be recorded much higher than it really is. As we know our present official method to be defective in that the powder absorbs non-tannins as well as tannins, it would clearly be very undesirable and unwise to modify it by the replacement of unchromed powder (bad as it is) by the powder of Dr. Paessler.

As is well known, the filter method rejects the first 30—35 c.c. of the filtrate in order to eliminate as far as possible the error due to soluble matter in the hide-

powder. This error is not completely eliminated in this way, however, and there is no doubt that the soluble matter from the hide-powder, being weighed along with the non-tannin matter, tends to raise the percentage of the non-tannins, and incidentally make the result more correct. Now, with a chromed powder it is known that the soluble matters are usually less, and it appeared desirable to find out how far the variations observed between chromed and unchromed powders could be accounted for by a difference in solubility. That this could only partially explain the difference in the percentage of non-tannins commented upon above, was clear from the variations in the extent of this difference; it being influenced, no doubt, by the nature of the non-tannin matters in the various extracts analysed.

The authors, therefore, proceeded to do "blank" tests with each of the powders, first with distilled water only, and afterwards with ½ per cent. acetic acid, which is the concentration necessary in the analysis by Kopecky's method. It was thought desirable to include here experiments with Miller's cellulose-free hide-powder, chromed and used as in the American official method. In each case 50 c.c. were pipetted off and evaporated just as in the course of the usual analysis by each of the methods. The results are stated in the tables below:—

A.—*Solubility of powders using distilled water.*

	Residue in mgrms. A.	B.
1. I.A.L.T.C. unchromed powder—		
Experiment 1	4·4	4·5
,, 2.	5·0	5·0
,, 3.	6·5	6·6
2. Kopecky's powder—		
Experiment 1.	1·1	1·1
,, 2.	1·6	1·7
3. Paessler's powder—		
Experiment 1.	3·3	2·3
,, 2.	3·6	3·7
4. Miller's powder (A.O.A.C.)	3·7	3·7

Solubility of powders using ½ per cent. acetic acid.

	Residue in mgrms. A.	B.
1. I.A.L.T.C. unchromed powder	Powder swells too much to allow the filtration.	
2. Paessler's lightly chromed powder		
3. Kopecky's powder	6·0	6·0
4. American shake method	1·6	1·9

The results of Table A confirm the view that Paessler's powder, though less soluble than the unchromed, is not sufficiently so to account for the difference in the percentage of non-tannins found in the comparative analyses, and hence that this difference must be accounted for by the absorption of more non-tannins in the case of the chromed powder. Kopecky's powder is shown to contain much the least quantity of matter soluble in distilled water.

The results of Table B confirm what has been previously observed as to the difficulty of working in the filter-bell with acid solutions. In the case of Kopecky's powder the results were unexpectedly high, the increase being evidently due to the solvent action of the acetic acid. The residues were bluish in colour, and when re-dissolved in a small quantity of distilled water answered the ordinary qualitative tests for chromium and sulphate. It is clear, however, that in the analysis of an extract the worst error due to solubility will occur in the analysis by Kopecky's method.

The authors now turned their attention to the analysis of tanyard liquors, comparative detannisations being made by the various powders and methods. The results are stated below. In the first three tables the powder used for the analysis by Kopecky's method was freshly prepared by one of the authors, following directions of Kopecky, and was used in the shake machine. In Table 4, powder of Kopecky's own make was used, with his maceration method, and in each case the liquor was incompletely detannised.

Tanyard Liquors.

Method.	Non-tans per cent. 1.	2.	3.	4.
1. A.O.A.C.	5·7	5·8	7·1	5·7
Paessler	4·0	5·6	6·4	4·0
Kopecky	3·2	4·9	6·0	3·2
2. A.O.A.C.	3·9	4·8	6·9	7·8
Kopecky	3·4	4·2	6·1	6·4
3. I.A.L.T.C.	2·5	3·0	3·1	—
Kopecky	2·3	3·0	3·5	—
4. Kopecky	5·6	7·7	5·5	—
I.A.L.T.C.	5·4	6·6	5·4	—
Paessler	5·1	6·3	5·2	—

The figures show up again emphatically the immense superiority of the American shake method over the filter-bell methods in the matter of used liquor analysis, and at the same time confirm the contention of Kopecky that his neutralised powder will not give good results unless the residues are re-dissolved, and corrections made for the free acid, in the way suggested by Professor Procter ("Leather Ind. Lab. Book," 126). This process, if made into an official decree, would make the analysis of liquors a very tedious business, and involve almost more labour than is justified by the value of the results. In a well-regulated tannery, however, the acidity is kept approximately constant at different stages, and the difficulty might be overcome by making an average correction which should be checked every few weeks in the manner suggested.

The advantages of the American shake method again came out strongly in the analysis of used liquors which were known to contain practically no tannin. The analyses are as follows:—

Spent Tanyard Liquors.

Sample I. Total solids 4·5 per cent.

Method.	Non-tans. per cent.	Tannin. per cent.
A.O.A.C.	4·5	0·0
I.A.L.T.C.	3·7	0·8
Kopecky	3·6	0·9
Paessler	3·5	1·0

Sample II. Total solids 3·7 per cent.

A.O.A.C.	3·6	0·1
I.A.L.T.C.	2·9	0·8
Kopecky	2·6	1·1
Paessler	2·4	1·2

Sample III. Total solids 3·4 per cent.

A.O.A.C.	3·4	0·0
I.A.L.T.C.	2·8	0·6
Kopecky	2·6	0·8
Paessler	2·5	0·9

The above shows most emphatically the absolute superiority of the A.O.A.C. method for the analysis of sour tanyard liquors, and the I.A.L.T.C. are to be congratulated on having adopted this method for that purpose; it also shows how inaccurate and misleading are the results obtained by Paessler's method, as all the above liquors were completely denuded of all tannin properties before analysis.

The use of unchromed powder being rejected as bad, and having found that the two methods which were proposed to supply its place were worse; and as the American shake method was already the official method even of the I.A.L.T.C. for used liquors, advisable for extracts, etc., containing quantities of gallic acid, and permissive always; it will be readily understood that the authors became at once very strongly inclined to urge the acceptance of the A.O.A.C. method of detannising in all cases, and to make it the official method of the I.A.L.T.C. This, of course, is not by any means a new recommendation to the I.A.L.T.C., being, in fact, proposed by Professor H. R. Procter at the Leeds Conference of 1902. The pity is that it was not accepted then. Now it is the only course left.

The superior accuracy of this method has been repeatedly demonstrated both by Americans and by members of the I.A.L.T.C., and the work of the present authors fully confirms this view. Even the analysis of the following few tanning materials makes this quite clear.

1. Solid Quebracho Extract (A).

Total solubles 71·8 per cent. Insolubles 7·5 per cent.

Method	Non-tannins. per cent.	Tannin. per cent.
A.O.A.C.	10·8	61·0
Kopecky*	10·3	61·5
I.A.L.T.C.	6·5	65·3
Paessler	6·1	65·7

2. Solid Quebracho Extract (B).

Total solubles 73·9 per cent. Insolubles 6·5 per cent.

Method.	Non-tannins. per cent.	Tannin. per cent.
A.O.A.C.	13·0	60·9
Kopecky*	11·1	62·8
I.A.L.T.C.	7·0	66·9
Paessler	7·0	66·9

3. Sulphited Quebracho Extract.

Total solubles 77·4 per cent. Insolubles 0·0 per cent.

Method.	Non-tans. per cent.	Tannin. per cent.
Kopecky*	21·8	55·6
A.O.A.C.	17·6	59·8
I.A.L.T.C.	12·3	65·1
Paessler	10·1	67·3

4. Sample of Leaf Sumach.

Total solubles 38·8 per cent.

Method	Non-tans. per cent.	Tannin. per cent.
A.O.A.C.	16·6	22·2
I.A.L.T.C.	16·2	22·6
Paessler	15·0	23·8

5. Hemlock extract.

Total solubles 46·8 per cent. Insolubles 2·7 per cent.

Method.	Non-tans. per cent.	Tannin. per cent.
Kopecky*	24·6	22·2
A.O.A.C.	21·3	25·5
I.A.L.T.C.	17·0	29·8
Paessler	16·0	30·8

* Incompletely detannised.

The rest of the work in this investigation consisted in the detannising of artificial mixtures of tannin and non-tannins, in various proportions, by all the four proposed methods. This method of working had already been used to some extent by Procter and Blockey (Collegium, 1903, 114 and 124) for comparative work on the two "official" methods. In the present work, however, the same amount (4·5 grms. per litre) of a sample of commercial "pure" gallotannic acid was used every time, and the quantities of the soluble non-tannin matter added were gradually increased from ½ grm., 1 grm., 1½ grms. to 2 grms. per litre. The method of calculating results was the same as is used by Procter and Blockey. The first column gives the weight of matter used for each experiment and the weight of residue from 100 c.c. (twice 50 c.c.) evaporated, from which the dry, or at least the non-volatile matter, can obviously be calculated. The "Total Soluble," the "Tannin," and the "Non-tannins" are given in percentage of the dry total soluble of the tannin employed, and obviously in each case the effect of the added non-tannins will be obtained separately by deducting the corresponding figures given by the determinations of the tannin alone by that particular method of analysis. The fifth column gives the difference between the amount of tannin estimated in the "pure" sample and the amount shown after the addition of the non-tannin substance. The last column gives the proportion of the added non-tannin substance estimated as tannin by the respective methods, calculated on the actual dry non-tannin matter in excess of the 100 per cent. reckoned for the "total soluble" of the "pure" tannin. Each of the "non-tannin" filtrates in all these experiments are tested with a 1 per cent. gelatine 10 per cent. salt solution, and in every case where Kopecky's method was used the presence of tannin was revealed, showing incomplete absorption by the powder, but this was observed in no other case.

Table I. gives the analysis of the "pure" tannin by each of the four methods, and Table II. gives the results for the mixtures of tannin with gallic acid.

The analyses by the official method with unchromed powder show up the long-known errors due to the absorption of gallic acid by the unacted-upon hide-powder in the upper part of the filter-bell. Curiously enough, the proportion of the gallic acid present absorbed in this way appears to be approximately constant. The analyses with Paessler's powder all show a higher amount of tannin than in the case of the official method of the I.A.L.T.C., and also reveal the fact that the proportion of the added gallic acid absorbed is decidedly more marked.

In the Kopecky analyses the added gallic acid appears to make his powder absorb tannin even less readily, so that after the gallic acid is added less "tannin" is recorded than before, and hence negative quantities appear in the fifth and sixth columns. As the proportion of gallic acid is increased, however, these negative figures decrease, and finally become increasingly positive, pointing to the conclusion that the powder absorbs gallic acid in considerable quantities, and that this error finally overwhelms the other.

In each case of analysis by the A.O.A.C. method, the results show up much the best, in that they are always nearer the real truth, and also that the proportion of the added gallic acid estimated as tannin is much smaller. This confirms the work of Reed (American Leather Chemists' Journal, 1906, 288).

Table III., giving the results obtained with mixtures of tannin and dextrin, show up again the errors due to the absorption of non-tannin matters by the filter-bell methods, which errors are greater in the case of Paessler's powder. It is observed, however, that as the proportion of dextrin is increased, the percentage of it estimated as tannin is decreased. The reason for this is not very obvious, but it may possibly be connected with the method of rejecting the first 30 c.c. from the filter-bell, or may possibly be partly accounted for by the influence of varying quantities of dextrin on the absorption of the other non-tannin matters present as impurities in the sample. In the Kopecky analyses, we have incomplete absorption, and hence also irregular variations on the results, illustrated by the uncertain extent on the negative values in columns 5 and 6. The American method shows that very little dextrin is absorbed, whatever the proportion of it present, and the results are a strong justification of the A.O.A.C. method of detannising.

Table IV. gives the results with the various mixtures with glucose. The filter-bell methods again show their usual position in the amount of tannin estimated both with regard to one another and to the shake method. It will be noticed that as the glucose increases in amount, negative values are recorded in the last two columns, and as this is not due to the non-absorption of tannin, it is an interesting confirmation of the observations of Procter and Blockey as to the solvent action of carbohydrates on hide-powder. With Paessler's powder this solvent action is distinctly more marked. With Kopecky's method we find here again incomplete absorption, and along with the solvent action of the glucose, we find tremendous negative errors of an irregularity which might be expected.

The A.O.A.C. method again shows up strongly in a very favourable light, the error being always extremely small and not increased with the increasing proportion of glucose to tannin.

Table V. illustrates the effect of increasing quantities of calcium acetate. Here we notice at once that all the values in columns 5 and 6 are decidedly negative. It was observed, too, that in all residues (both "solubles" and

"non-tans" from all the methods) were intensely dark coloured. The explanation of these facts is not far to seek. The presence of calcium ions and tannic and gallic acid ions (in the non-tannin filtrates of gallic acid ions only) results in the formation of calcium tannate and gallate, which readily oxidise when their aqueous solutions are evaporated at steam heat, producing those dark-coloured products of unknown composition which are familiar to those who are accustomed to the analysis of suspender liquors. It is possible that these products may have lost some of their carbon in volatile decomposition products, which may partly account for the decreased amounts of tannin recorded; but it is equally possible that this may also be partly accounted for by the fact that the formation of calcium tannate and gallate, being a double composition, involves the formation of acetic acid which also volatilises, and hence that all the matter added is not weighed, and consequently the amount of tannin appears to have decreased.

In this table the more significant column is that which shows the decrease in the amount of tannin estimated, as in that case the figures obtained depend more directly upon the non-tannin results, which, being affected only by the presence of gallic acid, should have an approximately constant error, for the quantity of gallic acid cannot vary much. Strictly speaking, only the results for one definite mixture are comparable, because in the estimation of the "total soluble" we have also the error due to the oxidation of calcium tannate, which varies with the quantity of calcium acetate added, and which will not be approximately constant until calcium acetate is in excess As each molecule of the tannin of gallotannic acid (containing six hydroxyl groups) will require 3 molecules of calcium acetate (shown by Procter and Bennett, this J., 1900, 251—254), 1 grm. of tannin would require 1½ grms. calcium acetate for excess of the latter, and this proportion is never reached in the above experiments. It is quite possible, however, that this variation in error has a small influence on the comparative value of the figures and may be left out of consideration.

The analyses with Paessler's powder again reveal a greater amount of tannin than that estimated by the I.A.L.T.C., and, as the tannin figure is low because of the oxidation phenomenon, by a compensation or errors Paessler's powder shows a less percentage error. In the analysis of liquors, therefore, Paessler's powder would tend to give a result nearer the actual truth, because of its tendency to absorb "non-tannin" matters, but it is scarcely to be recommended on that ground.

Table VI. gives the results for the mixtures with calcium lactate. In this case the observations were almost precisely similar to the mixtures with acetate of calcium; the residues were black and oxidised, and the "difference in tannin estimated" is again a negative quantity. With calcium acetate the extent of this is not so great, but this can be readily understood when we remember the tardiness with which lactic acid volatilises. There again, after allowing for the factor of oxidation, we see that the A.O.A.C. method is very much better than that of the I.A.L.T.C., and that Paessler's method is very much worse, Kopecky's being really out of the question on account of the uncertain amount of tannin left unabsorbed.

Table VII. gives another series with the use of Epsom salts. Once more the "difference in tannin estimated" is usually a negative quantity. This was rather surprising, for the metal of the salt is combined in this case with a strong acid radical, which would prevent the formation of any magnesium tannate or gallate. It is known, however, that tannin is capable of combining with some metallic salts, so that the acidic radical as well as the basic is taken up by the tannin molecule, and it is possible that the decrease in the amount of tannin recorded may be accounted for by the conversion of the gallotannic acid into some such "non-tannin" compound. This point, however, needs further investigation.

In this series also we notice that the American method gives results not only lower in tannin than the other methods, but much nearer the actual figure obtained by the analysis of the gallotannic acid alone, as shown in Table I.

Table VIII. shows the results obtained by the use of common salt as the added non-tannin substance. The analyses by the American method all show practically the same tannin content as before the addition of salt, which is extremely satisfactory. The filter bell methods reveal again a decreased amount of tannin after the addition of salt, and this decrease is approximately the same for each proportion of salt. What this is due to, is not exactly clear. It cannot be analogous to the case of calcium acetate, for the acidic radical of sodium chloride is too strong to allow of the formation of sodium tannate or gallate, and moreover no blackening was observed in the residues, as would be seen if there had been oxidation to any great extent. That common salt and tannin combine as a whole seems unlikely also. It is well known that salt solutions have a distinct solvent effect upon part of the hide-substance, and this, of course, would increase the non-tannins and lower the amount of tannin recorded; but the lowering observed is of such an order as to make it doubtful whether this can be the sole explanation of the negative values observed, especially when we bear in mind that the concentration of the salt is not large. Whatever the cause, however, it is clear that the results are a splendid justification of the American shake method. The amount of tannin shown is always greater for Paessler's chromed powder than by the official unchromed, which is readily explained by its greater absorption of salt, shown also by the lower negative values in the last two columns. The Kopecky analyses again showed incomplete absorption of tannin.

Table IX. gives analysis of sodium bisulphite mixtures. The amounts of tannin recorded are again less than before the addition of bisulphite, this being obviously due to expulsion of sulphur dioxide and consequent lowering of the "total soluble" percentage. As in the case of calcium acetate, this error will alter with the proportion of bisulphite used, so that only the results for one definite mixture are strictly comparable. In any mixture, however, it is clear that the American method gives the least error. In the Kopecky analyses the error is much intensified by the presence of the acetic acid essential to his method, and hence huge negative quantities appear in the last column. This again emphasises the undesirability of acidifying the solutions in the way suggested by him. It was also noticed that in all these analyses the non-tannin filtrates contained appreciable amounts of chromium.

The above experimental work has placed the authors in close familiarity with the working of each of the three proposed methods mentioned above, and they are, therefore, in a position to pass some judgment upon each.

1. *Kopecky's powder and method.*—In this case one can scarcely believe that the powder was in the same condition as when freshly made, or as it was used by Kopecky himself. The loss in absorbency was clearly due to the fact that the powder after being kept some time would not wet back, even with 24 hours' soaking. This can no doubt be partly accounted for by its being so heavily chromed, though possibly the neutralisation of the powder may act in this direction also. It is extremely disappointing to find this cheap source of a workable hide-powder cut off in this way, but it is hardly surprising when we remember the previous disappointments in various American attempts to prepare a dry chromed hide-powder that will keep.

The use of acidified solutions, which is necessary in the case of a neutral powder, has also been shown to be objectionable, more especially in the case of treated extracts, and if this course were to be finally chosen it would be obviously necessary to reduce the quantity of acid to a minimum. The quantity advocated by Kopecky (5 grms. per litre) seems altogether too large. Moreover, the addition of acetic acid to the solution of the extracts before making up to mark is open to strong objections from other standpoints, such as the action of the acid on the tannin, which makes quite an appreciable difference in the amounts of "total solids" and "total solubles" estimated, and also its effect upon the quantity of "Insolubles" and upon tintometer readings. On the other hand, the addition of acid just before detannising involves another correction.

2. *Paessler's powder and method.*—As the method consists in the use of the filter-bell, it is open to all those strong objections which have been repeatedly urged

against that method, and which have been once more emphasised in the results of the analyses in this investigation. Dr. Paessler has also had the misfortune of making a powder which, though in some respects an improvement upon the unchromed, possesses a decidedly more marked affinity for "non-tannin" matters, which feature is just the one that it is most strongly desirable to avoid. Again, the keeping properties of this powder have not been tested thoroughly, and in view of the difficulties already observed in preparing dry chromed hide-powders which will remain constant in quality, it is exceedingly important that this should be done before its adoption as an official powder.

3. *The American method.*—There can be no doubt in this case that the method is workable and reliable, for it has been very thoroughly tested by both American and European chemists.* In comparison with the other methods the authors find that it stands in an exceedingly favourable position. It is the easiest to work, the soundest in principle, the most accurate in its results, and duplicate experiments will always agree. Moreover, in spite of the supposed trouble in preparing the powder, the authors find that it is decidedly the quickest to work.

There can hardly be much difference of opinion as to the conclusions to be drawn from the above facts. It is perfectly clear that the I.A.L.T.C. cannot with any wisdom accept either the methods of Dr. Paessler or of Mr. Kopecky, and it is equally clear that the American method of detanning is much superior to our present method. The authors, therefore, very strongly urge that the International Commission which is now at work upon this question should recommend the adoption of a uniform and universal method, which should be on the lines at present used by the American Leather Chemists' Association.

In conclusion, the authors desire to thank Mr. D. Stewart, M.A., and Mr. A. T. Hough for assistance rendered in doing some of the analyses in this investigation.

TABLE I.—*Commercial "pure" gallotannic acid.*

Grms. per litre.	Percentage on dry gallotannic acid taken. Total sol.	Tannin.	Non-tans.	Method.
4·5 grms. dry soluble per 100 c.c. = 0·3964 ...	100·0	83·4	16·6	A.O.A.C.
	—	91·2	8·8	Kopecky
	—	93·9	6·1	I.A.L.T.C.
	—	94·6	5·4	Paessler.

TABLE II.—*Mixtures of this "tannin" with gallic acid.*

Tannin = 4·5. *Gallic acid* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4606. *Total sol.* = 116·2

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ...	32·8	83·4	+ 0·0	+ 0·0
Kopecky ...	31·8	84·4	— 6·8	— 42·9
I.A.L.T.C. ...	9·7	106·5	+ 12·6	+ 77·7
Paessler	9·0	107·2	+ 12·6	+ 77·7

Tannin = 4·5. *Gallic acid* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4972. *Total sol.* = 125·4.

A.O.A.C. ...	26·5	98·0	+ 15·5	+ 61·0
Kopecky ...	37·9	87·5	— 3·7	— 14·5
I.A.L.T.C. ...	11·6	113·8	+ 19·9	+ 78·3
Paessler	9·0	116·4	+ 21·8	+ 85·8

Tannin = 4·5. *Gallic acid* = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·5450. *Total sol.* = 137·5.

A.O.A.C. ...	31·6	105·9	+ 22·5	+ 60·0
Kopecky ...	25·8	111·7	+ 20·5	+ 54·6
I.A.L.T.C. ...	16·0	121·5	+ 27·6	+ 73·8
Paessler	15·3	122·2	+ 27·6	+ 73·8

Tannin = 4·5. *Gallic acid* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·5400. *Total sol.* = 0·6108.

A.O.A.C. ..	44·0	110·1	+ 26·7	+ 49·3
Kopecky ..	28·7	125·4	+ 34·2	+ 63·2
I.A.L.T.C...	11·6	132·5	+ 38·6	+ 71·3
Paessler ...	7·0	147·1	+ 52·5	+ 97·0

* J. Amer. Leather Chem. Assoc. 1906, 1—115.

TABLE III.—*Mixtures of "tannin" with dextrin.*

Tannin = 4·5. *Dextrin* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4388. *Total sol.* = 110·7.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	25·1	85·6	+ 2·2	+ 20·5
Kopecky ..	30·8	79·9	— 12·3	— 24·2
I.A.L.T.C...	13·6	97·1	+ 3·2	+ 29·9
Paessler ...	13·5	97·2	+ 2·8	+ 24·3

Tannin = 4·5. *Dextrin* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4832. *Total sol.* = 121·9.

A.O.A.C. ..	37·8	84·1	+ 0·7	+ 3·2
Kopecky ..	42·6	79·3	— 11·9	— 54·8
I.A.L.T.C...	22·8	99·1	+ 5·2	+ 23·4
Paessler ...	20·4	95·5	+ 0·9	+ 4·1

Tannin = 4·5. *Dextrin* = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·5280. *Total sol.* = 133·2.

A.O.A.C. ..	48·8	84·4	+ 1·0	+ 8·0
Kopecky ..	57·2	76·0	— 15·2	— 45·8
I.A.L.T.C...	33·6	99·6	+ 5·7	+ 17·2
Paessler ...	33·3	99·9	+ 5·3	+ 16·0

Tannin = 4·5. *Dextrin* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·5764* = 0·5814†. *Total sol.* = 145·6* = 146·9†.

*A.O.A.C...	60·0	85·6	+ 2·2	+ 4·8
†Kopecky ..	57·4	89·5	— 2·7	— 5·7
†I.A.L.T.C..	45·4	101·5	+ 7·6	+ 16·2
†Paessler ..	46·9	100·0	+ 5·4	+ 11·5

TABLE IV.—*Mixtures of tannin with glucose.*

Tannin = 4·5. *Glucose* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4364. *Total sol.* = 110·1.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	24·2	85·9	+ 2·5	+ 24·7
Kopecky ..	40·3	69·8	— 21·4	— 211·8
I.A.L.T.C...	16·0	94·1	+ 0·2	+ 2·0
Paessler ...	15·8	94·3	— 0·3	- 2·9

Tannin = 4·5. *Glucose* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4788. *Total sol.* = 120·7.

A.O.A.C. ..	33·9	86·8	+ 3·4	+ 16·4
Kopecky ..	51·3	69·4	— 21·8	— 153·1
I.A.L.T.C...	28·5	92·2	+ 1·7	+ 8·2
Paessler ...	26·2	94·5	— 0·1	— 0·1

Tannin = 4·5. *Glucose* = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·5168. *Total sol.* = 130·3.

A.O.A.C. ..	41·1	89·2	+ 5·8	+ 19·1
Kopecky ..	62·6	67·7	— 23·5	— 77·6
I.A.L.T.C...	43·1	87·2	— 6·7	— 22·1
Paessler ...	39·2	91·1	— 3·5	— 11·5

Tannin = 4·5. *Glucose* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0.5528. *Total sol.* = 142·2.

A.O.A.C. ..	60·6	81·6	— 1·8	— 4·2
Kopecky ..	99·1	43·1	— 48·1	— 113·9
I.A.L.T.C...	50·7	91·5	— 2·4	— 5·7
Paessler ...	50·7	91·5	— 3·1	— 7·3

TABLE V.—*Mixtures of tannin and calcium acetate.*

Tannin = 4·5. *Calcium acetate* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4188. *Total sol.* = 105·6.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	25·4	80·2	— 3·2	— 57·1
Kopecky ..	38·5	67·1	— 24·1	— 430·3
I.A.L.T.C...	24·3	81·3	— 12·6	— 225·0
Paessler ...	20·0	85·6	— ·90	— 160·7

Tannin = 4·5. *Calcium acetate* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4578. *Total sol.* = 114·2.

A.O.A.C. ..	37·7	76·5	— 6·9	— 48·6
Kopecky ..	53·1	61·1	— 30·1	— 212·0
I.A.L.T.C...	28·3	75·9	— 18·0	— 126·7
Paessler ..	24·2	80·0	— 14·6	— 102·7

Tannin = 4·5. *Calcium acetate* = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·4948. *Total sol.* = 125·3.

A.O.A.C. ..	49·6	75·7	— 7·8	— 34·3
Kopecky ..	64·4	60·9	— 30·3	— 119·7
I.A.L.T.C...	49·0	76·0	— 17·9	— 69·1
Paessler ...	47·5	77·8	— 16·8	— 66·4

Tannin = 4·5. *Calcium acetate* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·5364. *Total sol.* = 135.3.

A.O.A.C. ..	61·8	73·5	— 9·0	— 25·2
Kopecky ..	78·5	56·8	— 34·4	— 97·4
I.A.L.T.C...	63·1	72·2	— 21·7	— 61·5
Paessler ...	59·0	76·3	— 18·3	— 51·8

TABLE VI.—*Mixtures of tannin and calcium lactate.*

Tannin = 4·5. *Calcium lactate* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4368. *Total sol.* = 107·6.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	24·6	83·0	— 0·4	— 5·2
Kopecky ..	35·7	71·9	— 19·3	— 253·9
I.A.L.T.C...	17·2	90·4	— 3·5	— 46·0
Paessler ...	16·0	91·6	— 3·0	— 39·4

Tannin = 4·5. *Calcium lactate* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4668. *Total sol.* = 107·6.

A.O.A.C. ..	33·7	86·0	+ 2·6	+ 14·7
Kopecky ..	45·6	72·1	— 10·1	— 107·9
I.A.L.T.C...	28·8	88·9	— 5·6	— 26·2
Paessler ...	25·2	92·5	— 2·1	— 14·7

Tannin = 4·5. *Calcium lactate* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·4996. *Total sol.* = 126·0.

A.O.A.C. ..	43·7	82·3	— 1·1	+ 4·2
Kopecky ..	65·8	60·2	— 31·0	— 119·2
I.A.L.T.C...	37·7	88·3	— 5·6	— 21·5
Paessler ...	33·1	92·9	— 1·7	— 6·5

Tannin = 4·5. *Calcium lactate* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·5398. *Total sol.* = 136·1.

A.O.A.C. ..	52·9	83·2	— 0·2	— 0·5
Kopecky ..	53·3	52·6	— 8·4	— 22·2
I.A.L.T.C...	47·7	83·4	— 3·5	— 13·2
Paessler ...	49·7	92·4	— 2·2	— 8·0

TABLE VII.

Tannin = 4·5. $MgSO_4 7H_2O$ = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4644. *Total sol.* = 117·2.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	32·2	85·0	+ 1·6	+ 9·3
Kopecky ..	42·5	74·7	— 16·5	— 95·9
I.A.L.T.C...	29·8	87·4	— 6·5	— 37·7
Paessler ...	27·3	89·9	— 4·7	— 27·4

Tannin = 4·5. $MgSO_4 7H_2O$ = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·5280. *Total sol.* = 133·2.

A.O.A.C. ..	48·3	84·9	+ 1·5	+ 4·5
Kopecky ..	60·2	73·0	— 18·2	— 54·8
I.A.L.T.C...	49·1	84·1	— 9·8	— 29·5
Paessler ...	44·4	88·8	— 5·8	— 17·4

Tannin = 4·5. $MgSO_4 7H_2O$ = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·5850. *Total sol.* = 147·5.

A.O.A.C. ..	66·4	81·1	— 2·3	— 6·8
Kopecky ..	76·5	71·0	— 20·2	— 43·5
I.A.L.T.C...	64·2	83·3	— 10·6	— 33·2
Paessler ...	60·7	86·8	— 7·8	— 19·5

Tannin = 4·5. $MgSO_4 7H_2O$ = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·6540. *Total sol.* = 165·0.

A.O.A.C. ..	84·1	80·9	— 2·5	— 9·8
Kopecky ..	94·7	70·3	— 20·9	— 82·1
I.A.L.T.C...	80·3	84·7	— 9·2	— 14·1
Paessler ...	78·6	86·4	— 8·2	— 12·6

TABLE VIII.—*Mixtures of tannin with common salt.*

Tannin = 4·5. *Salt* = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4464. *Total sol.* = 112·6.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	27·6	85·0	+ 1·6	+ 12·7
Kopecky ..	42·5	70·1	— 21·1	— 167·4
I.A.L.T.C...	28·2	84·4	— 9·5	— 75·4
Paessler ...	24·1	88·5	— 6·1	— 48·4

Tannin = 4·5. *Salt* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4960. *Total sol.* = 125·1.

A.O.A.C. ..	41·7	83·4	0·0	0·0
Kopecky ..	55·7	69·4	— 21·8	— 85·5
I.A.L.T.C...	45·3	79·8	— 14·1	— 56·1
Paessler ...	35·4	89·7	— 4·9	— 19·6

Tannin = 4·5. *Salt* = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·5482. *Total sol.* = 137·5.

A.O.A.C. ..	54·1	83·4	0·0	0·0
Kopecky ..	72·0	65·8	— 25·7	— 68·1
I.A.L.T.C...	57·0	80·6	— 13·4	— 34·0
Paessler ...	53·0	84·5	— 10·1	— 27·0

Tannin = 4·5. *Salt* = 2·0. *Dry sol. matter per* 100 *c.c.* = 0·5940. *Total sol.* = 149·8.

A.O.A.C. ..	66·9	82·9	— 0·5	— 1·3
Kopecky ..	84·9	64·3	— 29·1	— 77·3
I.A.L.T.C...	69·2	90·3	— 15·6	— 41·5
Paessler ...	61·8	88·0	— 9·8	— 26·0

TABLE IX.—*Mixtures of tannin with sodium bisulphite.*

Tannin = 4·5. $NaHSO_3$ = 0·5. *Dry sol. matter per* 100 *c.c.* = 0·4264. *Total sol.* = 107·5.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	26·0	81·5	— 1·9	— 25·3
Kopecky ..	36·0	71·5	— 19·7	— 261·6
I.A.L.T.C...	26·5	81·0	— 12·9	— 172.6
Paessler ...	17·9	89·6	— 7·5	— 66·6

Tannin = 4·5. $NaHSO_3$ = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4500. *Total sol.* = 113·5.

A.O.A.C. ..	37·1	76·4	— 7·0	— 51·8
Kopecky ..	49·4	64·1	— 27·1	— 200·7
I.A.L.T.C...	33·2	80·3	— 13·6	— 100·7
Paessler ...	27·2	80·3	— 8·3	— 61·5

Tannin = 4·5. $NaHSO_3$ = 1·5. *Dry sol. matter per* 100 *c.c.* = 0·4884. *Total sol.* = 123·2.

A.O.A.C. ..	45·4	77·8	— 5·6	— 24·1
Kopecky ..	65·5	57·7	— 33·5	— 144·4
I.A.L.T.C...	53·0	70·2	— 23·7	— 102·1
Paessler ...	40·1	83·1	— 11·5	— 49·6

Tannin = 4·5. $NaHSO_3$ = 2·0. *Dry sol. matter per* 100 *c.c* = 0·5272. *Total sol.* = 133·0.

A.O.A.C. ..	53·4	79·6	— 3·8	— 11·5
Kopecky ..	76·5	56·5	— 34·7	— 105·1
I.A.L.T.C...	57·7	75·3	— 18·6	— 56·4
Paessler ...	51·1	81·9	— 12·8	— 38·8

TABLE X.—*Mixtures of Tannin with Oxalic Acid.*

Tannin = 4·5. *Oxalic acid* = 0·5 *Dry sol matter per* 100 *c.c.* = 0·4520. *Total sol.* = 108·6.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.		per cent.
A.O.A.C. ..	13·8	94·8	+ 11·4	+ 132·3
Kopecky ..	12·1	96·5	+ 5·3	+ 61·6
I.A.L.T.C...	14·7	93·9	0·0	0·0
Paessler ...	6·5	102·1	+ 7·5	+ 88·2

Tannin = 4·5. *Oxalic acid* = 1·0. *Dry sol. matter per* 100 *c.c.* = 0·4520. *Total sol* = 114·0.

A.O.A.C. ..	16·2	97·8	+ 11·4	+ 102·8
Kopecky ..	13·6	100·4	+ 9·2	+ 65·7
I.A.L.T.C...	20·6	93·4	+ 0·5	+ 3·5
Paessler ...	9·8	105·2	+ 10·6	+ 75·7

Tannin = 4·5. *Oxalic acid* = 1·5 *Dry sol matter per* 100 *c.c* = 0·4960. *Total sol.* = 125·1.

A.O.A.C. ..	20·5	104·6	+ 21·2	+ 84·4
Kopecky ..	26·5	98·6	+ 7·4	+ 29·5
I.A.L.T.C...	23·0	102·1	+ 8·2	+ 32·7
Paessler ...	9·9	115·2	+ 20·6	+ 82·0

Tannin = 4·5. *Oxalic acid* = 2·0 *Dry sol matter per* 100 *c.c* = 0·5264. *Total sol* = 132·8.

A.O.A.C. ..	27·8	105·0	+ 21·6	+ 65·8
Kopecky ..	32·2	100·6	+ 9·4	+ 31·7
I.A.L.T.C...	25·8	107·0	+ 13·1	+ 39·9
Paessler ...	19·1	113·7	+ 19·1	+ 58·2

TABLE XI.—*Quassia chips only.*

Tannin = 0·0. *Dry sol. matter per* 100 *c.c.* = 0·0815. *Total sol.* = 20·6.

Method.	Non-tannins.	Tannin.	Difference in tannin estimated.	Dry non-tannin estimated as tannin.
	per cent.	per cent.	per cent.	per cent.
A.O.A.C. ..	17·3	3·2	— 80·2	+ 15·97
Kopecky ..	16·9	3·6	— 87·6	+ 17·45
I.A.L.T.C...	14·1	6·4	— 87·5	+ 31·45
Paessler ...	12·7	7·9	— 86·7	+ 38·3

Manchester Section.

Meeting held at Manchester on Friday, November 2, 1906.

DR. G. H. BAILEY IN THE CHAIR.

REMARKS ON THE WORK OF THE SECTION.

The Chairman referred in some detail to the activity that was being displayed in developing new products, and hoped that communications might be made to the Section by those directly engaged in manufacture more freely than hitherto. He then supplemented these earlier remarks by touching upon some questions of general interest to all branches of chemical industry. From time to time the united efforts of the Sections had been devoted to the discussion of such matters as river pollution, technical education, sampling, patent laws, traffic rates, and means of transit for goods. But in cases where the information was required in support of public measures of reform, it was manifest that this want of completeness and the delay which occurred in getting together the necessary detail acted very prejudicially. Thus in regard to more ready and cheaper methods for the transit of goods, which had occupied the attention of a Committee of the Council for some years, there was surely no reason why it should not be part of the ordinary business of this or any other Section to constitute itself a medium for collecting information. In this way the necessary details would be ready to hand when called for, and with the further great advantage that, after preparation by a Committee of the Section, they might be thoroughly sifted and discussed before a meeting of the members. Any question affecting the relations of their industry with local or imperial authorities was capable of being so treated.

Dr. Bailey then considered the question of sampling in its various applications in order to indicate that even with such a topic there were many points which might with advantage receive further attention from the Section.

He had chosen sampling as an example of the complexity and the many-sided character of an operation of wide application. Any of the other questions touched upon would equally serve to show how essential it was to recognise the manifold conditions which surround science in its application to industry. The experience of any one branch of chemical industry, or even of several, however important or however well represented, could not suffice, and we were brought to realise how necessary it was that full use should be made of the opportunity of securing a sufficient array of facts and ample discussion, and of bringing together for this purpose representatives of all the branches of industry concerned.

It was also manifest that the chief responsibility in bringing about a satisfactory issue rested upon those actually engaged in manufacturing operations.

Moreover, it was only by the adoption of such means

that a satisfactory *modus vivendi* could be arrived at as between manufacturers and the local or imperial authorities, with whom they desired to work in amicable relation.

This was indeed one of the most important problems now in front of chemical industry, and its effective solution was urgently called for.

A GRAPHICAL METHOD OF RECORDING THE WORK OF VITRIOL CHAMBERS.

BY W. H. COLEMAN.

When looking at the daily report of the work of a set of vitriol chambers it is not easy to tell at a glance how it compares with the previous reports, and I have found the method about to be described very helpful in judging the history of the plant, with the view of giving such instructions as may serve either to remedy a defect in the working, or to increase, if necessary, the work done. The method adopted consists in plotting on squared paper the results of certain daily tests and data concerning the plant; the results chosen have been arrived at after considerable thought, and form a record of those facts which it is most important for the vitriol plant manager to keep in view. The method has been in use for about 18 months, and, for the sake of illustration, a diagram is given of the curves plotted during the months of September and October, 1905. The curves are classified into two series, and in the actual records they are drawn in different coloured inks to render them more distinct, but in the diagram different kinds of lines have been used. The horizontal line represents the days, and the vertical lines are numbered in the upper series so that each small division represents 2, and in the lower series 1 unit or decimal part, as the case may be.

On the upper half of the sheet are recorded daily: -

Curve I.—In black, (.-.-.-.-.-) the cubic feet of chamber space per lb. of sulphur charged per 24 hours; the figures represent units.

Curve II.—In red (· · · · · · · · · · ·) the percentage of nitre used on the sulphur charged; the figures represent tenths.

Curve III.—In blue (— — — — —) the total dip of acid in the chambers, that is the sum of the dips of the separate chambers; the figures represent units.

Curve IV.—In green (- - - - - - - - -) the daily average difference in temperature in degrees Centigrade between the gases entering the first Gay Lussac tower and the air; the figures represent units. On the lower half of the sheet are recorded daily: -

Curve 1.—In red (· · · · ·) the number of grams per cubic foot of total acids calculated as SO_3 in the exit gases.

Curve 2.—In green (- - - - -) the percentage of carbon dioxide in the exit gases.

Curve 3.—In black (.-.-.-.-) the percentage of oxygen in the exit gases.

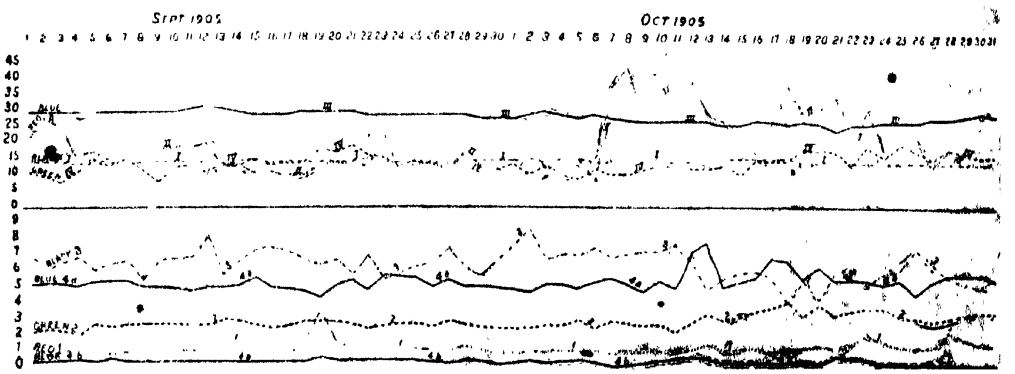
Curve 4 *a* and *b*.—In blue (————) the number of c.c. of nitric oxide gas obtained in the nitrometer from 1 c.c. of acid from the bottom of the Gay Lussac towers, the upper blue line, 4*a*, showing the results from the first and the lower 4*b*, from the second Gay Lussac.

In all cases, the small divisions represent tenths, and the figures represent either single estimations, or the average of several taken at intervals during the day It would, no doubt, be better to draw an average daily sample of the gases and acid, and to plot the results of the tests of these average samples; but owing to the unreliability of the ordinary methods of drawing samples of gases from a main, and to lack of time to work out better methods, these figures have been used. I hope in the near future to be able to devote more time to this subject.

I do not pretend to any great novelty in the method, but as I have never seen or heard of a graphic method applied in this way, I thought that it might be of interest, and I have personally found it helpful in many ways. It keeps very vividly before one's mind not only the present but the past condition of the plant, it points out any continued carelessness on the part of the men, or any other continued source of bad or irregular work, and enables a remedy to be sought for and applied; it also creates a healthy rivalry between the chamber managers who superintend different sets, and has finally the merit of keeping the chemist himself up to the mark, as it compels attention in a way never attained by written or tabulated records, however perfect. It should be remarked that during the month of October a portion of the sulphuretted hydrogen from the sulphate of ammonia plant was burned in addition to the oxide, and as the amount varied very frequently owing to causes which have nothing to do with the acid department, this accounts for the rather rapid variations in the nitre percentage.

Some few details concerning the plant and its working may be of interest. The set consists of a row of spent oxide burners, a Glover tower, three chambers, and two Gay Lussac towers, the latter being worked in series with a Kestner fan between them. The acids are raised by automatic Kestner elevators, so arranged that the distribution of the acid is not left to the tower man, but is regulated by the chamber manager from the indications of the meters attached to the elevators, and that the whole of the weak nitrous acid coming from the second Gay Lussac tower has to be passed down the first.

The average condition of the drips, &c., was as follows:—No. 1 chamber drip 130° Tw. temperature 85° C. No. 2, 125° Tw., 55° - 70° C.; and No. 3, 95° Tw., 35° C. Temperature of the gases passing from the Glover to No. 1 chamber averaged 95° C. The acid left the Glover tower at 140° C. and 140° Tw. The acid supplied to No. 2 Gay Lussac tower was at 23° C. and 143° Tw., and to No. 1 Gay Lussac tower 30° C., and 141° Tw. These figures vary somewhat from those obtained with ordinary pyrites plants, but the manufacture of acid from spent



oxide is neither so simple nor so steady, and requires close and careful watching. As the connections between the chambers have all been constructed on the plan suggested by Mr. Porter in the paper which he read before this Section some time ago, I may perhaps be permitted to make a few remarks on the results obtained in actual practice.

There is no doubt that the capacity of the chambers is increased, and that the greater part of the work of conversion of the sulphurous acid into sulphuric acid takes place in the first three-quarters of the chamber's length. On the other hand, the conditions seem less stable, and the plant must be very carefully and closely watched for the first signs of something wrong, and the proper remedy applied at once, or it will soon get out of hand—in fact, it becomes more sensitive and responds much more quickly to alterations in the conditions of working.

Discussion.

The Chairman thought if it had been customary to express such results on curves such as those shown, we might long ago have been in a position to diagnose what was going wrong in chambers, and many phenomena which were still obscure. It struck him that the acid in the bottom of the chamber played a very much more important part in the process than had hitherto been thought of, a view which received considerable support from a comparison of the curves on the diagram.

Mr. H. Porter thought the diagrams would be a great assistance to managers, foremen, and workmen. The blue line showing the level of acid in the chambers, and the red line indicating the consumption of nitre, were exceedingly interesting. At the point where the acid line showed variation, the nitre line also fluctuated, and there would appear to be a relation between the bottom acid and the gases in the chamber. That was not a new subject, and recent observations he had made pointed to this, especially in hot weather. Mr. Coleman had mentioned the bottom inlet into chambers, which he (Mr. Porter) demonstrated before this Society three years ago, and he stated that undoubtedly they increased the make of the acid. Experiments lately had shown this, and one firm introduced the bottom inlet at an angle instead of at right angles to the chambers, with the result of impinging the gases on to the surface of the acid in the chambers, causing a rippling of the surface. This caused the liberation of the nitrous compounds from the chamber acid, and had a very marked influence on the general working, especially in hot weather.

Mr. Herbert Morris thought it would be a rather dangerous thing to draw conclusions from the lines shown upon the diagram. Mr. Coleman had not mentioned that it was very probable that the oxide used varied in its sulphur content during the period in which the tests had been carried out; this might account for very considerable variations in the lines.

Mr. Coleman, in reply to Mr. Porter, said there was no doubt that the variation in the nitre line was due, not only to the irregular supply of sulphuretted hydrogen, but also to the falling stock of acid in the chambers as indicated by the dip line. If there was one fact more than another that was important in the manufacture of acid, it was the maintenance of the stock of acid and consequently the stock of nitre in the acid of the chambers. If the capital of the plant as represented by nitre was allowed to fall, it had a very prejudicial effect upon the working. With regard to the rippling of the acid, this would cause an increased surface of the acid in the chamber to be exposed to the action of the gas with a resulting increased rate of interchange between the molecules. In reply to Mr. Morris, he said that the oxide was tested daily, and no great variation in the amount of sulphur burnt took place, which would be seen from the black line in the upper diagram, which showed the relation between the sulphur charged and the chamber space. As to the ammonia, as a matter of fact, none did pass into the chambers, and the variation in the percentage of nitre was explained, not by the fact that sulphuretted hydrogen was being burnt, but by the fact that the supply of this gas was very irregular, and caused the conditions in the chambers to be constantly changing. If everything could be kept perfectly steady and constant, the manufacture of acid would be much simpler.

Nottingham Section.

Meeting held at Nottingham, on Tuesday, November 27, 1906.

Mr. J. M. C. Paton in the Chair.

THE SELECTION OF BENZINE FOR DEGREASING.

By S. R. Trotman, M.A., F.I.C.

The so-called benzine used in degreasing is a mixture of petroleum hydrocarbons of varying boiling points. Both the efficiency and economy of degreasing processes depend to a large extent upon the careful selection of the solvent. It may be taken as a general rule that the suitability of a benzine varies inversely with the percentages it contains, distilling below 80° C. and above 110° C., and directly with the shortness of the range of boiling points. The fractions distilling below 80° C. are very wasteful, owing to the difficulty of completely condensing them, and to their high vapour tension. The high boiling fractions, on the other hand, require more fuel, and are very difficult to expel from the residual grease without causing deterioration of colour, and sometimes loss of glycerin owing to decomposition of the fats. If they are left in they spoil the grease for soap making. There is, however, no doubt that the low fractions are by far the more expensive. A perfect spirit would be one having a constant boiling point of about 95° C. The value of commercial samples, in the absence of the low and high boiling fractions, depends upon the percentage distilling over within a short range of temperature on either side of this point, say from 90° to 100° C. The following are examples of good and inferior spirits (distilled by the method described below):—

Fraction distilling.	Good.	Poor.	
Below 80° C.	3·0	25·0	6·0
Between 80°—90°	12·0	33·0	14·0
" 90°—100°	82·0	16·0	33·0
" 100°—110°	3·0	14·0	26·5
Above 110°	—	12·0	20·5

The good sample will cause little waste, and contains much more spirit distilling between 80° and 90° than the other samples.

These facts make it obvious that the chief test upon which a benzine must be evaluated is a fractional distillation, with the proviso that the method employed must be capable of differentiating between the valuable and valueless fractions. This being so, it is a remarkable fact that the method of testing adopted by the trade is incapable of distinguishing between a good and a bad spirit, and is therefore, from a buyer's point of view, absolutely useless. For this test, 100 c.c. of spirit is placed in an ordinary distilling flask of about 100 c.c. capacity connected with a condenser, and is heated with a naked flame. The rate of distillation is such that the drops fall into the receiver as quickly as possible short of a stream. If the object of the test were to conceal the presence of fractions of low boiling point, it is difficult to see how a better test could have been devised. A prolonged experience of the test has convinced me that it entirely fails to distinguish between a good and bad sample from a degreaser's point

of view. The following method has for some time past been used by me with very satisfactory results. One hundred c.c. of the benzine are placed in a round bottomed flask of about 150 c.c. capacity, and having a short neck, 1 in. in length. The latter is connected to a Young's rod and disc fractionating column with 16 chambers, the distance from the neck of the flask to the lateral exit tube being 13 in. The bulb of the thermometer is placed 1 in. below the lateral exit tube. The fractionator having been connected to a condenser with adapter, the flask is placed upon a piece of asbestos with a circular hole, and heated with a shaded direct flame from a small Bunsen burner, the gas supply being controlled by a screw clamp placed on the supply tube. The rate of distillation is maintained at approximately one drop a second. The distillation is started with a flame which will produce the required rate, and its height is only altered when the temperature or rate of distillation shows any inclination to fall. The method is capable of giving perfectly consistent results. This may be seen from the following table, which gives the figures obtained, independently by three different persons, from the same benzine; the fourth column gives the results of the trade test upon the same sample:—

Fraction	1	2	3	4
Below 70° C	2·5	2·5	2·5	—
Between 70°—80°	21·5	20·5	22·0	5·0
,, 80°—90°	31·0	32·0	31·5	45·0
,, 90°—100°	23·0	23·5	22·0	35·0
,, 100°—110°	14·0	13·0	13·5	11·0
Above 110°	8·0	8·5	8·5	4·0

An inspection of these figures will at once show the extreme difference between the two methods. If the sample be judged upon the trade test it is an uncommonly good one, while in reality it should be condemned. The present method is suggested as one that is simple to work, does not require very delicate apparatus, and gives results comparable with practical experience. It is, of course, necessary that both buyer and seller should use the same test, and that the conditions of experiment should be carefully defined. It should not be difficult to do this if the question were treated in the same manner as the analysis of tanning materials by the International Association of Leather Trades Chemists. The persistent retention of a method which is admittedly unscientific and has been proved to be inaccurate cannot be too strongly condemned.

Discussion.

Mr. J. T. Wood was of opinion that an ideal spirit for degreasing should have a constant boiling point of about 90° C. Such a spirit might be found in benzol if the price admitted of its use. Spirit distilling above 110° C. was very undesirable, as it was difficult to remove it from the grease, so that it was not only lost, but also diminished the value of the grease. He quite agreed that the analysis of benzine ought to be put upon a proper basis, and some uniform and scientific method of distillation accepted. He suggested that the I.A.L.T.C. might do something in the matter.

Mr. F. D. Toyne wrote that analysis of spirit should always be directed to the estimation of the first runnings, say up to 80° C., and the last above 110° C. The most valuable fractions were those which had the highest boiling point consistent with their ready expulsion from the residual grease. He trusted Mr. Trotman's paper would have the effect of bringing about a change in the test upon which sellers of benzine approached the market.

Mr. F. V. Barnes said that coal-tar benzines were sold upon a simple distillation test, but when he really wanted to obtain any information about them, he invariably substituted some form of dephlegmator.

Mr. G. A. Shankland said that experience had shown him that the low boiling fractions were always expensive, and thought it of supreme importance that these solvents should be sold upon the results of a test which really gave some information upon that point. He would like to know whether the author thought the last runnings as expensive as the first.

Mr. T. A. Gerard spoke of the decreased value of recovered grease to soapmakers caused by the use of an unsuitable spirit.

Mr. J. Dunford drew attention to the fact that spirits were often offered which showed, according to the trade test, exactly the same range of boiling points, but which had very different specific gravities. Would these show different results if properly fractionated?

Mr. S. R. Trotman in reply thought, that while on the whole the low fractions were the most expensive, it was often forgotten, firstly, that the fractions boiling above 110° C. were liable to lag behind and not do much work, and, secondly, that they finally required the expenditure of a considerable quantity of steam to completely expel them, the cost of which should be reckoned in addition to their deleterious effect upon the grease. He had no doubt that the spirits mentioned by Mr. Dunford would prove to be dissimilar if properly distilled. The chief characteristic of the "accepted" test was, that it totally failed to distinguish between spirits of dissimilar composition unless the dissimilarity was very great. He had rarely met with a benzine which would not pass the test.

Yorkshire Section.

Meeting held at Leeds, on December 3, 1906.

MR. F. W. BRANSON IN THE CHAIR.

THE PRESENT DEVELOPMENT OF THE ANALYSIS OF TANNING MATERIALS.

BY PROF. H. R. PROCTER AND MR. H. G. BENNETT, B.Sc.

(Contribution from the Leather Industries Laboratories of the University of Leeds.)

That there is a pressing need of some advancement in our methods of analysis of tanning materials will scarcely be questioned by anyone. The dissatisfaction which is felt with regard to the present official method of the I.A.L.T.C.,* involving the percolation of the tannin solution through unchromed powder in the filter bell, is almost universal, both with regard to the accuracy and concordance of its results, and the length of time necessary to obtain them. In the earlier processes for tannin analysis, stronger solutions were used (1 per cent. of total solids) than at present, and it was thought necessary to macerate a tannin solution for many hours with repeated portions of hide-powder, in order to ensure complete detannisation. At the same time, the hide-powders available were often imperfect, and contained always a certain amount of soluble and putrescible matters. The filter bell was therefore invented to get over these difficulties. The comparatively rapid detannisation effected by percolation through the bell effectually prevented any dangers due to putrefaction, and the method of rejecting the first portions of the filtrate overcame to a considerable extent the difficulties due to the presence of soluble matter. It is now, however, well known that with tannin infusions of the strength used at present (about 0·4 per cent. tannin) the detannisation can be completely effected by about 15 minutes' agitation with no more

*(International Association of Leather Trades Chemists.

hide-powder than is used in the filter bell, and such treatment is the basis of the indirect gravimetric method used by the American Leather Chemists' Association, and known as the "shake" method. The adoption of such a method as this by the American Leather Chemists, and its subsequent improvement in their hands, has brought into a strong light the defects of the filter bell method, the chief of which may be mentioned here.

In the first place, the method of rejecting the first 30 c.c. of filtrate to get rid of soluble matter is far from being a complete elimination of this difficulty, and much of our trouble may be traced to this imperfect removal of these "solubles" in the powder. Moreover, it has been shown that the composition of the filtrate is not only variable with regard to the "solubles" of the hide, but also with respect to the amount of soluble non-tanning matters, there being in fact a continuous change in the composition of successive portions of the filtrate, according to the degree to which the powder in the bell has been tanned by the solution in use, and according to the regularity of the flow of the infusion through all parts of the powder, this latter being always an uncertain factor. Again, the method assumes that any variability in composition of the filtrate due to dilution by the moisture contained in the air-dry powder used, is eliminated by the rejection of the first portions, whereas this conclusion is really open to considerable doubt.

Another objection to this method is found in the difficulties experienced in the satisfactory "packing" of the filter bell with the powder. This operation, as is well known, requires considerable care and some skill, differences in the manner of packing producing a distinct effect upon the results; and in the hands of different operators and with various powders this difficulty becomes very much more pronounced.

In the first place, we may note the impossibility of obtaining satisfactory powders, and more especially in getting them sufficiently absorptive, and at the same time sufficiently free from soluble matter. The complete detannisation of certain extracts by neutral powders is practically an impossibility, and these difficulties have been accentuated, rather than removed, by the unauthorised acidification of powders with lactic and other acids, which has caused swelling of the hide-powder in the bell, and an increase in the soluble matters of the powder. These same troubles are also manifest to an even greater extent in any attempt to analyse acid liquors by the filter bell arrangement. The powder swells so much as in many cases to render the filtration practically impossible, and even if successful, the amount of powder dissolved is enough to seriously vitiate the result.

One of the greatest objections to the filter bell is that large quantities of soluble non-tanning matters are removed by the powder when used in this manner. The solution is almost completely detannised by the first portions of the hide-powder it meets, and hence the detannised solution has to flow through a certain amount of fresh and very absorptive hide-powder, which will readily take out of solution many soluble non-tanning matters which are of an acid nature, or from some other cause are capable of absorption. Many derivatives of the tannins, such, for example, as gallic acid, are thus reckoned as tannins. This objection applied also to the earlier maceration method of treating the solution with several successive portions of fresh powder; and when the filter method was first introduced, the danger of removing such non-tannins by these methods of successive treatment with hide-powder, was not so fully appreciated as it now is. Most of these strong objections are inseparably associated with the method, and they are therefore only very partially overcome by the use of Dr. J. Paessler's "lightly chromed" powder, and, as far as the absorption of non-tanning matters is concerned, Dr. Paessler's powder is distinctly worse than the unchromed powders, though it is decidedly better in concordance of results.

The superiority of the American method in this respect over all methods involving the use of the filter bell, has been repeatedly urged, and is proved quite conclusively by an extensive investigation recently made by Parker and Bennett (see this J., pages 1193–1200), in which it is demonstrated that in the American method the absorption of the non-tannins by the powder is very much reduced, and in many cases completely prevented. The American method has also other claims to scientific accuracy. It employs a definite quantity of powder, chromed with a fixed amount of chrome alum, which not only makes the powder sufficiently acid for the efficient absorption of tannin, but also renders it more insoluble; and all remaining soluble matters are removed by a thorough washing of the powder immediately before use, so that the residues observed on "blank" experiments may be reduced to quantities of the order of 1 mgrm. of dissolved matter on 50 c.c. of the non-tan filtrate. It has also been shown clearly that by chroming in this way, the quality of the hide-powder used has a much less influence on the result, and that suitable powders can be prepared with much greater ease. Moreover, as the method consists in bringing the powder into contact with every part of the liquid to be detannised, by rapid agitation for a given time, it is (especially with the improvements suggested below) more rapid, more uniform, and less troublesome than the filter method, while it demands no special manipulative skill.

At the recent Conference of the International Association of Leather Trade Chemists at Frankfort, at which the American Association was represented by its President, the defects of the official filter method were made so obvious that a Commission was appointed to consider the whole question, and if possible bring the European and American practice into harmony. There can be little doubt that the result will be the abandonment of the filter method for some modification of the shaking process, but as the form adopted by the American Association does not seem in all respects adapted to European requirements without modification, the authors desire to bring forward at this stage various criticisms and suggestions.

From the point of convenience, the principal objections to the American method are the long time (nearly 24 hours) required for chroming the powder, which should be freshly done for each set of analyses; and the somewhat tedious method of determining the water correction by drying a portion of the squeezed powder. A theoretical objection may also be raised that the percentage of chrome actually absorbed by the powder under the American conditions is extremely small, and scarcely seems enough to secure the sufficient insolubility of the powder under unfavourable conditions, while the large amount of unabsorbed chrome salt leaves scope for great variations in the amount of acid taken up, which as regards absorptive powers seems a more important factor than the chrome itself.

As regards rapidity of chroming, it may be noted that the American official method stipulates that the amount of water used in soaking and chroming the powder should be 25 times the weight of the powder used. This seems to be a quite unnecessarily large quantity, and a course of experiments with varying quantities of water leads us to suggest 10 times the weight of powder as an alternative. This quantity is found to be quite enough to render the mixture sufficiently liquid for the agitation required, and will make the powder wet enough to ensure a sufficient regularity in chroming. It is, moreover, much more convenient in practice, and if the time occupied in chroming is to be reduced, which is strongly desirable, it will be necessary to use a more concentrated chroming liquor. As it stands the method is a mere waste of distilled water.

In the next place, the A.L.C. use only 3 per cent. of chrome alum on the weight of the powder. One of the main reasons for chroming is to render the powder insoluble, and all practical experience and all recent work on the hide-powder question show that the greater the chroming the less is the error. It has also been shown by Kopecky and by various American chemists that heavily chromed powders have their absorbency for tannin very little affected by the degree of chroming, so that it would appear that the quantity used in the American official method was decidedly small. If all the chromium used in this method is absorbed by the powder, it will only contain 0·45 per cent. of chromic oxide; and this is by no means a true assumption, the percentage absorption of chromium varying with the quality of the powder used.

The authors have used a powder in which only 22 per cent. of the chromium was absorbed. Again, if we are to be safe-guarded against variations in the quality of the unchromed powder, a greater degree of chroming seems desirable, enough, in fact to render all powders that are at all useable, practically uniform when chromed. The authors desire to suggest that 0·75 to 1 per cent. of chromic oxide or its equivalent in chromium is not too much for this purpose.

An equally important point is the time required for the preparation of the powder. The official method is to "digest the powder with 25 times its weight of water till thoroughly soaked. Add 3 per cent. chrome alum in solution. Agitate by either shaking or stirring occasionally for several hours, and let stand overnight. Wash, &c." This practically means that it is necessary to commence the preparation of the powder 24 hours or more before it is required for use. It is imperative that this inconvenient time should be shortened. The authors find that this cannot be done satisfactorily by merely increasing the amount of chrome alum. Experiment shows that 15 per cent. of chrome alum will put into a powder in one hour no more chromium than 3 per cent. under the same conditions, and will probably give the powder far more acid than is necessary. The authors therefore suggest the use of a basic chroming solution, such as is already used at the Vienna Versuchsanstalt. In this way a rapid chroming may be effected, and there seems no objection to this except that the amount of washing required may be slightly increased. Any objection of this kind is quite overcome when we consider the saving in time by the rapid chroming of the powder. It is known, too, that fresh and well washed and ground chrome leather will detannise quite well.

The following table gives the results of experiments made in chroming powders under varying conditions. To make the figures comparable, the results are stated as percentages of chromic oxide (Cr_2O_3) in the dry powder, after it is chromed, washed, and ready for use, though this may not be strictly correct in all cases. In parallel experiments with chrome alum and chromic chloride, such a quantity of the latter was taken as would give the same quantity of chromium as in the former.

Chromium absorbed under varying conditions.

Chroming material.	Tie.	Amount of water.	Absorption of total chromium used.	Chromium oxide in powder.
Per cent.	hours.		per cent.	per cent.
3·0 Chrome alum ...	24	25 times weight of powder	22·0	0·10
1·65 Cryst. chromic chloride	,,		16·5	0·07
1·65 Cryst. chromic chloride (made basic)*	,,		31·0	0·14
3·0 Chrome alum ...	1		4·4	0·02
1·65 Cryst. chromic chloride	,,		10·3	0·05
1·65 Cryst. chromic chloride (made basic)*	,,		13·2	0·06
3·0 Chrome alum ...	1	10 times weight of powder	23·1	0·10
3·0 Chromic alum (made basic)†	,,		52·7	0·23
15·0 Chrome alum ...	1		4·0	0·09
15·0 Chrome alum (made basic)	,,		40·4	0·91
8·25 Cryst. chromic chloride	1		14·3	0·32
8·25 Cryst. chromic chloride (made basic)*	,,		40·9	0·93
3·0 Chrome alum ...	24		71·7	0·32
3·0 Chrome alum (if totally absorbed)	,,		100·0	0·45

* These solutions were made basic to such an extent as would correspond to the theoretical salt $Cr(OH)SO_4$ or $CrCl_2(OH)$.

† These solutions were made basic to the same extent as is used in the manufacture of the Vienna hide-powder, which is 50 per cent. greater than in the other cases.

In all these cases the chromium was estimated by drying and ashing the powder, and afterwards igniting strongly with a mixture of magnesium oxide and sodium carbonate, by which means the chromium is all converted to sodium chromate. By the addition of hydrochloric acid and potassium iodide, the chromate liberates an equivalent amount of iodine which is estimated in the usual way with starch and $N/10$ thiosulphate solution.

It will be noticed from the table given, that with only one hour's chroming under A.L.C.A. conditions, very little is absorbed, the resulting powder being practically unchromed; but that when the amount of water used is reduced to 10 times the weight of the powder, about the same degree of chroming is obtained as with the larger quantity of water and the longer time. Moreover, when the chroming solution is made basic, more than half the chromium used is absorbed, and if the longer time be used, the absorption is again increased considerably. By far the most satisfactory results are obtained, however, through the use of larger quantities of chromium. When quantities of chromium were taken equivalent to the amount used in making the Vienna hide-powder, and the solutions made basic, the resulting powders contained practically 1 per cent. chromic oxide even with only one hour's chroming, but the required washing was somewhat increased.

The amount of chromium is not the only point of importance in the manufacture of a suitable hide-powder, and in rendering the powder sufficiently absorptive for tannin and at the same time less absorptive of gallic and other acids it is in all probability the amount of acid which is the determining factor. The use of volatile organic acids, such as formic, acetic, and lactic acids, is open to various strong objections. They are all difficultly volatile, and have been shown to have a decided effect upon the residues, and in addition they are difficult to estimate with accuracy. This last point is especially important when we remember the desirability of fixing some limits to the acidity of the powder or of the estimating the extent to which the acids occur, in the non-tannin filtrates and residues, and also of the control of the washing process, if some method such as is suggested below should be adopted. Hence, the chromic salt of some mineral acid would appear to be the best, and we are practically limited to either a basic chrome alum solution or a basic chromium chloride solution, since these are the only soluble salts which are readily obtained of constant composition. The authors have made various experiments with each of these, and find that both are fairly satisfactory, but that on the whole, the chloride solution is preferable, especially on account of the easy and accurate estimation of chlorine for purposes of control. The chloride solution is also free from the complication due to the useless presence of potassium sulphate in the solution of chrome alum, and hence less washing will probably be required. Again, the chloride and its basic salts are more readily soluble in water and less liable to precipitation when diluted by the water used in the chroming of the powder; and it appears from the results in the above table, that a less basic chloride will chrome a powder to a greater extent than a more basic sulphate under similar conditions. A point not fully explained is that even if chromed powders are washed until the wash liquors show no reaction for sulphate or chloride, these ions always reappear in the non-tannin filtrates, possibly due to substitution by tannic acids, or in some cases to double decomposition of the basic chrome salt with alkaline tannates. Investigation has shown that some portions at least of these compounds are volatile, and are in all probability free hydrochloric and sulphuric acids, so that in considering the effect upon the nature and weight of the residues, we think that the balance is in favour of hydrochloric acid as being the more volatile and less drastic reagent. The chromic chloride used in this work has been Kahlbaum's "crystallised chromium sesquichloride," the estimation of chromium in which is in agreement with the formula $CrCl_3 6H_2O$. As to what is the most convenient and desirable quantity to adopt for an official process, we do not at present wish to be dogmatic. What is wanted, is to get into the powder sufficient chromium to render it insoluble and uniform, and sufficient acid to ensure its efficiency in absorptive

hide-powder than is used in the filter bell, and such treatment is the basis of the indirect gravimetric method used by the American Leather Chemists' Association, and known as the "shake" method. The adoption of such a method as this by the American Leather Chemists, and its subsequent improvement in their hands, has brought into a strong light the defects of the filter bell method, the chief of which may be mentioned here.

In the first place, the method of rejecting the first 30 c.c. of filtrate to get rid of soluble matter is far from being a complete elimination of this difficulty, and much of our trouble may be traced to this imperfect removal of these "solubles" in the powder. Moreover, it has been shown that the composition of the filtrate is not only variable with regard to the "solubles" of the hide, but also with respect to the amount of soluble non-tanning matters, there being in fact a continuous change in the composition of successive portions of the filtrate, according to the degree to which the powder in the bell has been tanned by the solution in use, and according to the regularity of the flow of the infusion through all parts of the powder, this latter being always an uncertain factor. Again, the method assumes that any variability in composition of the filtrate due to dilution by the moisture contained in the air-dry powder used, is eliminated by the rejection of the first portions, whereas this conclusion is really open to considerable doubt.

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distinctly damp, for the ordinary desiccating agent. A few drops of chloroform were added as an antiseptic. Under these conditions, the moisture in the powder remains practically constant for several days, but after 48 hours detannisations of the same solution showed rather higher non-tannins. It is possible that even after keeping for some days, re-washing might make the powder quite satisfactory, but this would involve a fresh determination of moisture in a portion of it by drying and weighing as in the case of the A.L.C.A.

One of the features peculiar to the A.L.C. method is the agitation of the solution in detannising, by "shaking for 10 minutes in some form of mechanical shaker," the usual form being the ordinary "milk shake" machine. Mr. H. C. Reed, in an essay for the Klipstein Prize, states that a rotating arrangement of about 60 revolutions per minute used for 15 minutes will give practically the same results as 10 minutes in the milk shake, while the rotating machine is much simpler and more convenient. The authors can confirm this statement in general terms, but think that further experiments are desirable to determine whether a longer time is required in the case of certain tanning materials which detannise with difficulty. It is certain that a "churn" arrangement would be more generally acceptable than the shake machine, which is noisy and uses considerable power, while its advantages over a slow maceration method are equally evident.

The regulations of the A.L.C.A. state that "the non-tannin filtrates must not give a precipitate with a solution of 1 per cent. gelatin and 10 per cent. salt. The disadvantage of this testing solution is that it gelatinises at the temperature of the laboratory, and as a substitute a solution of gelatin peptones (practically a modified "collin") was made up as follows:—5 grms. of good gelatin was soaked in water and dissolved on the water-bath to 50 c.c.; 10 c.c. of $N/1$ sodium hydroxide were added and the mixture heated in the water-bath for 20 minutes; 10 c.c. of $N/1$ hydrochloric acid were then added, the liquid made up to 100 c.c., filtered, and two drops of chloroform added as a preservative. The mixture is at least as sensitive as the gelatin solution, and either will just show visible opalescence with a solution of gallotannic acid of 1 part in 100,000. Since, therefore, all detannised filtrates are tested in this way, any error caused by imperfect detannisation cannot exceed 0·0005 grm. per 50 c.c., and obviously any higher result in tannin obtained by other methods must depend either on lessened solubility of the powder, or absorption of substances which are not tannins. As the total solubility of the powder can be reduced by careful washing to less than 0·001 per 50 c.c., there is obviously not much room for the first of these explanations.

The authors propose continuing their work regarding the details of the process, and especially with regard to the filtration of opalescent tannin solutions, but in view of the deliberations of the Commission now sitting, have been anxious to publish the results of their investigation, so far as it has proceeded, without delay.

Discussion.

Mr. H. G. Bennett said a great many interesting points had arisen in connection with the constitution of chromium salts. A slightly different effect was obtained in the chroming of hide-powder by chrome alum dissolved in the cold, and by a similar solution previously boiled. They hoped to deal with the actual constitution of basic chromium salts at a future date. The fact that Prof. Procter advocated the abolition of a method of his own invention which had been in vogue for many years showed clearly how much he desired improvement in the methods of analysis The German Section of Leather Chemists had raised objections to any change, and their conservative attitude had been an obstacle to advancement.

Mr. J. A. Craven realised the importance of obtaining more accurate results, but thought it was a serious thing to change a method which had been in use so long and to which tanners had grown accustomed. Probably alterations would be felt more by people in the trade than the chemist could realise. More extracts than crude materials were sold on the percentage. Tanners had begun to realise the value of analyses, and now stipulated for a certain percentage of tannin. It would be difficult to convince them that they were getting the same value for their money if the new method gave lower results than the old one on the same materials.

Mr. T. Fairley asked if it was possible to devise a factor showing the relationship between the former method and this later one. Reports could then be given with percentages by each method.

Mr. W. McD. Mackey pointed out that if a factor were used it would go to prove that the old method was as good as this one, whereas what was aimed at was a nearer approach to accuracy. It was his custom to state the method used in each report. Merchants and tanners had built up their data on certain methods, and change would be awkward. Would it not be advantageous to have a standard temperature for the shaking in the American method?

Mr. W. B. Hill hoped that Prof. Procter would have said more about the absorption of acid. The maceration method required over an hour to get good results.

Prof. Procter, in reply, mentioned a paper given by Kopecky (Collegium, 1906, p. 97) in which he described a method of using the maceration process with highly chromed powder. The first results were good; but as the hide-powder was kept, worse and worse results were obtained, the difficulty arising from changes which took place in the powder, probably due to loss of moisture which lessened its absorbency. It was not improbable that the German lightly chromed powder would ultimately suffer in the same way. Mr. Kopecky in the States, and Mr. J. T. Wood of Nottingham, had used commercial chrome leather machine shavings damp, after washing, and had obtained good results. Heavy chroming did not interfere with absorption. The chemists working specially for the leather trade in England had agreed to give the results by both methods for a few months without extra charge, and in view of the approaching change it was desirable to determine contracts by more than one method. The Commission could not unfortunately report before April. No advantage was gained by a factor connecting the two methods if one of them gave wrong results.

THE JUBILEE OF THE COAL TAR COLOUR INDUSTRY.

AMERICAN CELEBRATIONS.

New York.

On Saturday, October 6, a banquet was given to Sir Wm. H. Perkin at Delmonico's. Dr. Chas. F. Chandler occupied the chair, and some 400 guests were present. Mention was made of the general fund that was being solicited for a Perkin Chemical Library, to be installed at the Chemists' Club. After the usual loyal toasts, and a welcome from the City of New York by the Hon. Patrick F. McGowan, Dr. Hugo Schweitzer, Secretary of the Organising Committee, gave an address, in which he described eloquently the history of the discovery o

mauve, the evolution of the coal tar colour industry, the synthesis of medicinal remedies, and the new fields now opened, in all of which coal tar forms the base.

Dr. Wm. H. Nichols then handed to Sir Wm. H. Perkin the first impression of the Perkin medal, in gold, which is to be given annually to the American chemist who has most distinguished himself by his services to applied chemistry. Mr. Adolf Kuttroff, treasurer of the Organising Committee, next presented a tea service as a token of gratitude from American friends.

Dr. W. F. Hillebrand, president of the American Chemical Society, presented the honorary membership of the American Chemical Society. The other speakers were President N. Murray Butler, Prof. Hermann Schumacher (Bonn), President Ira Remsen, Prof. Nernst (Berlin), Dr. H. W. Wiley, and Mr. H. A. Metz.

Sir Wm. H. Perkin, in reply, expressed himself as both honoured and gratified by the warm welcome extended towards him, and for the presentation made. He trusted that the medal would encourage and stimulate chemists to increased activity in research, and he felt sure that the tea service would be valued not only by himself, but by Lady Perkin and his family. He also greatly appreciated the association of his name with the American Chemical Society. After thanking the various speakers for their kind references, Sir Wm. Perkin gave the history of his life's work from the discovery of mauve to the establishment of the coal-tar colour industry. He then referred to the subsequent developments which enabled him to retire from business and once more occupy himself with pure scientific research. In conclusion, he alluded to the influence which the industry had had upon the development of science, and the vast amount of employment it had given to the working classes.

Boston.

On Wednesday, October 10, Sir Wm. H. Perkin was entertained at the Algonquin Club at Boston. About 170 representatives of chemical industry were present. The chair was taken by Mr. F. E. Atteaux, and Prof. H. P. Talbot of the Mass. Inst. of Technology acted as toastmaster. After the usual loyal toasts, Governor Curtis Guild, Jr., welcomed Sir William on behalf of the Commonwealth of Massachusetts, the first textile State in the Union; and the Hon. Thos. A. Mullen followed on behalf of the City of Boston. After speeches by Senator Cabot Lodge; Capt. W. Wyndham, British Consul at Boston; President Henry S. Pritchett, Mass. Inst. of Technology; and Mr. Wm. Whitman, President of the Arlington Mills, Dr. W. H. Walker presented Sir Wm. Perkin with a silver punch bowl, for which Sir William expressed his thanks.

On Thursday morning Sir William and his party visited Harvard University, where they were received by President and Mrs. Eliot, and in the afternoon the Mass. Institute of Technology.

Obituary.

Edmund H. Miller, M.A., Ph.D.

Edmund H. Miller was born at Fairfield, Connecticut, U.S.A., on September 12, 1869. He was admitted to Harvard University in 1886, and in 1887 he entered the School of Mines of Columbia University for special preparation in the branches of analytical and applied chemistry. He graduated as Ph.B. in 1891. From 1891 to 1894 he held the post of Assistant in Assaying, and from 1894 to 1897 that of Tutor in Analytical Chemistry and Assaying. In 1897 he was appointed Instructor in Columbia University, Adjunct Professor in 1901, and Professor of Analytical Chemistry and Assaying in 1904. In conjunction with his students, Dr. Miller published some forty papers on subjects in inorganic and analytical chemistry, including papers on Ferro-, Chromic-, and Cobalticyanides, and on the Platinum metals and their alloys. He published the following books: "Notes on Assaying," in conjunction with Dr. Ricketts; "Calculations in Analytical Chemistry," and, "Quantitative Analysis for Mining Engineers." In addition to his duties in the Department of Chemistry, Dr. Miller was engaged with the administrative affairs of the Columbia University, serving on the Committee of Admissions for three years, during two of which he was Chairman. As a technologist, he had had some practical experience in the laboratories of Messrs. Ricketts and Banks in 1891, and as Chemist for the Arlington Manufacturing Company. Dr. Miller was a member of the Society of Chemical Industry, and of the Committee of its New York Section; a member of the American Chemical Society, Vice-Chairman of its New York Section in 1902–3, Chairman in 1904, and later he was made a Vice-President of the Society. His death took place on November the 8th.

William H. Chandler, Ph.D.

William H. Chandler was born at New Bedford, Mass., on December 13, 1841, and graduated at Union College, Schenectady, in 1862. In 1872 he received the degree of Ph.D. from Hamilton College. Having taught for four years in the Columbia School of Mines, in 1871, he received an appointment in Lehigh University, as Professor of Chemistry. He finally became President of the University, acting also as Emeritus Professor of Chemistry. Dr. Chandler, in 1898, published an encyclopædia of universal knowledge. He was a member of this Society, and also of the American Chemical Society, a Fellow of the Chemical Society of London, member of the Société Chimique de Paris, and of the American Association for the Advancement of Science. He died on November the 30th.

Journal and Patent Literature.

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 1138.)

ENGLISH PATENTS.

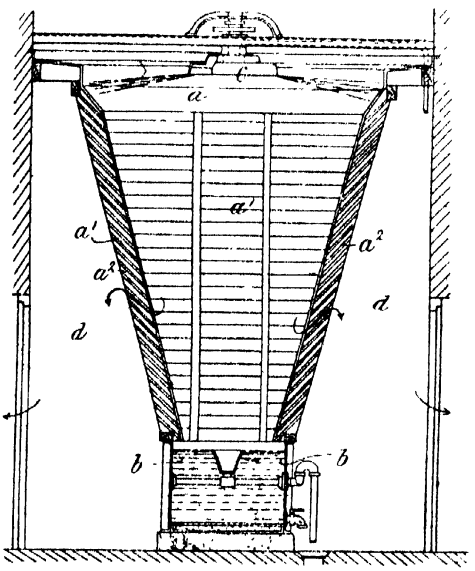
Drying of granular, pulverulent, and other substances ——. A. J. Lehmann, Liverpool. Eng. Pat. 23,106, Nov. 10, 1905.

THE materials to be dried are supported on trays, or by other suitable means in a chamber into which a current of air is forced, under pressure, through several inlets, so that it passes through the chamber and over the materials with a whirling motion in a similar manner to that described in Eng. Pats. 11,705 of 1904 and 3645 of 1905. The moisture-laden air is withdrawn at a slightly higher rate than the fresh air enters to ensure a slight vacuum in the chamber. When dry the contents of the trays are tipped on to the inclined bottom of the chamber from which they are removed.—W. H. C.

Cooling and drying fluids; Processes for ——. F. Kneller, Kalk, and W. Schumacher, Berlin, Germany. Eng. Pat. 24,927, Dec. 1, 1905.

THE fluid is cooled by causing it to exchange heat with a single cooling medium only, which circulates through successive cooling coils. The cooling medium is caused to evaporate at different pressures and consequently at different temperatures in successive coils.—W. H. C.

Purifying, humidifying, or cooling of air or other gaseous fluids. T. F. Shillington and J. A. Hanna, Belfast. Eng. Pat. 1003, Jan. 13, 1906.



THE claim refers to the spraying device described in Eng. Pat. 10,552 of 1905 (this J., 1906, 419). The air or other gas enters the top of the inverted conical chamber, *a*, and after becoming mixed with the spray from the nozzles, *c*, passes in the direction indicated by the arrows, through the spaces, a^2, between the louvres, a^1, which form the sides of the chambers, into the distributing flue, *d*. The excess of liquid is stopped by the louvres, a^1, trickles down, and collects in the reservoir, *b*, carrying with it any impurities taken up from the air.—W. H. C.

FRENCH PATENT.

Mixture of gases or vapours with liquids; Process for the production of a ——. G. Meyersberg. Fr. Pat. 368,235, July 20, 1906.

SHORT pistons or columns of liquid and gas are caused to succeed one another very rapidly so that they become intimately mixed. The liquid is delivered from a distributing wheel or turbine, the rim of which is divided by partitions into a number of compartments. The width of the partitions increases from the inlet to the delivery side of the wheel, which is rotated in front of a similarly divided wheel, so that the width of the partitions governs the length of each fluid piston. As each liquid piston passes from one wheel to the other, it draws in a short piston of gas from the space between, and the mixture is delivered on the further side.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 1140.)

Hydrocarbons; Explosive combustion of ——. *II.* W. A. Bone, J. Drugman, and G. W. Andrew. Chem. Soc. Trans., 1906, **89**, 1614–1625. (See this J., 1906, 526.)

MIXTURES of ethane and oxygen, and ethylene and oxygen, corresponding to $C_2H_6+O_2$ and $3C_2H_4+2O_2$, respectively, were ignited in vessels having different surface areas per unit volume, with the view of discriminating between the various combustion products, it being argued that the greater the cooling effect of the walls of the containing vessel, the larger will be the proportion of primary products of combustion. The results obtained were entirely in accord with the view previously put forward (*loc. cit.*) that combustion both above and below the ignition point involves the initial formation of hydroxylated molecules.

Experiments were also made on the explosion of an equimolecular mixture of ethane and oxygen, and a mixture of butane and oxygen corresponding to $C_4H_{10}+2O_2$, in a stout leaden coil immersed in a water-bath, which, after the explosion, could be rapidly emptied, and then immediately filled with cold water. Examination of the products showed that in all cases a considerable proportion of methane (6·2—8·1 per cent.) was present, and that from 15 to 22 per cent. of the original oxygen appeared in the condensed products of combustion. As a whole, and taking into consideration the higher temperature, it appears almost certain that in exploding, as in ordinary inflammation, hydroxylated molecules are initially produced; and there is no evidence of a preferential combustion of carbon.—A. S.

Coal production and consumption in the principal countries of the world. Bd. of Trade J., Nov. 29, 1906. [T.R.]

THE following particulars, relating to the production and consumption of coal in the principal countries of the world, are extracted from a Return [321/1906] recently issued by the Board of Trade:—

Production.—The production of coal in the five principal coal producing countries of the world in 1903, 1904, and 1905 was as follows, in long tons:—

Countries.	1903.	1904.	1905.
	Tons.	Tons.	Tons.
United Kingdom	230,334,000	232,428,000	236,129,000
Germany.....	114,763,000	118,874,000	119,849,000*
France.....	33,668,000	32,964,000	34,778,000*
Belgium	23,415,000	22,395,000	21,506,000
United States of America	319,068,000	314,563,000	350,821,000*

* Provisional figures.

The production of coal in 1905, in the United Kingdom, Germany, France, and the United States was greater than in any previous year, but in Belgium the output again shows a decline. The total known coal production of the world (exclusive of brown coal or lignite) in 1905 was about 840 million tons. The following statement shows the production of coal in the principal British Colonies and possessions in the years 1903, 1904, and 1905, in long tons:—

Countries.	1903.	1904.	1905.
	Tons.	Tons.	Tons.
British India	7,438,000	8,217,000	8,425,000
Australian Commonwealth	7,112,000	6,854,000	7,496,000
New Zealand	1,420,000	1,538,000	1,586,000
Canada	6,825,000	6,705,000	7,836,000
Transvaal	2,012,000	2,151,000	2,327,000
Cape of Good Hope .	185,000	154,000	147,000
Natal	714,000	858,000	1,129,000

Nearly the whole of the output of the Australian Commonwealth is produced in New South Wales. The principal lignite-producing countries are Germany, Austria, and Hungary, which in 1904 produced 47,853,000 tons, 21,635,000 tons, and 5,430,000 tons respectively, whilst the provisional figures available for the production of Germany in 1905, indicate an increased production of 51,655,000 tons. In Austria the output of lignite for 1905 was 22,327,000 tons. The quantity of lignite produced in the United States is included in the figures for the production of coal already given. The latest available figures giving the production of lignite separately, relate to 1904, when it amounted to 5,725,000 tons.

Consumption.—The consumption of coal in some of the chief consuming countries is shown in the following statement:—

Countries.	1903.	1904.	1905.
	Tons.	Tons.	Tons.
United States	314,114,000	307,610,000	343,280,000*
United Kingdom	166,532,000	166,609,000	169,017,000
Germany	100,164,000	104,094,000	106,715,000*
France	40,571,000	45,433,000	46,046,000*
Russia	20,882,000*	22,724,000*	20,890,000*
Belgium	20,682,000	19,726,000	19,661,000
Austria-Hungary	17,987,000	18,421,000	19,390,000*

* Provisional figures.

ENGLISH PATENTS.

Fuel; Artificial ——, and manufacture thereof. Internat. Patent Fuel Syndicate, Ltd., and J. J. Shedlock, London. Eng. Pat. 22,677, Nov. 6, 1905.

SMALL or refuse coal, mixed according to its character with a suitable quantity of liquid hydrocarbons, such as gas tar, astatki, refuse petroleum, &c., is fed into a hopper and conveyed to an automatic mixer. The mixture is passed through an automatic measuring and feeding device into a cylindrical gas-tight chamber. The chamber contains a number of hollow circular shelves or trays, and the mixture is moved along each shelf, by radial arms on a central vertical spindle, until it drops through an aperture to the shelf below. Steam, hot air, or furnace gases are drawn through the hollow shelves by a fan, and the fuel mixture is heated so as to produce a tacky pitch-like coating. The heated mixture is discharged at the bottom of the chamber through an automatic device which does not allow the escape of gas, and is formed into briquettes in a press. The gases and vapours evolved in the heating chamber are withdrawn by an exhauster, and passed through a condenser.—A. T. L.

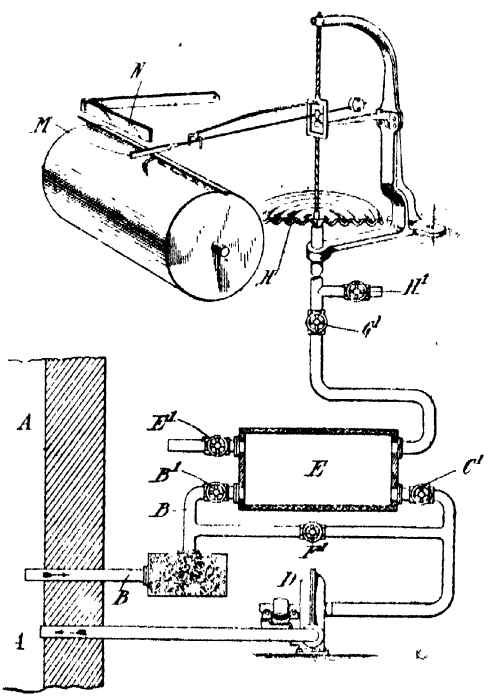
Coal-washing installations; Fine-coal or schlamm extractor for ——. G. Smith and the Hardy Patent Pick Co., Ltd., Sheffield. Eng. Pat. 25,135, Dec. 4, 1905.

THE water from the coal washers, having the fine coal in suspension, is led through a long settling tank, of suitable length and depth, from the discharge end of which the top- or clean water overflows into a receiver, whence it is pumped back into the washers. An endless chain, provided with scrapers, travels slowly along the bed of the tank and up an inclined shoot, carrying with it the sediment of coal, allowing the water to drain back on the shoot, and delivering the coal-mud where desired. Preferably, the sides of the settling tank converge towards the bottom, and the scrapers are shaped so that they will always fit themselves to the sides and bottom and thus compensate for wear.—H. B.

Washing coal, coke, minerals, and the like; Machine for ——. G. H. Rayner and The Hardy Patent Pick Co., Ltd., Sheffield. Eng. Pat. 1660, Jan. 22, 1906.

IN the type of apparatus in which the material to be treated is conducted up an inclined trough against a current of water, which carries the small coal, &c., to the lower end, whilst the dirt settles between the scrapers of the conveyor, and is collected at the upper end, means are provided for raising, or raising and rotating, some of the scrapers at certain parts of the trough, so that the material is carried back and re-washed; efficient re-washing is ensured by admitting air or water under pressure through perforations in the trough of the conveyor. In the arrangement described, the material is released for re-washing by every second scraper at one point, and by the other scrapers at another point, both points being near the upper end of the trough.—A. T. L.

[*Flue*] *Gases; Method and apparatus for estimating and recording the quality of ——.* Cambridge Scientific Instrument Co., Ltd., and C. V. Burton, Cambridge. Eng. Pat. 22,919, Nov. 8, 1905.



The valves, E^1, F^1, and G^1, being closed and the valves B^1, C^1, open, flue gas is continuously circulated by the pumping apparatus, D, from the chimney, A, by way of the supply pipe, B, through the diffusion chamber, E, and back by the return pipes, C, to the chimney. Thus a sample of flue gas is secured in the chamber, E. At the same time the valve, H^1, remains open so that the

pressure inside the chamber, H, is the same as the surrounding atmospheric pressure. After the lapse of a short interval of time (say, one minute), the valves, B^1, C^1, are closed, while the valve, E^1, after being momentarily opened to equalise the pressure inside and outside the chamber, E, is closed again, while at the same time the valve, H^1, is closed and the valves, F^1, and G^1, are opened. Flue gas can now circulate from the supply pipe, B, to the return pipe, C, through the by-pass, F, while the chambers, E, and H, are shut off from communication with anything but one another, and are initially at atmospheric pressure. The flue gas in the chamber, E (composed of porous material or containing a porous septum) being of greater density than the air outside diffuses outwards through the porous septum more slowly than the air diffuses in. This causes the pressure in the chambers, E, H, to rise above the atmospheric pressure and to continue rising until a maximum is reached after which it again begins to diminish. The maximum pressure is greater the greater the density of the flue gas and where the fuel being burnt is coal or coke the density of the flue gas is generally determined by the proportion of carbon dioxide present. Thus by registering the variations of pressure within the chambers, E, H, a record is obtained showing from time to time the density of the flue gas, and, approximately, its carbon dioxide content. After momentarily opening E^1 to the air, the valves, G^1 and F^1, are opened, thus connecting the box, E, with a manometer box, H, to which is attached an indicator, M. A hammer, N, actuated by clockwork, strikes the indicator, M, at regular intervals, thus recording the pressure in the box, E, after the gas has diffused for a given time. More gas is then automatically admitted by a turn of the spindle operating the three valves mentioned above, the pressure inside and outside the box again equalised by opening E^1, and diffusion allowed to take place as before. B. J. S.

Fire-clay and other retorts for making gas and for other purposes. G. H. Timmis, Stourbridge, and W. D. Jones, Bristol. Eng. Pat. 23,464, Nov. 15, 1905.

Two or more horizontal fire-clay retorts are made in one piece, the one above the other, and are united for the whole of their length, or are provided with holes or passages through the connecting wall, for the passage of the hot gases between them. The retorts are fitted with a single cast-iron mouthpiece, gas-outlet, and ascension-pipe in common. A movable tray, adapted to be fitted upon lugs on the sides of the mouthpiece, is provided to facilitate the charging and drawing of the upper retorts —H. B.

Filaments of electric glow lamps; Process of electrically connecting the —— with their supply wires. H. Kuzel, Baden, Austria. Eng. Pat. 12,153, May 24, 1906. Under Int. Conv., Aug. 4, 1905.

SEE Fr. Pat. 366,267 of 1906; this J., 1906, 1035.—T. F. B.

FRENCH PATENTS.

Coke-oven; Recovery —— working with or without regeneration of heat without reversal of the gaseous currents within the oven. E. Clère. Fr. Pat. 368,217, July 19, 1906.

THE gaseous fuel mixed with air is burnt in a combustion chamber situated beneath the ovens, and the gases are only admitted to the heating flues after the combustion has been completed. When it is desired to utilise the heat of the waste gases, the reversal of the currents is effected in a subsidiary chamber, the direction in the oven flues remaining always the same.—W. H. C.

Hydrocarbon liquid; Manufacture of a ——. E Luserna di Rora. Fr. Pat. 368,403, Feb. 19, 1906.

ACETYLENE and water-gas are passed simultaneously through a vessel heated to about 200° C., and the gaseous mixture is then led through a refrigerating apparatus, within which it is said to deposit a highly refractive liquid (named "Azurrol"), of sp. gr. 0·6—0·8, which, it is stated, "may advantageously replace sulphuretted hydrogen, petroleum spirit, and other similar liquids."—H. B.

Alcohol for lighting, heating, and power purposes; Treatment of ——. G. E. Lebœuf. Fr. Pat. 367,985, July 11, 1906.

THIS treatment of alcohol, carried out with a view of producing a carburetted and illuminating mixture useful for lighting, heating, or motive purposes, consists in partially transforming the alcohol into more highly illuminating bodies, such as ethers, acetone, or benzoïn, and in adding, as required, an animal, vegetable, or mineral hydrocarbon. The process is applicable to alcohols of all kinds and all concentrations, and to the ethers and other compounds derived from them.—T. H. P.

Coal gas and the like; Process of cooling and condensing —— so as to avoid decomposition of the heavy hydrocarbons and similar substances. P. A. Mallet. Fr. Pat. 361,778, Sept. 19, 1905.

A JET of atomised liquid, such as water, is injected into the ascension pipes or the like, so as to reduce suddenly the temperature of the gas to, say, 100° C., whereby the condensed tar is kept in a fluid state, and produces no stoppages.—H. B.

Suction gas producer. A. Béchevot. Fr. Pat. 361,792, Dec. 8, 1905.

THE hopper of the producer is provided at its lower part with a conical extension, which projects into the combustion chamber and is provided with an external flange at a level below that of the gas outlet pipe of the producer. The area of the annular space between the flange and the wall of the producer is equal to that of the gas outlet pipe; by this means the formation of channels in the fuel, through which the gas may take a short cut to the outlet, is prevented. The fuel in the producer rests on a conical, hollow, steel bed, which serves as a vaporiser, through which the air supply is drawn on its way to the bottom of the fuel; this device is kept filled to a constant level with water overflowing from the main vaporiser, which latter is situated at the side of the producer and is heated by the hot gases. The air-inlet to the producer is controlled by a flap-valve, which can be set, by means of an adjustable stop, to any desired limit of movement.—H. B.

Gas; Process and apparatus for making ——. P. I. Cohen. Fr. Pat. 368,508, July 30, 1906.

SEE U.S. Pat. 827,081 of 1906; this J., 1906, 842.—T. F. B.

Gas works; Process for increasing the yield of gas, with simultaneous automatic revivification of the purifying materials (oxide of iron) in ——. E. E. P. M. Blanc and P. A. Caton. Fr. Pat. 368,520, July 30, 1906.

A CERTAIN proportion of air is mixed with the coal gas, the air having previously been brought into contact with tar heated to a temperature short of 200° C., whereby the air becomes impregnated with lighting hydrocarbons contained in the tar. The mixture of gas and air is enriched further with benzol, and is then passed through purifiers containing oxide of iron. Owing to the presence of oxygen in the gas, the revivification of the oxide proceeds continuously and simultaneously with the removal of the sulphur from the gas.—H. B.

Pyrophoric alloys for igniting and lighting purposes. C. Auer von Welsbach. First Addition, dated July 18, 1906, to Fr. Pat. 337,320, Oct. 31, 1903 (this J., 1904, 484).

IN preparing the pyrophoric alloys of iron and an earth metal, such as thorium, as described in the principal patent, a small proportion of cerium is added. This may be effected by using the commercial salts of thorium, &c., which contain cerium as an impurity.—H. B.

Glow-bodies, especially filaments of tungsten; Manufacture of metallic —— for electric lamps. Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 367,386, June 8, 1906.

A CONTINUOUS, instead of an alternating, current is employed in the process of concretion of tungsten filaments, wherein the crude filament is heated to incandescence in a neutral atmosphere.—H. B.

Glow-bodies for incandescence electric lamps; Manufacture of metallic ——. Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 368,225, July 19, 1906.

FILAMENTS composed of powdered metallic molybdenum, tungsten, vanadium, or tantalum, and a carbonaceous agglutinant, are heated in an atmosphere of ammonia gas, or of a mixture of hydrogen and nitrogen, whereby the carbon is eliminated from the filaments in the form of cyanogen and hydrocyanic acid, and the risks attendant upon the use of an oxidising gas are avoided.—H. B.

Filaments of vanadium carbide. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 368,506, July 30, 1906.

SEE Eng. Pat. 19,264 of 1905; this J., 1906, 803.—T. F. B.

GERMAN PATENTS.

Lignite briquettes; Process and apparatus for scrubbing the fumes ("Wrasen") evolved in the manufacture of ——. H. Emonds. Ger. Pats. 166,355, March 26, 1904, and 166,356, Jan. 1, 1905.

THE fumes are passed by means of forced draught, or by a fan or the like, up a washing tower divided by horizontal partitions into a number of compartments, each provided with a rose through which water is forced under pressure. The carbonaceous particles in the fumes and the particles of water move in opposite directions, in nearly straight, vertical lines, and on meeting, the former are brought to a standstill and saturated with water, whereupon they fall with the descending water. According to Ger. Pat. 166,356, the washing tower is divided into compartments by inclined, helical, or horizontal partitions of wire gauze or of perforated sheet metal, and the carbonaceous particles are separated as a mud by impact with water, steam, or other fluid substance. The tower, also, may be provided with a head-piece with the walls tapering downwards, and resting in the upper part of the tower. The upper parts of the walls of the head-piece taper upwards, and inside are baffle-plates, whereby a whirling motion is imparted to the fumes, and the separation of the carbonaceous particles is improved.—A. S.

Briquettes from lignite and lime; Process for the manufacture of weather-resistant ——. F. Richter. Ger. Pat. 165,804, Aug. 12, 1904, and Ger. Pat. 166,836, Dec. 9, 1904, Addition to Pat. 165,804.

To the powdered lignite is added as much quicklime as will correspond to the sulphuric acid present in the lignite, and the mixture is formed into briquettes in the usual manner. It is stated that calcium sulphate is formed, if a sufficiently high pressure be employed, and acts as binding agent. According to Ger. Pat. 166,836, the mixture of lignite and lime is warmed before being compressed into briquettes.—A. S.

Water-gas or mixed gas; Process for the continuous production of ——. G. Horn. Ger. Pat. 167,112, May 2, 1903.

THE apparatus comprises a vertical retort, the height of which is varied according to the kind of combustible used, and a decomposing chamber below the retort, and forming a direct continuation of the same. One or more sides of the decomposing chamber are formed of gratings through which highly superheated steam is introduced. The combustible in the form of fine powder or spray is allowed to fall freely through the vertical retort, which is heated to incandescence. The incandescent, carbonaceous material reacts with the steam in the decomposing chamber, with the production of water-gas, whilst non-volatile impurities are deposited below the decomposition-zone.—A.

Air-gas [Carburetted air] of uniform composition; Process and apparatus for the manufacture of ——. G. Spork. Ger. Pat. 169,179, Jan. 17, 1904.

THE cylinder in which the carburetted air is produced has a valve near the exit end for the introduction of the carburetting liquid, and a second valve nearer the other end of the cylinder for the introduction of air. When the piston working in the cylinder is set in motion, the air is partially exhausted from the cylinder, and a definite quantity of the carburetting liquid is drawn in. This rapidly evaporates, and mixes with the air drawn in after the piston passes the air-inlet valve, whilst, on the return stroke of the piston, the mixture is compressed and forced out from the cylinder into a gas-holder.—A. S.

Heating gases; Device for the production of ——. P. Mongenast. Ger. Pat. 169,751, March 4, 1904.

THE gases produced in a combustion-shaft, before they come in contact with any cold surfaces, are led through a mixing chamber, in the walls of which are air-inlet openings. In the mixing chamber is a series of horizontal partitions forming parallel passages for the gases. Air-supply pipes pass vertically through perforations in the horizontal partitions.—A. S.

Gases evolved during the charging of vertical gas-retorts; Device for leading away the ——. Dessauer Vertikal-Ofen Ges. m.b.H. Ger. Pat. 167,277, Oct. 1, 1904.

PROTECTING walls or plates are fixed on the sides of the charging hoppers, and abut against the charging floor above the retorts, in order to prevent the evolved gases having exit sideways. Also, above the charging floor is a flue, acting as a chimney, between the coal wagons, whereby the tendency of the gases to rise is favoured.—A. S.

ERRATUM.

This J., 1906, page 1139, col. 2, line 4 from bottom, *for* "Sickert" *read* "Sichert."

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 1142.)

UNITED STATES PATENT.

Furnace; Retort [for wood distillation]. P. Brown, Bellingham, Wash. Assignor to Troy Chem. Manufacturing Co., Ltd., Troy, Idaho. U.S. Pat. 835,237, Nov. 6, 1906.

THE apparatus, which is adapted for the distillation of wood, comprises a chamber containing a series of interchangeable retorts filled with flanged covers, each retort having an opening in the end to receive a pipe, which passes through the wall of the furnace and is capable of longitudinal movement, so as to permit of its being fitted into the hole in the particular retort to which it belongs. Each pipe has a separate delivery for the by-products escaping from the retort.—D. B.

GERMAN PATENT.

Ammonia; Process and apparatus for the recovery of —— from coke-oven gases. W. Heinemann. Ger. Pat. 166,380, Nov. 25, 1903.

THE patent relates to a process for the recovery of ammonia from coke-oven gases by leading such gases into concentrated acid, provision being made for the continuous removal of the separated tar, which collects on the surface of the acid. By means of a jet of steam, to which sufficient acid may be added to neutralise the ammonia in the gases, the latter are caused to enter the acid-bath at such an angle that they set the supernatant layer of tar in motion. The vessel containing the acid is divided transversely by an overflow device, over which the tar passes into a separate compartment, from which it is withdrawn.—A. S.

Column still for ammoniacal liquor. C. Francke. Ger. Pat. 169,444, June 4, 1904.

In a column still for ammoniacal liquor, the immersion bells in the still are connected, either singly or in groups, to a kind of frame, which can be raised or lowered from outside the apparatus. By this means the depth to which the bells are immersed in the liquid can be easily regulated, and stoppages avoided.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 1143.)

Nitration; A new process of ——. O. N. Witt and A. Utermann. Ber., 1906, **39**, 3901—3905.

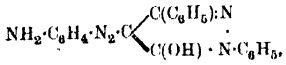
The method consists in the use of acetic anhydride or glacial acetic acid instead of sulphuric acid as a means of absorbing the water produced in nitration operations. Example: 45 grms. of acetanilide are dissolved in 22 grms. of glacial acetic acid, and to the solution is added a mixture of 23 grms. of nitric acid, sp. gr. 1·5, and 1 grm. of urea (to destroy any nitrous acid) with 23 grms. of glacial acetic acid. After 24 hours 360 grms. of ice are dropped in, and the crude products which separate are treated with a mixture of 1 vol. of 50 per cent. caustic potash, 4 vols. of alcohol, and 1 vol. of water. On filtering, pure *p*-nitroacetanilide remains behind, and the filtrate, after gentle warming to complete the saponification, yields the *o*-nitroaniline. The yield (calculated on the acetyl compounds) was 10·8 grms. of *p*- and 32·8 grms. of *o*-nitroacetanilide. The process is recommended as a very convenient one for the preparation of *o*-nitroaniline on the large scale, being simpler and cheaper than that of Nietzki and Benckiser (this J., 1885, 276).—J. C. C.

b(b)*b'-Disazo-compounds of p-phenylenediamine with heterocyclic components.* C. Bulow and F. Busse. Ber., 1906, **39**, 3861—3868.

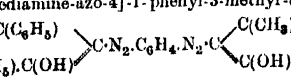
By combining diazotised aceto-*p*-phenylenediamine with benzoylacetic ester in presence of sodium acetate, aceto-*p*-phenylenediamine-azo-benzoylacetic ester

$$CH_3.CO.NH.C_6H_4.N_2.CH(CO_2C_2H_5).CO.C_6H_5$$

is obtained in yellow needles, m. pt., 95·5° C. Fatty aromatic azo-compounds of this kind are comparable with the corresponding β-naphthol dyestuffs. On boiling with phenylhydrazine in glacial acetic acid solution, this compound gives rise to [aceto-*p*-phenylenediamine-azo-4]-1:3-diphenyl-5-pyrazolone, which crystallises from dilute acetic acid in red needles, and on saponification yields [*p*-phenylenediamine-azo-4]-1:3-diphenyl-5-pyrazolone,



crystallising from alcohol in red-brown needles melting at 208°—209° C. This amino-azo-compound can be further diazotised, and then on combination with aceto-acetic ester in sodium acetate solution, yields 1:3-diphenyl-5-pyrazolone-[4-azo-*p*-phenylenediamine-azo-4]-aceto-acetic ester, which crystallises from alcohol in red needles melting at 195°—196° C., and on condensation with phenylhydrazine gives 1:3-diphenyl-5-pyrazolone-[4-azo-*p*-phenylenediamine-azo-4]-1-phenyl-3-methyl-5-pyrazolone,



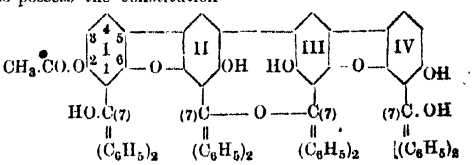
crystallising from benzene in brown-red leaflets with a greenish metallic reflex, melting at above 270° C. This disazo-compound dissolves with a deep red colour in concentrated sulphuric acid. It is also obtained by combining diazotised 1-phenyl-3-methyl-5-pyrazolone-[4-azo-phenylenediamine] with benzoylacetic ester and condensing the product with phenylhydrazine.—J. C. C.

Isorosindone and thiorosindone; Action of hydroxylamine on ——, *and formation of naphthosafranol from isorosindone.* O. Fischer and K. Arntz. Ber., 1906, **39**, 3807—3812.

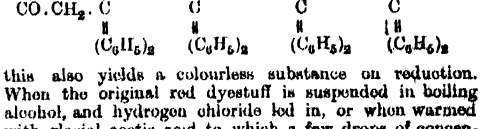
The substance obtained by the action of hydroxylamine on isorosindone, hitherto regarded as isorosindoneoxime, is shown to be *s*-amino-isorosindone. By boiling the diazo-compound of the latter base with alcohol, isorosindone was produced, whilst the amino-compound on being heated with glacial acetic acid and hydrochloric acid under pressure to 180°—190° C. gave rise to oxyisorosindone, which on treatment with caustic potash and methyl- or ethyl iodide yielded the corresponding ether of the isomeric naphthosafranol. As a consequence of these experiments the so-called *ms-o*-tolylisorosindone is now to be regarded as *ms-o*-tolylamnorosindone. By the action of hydroxylamine on thiorosindone a substance of the composition $C_{22}H_{15}ON_3$ is obtained, which is identical with the product of the interaction of hydroxylamine and phenylnaphthophenazonium-6-sulphonic acid. It is not yet possible to say whether this compound is rosindoneoxime or 6-oxamnophenylnaphthophenazonium anhydride. By heating isorosindone with glacial acetic acid and hydrochloric acid to 200° C., oxyrosindone (naphthosafranol) is obtained.—J. C. C.

Benzil with resorcinol; Condensation of ——. *Pt. II. Derivatives of m-tetra-2:6-dihydroxytritanol.* H. von Liebig. J. prakt. Chem., 1906, **74**, 345—419.

By fusing benzil (200 grms.) with resorcinol (160 grms.) in presence of caustic potash or potassium carbonate (200 grms.) at 130°—140° C., a mixture of 10 new compounds results, from which a red dyestuff, $C_{78}H_{54}O_{10}$, is separated by extraction with boiling glacial acetic acid. This is said to possess the constitution—

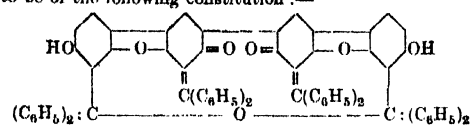


and is given the name: 2I-acetoxy-*m*-tetra-2:6-dihydroxy-tritanol-6I2II6III2IV-diether-7II7III-anhydride. (The word "tritan" represents the triphenylmethane nucleus $(C_6H_5)_3C$-, "ether" denotes the phenyl ether linking $C_6H_5.O.C_6H_5$, and *o*, *m*, *p* before the Greek numerals tetra, &c., indicate that a direct union takes place between the corresponding number of phenyl groups (in the above case, four) in the *o*-, *m*-, or *p*-position. "Anhydride" indicates the etheric union between the aliphatic carbon atoms, and "anhydro" denotes that water has been eliminated between the groups numbered.) The substance is only sparingly soluble in the usual organic solvents (with the exception of the aliphatic hydrocarbons); its solutions are yellow with a bright green fluorescence. Concentrated solutions of the alkali salts are dark violet-red and do not fluoresce. On dilution, however, an intense green fluorescence is noticed, and the diluted solutions are bluish-red, resembling that of eosin. The red dyestuff is reduced to a colourless substance by zinc and glacial acetic acid, and on being heated alone to 280°—320° C. yields a dark brown compound soluble in chloroform giving a brown solution with green fluorescence, and, according to the author, possessing the constitution—

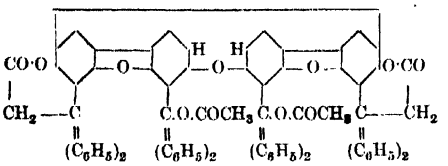


this also yields a colourless substance on reduction. When the original red dyestuff is suspended in boiling alcohol, and hydrogen chloride led in, or when warmed with glacial acetic acid to which a few drops of concentrated sulphuric acid have been added, the substance is

converted into the red "tritanone other" crystallising from chloroform in red needles, m. pt. 274° C., and stated to be of the following constitution :—



This compound yields a colourless substance on reduction. When either of the two preceding compounds is heated with acetic anhydride and sodium acetate, a blue tetracetyl-derivative is obtained stated to have the formula—



This body yields a deep blue solution in benzene, and melts at about 200° C. A large number of salts, acetyl-derivatives, and addition compounds of these substances is described, and their constitution discussed with reference to the existing theories of colour and fluorescence.—J. C. C.

Dyestuffs of the stilbene group. Part III. A. G. Green and P. F. Crosland. Chem. Soc. Trans., 1906, **89**, 1602—1614.

It has been shown previously (this J., 1893, 146, 837; 1904, 1142) that in the production of stilbene dyestuffs from *p*-nitrotoluene or its ortho substituted derivatives by heating with caustic alkalis, the first step is the formation of unstable and easily oxidisable dinitrosostilbene compounds of the type: $(NO)(X)C_6H_3.CH{:}CH.C_6H_3(X)(NO)$. These nitroso compounds have, in alkaline solution, a deep crimson, violet, or blue colour. In order to ascertain the nature of the change of the nitroso compounds into stilbene dyestuffs on further heating with caustic alkalis, a number of dyestuffs (Stilbene Yellow 8 G and 4 G, Direct Yellow RT, and Mikado Orange) were (1), reduced to diaminostilbenedisulphonic acid by titration with titanium trichloride (see Knecht, this J., 1903, 825; J. Soc. Dyers and Col., 1905, **21**, 292), and the quantity of hydrogen consumed, determined; (2) oxidised with permanganate in cold dilute aqueous solution to aldehydes (see Eng. Pat. 1431 of 1898; this J., 1899, 133), in order to determine the number of ethylene groups. The aldehyde groups produced in (2) were determined by titration with phenylhydrazine; and the aldehydes were isolated and identified. The results obtained, indicate that the second step in the production of stilbene dyestuffs from the intermediate nitroso compounds consists in the oxidation of one nitroso group at the expense of the other, and the union of the remaining nitrogen atoms of two molecules of the nitroso compound to form an azo-group.

$$2\ \begin{matrix}CH.C_6H_3(SO_3Na)NO\\ \ddot{C}H.C_6H_3(SO_3Na)NO\end{matrix}$$

$$\begin{matrix}CH.C_6H_3(SO_3Na)\cdot N & \text{----} & N.C_6H_3(SO_3Na)CH\\ \ddot{C}H.C_6H_3(SO_3Na)(NO_2) & & (NO_2)(SO_3Na)C_6H_3.\ddot{C}H\end{matrix}$$

In the case of the redder yellows and of the orange dyestuffs, the two nitro groups are reduced first to an azoxy-, and finally to an azo-group.

Stilbene Yellow 8G.—The dyestuff was purified by repeated precipitation as the potassium salt, and the latter finally washed with 50 per cent. alcohol. On reduction with titanium trichloride according to Knecht's method (*loc. cit.*), the amount of reducing agent agreed well with that required for the reduction of dinitroazodistilbenedisulphonic acid, and this view was confirmed by the result of the oxidation with permanganate. The aldehydes produced were identified as nitrobenzaldehydesulphonic acid and azobenzaldehydesulphonic acid. Stilbene Yellow 8 G thus consists almost entirely of the sodium salt of dinitroazodistilbenedisulphonic acid, formulated above.

Stilbene Yellow 4 G.—This consists substantially of the same compound as the 8 G brand of dyestuff, but contains in addition a small quantity of the corresponding azoxy compound:

$$\begin{matrix}CH.C_6H_3(SO_3Na).N=N.C_6H_3(SO_3Na).CH\\ \ddot{C}H.C_6H_3(SO_3Na).N\text{—}N.C_6H_3(SO_3Na).\ddot{C}H\\ \qquad\qquad\qquad\qquad\quad \backslash O /\end{matrix}$$

Direct Yellow RT (Direct Yellow, Curcumine S, Sun Yellow, Naphthamine Yellow).—This dyestuff contains considerable quantities of an azomethine compound. After purification, it gave results showing that the pure stilbene dyestuff was the sodium salt of azoxyazodistilbenedisulphonic acid. It was not found possible to effect a separation of the two aldehydes produced on oxidation, but the mixture gave the characteristic colour reactions of azobenzaldehydedisulphonic acid, and on titration with phenylhydrazine gave a result corresponding with that required by a mixture of equimolecular proportions of azobenzaldehydedisulphonic acid and azoxybenzaldehydedisulphonic acid.

Mikado Orange.—Of the various brands of this dyestuff, that marked 3RO appears to be the most completely reduced product, the brands, 4RO and 5RO, being probably mixtures of this with a red dyestuff. It was not found possible to completely free the dyestuff from an accompanying azomethine compound, which was present in large quantities. As the purification progressed, however, the results obtained on reduction of the dyestuff with titanium chloride, and on oxidation, approximated more and more to those required for the alkali salt of disazodistilbenedisulphonic acid,

$$\begin{matrix}CH.C_6H_3(SO_3Na)\,N{:}N.C_6H_3(SO_3Na).CH\\ \ddot{C}H.C_6H_3(SO_3Na).N{:}N.C_6H_3(SO_3Na).\ddot{C}H\end{matrix}$$

From the oxidation products two aldehydes were isolated, of which one proved to be azobenzaldehydesulphonic acid formed from the disazodistilbenedisulphonic acid, whilst the other was probably an oxidation product of the azomethine compound.—A. S.

English Patents.

Sulphine colours [Sulphide dyestuffs]; Preparations of ——. R. B. Ransford, Upper Norwood, Surrey. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 7273, March 26, 1906.

The transformation of sulphide dyestuffs into colours which dissolve easily in dilute alkalis may be effected by desiccating their pastes with glucose. The following example illustrates the method of working:—100 kilos. of Immedial Black NG, 40 per cent. paste, are mixed with a concentrated solution of 40 kilos. of glucose, and desiccated in a vacuum, at 140° C. The dried product is readily soluble in dilute alkalis, and dyes cotton direct a black shade. The dyeings are best carried out with the addition of sodium sulphate or chloride.—D. B.

Phenylglycine or its homologues; Manufacture of ——. O. Imray. London. From Farbwerke vorm. Meister, Lucius, and Brüning, Hoechst a/Main, Germany. Eng. Pat. 9700, April 25, 1906.

The process consists in heating nitrobenzene or a homologue with iron and chloracetic acid, *e.g.*, 620 kilos. of nitrobenzene, 1000 kilos. of finely-divided cast iron, and 70 kilos. of aniline are introduced into a vessel provided with an agitator, reflux condenser, and thermometer. The whole is heated to about 70° C., whereupon a solution of 470 kilos. of monochloracetic acid in 1000 litres of water is gradually run in. The chloracetic acid is added in such a manner that the mass may remain boiling. The heating is continued for another couple of hours at 98°—100° C., and the mass is then neutralised with a concentrated solution of sodium carbonate, and distilled with steam, about 70 kilos. of aniline passing over, which can be used again. The mixture is passed through a

filter-press and the residue washed with water. The phenylglycine is separated from the combined filtrate and washings by the addition of the requisite quantity of a mineral acid. The nitrobenzene can be replaced by its homologues.—A. B. S.

Indigo; Manufacture of substances suitable for use in the production of ——. E. C. Schrottky, London. Eng. Pat. 10,506, May 4, 1906.

It has been found that alkaline glucosates or saccharates can be used with great advantage in the process of extracting indigo from the plant. For their production, 100 parts of caustic soda are dissolved in about 200 parts of water, and after bringing the solution to a temperature of 140°—160° F., 100 parts of glucose are gradually added to the mass with constant stirring during a period of 10 minutes, to cause the temperature to rise either spontaneously, or, if necessary, with the aid of heat to 240° F. The resulting solution is employed in the following manner:—For treating 1000 cb. ft. of indigo plants from 40 to 80 lb. are diluted with about 10 times the weight of water, the solution is mixed with the steeping water, and allowed to remain for 16 hours or more in contact with the plants. The steeping liquor is then removed and treated, prior to being heated, with about 40 lb. of caustic soda, after which, and before boiling, 20 lb. of concentrated sulphuric acid, previously diluted with 10 times the weight of water, are added to the indigo fecula.—D. B.

FRENCH PATENTS.

5-Hydroxy-1.2-naphthimidazole-7-sulphonic acid; Production of derivatives of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 368,297, July 19, 1906.

The derivatives of 1.2-naphthimidazole-5.7-disulphonic acid, obtained by combining a suitable diazo-compound with 2.5.7-naphthylamine-disulphonic acid, diazotising the product, combining with an aromatic aldehyde, and reducing, are converted into the corresponding derivatives of 5-hydroxy-1.2-naphthimidazole-7-sulphonic acid by fusion with an alkali hydroxide. When combined with a diazonium compound, these compounds produce dyestuffs which dye unmordanted cotton directly, in a variety of shades from red to blue. (Compare Eng. Pat. 11,759 of 1905; this J., 1906, 215.)—T. F. B.

Dyestuff; Process for preparing a new orange monoazo —— Act.-Ges. f. Anilinfabr. Fr. Pat. 368,259, July 21, 1906.

The combination of diazotised *o*-chloro-*p*-nitraniline with β-naphthol gives rise to a dyestuff which produces orange shades when dyed on textile fibres. The dyestuff may, when desired, be produced on the fibre in the same manner as *p*-Nitraniline Red, or it may be formed in presence of the various compounds necessary for lake formation. Both the dyeings and the lakes obtained, are said to be extremely fast to light.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 1145.)

Fibres in a mixed fabric; Identification and counting of the various ——. O. Lecomte. J. Pharm. Chim., 1906, **24**, 447.

One hundred sq. cm. of the bleached fabric are soaked in 30 c.c. of 10 per cent. nitric acid until saturated. Thirty c.c. of a 5 per cent. sodium nitrite solution are then added a little at a time during three minutes. The diazotisation is completed in 10 minutes, and the fabric is well washed with water for two minutes and then cut in halves. One portion is placed in 40 c.c. of an alkaline solution of plumbite and naphtholate of soda, and the other portion in 40 c.c. of an alkaline solution of plumbite and resorcinate. This operation should be carried out below 20° C. At the end of two hours the operation is terminated. The two pieces are well washed with water and then soaked for five minutes in a 5 per cent. solution of hydrochloric acid, and finally well washed and dried in the dark. In the portion treated with plumbite and naphtholate, the silk threads appear a rose-red, the wool black, and the vegetable fibres white. In the other portion the silk appears orange, and the wool and vegetable fibres the same as with the naphtholate.—A. B. S.

Carbonising with bisulphate of soda. Spennrath. Oesterr. Wollen und Leinen Ind., 1906, 962. J. Soc. Dyers and Col., 1906, **22**, 383.

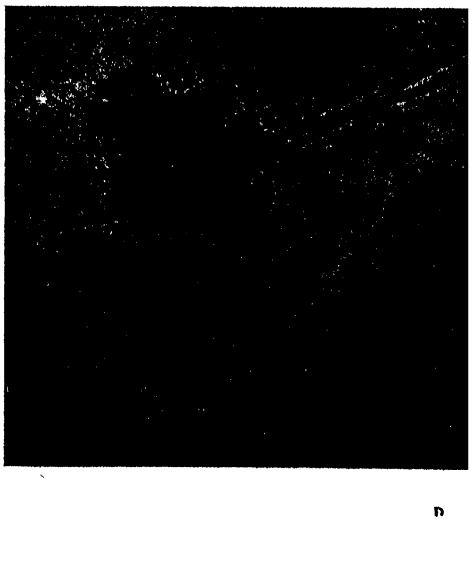
The goods are impregnated with a solution of sodium bisulphate at 10° T., and are left in the bath for a somewhat longer period than when sulphuric acid is used. After squeezing, the material is dried in a stove at 100° C., whereby, it is stated, the vegetable fibres are disintegrated but not blackened. The process would appear, therefore, to be specially suitable for white or light-coloured goods, and is also stated to be very advantageous for loose wool. For neutralising, a "soda solution" of not more than 2° T. is employed. The great advantage of carbonising with sodium bisulphate is said to be that the "nature" of the wool is preserved, especially with regard to tenacity, softness, and milling qualities.—A. S.

Antimonine [*Antimony lactate*] J. C. Oxley. J. Soc. Dyers and Col., 1906, **22**, 369—370.

The author points out the advantages of antimonine over other antimony mordants (this J., 1900, 1107). In preparing the mordant, antimonine is first boiled with very little water; about 2 galls. of acetic acid are added per 1000 galls. of mordant liquor. It is stated that the antimony is completely exhausted from the bath, and the shades obtained are faster and deeper than those produced with tartar emetic or antimony salts (antimony fluoride and ammonium sulphate). Antimonine is stated to be specially suitable for darkening with iron salts, and for dyeing half-silks. It is also useful in calico printing, a quantitative precipitation of the tannin being obtained; it does not crystallise out from the printing paste.—A. S.

Silk; Curling and fraying of dyed ——. A. Sansone and R. Sansone, jun. Rev. Gen. Mat. Col., 1906, **10**, 354—362.

The authors give an abstract of a paper published by the *Laboratoire d'études de la Soie de Milan*. The curling and fraying out of silk during the processes of manufacture and dyeing have been observed for many years, and a number of attempts have been made to explain the cause. The



defect shows itself by the presence of a number of little knots or bundles of very fine filaments which are irregularly distributed and appear of a lighter colour than the remainder of the thread or the surrounding fabric. The diameter of these fine filaments is sometimes less than one-tenth of that of the single degummed ordinary fibre. These twisted filaments are called "flocons" or "pelotons," and, as they consist of fibroin, attract colouring matters well, but appear lighter than the main thread owing to their extreme fineness. When the ordinary raw silk fibre or "bave" has had its sericin removed, the single fibres or "brins" frequently exhibit irregularities The fibroin appears to be swollen up in places, and these places frequently show a striated appearance and even longitudinal fissures. These fissures and the division of the fibre into filaments can also be obtained by chemical and mechanical means, and, as a result, it is concluded that the fibroin fibre is not a single, continuous, homogeneous mass, but consists of a bundle of very fine filaments which can become separated by certain treatments and then become entangled together, giving rise to "flocons." (see figure) The authors state that all silks are subject to this "fraying," the tendency to fray being influenced by the breed, method of culture, and diseases of the silk worm, and also by the degumming, dyeing, and mechanical operations to which the silk is subjected. The formation of "flocons" is not observed in raw silk, but only appears after degumming The amount of fraying has been measured by the number of knots in a length of 1000 m of the thread. By this method it was found that a silk degummed once in a 3 per cent soap solution showed from 110—155 knots per 1000 m, whilst after a second treatment the number had increased to 414—559. With an alkaline soap containing 0·5 per cent of caustic soda, the number after four treatments was 5540 The presence of an excessive quantity of sericin in the boiling-off bath favours the formation of "knots." The mechanical treatment of the fibre, and especially the method of degumming, has a great influence on the fraying. Silk degummed at the boil followed by "chevillage" showed 1254 per 1000 m The same silk degummed on a water-bath showed 649, whilst on bobbins it only showed 16. These figures show that the fibre should be moved as little as possible during the degumming. Weighted silk shows a large increase in the number. In the old method of degumming in sacks there was little formation of "flocons," as the silk did not move For use on the large scale the authors recommend an apparatus in which the silk should remain at rest whilst the scouring liquid should be circulated by means of a pump It is also shown that the best results are obtained by degumming at a moderate temperature.—A. B. S

Indigo; Action of chlorates on —— on the fibre. A. A. Radkiewicz. Z. Farben-Ind., 1906, 5. 422-425, 436—441

The author has studied the influence of the chlorates of certain metals belonging to each group of the periodic system, used in conjunction with vanadium salts or potassium ferricyanide for discharging indigo on the fibre. The nature of the chlorate exerts a very distinct influence on the process, and the presence of vanadium salts has a deteriorating action on the fibre. When potassium ferricyanide is used as oxidising agent, the chlorates examined can be arranged in the following series according to their action on indigo, those exerting the greatest action coming first Copper, in combination with chloric acid, shows the greatest destructive effect on both indigo and the fibre Then follow iron, aluminium, and calcium chlorates, which give a sharp design, but rot the fibre. Sodium and barium chlorates, the former with ammonium ferricyanide and the latter with ammonium and potassium ferricyanides, yield a good white discharge, and the fibre is not weakened. Potassium and ammonium chlorates give rather a weaker discharge, and are therefore not suitable for dark shades or for very heavy materials. The strength of the fibre is not affected by potassium chlorate and ammonium ferricyanide, or ammonium chlorate and potassium ferricyanide. Chromium, magnesium, and manganese chlorates give a poor result, and chromium and nickel chlorates produce hardly any discharge, and the weakening of the fibre is appreciable. Zinc chlorate does not act on indigo. The best results were obtained with a mixture of ammonium ferricyanide and sodium chlorate. The chlorate is dissolved in water and mixed cold with the solution of ammonium ferricyanide; a small quantity of an organic acid (citric or tartaric) is then added. In an example, 400 grms. of crystallised sodium chlorate, 200 grms. of ammonium ferricyanide solution of 21° B., 60 grms. of citric acid, and 1000 grms. of water were used The mixture is allowed to stand for one to two days in a cool place, when the excess of salts crystallises out After filtering, the solution is mixed in the cold with the thickening material (tragacanth, 1:1). The goods, after drying, are steamed for three to four minutes and then soaped at 50° C. The advantages of this method are that the discharge can be kept for a week, no crystals separate on the rollers of the printing machine, a three to four minutes' steaming is sufficient, washing in hot caustic alkali is avoided, the fibre is in no way weakened, and the chemicals used are comparatively cheap.—J. C. C.

English Patents.

Leaf or fabric; Thin ——, and method of making the same. W. A. Ker, Brooklyn, U.S.A. Eng. Pat. 13,005, June 5, 1906

See U.S. Pat. 826,781 of 1906; this J., 1906, 1040.—T. F. B

Wool; Process for cleansing —— and recovering the grease and the solvent used. A. P. Quackenbos, Boston, U.S.A. Eng. Pat 16,159, Aug. 8, 1905.

See U.S Pat. 796,530 of 1905; this J., 1905, 966.—T. F. B.

Sterilisation [Electrolytic] of wool, cotton, rag, hair, fibres, or similar material for prevention of anthrax. I Ickringill, Keighley, York. Eng. Pat. 23,345. Nov. 14, 1905.

The material is placed in a tank containing a suitable liquid such as sulphuric acid of 1°—5° T., and an electric current is passed through until the material is sterilised. —A. B. S.

Dyeing apparatus. P. Klug, Krummitschau, Saxony Eng. Pat. 23,050, Nov. 10. 1905.

See Fr. Pat. 359,344 of 1905; this J., 1906, 373.—T. F. B

Dyeing acetylated cellulose or artificial silk made therefrom, Process for ——. C. D. Abel, London From Act.-Ges f. Anilinfabr., Berlin. Eng. Pat. 1939, Jan 25, 1906.

See Fr. Pat. 362,721 of 1906; this J., 1906, 692.—T. F. B

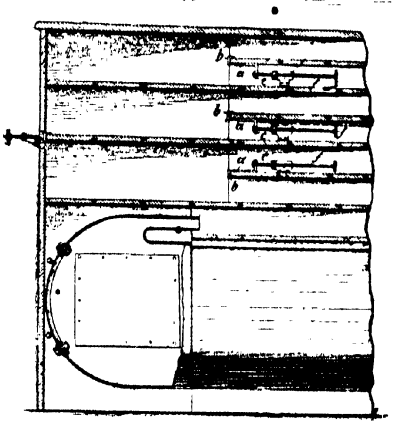
Fabrics; Apparatus for the wet treatment of ——. G. R Richter. Seifhennersdorf, Germany. Eng. Pat. 19,182. Aug. 28, 1906.

Claim is made for a machine for the dyeing, &c., of textile fabrics in the open width. For use with fabrics of various widths, a number of "liquor troughs" of various lengths are provided. These are similar in shape and can be fitted one within the other, so that the trough most suitable for the particular fabric may be readily selected, thus economising the liquor. Each trough contains steam pipes, guide rolls, &c.—A. B. S.

United States Patent.

Drying apparatus [for textile fabrics]. J. Tattersall. Enschede, Netherlands. U.S. Pat. 835,168, Nov. 6. 1906.

The apparatus consists of a series of drying chamber, separated by floors of transversely arranged boards with adjusting devices for pressing the boards laterally together, each device comprising a bent piece, *a*, having a part, *b*, adapted to engage the edge of the board, and a part, *c*,



and a screw, *f*, engaged with part *e*, by means of a pivot, and a fixed nut engaged by said screw.—D. B.

FRENCH PATENTS.

Broom, Process for obtaining textile fibres from ——. E. Genin and H. Colomb. Fr. Pat. 361,805, Sept. 29, 1905.

THE green broom is boiled for about an hour in a 2 per cent. solution of crystal sodium carbonate in order to separate the bark from the wood. It is next soaked in cold water for two hours, and then, after draining, it is ground in a revolving mill, similar in principle to a mechanical kneading trough, in order to detach the fibre. The material is then passed between two or more drums covered with teasles and combs in order to separate the fibre.—A. B. S.

Silk, artificial, Production of —— *from collodions made with acetone or ethyl acetate.* J. A. E. H. Boulher. Fr. Pat. 368,190, July 19, 1906.

ACETONE or ethyl acetate alone are not suitable for use in dissolving the nitrated cotton, as, owing to the fact that they have a rather low vapour tension, they evaporate too slowly from the silk thread, and so do not give a satisfactory product. This defect is removed either by raising the temperature at which spinning is carried on, or else by the addition of a small quantity of a liquid, such as ether, which has a high vapour tension. The absence of water is also of great importance, as small traces lower the vapour tension of the solvent considerably.—A. B. S.

Imitation-fabrics; Production of —— *from viscous materials* [*collodion, &c.*]. E. Dumat. Fr. Pat. 368,393, July 27, 1906.

THE viscous material is forced under a suitable pressure through a slit the length of which is equal to the desired width of the fabric and the breadth of which is the same as the required thickness of the fabric. In front of, and in contact with this opening works a plate with openings of a particular shape depending on the pattern desired. This works to and fro in front of the slit, and so cuts the flat sheet of viscous material into a definite pattern. The sheet so formed is received on a drum or endless band, and dried in a suitable manner.—A. B. S.

Scouring of old textile materials, cotton waste, &c. E. Favier. Fr. Pat. 368,036, July 13, 1906.

OLD materials containing cotton, linen, hemp, jute, ramie, or other vegetable fibres, are treated with carbon tetrachloride in order to eliminate fatty or resinous matters, and then with soluble sulphites to remove pectic matters and leave the pure cellulose.—A. B. S.

Bleaching wool; Process and apparatus for [*electrically*] ——. G. Pansa and A. Romberg. Fr. Pat. 368,280, June 18, 1906.

THE wool is placed in the middle portion of a spherical vessel which is divided into three parts by two parallel, perforated plates, and can be revolved on an axis parallel to the perforated partitions. The vessel is closed, some suitable solvent for fatty matters, such as carbon bisulphide, is run in, and the vessel slowly revolved on its axis so as to cause a circulation of the solvent through the wool. When the process is completed, the solvent is run off and the portion adhering to the wool is removed by a vacuum pump. To bleach the wool it is placed in a vessel the top and bottom of which form two electrodes, and are connected with a suitable source of electricity. The cathode is a plate of lead, and the anode a plate of retort carbon, graphitised wood charcoal, or, preferably, platinised zinc. The vessel is filled with a dilute solution containing chloride of lime, ferrous chloride, sodium thiosulphate, and a little sulphuric acid to give conducting power to the bath. After allowing the current to pass for some few hours, the wool is said to be bleached.—A. B. S.

Spindle for bobbin-dyeing. Soc. Anon. des Usines de Navarre. Fr. Pat. 367,859, July 7, 1906.

THE upper end of the tube, *c*, (Fig. 1), through which the dye liquor is introduced, is formed with grooves, *b*, and

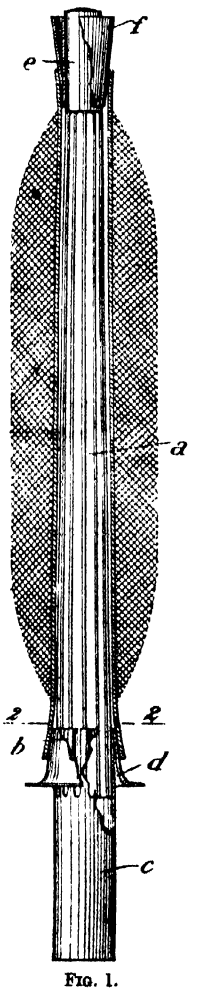


FIG. 1.

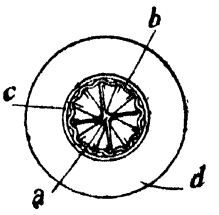


FIG. 2.

into these are soldered the radial wings of a metallic rod, *a* (Fig. 2). The upper end of *a* is fitted into a closed cylindrical tube, *e*, a cone, *f*, slipping easily over this tube and closing the end of the bobbin. The lower end of the latter is closed by a cone, *d*, soldered to the tube, *c*.—B. N.

Dyeing spindle with fibrous cover. O. Bauer and K. Suttner. Fr. Pat. 368,355, July 25, 1906.

The spindle consists of three wires, which meet at one end in a cap and are fastened at the other into a metal tube furnished with a screw for connecting with the dyeing apparatus. The wire support is covered with a tube of some thin fabric which slips on the wire frame and is held there by friction. The thread to be dyed is wound on the spindle, and the dye is forced through in the usual manner. After dyeing, the tube can be removed with its bobbin of cotton.—A. B. S.

Dyeing apparatus which can be taken to pieces. J. Schmitt and E. Handschin. Fr. Pat. 368,485, July 28, 1906.

The machine consists of a cylinder with perforated wall, which is fixed by means of keys on a circular bed-plate. The cylinder consists of four quadrants which are also held together by keys. These quadrants can be easily removed by means of handles on releasing the keys. The perforated cylinder is placed inside another unperforated cylinder, which can be taken to pieces in a similar manner. A perforated pipe connected with the supply of dye liquor passes centrally through the middle vessel. The material to be dyed is placed inside the middle vessel, and a suitable top is screwed down on to it. After the material has been dyed in the usual manner by the circulation of the dye liquor, the two cylinders are taken to pieces, and the dyed materials removed. A. B. S.

Sulphide colours; Process of dyeing by means of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 367,921, July 9, 1906. Under Int. Conv., June 28, 1906.

In dyeing with sulphide colours, ammonia or ammonium salts are added to the dye-bath in addition to alkali sulphides.—B. N.

Ossein; Preparations and applications of ——. A. Helbronner and E. A. Vallée. Fr. Pat. 361,796, Sept. 26, 1905. XIV., page 1227.

German Patents.

Wool and other animal fibres; Process for altering the affinity of —— for dyestuffs by treatment with concentrated sulphuric acid. M. Becke and A. Beil. Ger. Pat. 168,026, Oct. 28, 1902.

Wool is treated in sulphuric acid baths of successively diminishing concentrations, starting with acid of about 66° B., and finishing with very dilute acid or water. After this treatment, it is stated, the wool has entirely lost its affinity for the usual acid dyestuffs, but can be readily dyed with basic dyestuffs.—T. F. B.

Wool; Process for partially altering the affinity for dyestuffs of a spun fabric containing ——. M. Becke and A. Beil. Ger. Pat. 168,113, Feb. 28, 1903.

Fabrics containing wool or other animal fibre are treated or printed, in the desired portions, with sulphuric acid (64°–66° B.), thickened with kaolin or the like; this has the effect of rendering the portions treated capable of being dyed with basic dyestuffs, whereby a variety of effects may be produced. The fabric must be thoroughly washed after the treatment.—T. F. B.

Aniline Black on wool; Process for producing ——. G. Bethmann. Ger. Pats. 170,228, March 31, 1904, and 171,351, May 7, 1904.

In Eng. Pat. 26,962 of 1905 (this J., 1906, 753) the words "sodium chloride" should be replaced by "sodium chlorate." The wool may also be treated, before dyeing, with a solution of aluminium chloride, magnesium chloride, or similar salt capable of forming an insoluble salt with the organic compounds in the wool.—T. F. B.

Dyeings and printings with basic dyestuffs; Process for rendering —— fast to light. Anilinfarben und Extrakt Fabrik. vorm. J. R. Geigy. Ger. Pat. 169,923, April 12, 1904.

The fastness to light of dyeings and printings with basic dyestuffs is greatly increased by a subsequent treatment with a solution of glucose and a copper salt (*e.g.*, the sulphate). Such treatment gives results fully equal to those obtained with zinc polyglucosate (Ger. Pat. 141,508), with the advantage that the solution containing a copper salt does not become dark in colour on keeping.—T. F. B.

Dyeings produced with "chroming" dyestuffs; Improvement of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 166,351, Nov. 1, 1904.

Faster dyeings with dyestuffs which can be chromed are obtained by adding to the mixture of dyestuff and chromium salt a substance which is easily oxidised, or readily forms lakes, *e.g.*, gallic acid, tannin, anthranilic acid, qumol, α-naphthol, dihydroxynaphthalenes, or aminonaphthols; or these substances may, if desired, be used subsequent to the dyeing process. The dyeings are said to be exceptionally fast to fulling and water; the fastness to alkalis and soaping is also much increased.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 1093.)

German Patent.

Wood; Process for producing a dark colour on ——, without injuring it. Chem.-Techn. Laboratorium E. Bartels. Ger. Pat. 170,565, Nov. 7, 1905.

Dry or green wood is heated in a closed vessel, to between 200° and 350° C. in a mass of a liquid hydrocarbon, animal oil, mineral oil, or vegetable oil, of high boiling point, until the desired colour is reached; the temperature should be sufficiently high to remove the sap. When the process is finished, the liquid is run off, and the wood kept in the vessel until cool.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 1147.)

Oxides, Behaviour of metallic —— at very high temperatures. F. O. Doeltz and C. A. Graumann. Metallurgie, 1906, **3**, 212—216, 233—238, 372—375, and 406—408. Science Abstracts, 1906, **9A**, 587.

The experiments were made with zinc oxide, cadmium oxide, and lead oxide. For the lower temperatures the oxides were heated in a platinum boat, but above 1,400° C. the micro-furnace of Doeltz was employed. This consists of an electrically-heated (5 amps. at 1—2 volts) horizontal platinum wire 0·15 mm. diameter and 6 to 8 mm. long. The material to be examined is spread upon the wire, and observed through a microscope. Below 1200° zinc oxide loses practically nothing, the loss gradually increasing (1 per cent. at 1300°, 13 per cent. at 1400°, in two hours) until at 1710° C. immediate evaporation takes place with formation of needle-shaped crystals. The behaviour of the cadmium and lead oxides was examined up to 1000° C.

Platinised electrodes for alkali chloride electrolysis; Application of grey ——. J. W. Goibel. XIA., page 1224.

Nitrates; Determination of ——. F. S. Sinnatt. XXIII., page 1233.

Hydrazine salts; Iodometric determination of ——, and its application in volumetric analysis. E. Rimini. XXIII., page 1233.

Food products; Standards of purity for ——. XVIIIA., page 1229.

ENGLISH PATENTS.

Sodium nitrate; Dissolving plant for the recovery of —— from caliche. W. C. Fairweather, London. From J. R. Beaver and R. de Nordenflycht, Valparaiso, Chile. Eng. Pat 7478, Mar. 28, 1906.

THE "dissolver" or boiling tank, for the recovery of sodium nitrate from caliche, is an upright cylinder having conical ends, the top of the upper cone being formed with a cylindrical collar having an air-tight balanced door. The lower conical end is closed by a perforated bottom formed of two semi-circular discs, capable of being revolved, below which is a receptacle closed by an air-tight door similar to that above. An open tube leads upwards from the receptacle, outside the apparatus, nearly to the top of the dissolver, through which, by means of a pump, air is drawn so as to agitate the charge of caliche resting on the false bottom, in presence of water or solution. The dissolvers are arranged horizontally in a battery of five, and from the lower receptacle of each, a valved tube passes into a horizontal pipe through which, by suitable adjustment of valves, any dissolver may independently be charged with liquid, or be placed in connection with any other dissolver. In practice, the weak liquors from one end of the battery pass through successive elements of the same, to emerge from the last at full strength. Each dissolver is provided with a steam coil, and arrangements are made whereby primary or secondary steam may be supplied as needed. The apparatus includes a steam boiler, a settling and "relave" tank, valved pipe connections between the tanks and the dissolvers, a source of water supply, and pipes for waste liquor, ordinary water, and "relaves" or second, or weak washings, connected to the upper conical ends of the dissolvers, besides accessory details.—E. S.

Iodine; Method of extracting — — from liquids containing compounds of iodine. Soc. Franç. La Norgine, Paris. Eng. Pat 9621, April 24, 1906. Under Int. Conv., May 23, 1905.

SEE Fr. Pat. 361,499 of 1905; this J., 1906, 864.—T. F. B.

Oxygen gas; Compositions of matter for use in the generation of — —. G. F. Brindley, Niagara Falls, U.S.A. Eng. Pat. 11,981, May 22, 1906. Under Int. Conv., April 14, 1906.

SEE Fr. Pat. 366,526 of 1906; this J., 1906, 1045.—T. F. B.

FRENCH PATENTS.

Sulphur dioxide; Process for the utilisation of the —— produced in the smelting of antimony. G. R. M. Sweeting. Fr. Pat. 361,808, Oct. 3, 1905. X., page 1224.

Nitric acid; Manufacture of —— by means of atmospheric air. Chem. Fabr. Gladbeck G. m. b. H. First Addition, dated July 13, 1906, to Fr. Pat. 341,109, March 10, 1904 (this J., 1904, 823).

BY the present Addition the scope of the main patent is made to include, as the source of nitric acid, any mixture whatever of oxygen with nitrogen.—E. S.

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BAUXITE, clay, or other aluminous bodies, in fine powder, are added to sodium chloride melted in a closed vessel, connected with apparatus for condensing the hydrochloric acid evolved. Superheated steam is injected into the melt during the process. The mass is lixiviated, and carbon dioxide is passed into the cleared solution of sodium aluminate obtained, from which the aluminium hydroxide precipitated is removed, the filtrate being evaporated to recover sodium carbonate. The process may be repeated with the aluminium hydroxide thus obtained, in which case the injection of steam, except towards the end of the process, may be dispensed with.—E. S.

Gases [hydrochloric acid] and liquids; Purification of —— [from arsenic, &c.]. Verein Chem. Fabr. in Mannheim. Fr. Pat. 368,452, July 27, 1906.

HYDROCHLORIC acid gas, as produced in the manufacture of sodium sulphate [salt-cake], after being cooled and dried, and in some cases filtered through coke, is brought into intimate contact in a tower or otherwise, with an oil, preferably a mineral oil, or oil from lignite tar, such oil readily absorbing arsenic chloride without itself becoming chlorinated, provided the temperature be kept low. The oil thus used is recovered, and may be fitted for re-use by washing with lime water, and lastly with hydrochloric acid. Ordinary liquid hydrochloric acid may be freed from arsenic by agitating it with the oil in suitable proportion. To free sulphuric acid from arsenic, hydrochloric acid is added to it, in order to convert any arsenic present into chloride, when the arsenic chloride may be dissolved out by the oil treatment, as already described. —E. S.

Antimony oxides; Preventing the formation of crystallised oxides in the manufacture of — —. H. L. Herrenschmidt. Fr. Pat. 368,037, April 10, 1906.

BRICKWORK and masonry are replaced by sheet or cast-iron apparatus in the chambers and adjuncts used for collecting the antimony oxides, whereby quick cooling is insured, and the formation of crystallised oxides is prevented.—E. S.

Sulphates [Copper sulphate]; Manufacture of metallic ——. H. Abraham. Fr. Pat. 367,947, July 10, 1906.

THE invention is described with reference to obtaining copper sulphate from the sulphide, which latter is granulated and submitted to the action of a mixture of nitric and sulphuric acids with water. The nitrogen oxides evolved are led away to be converted, by air and water or steam, into nitric acid for use over again; and the nitrogen remaining after absorption of the oxygen of the air, may, if desired, be collected and utilised. The copper sulphate solution obtained, after separation from the sulphur set free, is set to crystallise, and the mother liquor is treated for the recovery of precious metals by immersing in it pairs of plates of copper and silver, in metallic contact, when it is stated the precious metals deposit chiefly on the silver plate.—E. S.

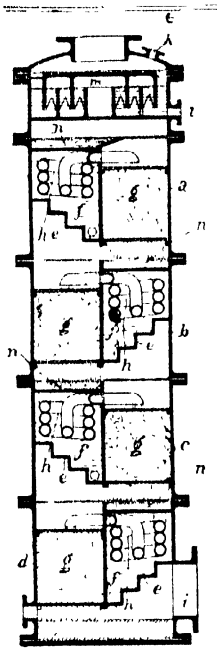
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THE tower is constructed in sections (*a*, *b*, *c*, *d*, see figure) each of which is divided by a partition into a cooling chamber, *f*, and an absorption chamber, *g*, disposed as shown in the illustration. The cooling chambers have their bottoms shaped in the form of steps, *e*, and are provided with hollowed covers, *n*; in each chamber is a coil, *h*, leading from the cover, and opening above the adjacent absorption chamber. The plates forming the top and bottom of the absorption chambers are perforated. Above the upper section of the tower is a cover, *m*, having inlets, *k*, *l*, for the sulphuric acid used as absorbing agent; the walls of the cover are cut away in the form of teeth



to form a mixing chamber, which communicates with the upper section of the tower.—A. S

Kieserite ; Process for obtaining —— from a mixture of kieserite and rock salt. Gewerkschaft Carlsfund. Ger. Pat. 166,187, Jan. 12, 1904

THE mixture of kieserite and rock salt is treated in a solution more or less saturated with common salt The minerals disintegrate, and the resulting crystalline mass is separated into its constituents by sifting The crystals of rock salt cannot dissolve in the solution, and they can be separated from the kieserite crystals on account of their larger size.—A. S.

Potassium chloride ; Process of obtaining —— from crude potassium salts. J. Maurer. Ger Pat 166,558, June 1, 1904.

THE hot solution (at 90°—100° C.) of the crude salts is run into the first crystallising vessel, and cooled to from 15°—30° C. ; during the crystallisation of the potassium chloride, fresh hot solution is run in When the crystallisation is complete, the cool (15°—30° C.) mother liquor is run into a second crystallising vessel, wherein it is heated to about 80° C., and a quantity of crystallised potassium chloride added to facilitate the separation of the potassium chloride still contained in the mother liquor. The mother liquor from this vessel is mixed with a further quantity of fresh hot (90°—100° C.) solution of crude potassium salts, and the operations described are repeated. —A. S.

Nitrite ; Process for the manufacture of ——. M. Binsfeld. Ger. Pat 168,450, Sept. 1, 1904.

THE production of nitrite by the reduction of alkali nitrate with zinc and small quantities of ammonia is already known. The author finds that much better yields are obtained in less time by the use of a considerable excess of ammonia.—A. S.

Ammonium nitrate free from nitrite ; Process for the manufacture of ——. J. Rudeloff. Ger. Pat. 166,427, Sept. 4, 1904.

IN the denitration of the spent acid from the nitration of glycerin, cellulose, &c., the mixed acid is heated in a suitable vessel, and the nitric acid vapours are expelled by steam or hot air. It is found that these vapours may be suitably utilised for the manufacture of ammonium nitrate. The hot vapours are treated with ammonia solution, and the resulting solution of ammonium nitrate is concentrated in pans heated by the residual sulphuric acid from the denitrating apparatus. The ammonium nitrate is then separated by crystallisation.—A. S.

Selenium ; Process for obtaining pure —— from "chamber mud." H Koch. Ger. Pat. 167,457, Dec. 2, 1903.

THE mud obtained from lead chambers used for the manufacture of sulphuric acid, is heated moderately with sulphuric acid and potassium permanganate, some sodium chloride is added, the solution is diluted and filtered, and the selenium precipitated from the solution by reducing agents according to known methods. Care must be taken not to add too much permanganate, otherwise explosions may occur. The selenium separates in the cold as a red, amorphous powder, which on warming the solution melts together to coarse lumps, which can be removed by ladles without filtration —A. S.

Carbon dioxide absorption apparatus. E. Chur. Ger. Pat. 166,973, April 28, 1905.

THE absorption vessel is divided into rectangular chambers by vertical partitions The gases containing carbon dioxide are introduced to the chambers through immersion-bells, and the chambers are so connected that the absorbing liquid (milk of lime) follows a tortuous course, in order that efficient washing of the gases may be attained without the bells being immersed deeply in the liquid. Baffle-plates may be arranged parallel to and along both sides of the immersion-bells in order to ensure good contact between the gases and the milk of lime – A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 1148.)

Glass ; Electrically-conducting ——. C E. S Phillips. Oesterr Zeits. Elektrotechn. und Maschinenb., 1906, **24**, 811. Chem.-Zeit., 1906, **30**, Rep., 392.

THE glass is prepared from a mixture of 32 parts of sodium silicate and 8 parts of calcined borax ; an addition of 1·25 parts of flint glass improves the surface and the durability of the resulting glass The glass melts at a low temperature, and can be easily formed into sheets, rods, and threads. It has a sp. gr. of 2·49, is harder than ordinary glass, and has an electric conductivity 500 times greater. It is impermeable to ultra-violet rays, but allows Röntgen rays to pass ; it does not exhibit fluorescence under the influence of cathode rays. In the powdered condition it can be fused on to copper, and remains adherent on cooling.—A. S.

FRENCH PATENTS.

Glass-furnace. C. Krug. Fr. Pat. 368,208, July 19, 1906.

THE glass-furnace described has no hearth, and is heated by one or more burners situated at one end, from which liquid fuel mixed with air or oxygen is sprayed into the furnace. The burners are placed so that the flame does not impinge directly on the glass to be melted. The resulting products of combustion escape through openings placed preferably at the other end of the furnace.—A. G. L.

Ceramic product. Méran Frères. Fr. Pat. 361,814, Oct. 6, 1905.

SEE U.S. Pat. 827,550 of 1906; this J., 1906, 885.—T. F. B.

Food products; Standards of purity for ——. XVIIIA., page 1229.

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Iodine; Method of extracting — — from liquids containing compounds of iodine. Soc. Franç. La Norgine, Paris. Eng. Pat 9621, April 24, 1906. Under Int. Conv., May 23, 1905.

SEE Fr. Pat. 361,499 of 1905; this J., 1906, 864.—T. F. B.

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THE tower is constructed in sections (*a*, *b*, *c*, *d*, see figure) each of which is divided by a partition into a cooling chamber, *f*, and an absorption chamber, *g*, disposed as shown in the illustration. The cooling chambers have their bottoms shaped in the form of steps, *e*, and are provided with hollowed covers, *n*; in each chamber is a coil, *h*, leading from the cover, and opening above the adjacent absorption chamber. The plates forming the top and bottom of the absorption chambers are perforated. Above the upper section of the tower is a cover, *m*, having inlets, *k*, *l*, for the sulphuric acid used as absorbing agent; the walls of the cover are cut away in the form of teeth

No.	Melting point. °C.	Formula for composition. Pb.	Sn.	Bi.	Cd.	Percentage composition (calculated). Pb	Sn.	Bi.	Cd.	Observer or special name.	References and occasional variations
1	55·5	2 0	1 0	4·0	1·0	25·00	12·50	50·00	12·50	—	L 426
2	55·5	3 0	4 0	15·0	3·0	12·00	16·00	60·00	12·00	—	L. 456; Dpf 126 (56°)
3	60—65·2	26·7	13·3	50·0	10·0	26·70	13·30	50·00	10·00	—	L. 484
4	60—68	8 0	4 0	15·0	3·0	26·70	13·30	50·00	10·00	*Lipowitz*	D. 158, 376; 164, 108 (65·5°); Ch 89 (60—65°); M2 (soft, 52°—60°, liquid. 67°—70°); T. (60°); L. 425, 448 (70°)
5	65·5	2·0	1 0	4·0	1·0	25·00	12·50	50·00	12·50	*Wood*	D 164, 108; Ch 89, M2
6	65·5	3 0	4 0	15·0	3·0	12·00	16·00	60·00	12·00	—	M2
7	65·5	Pb[5]	Sn[5]	Bi[5]	Cd[4]	24·81	13·92	50·42	10·75	*Wood* / *von Hauer*	Ch. 89 ($Pb_5Sn_3Bi_{16}Cd_4$) D. 177, 154; M2
8	65·5	24·9	14·2	50·1	10·8	24·90	14·20	51·00	10·80	—	L. 484
9	67·5	Pb[6]	Sn[4]	Bi[4]	Cd[3]	25·21	14·10	51·07	9·60	*Wood* / *von Hauer*	Ch. 89 ($Pb_4Sn_4Bi_8Cd_3$) D. 177, 154, M2
10	67·5	25·1	14·3	50·4	10·2	25·10	14·30	50·40	10·20	—	L 484
11	68·5	Pb[1]	Sn[1]	Bi[1]	Cd[1]	24·24	13·65	49·09	13·09	*von Hauer*	D. 177, 154; M2; Ch. 89 ($PbSnBi_2Cd$)
12	68·5	24·3	13·8	48·8	13·1	24·30	13·80	48 80	13·10	—	L. 484
13	68·5	Pb[2]	Sn[2]	Bi[2]	Cd[1]	25·94	14·51	52·53	7·00	*von Hauer* / *Newton*	D 177, 155, M2 Ch 89 ($Pb_2Sn_2Bi_4Cd$)
14	68·5	26·0	14·8	52·2	7·0	26·00	14·80	52·20	7·00	—	L 484
15[1]	65—70	25·0	12·5	50·0	12·5	25·00	12·50	50·00	12·50	*Wood*	T (2Pb, 1Sn, 4Bi, 1Cd = 71°); L. 484, Dpf. (70°)
16[1]	65—71	4·0	2 0	5—8	2·0	30·77— 25·00	15·38— 12·50	38·77— 50·00	15·38 12·50	*Silliman* / *Wood*	D 158, 271, M2 (66°—72°)
17	70·0	4 0	2 0	7·0	1·0	28·60	14·30	50·00	7·10	*Wood*	D. 164, 108 (solid pt. 68°); L. 448
18	70 0	Pb_6	Sn_5	Bi_{11}	Cd_4	27·19	12·91	50·09	9·81	*Wood*	Ch 89
19[2]	72 0	27 0	8 0	50·0	6·0	29·66	8·80	54·94	6·60	—	Museum für Naturkunde, Berlin (solid pt.)
20	75 0	8 0	3 0	8·0	10·0	27·60	10·30	27·60	34·50	—	L. 426, 448 (9 Cd); M2 (8—10 Cd)
21	75·5	25·8	14·7	52·4	7·0	25·80	14·70	52·40	7·00	*Wood*	Ch 131 (*Mazotto*)
22	75·5	25·0	14·2	50·7	10·1	25·00	14·20	50·70	10·10	*Lipowitz*	Ch. 131 (*Mazotto*)
23	76·5	34·4	9·4	50·0	6·2	34·40	9·40	50·00	6·20	—	L. 484
24	76·5	11 0	3 0	16·0	2·0	34·38	9·37	50·00	6·25	*v. Hauer* / *Lipowitz-Eratz*	D 177, 154 M2, L. 426 (76·6°)
25	76·6	3·0	2 0	5 0	1 Hg	27·27	18·18	45·46	9·09Hg	—	L. 427
26	77·0	5 0	3 0	8·0	1·0	29·41	17·65	47·06	5·88	—	Dpf
27	80 0	4 0	4 0	7·0	1·0	25 00	25·00	43·75	6·25	*Harper*	T
28	80·0	3 0	3 0	8·0	—	21·43	21·43	57·14	—	*d'Arcet*	Chem.-Ztg. Rep 1906, S. 147 (from Giesserei-Ztg.)
29	80 0	Pb_4	Sn_4	Bi_4	Cd_2	35·15	20·03	35·31	9·51	—	Ch. 89
30	82 0	6 0	—	7·0	1·0	42·86	—	50·00	7·14	*Wood*	D 164, 108; M2; L. 126
31	88 0	6 0	—	7·0	1·0	42·86	—	50·00	7·14	n. *v. Hauer*	D. 177, 145; M2; L. 126
32	89·5	Pb[3]	—	Bi[2]	Cd[1]	39·52	—	53·36	7·11	*v. Hauer*	D. 177, 154, Ch. 89 (Pb_3Bi_4W)
33	89·5	3 0	—	2·0	1·0	50·00	—	33·33	16·67	—	M2
34	89·5	2 0	—	3·0	1·0	33·33	—	50·00	16·67	—	L 126
35	89·5	39·7	—	53·2	7·1	39·70	—	53·20	7·10	—	L. 484
36	90 0	Pb_4	Sn_6	Bi_4	—	34·97	29·90	35·13	—	*Rose*	Ch 89
37	90 0	5 0	3 0	8·0	—	31·25	18·75	50·00	—	*d'Arcet*	L. 51 (72° R.)
38[3]	91·6	3 0	2 0	5·0	—	30·00	20·00	50·00	—	*Onions* / *Lichtenberg*	D. 8, 254 (197° F.) T.; L 427, 447 (90°)
39	91·6	Pb_3	Sn_2	Bi_5	—	32·73	12·44	54·83	—	*Lichtenberg*	Ch. 89
40	92—93	50 Quick solder	($PbSn_3$)	50·0	—	18·45	31·55	50·00	—	*v. Hauer*	D 177, 154; M2
41	93·0	1 0	1·0	2·0	—	25·00	25·00	50·00	—	*Erman* / *Rose*	T T. (93·75°); W. (94°)
42	93·0	3 0	5·0	8·0	—	18·75	31·25	50·00	—	*Newton* / *Melotte*	D. 129, 438 T.
43	93·75	Pb	Sn	Bi_2	—	27·94	15·92	56·16	—	*Rose*	Ch. 89
44	94·0	1 0	1·0	4·0	—	16·67	16·67	66·66	—	—	D. 158, 376
45	94·0	8·0	3·0	8·0	—	42·10	15·80	42·10	—	*Rose*	M2; Dpf.; W. (94·5°)
46	94·0	3 0	5·0	3·0	—	27·50	45·00	27·50	—	*Bismuth solder*	Ch. 515
47	94·44	Pb_5	Sn_3	Bi_3	—	33·90	11·60	54·50	—	*Newton*	Ch. 89
48	94·5	5 0	3·0	2·0	—	50·00	30·00	20·00	—	*Newton*	T.
49	95·0	—	2·0	3·0	1·0	—	33·33	50·00	16·67	*v. Hauer*	D 177, 154; M2; L. 426, 448
50	95·0	—	3·0	5·0	2·0	—	30·00	50·00	20·00	*v. Hauer*	D. 177, 154
51	95·0	—	3·0	5·0	1·0	—	33·33	55·56	11·11	—	M2; L. 426, 448
52	95·0	—	1·0	2·0	1·0	—	25·00	50·00	25·00	*Wood* / *v. Hauer*	D. 167, 286 D. 177, 154; M2; L. 426, 448
53	95 0	Pb[3]	—	Bi[4]	Cd[2]	43·26	—	50·66	6·67	*v. Hauer*	D. 177, 154
54	95 0	7 0	—	4·0	1·0	58·33	—	33·33	8·34	—	M2
55	95·0	4 0	—	7·0	2·0	30·77	—	53·84	15·39	—	L. 126.
56	95·0	43·4	—	49·9	6·7	43·40	—	49·90	6·70	—	L. 484
57	95 6	33·13	32·15	—	34·40	33·13	32·15	—	34·40	—	L. 425
58	95 0	Pb_2	Sn_2	Bi_3	—	32·49	18·51	49·00	—	*d'Arcet*	Ch. 89, 130 (96°, *Person*)
59	95 0	1 0	1·0	2·0	—	25·00	25·00	50·00	—	*Rose*	D. 129, 438; L. 484
60	98·0	5 0	3·0	8·0	—	31·25	18·75	50·00	—	*Newton* / *d'Arcet*	D. 129, 438, 8, 254 (212° F.); 158, 376 (98°) L 484 (95°); 427 (below 100°)
61	98·75	1656 0	354 0	1063	—	45·10	9·60	45·30	—	*d'Arcet*	L. 51 (79° R.) ($Pb_2Sn_3Bi_3$)
62	98·8	24 0	27·3	48·7	—	24·00	27·30	48·70	—	*Rose*	Ch. 130 (*Mazotto*)
63	99·0	1 0	1·0	1·0	—	33·34	33·33	33·33	—	—	Dpf
64	100 0	5 0	3·0	2·0	—	50·00	30·00	20·00	—	—	L. 427
65	100 0	2 0	5·0	5·0	—	16·67	41·67	41·66	—	*Newton*	Chem.-Ztg. Rep. 1906, S 147 (from Giesserei-Ztg.)
66	100·0	4 0	4·0	8·0	—	25·00	25·00	50·00	—	*Smith*	D. 8, 254 (212° F.)
67	104·0	Pb_2	Sn	Bi_5	—	26·33	7·51	66·16	—	*Krafft*	Ch. 89
68	105·0	75 Drop solder	($PbSn_3$)	25	5·0	26·67	44·76	23·81	4·76	*v. Hauer*	D. 177, 154
69	111·0	2·0	1·0	2·0	—	40·00	20·00	40·00	—	*Bismuth solder*	Ch. 515
70	119·0	30·0	24·0	8·0	—	48·39	38·71	12·90	—	—	W.
71	122·0	Pb	Sn	Bi	—	39·28	21·25	39·47	—	*Homberg*	Ch. 89; D. 167, 289 (31·15—57·23—10·15)

No.	Melting point. °C.	Formula for Composition.				Percentage Composition (calculated).				Observer or Special Name.	References and occasional variations.
		Pb.	Sn.	Bi.	Cd.	Pb.	Sn.	Bi.	Cd.		
72	123·3	8·0	8·0	8·0	—	33·33	33·33	33·34	—	—	W.
73	123·75	5·0	3·0	4·0	—	41·67	25·00	33·33	—	—	L. 831
74	124·0	207·0	118·0	208·0	—	38·84	22·14	39·02	—	—	L 447 ($PbSnBi$)
75	124·0	3·0	3·0	1·0	—	42·86	42·86	14·28	—	—	Dpf.
76	125·3	27·2	—	72·8	—	27·20	—	72·80	—	*Rudberg*	L. 484
77	127·0	Pb_3	—	Bi_4	—	42·74	—	57·26	—	—	Ch 130
78	128·0	4·0	4·0	1·0	—	44·45	44·44	11·11	—	—	Dpf.
79	130·0	10·0	8·0	8·0	—	38·46	30·77	30·77	—	—	Dpf
80	132·0	75 Drop solder	($PbSn_3$)	—	25·0	28·00	47·00	—	25·00	*v Hauer*	D 177, 154
81	136·0	92 Drop solder	($PbSn_3$)	—	8·0	34·36	57·64	—	8·00	*v Hauer*	D 177, 154
82	136·0	Pb	Sn^4	—	Cd	26·47	59·32	—	14·30	*v Hauer*	D 177, 154 ($CdSn + PbSn^3$)
83	136·0	Pb	Sn^5	—	Cd	20·43	68·54	—	11·03	*v Hauer*	D. 177, 154 ($CdSn^3 + PbSn^5$)
84	136·4	—	29·8	70·2	—	—	29·80	70·20	—	*Rudberg*	L. 484
85	140·0	—	Sn_4	Bi	—	—	68·29	31·71	—	—	Ch 130
86	140·0	1·0	1·0	1·0	—	33·33	33·33	33·34	—	—	Dpf ; L 448
87	140·0	16·0	14·0	8·0	—	42·10	36·84	21·06	—	—	W
88	145·0	414·0	236·0	208·0	—	48·25	27·50	24·25	—	—	L. 447 (Pb_2Sn_2Bi)
89	145·0	5·0	3·0	2·0	—	50·00	30·00	20·00	—	—	L. 831
90	146·3	—	—	78·8	21·2	—	—	78·80	21·20	*Rudberg*	L 484
91	149·0	2·0	4·0	—	2·0	25·00	50·00	—	25·00	—	L. 126, 447, 448 (145°) ; M2
92	150·0	22·0	24·0	8·0	—	40·74	44·44	14·82	—	—	Dpf
93	155·0	3·0	3·0	1·0	—	42·86	42·86	14·28	—	*Bismuth solder*	Ch 515
94	155·0	621·0	354·0	208·0	—	52·50	30·00	17·50	—	—	L. 447 (printed 255°) (Pb_3Sn_2Bi)
95	160·0	3·75	2·25	1·0	—	53·57	32·14	14·29	—	—	L 831
96	160·0	32·0	36·0	8·0	—	42·10	47·37	10·52	—	—	Dpf.
97	160·0	828·0	472·0	208·0	—	54·90	31·90	13·80	—	—	L 447 (Pb_4Sn_4Bi)
98	160·0	207·0	236·0	208·0	—	31·80	36·20	32·00	—	—	L 447 ($PbSn_9Bi$)
99	160·0	4·0	4·0	1·0	—	44·45	44·44	11·11	—	*Bismuth solder*	Ch. 515
100	165·0	—	Sn^5	—	Cd^1	—	75·65	—	24·35	*v Hauer*	D. 177, 154
101	168·0	1·0	1·5	—	—	40·00	60·00	—	—	(*Prechtl*) (*Tin solder*)	L. 484, Ch 515 ; W. (169°)
102[4]	168·0	26·9	68·9	—	4·2Zn	26·90	68·90	—	4·20Zn	*Svanberg*	L. 484
103[5]	171·0	1·0	2·0	—	—	33·33	66·67	—	—	(Soft quick solder)	D. 129, 438 ; Ch. 515 , L. 484 ; Dpf ; W.
104	173·8	—	—	67·8	32·2	—	—	67·80	32·20	*Rudberg*	L 484
105	175·0	Pb_5	Sn	—	—	89·77	10·23	—	—	*Spring*	Ch 130
106	175·0	Pb_4	Sn	—	—	87·53	12·47	—	—	*Spring*	Ch 130
107	176·5	Pb_7	Sn	—	—	77·82	22·18	—	—	*Spring*	Ch. 130
108	177·0	Pb_3	Sn	—	—	84·03	15·97	—	—	*Spring*	Ch 130
109	177·5	Pb	Sn	—	—	63·70	36·30	—	—	*Spring*	Ch 130
110[6]	179·0	Pb	Sn_3	—	—	36·90	63·10	—	—	*Spring*	Ch 130
111	180·0	1·0	3·0	—	—	25·00	75·00	—	—	*Prechtl*	L. 484 ;
112	180·0	207·0	354·0	—	—	36·90	63·10	—	—	—	L. 449 ($PbSn_3$)
113	180·0	10·0	17·0	—	—	37·00	63·00	—	—	*Drop solder*	D 129, 438 (in per cent) ; L. 447, 448, 449
114	181·0	Pb	Sn_3	—	—	37·35	62·65	—	—	*Pillichody*	D 162, 217 , L. 484
115	181·0	60—66·6	100·0	—	—	ca 37·5	ca 62·50	—	—	—	L. 449
116	181·0	1242·0	1180·0	—	—	51·28	48·72	—	—	—	L 427 (Pb_6Sn_{10})
117	181·2	1·25	1·0	—	—	55·64	44·36	—	—	*Pohl*	D 122, 62 (solid. pt. 178°)
118	183·0	Pb	Sn_4	—	—	30·50	69 50	—	—	*Spring*	Ch 130
119	185—190	1·0	2—2·5	—	—	33·33	66·67	—	—	—	L 447, 448
						28·57	71·43				
120	185—190	0·4—0·6	1·0	—	—	28·60 - 37·50	71·40 — 62·50	—	—	—	M 1
121	185—190	1·0	1·0	—	—	50·00	50·00	—	—	*Quick solder*	D. 129, 438 ; L. 484
122	185·0	1035·0	1180·0	—	—	46·73	53·27	—	—	—	L. 427 (Pb_6Sn_{10})
123	186·0	3·0	5·0	—	—	37·50	62·50	—	—	—	Dpf
124	186·0	1·0	4·0	—	—	20·00	80·00	—	—	*Prechtl*	L. 484 ; W.
125	187·0	45·0	100·0	—	—	31·00	69·00	—	—	—	L. 427, 449
126	187·0	50·0	100·0	—	—	33·33	66·67	—	—	—	L 449.
127	187·0	Pb	Sn_4	—	—	30·50	69·50	—	—	*Pillichody*	D. 162, 217 ; L. 484
128	189·0	207·0	118·0	—	—	63·70	36·30	—	—	—	L 449 (PbSn)
129	189·0	1·0	1·0	—	—	50·00	50·00	—	—	*Prechtl*	L. 449 ; Dpf. ; W.
130	189·0	1035·0	236·0	—	—	81·40	18·60	—	—	—	L 449 (Pb_8Sn_3, soft. pt. 185°)
131	189·0	5·0	2·0	—	—	71·43	28·57	—	—	—	L. 427 (soft pt. 187°)
132	190·0	207·0	708·0	—	—	22·62	77·38	—	—	—	L. 449 ($PbSn_6$)
133	190·0	828·0	1180·0	—	—	41·23	58·77	—	—	—	L. 427 (Pb_4Sn_{10})
134	192·0	1·0	5·0	—	—	16·67	83·33	—	—	*Prechtl*	L. 484 , W.
135	194·0	1·0	6·0	—	—	14·30	85·70	—	—	*Prechtl*	L. 484 , W. ; Dpf.
136	194·0	16·67	100·0	—	—	14·29	85·71	—	—	—	L. 427, 449 (16·5 + 100)
137	194·0	30·0	100·0	—	—	23·08	76·91	—	—	—	L 449
138	194·0	33·3	100·0	—	—	25·00	75·00	—	—	—	L. 449
139	194·0	40·0	100·0	—	—	28·58	71·42	—	—	—	L. 449
140	194—195	1242·0	236·0	—	—	84·00	16·00	—	—	—	L. 449 (Pb_8Sn_3, soft. pt. 189°)
141	194—195	6·0	2·0	—	—	75·00	25·00	—	—	—	L. 427 (soft. pt. 189°)
142	197·0	90·0	100·0	—	—	47·37	52·63	—	—	—	L. 427
143	197·0	Pb	Sn_2	—	—	47·20	52·80	—	—	*Pillichody*	D. 162, 217 ; L. 484
144	197·0	119·0	100·0	—	—	54·34	45·66	—	—	—	L. 449
145	198·0	1449·0	236·0	—	—	86·00	14·00	—	—	—	L. 449 (Pb_7Sn_2, soft. pt. 192°)
146	198·0	7·0	2·0	—	—	77·78	22·22	—	—	—	L. 427 (soft. pt. 192°)
147	200·0	2070·0	1180·0	—	—	63·70	36·30	—	—	—	L. 427 ($Pb_{10}Sn_{10}$)
148	200·0	1·0	1·0	—	—	50·00	50·00	—	—	—	L. 447, 448, 449 (100 + 100 = 197°) ; M1

15 and 16.—According to D. 158, 271, Wood's formula was 4 parts lead, 2 tin, 7—8 bismuth, 1—2 cadmium (m. pt. 65°—71°). Silliman repeated Wood's experiments, and found that an alloy of 4 parts lead, 2 tin, 8 bismuth, and 2 cadmium, melted almost exactly at 70° C.

19.—Only solidifying point given. Used to inject into the bronchiæ in anatomical preparations.

38.—According to Gill's "Technical Repository," May, 1822, p. 349, proposed by W. Onions, a Bristol mechanic (m pt 197°F.).

102.—A Babbit's metal should be added—5Pb + 4Cu + 69Zn + 8Sb + 19Sn, sp. gr. 8·32, softening point, 165°, m. pt., 170° C. (D. 236, 347).

103.—Hard quick solder, 2Pb + 1Sn, m. pt. 224° C. (D. 129, 438 ; Ch. 515 ; Dpf. (227°) ; W. (227°) ; L 448 (240°), 449 (239°), 484 (227°).

110—115.—All these refer to the "Drop solder" $PbSn_3$.

—J.T.D.

Mineral exports of Mexico. For. Off. Ann. Ser., No. 3733. [T.R.]

THE following are statistics of the exports of minerals from Mexico during the years ended 30th June, 1905 and 1906:—

	1904–5.	1905–6.
	£	£
Gold bullion	2,595,365	2,772,131
„ in other forms	214,743	396,939
Silver bullion.....	5,301,402	6,604,310
„ in other forms	1,053,177	956,251
Antimony	78,623	103,908
Copper	2,980,342	2,865,590
Lead	550,467	496,781
Other minerals	32,413	95,054

Zinc industry of British Columbia. Bd. of Trade J., Nov. 29, 1906. [T.R.]

THE report of the Commission appointed to investigate the zinc resources of British Columbia states that zinc in large commercial quantities can be produced. The quantity immediately available in the Ainsworth and Slocan districts is estimated at 30,000 tons, of nominal zinc content of 50 per cent., equal to 12,000 tons of spelter. With correct methods of milling and treatment for the different classes of ores, a stable zinc industry should be established. Up to 1905 the production of zinc ore in British Columbia was 11,623 tons, which was chiefly exported to the United States. Since the establishment of smelting works at Frank (Alberta), Canada has entered the market for these ores.

Platinum in New Zealand. New Zealand Geological Survey, Bulletin No. 1, 1906, p. 50 and 96. [T.R.]

IN the Hokitika district of New Zealand, platinum has been found in quartz reefs intercalated in dark shaly *phyllite*. In the Taipo Gorge reef the platinum amounted to 1 dwt. per ton with 6 dwt. 13 gr. silver, gold being absent. In Harley's Creek reef, one sample gave 3 dwt. 8 grs., and another, 1 dwt. 2 grs. of platinum, gold being absent. As in the Urals, the platinum is here associated with magnesian eruptive rocks, and it is found that silver accompanies it in a fairly definite ratio of seven to one. Although the veins found up to the present time could scarcely be worked at a profit, it is suggested that others might be discovered if searched for within about a quarter of a mile of the Pounamu belt of eruptive rocks.

ENGLISH PATENTS.

Zinc; Treatment of sulphide ores containing ——. R. W. E. MacIvor, M. Fradd, and The Metals Extraction Corporation, London. Eng. Pat. 23,977, Nov. 21, 1905.

SEE Fr. Pat. 362,677 of 1906; this J., 1906, 765.—T. F. B.

Zinc; Method of realising the value of material containing —, and simultaneously profiting by the zinc and carbon constituents contained in the residue of zinc works. G. Stolzenwald, Valea Calugaresasca, Roumania. Eng. Pat. 18,134, Aug. 13, 1906.

THE residue from zinc distillation, containing both zinc and carbon, is mixed with fresh zinciferous material, and heated in a "long bedded, continuous acting furnace (Fortschaufelungsofen)," without further addition of combustibles or fluxes. Thus 100 parts of fresh material, containing 10 per cent. of zinc, may be mixed with 20 parts of a zinc residue containing 2 per cent. of zinc and 22 per cent. of carbon.—A. G. L.

Washing coal, coke, minerals, and the like; Machine for ——. G. H. Rayner and The Hardy Patent Pick Co. Eng. Pat. 1660, Jan. 22, 1906. Ill., page 1210.

FRENCH PATENTS.

Steel; Fibrous ——, and method of producing the same. E. F. Colborn. Fr. Pat. 367,999, July 12, 1906.

THE steel to be treated is heated to redness and then plunged into a solution consisting of 0·062 to 0·102 grm. of hippuric acid, 0·102 grm. of magnesium chloride, 1·555 grms. of chlorine, 12·441 grms. of sodium chloride, 12·441 grms. of ammonium chloride, 0·039 grm. of ammonia, and 4·543 litres of water. This solution is preferably contained in a closed vessel, which, after the steel has been introduced, is subjected to a pressure of from 3·5 to 7 kilos. per sq. cm. The quantity of the solution contained in the closed vessel should be such that the greater part is vaporised by the hot steel, the solution being stated to be more active in the gaseous state. The invention is especially applicable to inferior Bessemer steel, the strength of which is claimed to be greatly increased by the treatment.—A. G. L.

Metals in impalpable powder; Process of oxidising ——. C. L. C. Bertou. Fr. Pat. 361,798, Sept. 27, 1905.

METALS, such as tin, zinc, lead, or antimony, in impalpable powder, are submitted to the action of nascent oxygen, ozonised air or oxygen, or hydrogen peroxide in a vessel provided with heating and agitating means.—E. S.

Sulphur dioxide; Process for the utilisation of the —— produced in the smelting of antimony. G. R. M. Sweeting. Fr. Pat. 361,808, Oct. 3, 1905.

THE gases produced by the roasting of antimony ore to oxide are passed through a series of chambers containing water, the unabsorbed gases finally going to a chimney. The pipe leading the gases from the furnace into the first chamber is surrounded by a cold-water jacket, to prevent its attack by hot antimony oxide, some of which passes over with the gases. The water in the chambers must be kept well agitated to prevent stoppage of pipes by deposited antimony oxide. The solution finally obtained is filtered or decanted from the antimony oxide.—A. G. L.

Pyrophoric alloys for igniting and lighting purposes. C. Auer von Welsbach. First Addition, dated July 18, 1906, to Fr. Pat. 337,320, Oct. 31, 1903. Ill., page 1211.

Zinciferous material; Process for treating ——, and simultaneous recovery of the zinc and carbon contained in residues from the metallurgical treatment of zinc. G. Stolzenwald. Fr. Pat. 368,458, July 27, 1906. Under Int. Conv., Nov. 7, 1905.

SEE Eng. Pat. 18,134 of 1906; preceding these.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 1157.)

(A.)—ELECTRO-CHEMISTRY.

Platinised electrodes for alkali chloride electrolysis; Application of grey ——. *I.* W. Geibel. Z. Elektrochem., 1906, **12**, 817—819.

IT has previously been demonstrated by Foerster (this J. 1902, 252) that platinum electrodes, upon which a fine black deposit of platinum has been made, enable the electrolytic production of hypochlorites and chlorates to be effected with a P.D. of from 0·5 to 0·6 volt below that necessary with bright polished platinum electrodes. For practical purposes this method is useless on account of the lack of durability of the black platinising. Grey platinising has up to the present proved unsuitable, but it has recently been found by Heraeus that a uniform and durable grey platinising can be carried out which the present author finds to give nearly as good results as Foerster obtained with platinum black, whilst at the same time the deposit seems to be lasting. Experimental results are given of a comparison of bright electrodes with black and grey platinised electrodes, showing that the difference in favour of the black platinising is only 0·04 to 0·1 volt, and that consequently the saving in energy over the bright electrodes is at least 80 per cent. of that attainable with black platinised electrodes. On the

other hand, the current yield is several per cent. better than with bright electrodes, and shows no marked difference from that obtained with the black platinised electrodes. —R. S. H.

Glass; Electrically-conducting ——. C. E. S. Phillips. VIII., page 1220.

ENGLISH PATENT.

Sterilisation [Electrolytic] of wood, cotton, rag, hair, fibres, or similar material for prevention of anthrax. I. Ickringill. Eng. Pat. 28,345. Nov. 14, 1905. V., page 1216.

UNITED STATES PATENT.

Electric Furnace. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 834,948, Nov. 6, 1906.

THIS furnace, which is of the resistance core type, is provided with side walls formed in movable sections which converge towards the base of the furnace. The base of the furnace is stationary, and is provided with a space for a cooling medium sufficient to prevent any substantial diversion of the current through the base. In this manner the current traverses the conducting material between the end electrodes, and heats the charge surrounding this conducting core. —R. S. H.

FRENCH PATENTS.

Furnace; Electric ——. B. Platschick. Fr. Pat. 361,831, Oct. 9, 1905.

SEE U.S. Pat. 826,962 of 1906; this J., 1906, 936.—T. F. B.

Glow-bodies, especially filaments of tungsten; Manufacture of metallic —— for electric lamps. Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 367,386, June 8, 1906. II., page 1212.

Glow-bodies for incandescence electric lamps; Manufacture of metallic —— Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 368,225, July 19, 1906. II., page 1212.

Bleaching wool; Process and apparatus for [electrically] ——. G. Pansa and A. Romberg. Fr. Pat. 368280, June 18, 1906. V., page 1217.

(B.)—ELECTRO-METALLURGY.

Iron; Polarisation capacity of —, and its relation to passivity. C. McC. Gordon and F. E. Clark. Z. Elektrochem., 1906, **12**, 769–772.

THE investigation was undertaken with a view of distinguishing whether the passivity of iron should be ascribed to the formation of an oxide film or to some allotropic change in the metal. A number of different electrolytes were employed, and short lengths of iron wire served as electrodes. The polarisation capacity was measured by comparison with a metallic condenser, and it was frequently found necessary to arrange a resistance in parallel with this condenser. This auxiliary circuit is found to be necessary in such cases as aluminium, where the capacity corresponds to a true electrostatic capacity, and is caused by the formation of a film of oxide. In all cases except in dilute nitric acid, in ferrous sulphate, and in ferric chloride solutions, a parallel shunted resistance is necessary with iron electrodes. The authors, therefore, conclude that the passivity of iron is caused by the formation of a film or layer of oxide upon the surface of the metal.—R. S. H.

ENGLISH PATENTS.

Gold; Apparatus for use in recovering —— from disintegrated ores. T. E. Beaumont, London. Eng. Pat. 25,319, Nov. 13, 1905.

THE ore pulp is supplied to the top of a wooden vat containing a 0·1 per cent. solution of potassium cyanide. In the centre of the lower part of the tub is supported a cylinder open at both ends, within which revolves a vertical propeller at an adjustable speed. The blades of this propeller are mounted so as to cause a continuous downward flow of the ore pulp through the cylinder; the pulp is then forced to pass between a wide horizontal flange attached to the cylinder and the surface of mercury contained in a cast-iron tray placed at the bottom of the vat. The amalgam can be removed from time to time by means of a stop-cock in this tray. The lighter particles of gangue and the fine gold not absorbed by the mercury pass upwards with the current of water outside the cylinder, and then pass between a series of concentric annular electrodes of amalgamated copper and iron, which are mounted on brackets in the upper part of the vat. The amalgamated copper electrodes, as well as the mercury at the bottom of the vat, are connected with the negative terminal of a generator giving a continuous current of about 6 volts, whilst the iron electrodes and the cylinder are connected to the positive terminal. Whenever the resistance in the vat becomes too great, as indicated by an ammeter in the circuit, additional cyanide solution is supplied so as to keep the strength of the solution approximately constant. An overflow pipe conducts excess of solution, and the lighter particles of the ore into a spitzkasten, from which the fine gold still unabsorbed, together with the finest particles of gangue, pass into a second vat similar to the first. If necessary, a third vat may receive the overflow from the second, but this should not be needed.—A. G. L.

Metallic compounds or ores; Electrolysis of —. E. A. Ashcroft, New York. Eng. Pat. 26,813, Dec. 22, 1905.

THE ore is electrolysed over a cathode which produces a fusible alloy with the metals, this alloy being conducted to a second cell, where it is used as an anode, and wherein the metals are precipitated fractionally at the cathode. The process may be applied to the elimination of iron from mixed ores, &c., of zinc or lead, the electrolysis being conducted at a high temperature to precipitate the iron before the lead, the corresponding solution of the iron before the lead in the second cell being effected by conducting the operation there at a lower temperature. —C. S.

Furnaces; Electric ——. H. Röchling and W. Rodenhauser, Völklinghen, Germany. Eng. Pat. 12,329, May 26, 1906.

SEE Fr. Pat. 366,440 of 1906; this J., 1906, 1054.—T. F. B.

FRENCH PATENTS.

Metallic flakes; [Electrolytic] Production of —. T. A. Edison. Fr. Pat. 367,863, July 7, 1906.

THE flakes of cobalt or of any alloy of cobalt or nickel required in the positive electrode of the Edison cell are produced by a modification of the method previously described (this J., 1906, 643). The present process consists in depositing electrolytically upon a suitable cathode a film of copper, then in another bath a film of cobalt, or cobalt-nickel alloy, subsequently a fresh layer of copper and so on, building up a composite deposit of alternate layers of copper and cobalt. The deposit is eventually removed *en bloc* from the cathode; it is cut up into strips of the size desired, and the copper is then removed. The treatment for the removal of the copper consists in acting upon the divided mass with a strong solution of cyanide, either directly or after the copper has been converted into some soluble salt.—R. S. H.

Metal pieces [rails]; Process of joining —— [by electrolysis]. C. F. Jacobs. Fr. Pat. 367,864, July 7, 1906.

THE metal pieces to be joined are surrounded by a mould, a molten flux or electrolyte is then poured into the cavity, and the ends of the metal heated by the passage of an electric current between them and through the flux. The flux may be composed of equal parts of borax, calcium fluoride, zinc chloride, and sodium chloride. When the ends of the metallic pieces are sufficiently heated, molten metal is poured into the mould. This metal may displace the flux by gravity, or, if desired, the flux can be run off before the admission of the metal.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 1161.)

Cocoa nut oil; Alcoholysis of ——. A. Haller and Yousoufian. Compt. rend., 1906, **143**, 803—806.

The fatty matter from cocoa nut is submitted to the action of absolute methyl, ethyl, or other alcohol of this series, in the presence of a catalytic agent such as hydrochloric or phenylsulphonic acid, the proportion of catalyst present being 2 per cent. of the alcohol. The operation may be carried out in closed vessels at a temperature of 100° C., or in a flask attached to a reflux condenser, and the reaction even takes place at the ordinary temperature if the mixture be well shaken. The reaction is complete when the mass becomes homogeneous. In this way it was found possible to convert the constituent glycerides of the fat into their corresponding methyl esters, and to separate the latter from each other by means of fractional distillation. The total yield of esters agreed with that required by theory, and the distillation gave methyl caproate, caprylate, caprate, laurate, myristate, palmitate, stearate, and oleate. The corresponding glycerides are, therefore, present in cocoanut oil. Methyl butyrate was not found in the mixed esters. (See also this J., 1906, 1159.)—W. P. S.

Food products; Standards of purity for ——. XVIII., page 1229.

English Patent.

Detergent for use with hard and salt waters. R. Macpherson, Brondesbury, and W. E. Heys, Bushey. Eng. Pat. 23,546, Nov. 16, 1905.

See Fr. Pat. 364,975 of 1906; this J., 1906, 938.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 1162.)

(*A.*)—PIGMENTS, PAINTS.

English Patent.

Black oxide of iron; Manufacture of —— [*for use as a paint*]. J. Wetter, London. From C. F. Wülfing, Honningen-on-Rhine, Germany. Eng. Pat. 1050, Jan. 15, 1906.

Waste ferrous chloride liquors, after digestion with iron filings to neutralise free acid, are somewhat diluted, and two-thirds of the quantity of liquid ammonia necessary for saturation is added. Air is blown through the liquor, and after heating with steam, the remaining third of the ammonia required (or slightly more) is added. The mixture is again heated, the pan being closed, until about half an atmosphere pressure over the normal is attained. Finally, air is blown into the liquid until it is free from dissolved iron. The residual solution of ammonium chloride is concentrated to yield that salt as a by-product. The precipitated blue-black magnetic iron oxide, separated by filtration, is available as the basis for a paint for iron work. Waste ferrous sulphate liquors may be similarly treated.—E. S.

French Patent.

Lithopone, stable towards the action of light. W. Ostwald. Fr. Pat. 368,301, July 23, 1906.

The crude mixture of barium sulphate and zinc sulphide is roasted in a closed vessel, to prevent access of air, and means are devised for keeping out air in the subsequent slaking process. The roasting may also be performed continuously, in apparatus traversed by a current of gas free from oxygen.—C. S.

German Patent.

Silicate colours [pigments]; Process for the manufacture of ——. C. Barth. Ger. Pat. 167,934, June 19, 1904.

An aqueous solution of a suitable mixture of metallic salts is treated with a solution of an alkali- or alkaline-earth silicate, and the precipitated hydrous silicate is ground after being partially or completely dehydrated.
—A. S.

(*B.*)—RESINS, VARNISHES.

Copals; Study of some American ——. C. Coffignier. Bull. Soc. Chim., 1906, **35**, 1143—1150.

Employing the same methods as on former occasions (this J., 1902, 918; 1903, 808; 1905, 203) three American copals have been examined with the following results (the numbers placed against the various solvents are the percentages left undissolved by the boiling solvent):—

	Demerara	Columbia.	Brazil
Sp. gr. at 19° C.	1·047	1·054	1·053
Melting point	180° C.	above 300° C.	100° C.
Acid value	97·7	118·8	123·0
Saponification value	102·4	155·7	133·3
Solubility in —	per cent.	per cent.	per cent.
Ethyl alcohol	72·1	17·0	30·2
Methyl ,,	77·4	60·0	50·0
Amyl ,,	53·0	4·9	1·8
Ether	55·4	50·0	29·7
Chloroform	56·9	54·7	36·0
Benzene	70·9	60·8	40·5
Acetone	69·2	43·6	37·6
Oil of turpentine	92·5	68·7	48·2
Benzaldehyde	50·2	18·3	26·7
Aniline	73·9	2·2	8·3
Amyl acetate	37·1	6·0	3·4
Carbon tetrachloride	75·5	69·6	44·9

A peculiarity of Demerara copal is that it evolves a definite odour of valeric acid when it is freshly powdered. It is readily distinguished from Madagascar copal by the great difference between their solubilities in aniline.
—M. J. S.

French Patents.

Oil of turpentine and other products of wood; Extracting ——. M. McKenzie. Fr. Pat. 367,926, July 9, 1906.

The wood is subjected to the action of a heated bath of resin, rosin oil, other oils, hydrocarbons, or the like, in a still, the whole or part of the bath contents being then drawn off into a cooling vessel, and returned to act again on fresh wood. The bath is reheated before treating the next charge of wood. Means are provided for transferring the bath from one vessel to the other and through the heater; also for admitting steam or other suitable cooling agent to the cooling vessel.—C. S.

Wood; Treating —— *for the extraction of the oil of turpentine, with pitch and charcoal as by-products.* F. T. Snyder. Fr. Pat. 368,198, July 19, 1906. Under Int. Conv., Dec. 1, 1905, and May 31, 1906.

The wood is placed in an air-tight receptacle, which is inserted from below into a furnace, where it is heated, preferably by electricity. The oil of turpentine is drawn off from the bottom of the receptacle, which is kept cold, so that the pitch is not decomposed. When the distillation is finished, the receptacle is withdrawn and set aside in an upright position, to prevent access of air to the charcoal, whilst a fresh charged receptacle is inserted in the furnace.—C. S.

Driers for paint, varnish, and oil; Colourless ——. G. Guittet. Fr. Pat. 367,989, July 11, 1906.

Soluble metallic salts, such as lead acetate, manganese acetate, &c., are dissolved in alcohol, acetone, or amyl acetate, with or without the addition of a spirit varnish.
—C. S.

(C.)—INDIA-RUBBER, &c.

Rubbers from Uganda.—Bull. Imp. Inst., 1906, **4**, 202—204 and 226.

Samples of three different rubbers from the Uganda Protectorate have been examined, with the following results:—

(*a*) Rubber from *Funtumia elastica* (compare this J., 1906, 940).—The sample consisted of a rather dark coloured "biscuit," possessing good physical characteristics, and containing moisture, 1·7; caoutchouc, 84·6; resin, 6·4; albuminoid matter, 6·5; and ash, 0·8 per cent.

(*b*) Rubber from *Clitandra orientalis*.—The sample was in the form of a thin cake, dark brown in colour, and very strong and elastic. It contained moisture, 2·8; caoutchouc, 77·9; resin, 8·8; albuminoid matter, 9·4; and ash, 1·1 per cent.

(*c*) Rubber from *Landolphia Dawei*. Samples from three different localities were examined. All were in the form of thin sheet, pale in colour, and of good elasticity and strength. The samples contained moisture, 4·9; caoutchouc, 76·2; resin, 14·1; albuminoid matter, 2·0, and ash, 2·8 per cent. The amount of resin in rubber from *L. Dawei* probably varies with the age of the vine, a specimen previously examined having contained only 8 per cent. of resin in the dry material. The valuation in London of rubbers (*a*), (*b*) and (*c*), at a time when "fine hard Parà" was 5s. 5d. per lb., and Ceylon Parà "biscuits" 6s. 3d. per lb., was 5s. 6d. to 5s. 7d., 5s. 9d. and 5s. 9d. respectively. *Landolphia Dawei* is considered by Chevalier (Bull. Soc. Botanique de France, 1906, 17) to be one of the most promising of the *Landolphias* for cultivation in tropical Africa, at altitudes between 500 and 2000 m., or at lower elevations where there is a fairly uniform rainfall throughout the year. Monte Café, with altitude 700 m., average temperature 18° to 20° C., and annual rainfall 1·5 m., appears to be a particularly favourable spot. The yield of rubber is large, and the product of good quality, specimens being valued in Paris at 12 frs. per kilo (4s. 4d. per lb.), with fine Parà at 5s. 4d. per lb. (compare above, London valuation). E. W. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 1162.)

French Patents.

Tanning extracts; Decolorisation of —. L. Dufour. Fr. Pat. 367,917, July 9, 1906.

The extracts are treated with a mixture of hypophosphorous and phosphorous acids, or salts of these acids with sulphurous acid, or sulphites, bisulphites, and hypophosphites. Such mixtures have marked reducing and decolorising powers, which are increased by the addition of formalin and the application of a certain amount of heat. The quantities of the decoloriser and the temperature of the reaction depend upon the nature of the tanning material.—S. R. T.

Chrome tanning; Process of —. Lederfabrik Hirschberg vorm. H. Knoch und Co. Fr. Pat. 368,122, July 17, 1906.

According to the invention, a solution of the double pyrophosphate of sodium and chromium is decomposed by skin substance, and tans without the formation of acid or alkali. The double salt may be prepared beforehand, or produced during the tanning process from separate baths of sodium pyrophosphate and a chromium salt. Concentrations of 10° to 30° B. have given good results, but should be varied according to the quality of the skin and the kind of leather or rate of tanning desired. The method may be used in conjunction with other, mineral or vegetable tannages, and the addition of neutral salts or alkaline bodies, in solution or suspension, is beneficial.—S. R. T.

Ossein; Preparations and applications of —. A. Helbronner and E. A. Vallée. Fr. Pat. 361,796, Sept. 26, 1905.

Claim is made for solutions obtained by treating finely-divided ossein with cold alkaline solutions, and an intermediate body produced by arresting the action of the alkali when a transparent homogeneous colloidal mass has been formed. The latter is soluble in water, ammonia, alkalis, &c., and from these solutions, as also from those produced by the prolonged action of alkali, the ossein may be precipitated by neutral salts, acids, and certain organic liquids. The precipitated products are suitable for the preparation of textile fibres, dressings for various materials, or as a base for photographic emulsions.

—S. R. T.

German Patent.

Tanning hides and skins; Process for —. L. Ziegel. Ger. Pat. 165,238, July 31, 1902.

Skins or hides, prepared in the usual way, are treated with a solution containing aluminium phosphate, an alkali chloride, and a small quantity of sulphuric acid, and are finally worked in a soap solution. This process is stated to produce a leather similar to tawed leather; the product is very little affected by water, only a very small quantity of aluminium salt being extracted after long soaking.—T. F. B.

XV.—MANURES, &c.

(*Continued from page* 1163.)

French Patents.

Peat; Industrial treatment of — *to increase its content of nitrogen, in view of its application as a manure.* E. V. H. Bazin. First Addition, dated July 3, 1906, to Fr. Pat. 360,484, Dec. 14, 1905 (this J., 1906, 488).

A nitrière, or nitrate-producing ground, formed by the aid of blocks of peat, as described in the main patent, is supplied with effluent from sewage septic tanks. Such sewage, after remaining in the tank long enough to effect the necessary fermentation, may be siphoned on to the *nitrière*.—E. S.

Phosphates of iron and aluminium; Treatment of double — *in order to render the combined phosphoric acid soluble in ammonium citrate.* Pilon, Buffet, Durand-Gasselin et Cie. Fr. Pat. 368,521, July 30, 1906.

Native phosphates of iron and aluminium, either contained in upright retorts or directly exposed to the furnace flames, are slowly heated up to bright redness, the very slow and gradual character of the heating being an essential condition. The heating is sufficiently prolonged to expel both the combined and free water from the mineral. It is stated that the described treatment renders the insoluble phosphoric acid soluble in ammonium citrate.

—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 1165.)

Muscovado sugars; Fermentation changes occurring in —. F. Watts and H. A. Tempany. West Indian Bull., 1906, **7**, 226—236.

One of the authors has already called attention to the occurrence of fermentation changes in Muscovado sugars in the West Indies, whereby the polariscope test is subjected to alteration. It has been observed that the polarimetric reading varies, gas is evolved, and a vinous odour is produced, which, if the sample were enclosed in an air-tight vessel, after a time, becomes very strong indeed. To obtain an insight into the changes that occur during such fermentation, the authors have analysed, from time to time, a number of samples of fermenting sugar. It was found in all cases that the polarimetric reading first increased and then fell; at the same time, the amount of reducing sugar was diminished. If a fermenting sugar is kept for any long period of time, it was

found that it undergoes very marked deterioration in appearance. The preliminary rise of the polarisation reading appears to be due, in part, to the destruction of the lævulose preceding that of the dextrose. That the dextrose does undergo fermentation, was proved by inoculating a sterile solution of dextrose (containing traces of plant food) with fermenting sugar. The destruction of dextrose accounts for the first part of the fall of the polarimetric reading of the fermenting sugar; the subsequent fall is due to destruction of sucrose, as shown by determining, at intervals, the percentage of sucrose by Clerget's method. According to Greig-Smith and Steel, the decomposition of raw cane sugar is due to an organism, *Bacillus levaniformans*, the spores of which withstand a high temperature for a considerable time; this organism inverts the sugar and converts the product into a gum. The authors have found that fermenting muscovado sugar contains an organism, or organisms, which, when sown in sterile sucrose solutions containing traces of plant food, forms invert sugar and gum, and they are inclined to the opinion, that at certain stages of fermentation of fermenting sugar, dextro-rotatory substances are formed. Bacteriological examination of fermenting sugar showed that, in addition to some torula-like forms, numerous oval, free bacteria, 1—2 $\mu\mu$ long and 0·5 $\mu\mu$ broad, agreeing fairly well with the description of *B. levaniformans*, were present. On heating fermenting muscovado sugar at 100° C. for 1½ hours, it was found that the samples were completely sterilised; hence, unless the bacteria, present in the samples investigated, were free from spores, it appears that muscovado sugar does not contain a spore-bearing organism of a type very resistant to heat. L. E.

l-Iditol; Preparation and properties of crystallised ——. G. Bertrand and A. Lanzenberg. Bull. Soc. Chim., 1906, **35**, 1073—1079.

l-Iditol was prepared as follows:—Xylose, after solution in water, was converted by treatment with hydrocyanic acid, a little ammonia, and subsequent hydrolysis, into a mixture of *l*-gulonic and *l*-idonic acids; these were separated by alcoholic crystallisation. *l*-Gulonic lactone, which crystallised from the alcoholic solution, was converted, by treatment with pyridine, into *l*-idonic acid. By reduction, *l*-idonic acid furnished *l*-iditol which was purified, first by conversion into the tri-benzal derivative, and finally by crystallisation from alcohol. *l*-Iditol forms transparent, deliquescent, rhombic crystals (m. pt. 73·5° C.); in 10 per cent. aqueous solution the rotatory power is $[\alpha]_D^{20°} = +3·5°$. The hexacetate melts at 121·5°; $[\alpha]_D^{20°} = +25·33°$ in 5 per cent. chloroform solution.—L. E.

Food products; Standards of purity for ——. XVIIIA., page 1229.

Dextrose; Decomposition of —— *with ammoniacal zinc hydroxide, in the presence of acetaldehyde.* A. Windaus. XXIV., page 1234.

FRENCH PATENTS.

Sugar; Apparatus for extracting molasses from —— *by means of hot, compressed air.* A. Delettre. Fr. Pat. 368,007, April 17, 1906.

THE object of this apparatus is to extract molasses from sugar without recourse to a centrifugal machine. It includes a compressed-air chamber fitted with valves for admitting air, steam, and massecuite, and a valve for discharging sugar. A belt (consisting of an interlaced steel wire supporting belt, to which is fastened, by brass wire, a brass belt of similar construction), which passes over two drums, forms the bottom of the chamber. Massecuite is introduced into the chamber to a depth of 8—10 cm., the air valve is opened, the hot, compressed air drives the molasses through the belt into a hopper below, and the belt then moves forward a distance equal to the length of the chamber, the sugar being thereby discharged from the latter. The cycle of operations is then repeated.—L. E.

Saccharine juices; Economical process for purifying —— *by means of hydrofluosilicic acid, and the subsequent recovery of the acid.* H. Bertels. Fr. Pat. 368,421, June 20, 1906

SEE Eng. Pat. 17,554 of 1905; this J., 1906, 859.—T. F. B.

Sugar; Process for denaturing ——. P. Landouzy. Addition, dated June 29, 1906, to Fr. Pat. 364,072, March 13, 1906 (this J., 1906, 901).

THE inverted sugar to which tannin is added as denaturing agent, may be in the form either of massecuite or of syrup. —T. H. P.

Starch or alcohol; Process for extracting —— *from potatoes, together with a paste rich in nutritive matter.* C. Steffen. Fr. Pat. 368,002, July 12, 1906. XVIIIA., page 1230.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 1168.)

Brewing value of barley; Mealiness as a factor in estimating the ——. J. Brand. Z. ges. Brauw., 1906, **29**, 661—667.

THE conclusions at which the author arrives are briefly as follows:—An estimation of the original steeliness of a barley is no criterion of its value for malting. A knowledge of the degree of mealiness of a barley after steeping gives important indications as to the method of treatment to be adopted in the malt-house, but it gives no precise information with regard to the total nitrogen content of the barley. Corns which remain steely after steeping are always richer in protein than the mealy ones of the same kind, and are also those which yield steely malt and sinkers. Estimation of the steeliness after steeping is of the greatest value, as the irregularity of the modification increases with the proportion of corns exhibiting this residual steeliness. P. Lindner states that it is exceptional for a barley rich in protein to be mealy. This observation seems to have an anatomical basis, since barley corns rich in protein contain from four to six layers of aleurone cells and exhibit also an extraordinarily dense deposit of so-called histological protein; the aleurone layers of barleys poor in protein are only from two to four cells in thickness.—T. H. P.

Beer; Use of short-grown malt for the production of full-bodied ——. E. Rüffer. Woch. f. Brau., 1906, **23**, 671—672.

REFERRING to a recent lecture on the advantages of using a short-grown malt for the brewing of full-bodied beers, the author relates how this principle was being applied 50 years ago. At the brewery in question, the grist was made up with 50 per cent. of malt grown as long as possible, 25 per cent. of malt of a growth of only half the length of the first, and 25 per cent. of malt which had only just reached the sprouting stage. The long-grown malt was cured at a temperature of 81°—87·5° C., and the shorter malts were cured at 62·5°—69° C., the final curing temperature being maintained for three hours. The mash was mixed cold, and allowed to soak for an hour; heat was then applied by the direct introduction of steam into the mash tun, so that the temperature rose very slowly to 62·5° C. in about one hour. After a pause of three-quarters of an hour, the temperature was further raised to 77·5° C., and kept at that for one hour; then the wort was run off. The hops were mixed with the main wort in the copper, and allowed to steep whilst the grains were being sprayed with boiling water. When the last liquors were through, the wort was boiled for two hours. The worts were pitched at a gravity of 14° Balling, and fermentation was started at 5° C. for summer beers, and 7°—7·5° C. for winter beers. The summer beers were fermented for 14—16 days the winter beers for 8—10 days. Winter beers were browed with a larger proportion of long-grown malt and a smaller proportion of short-grown. The beers were cleared on shavings and were ready in 14 days. These beers were distinguished by their full body-flavour and excellent condition, and although highly attenuated, they required no "Kräusen" to prepare them for consumption.—J. F. B.

Maltase from malt; Hydrolytic action of ——. L. Marino and G. Fiorentino. Gaz. chim. ital., 1906, **36** [2], 395—427.

THE authors find that maltase of malt, free from emulsin and invertase, is capable, not only of decomposing maltose, but also of hydrolysing those natural and artificial glucosides which are decomposed by emulsin. The maltase was prepared by drying germinated barley at 25°—35° C., digesting it with three times its weight of water saturated with thymol, filtering, concentrating the filtrate at 35°—40° C. *in vacuo*, and precipitating the enzyme with 98 per cent. alcohol. It had the composition:—Carbon, 46·0; hydrogen, 7·2; nitrogen, 7·53; and ash, 1·5 per cent.; and contained traces of sulphur. The absence of emulsin in the maltase is shown by the fact that when the maltase was allowed to act upon amygdalin in concentrated solution, the hydrocyanic acid set free almost destroyed the activity of the enzyme, since on recovering the latter, it was found to be almost entirely without action on maltase or salicin. On adding a trace of emulsin to the recovered maltase, however, it became capable of almost completely hydrolysing salicin. Benzaldehyde and hydrocyanic acid have no influence on the activity of emulsin. Of the artificial glucosides, only the β-stereoisomerides of dextrose are decomposed by the maltase, and it is concluded, therefore, that the natural glucosides which are decomposed are also β-derivatives of dextrose. It appears evident from the results of these experiments that one and the same enzyme is capable of effecting hydrolysis in cases where it has hitherto been held that the action of two or more enzymes is required. The maltase from malt is capable of synthesising the same isomaltose from dextrose as is the maltase from beer yeast. (See also this J., 1906, 228.)—A. S.

Food products; Standards of purity for —— XVIII.A., see next column.

ENGLISH PATENTS.

Brewing; Process of — —. J. House, London. Eng. Pat. 18,351, Sept. 11, 1905.

A MIXTURE of malt and kilned raw grain is mashed, the temperature at the beginning being below 50° F., and rising to 150° F., the various enzymes being thereby enabled to exert their specific functions. The wort is then boiled, and cooled to 57° F., 10 per cent. of malt being mashed in at this temperature; the temperature is finally raised to 75° F. The wort is run off and boiled, that retained by the grain being expressed by air pressure. The grain residues are hydrolysed with acid, the wort being filtered by fluid pressure. The wort is cooled in a closed vessel, aerated by cold air, and fermented (preferably with a variety of types of true *S. cerevisæ*) in a closed vessel supplied with sterilised air, the beer being stored under carbon dioxide gas pressure. —L. E.

Brewing material, applicable also to other purposes, derived from starch and analogous farinaceous materials, and a new and useful process of making said brewing material. T. B. Wagner, Chicago. Eng. Pat. 2242, Jan. 29, 1906.

FARINACEOUS material is mixed with water, so as to form a "starch milk" (gravity about 22° B.), which is heated along with an acid for 40 minutes under a pressure of 20 lb., until reducing sugars begin to appear, their development being checked by neutralising the mass with alkali. The product is evaporated to dryness, preferably on a rotary hot cylinder. This product is amorphous, reduces Fehling solution, gives a perfect mash in presence of malt, is soluble in water at ordinary temperature, gives a violet or purple reaction with about 12 per cent. of iodine, and a reddish-brown with about 66 per cent. of that reagent.—C. S.

Beer; Vessels for use particularly in the sterilised manufacture of ——. L. Nathan, Zurich. Eng. Pat. 5619, March 8, 1906. Under Int. Conv., March 8, 1905.

THE vessel consists of an outer, cylindrical, iron shell, with an interior lining formed of a number of glass plates (preferably of milk-glass) concentric to the shell, and cemented to the latter with non-swelling cement, the edges of the plates being cemented together with acid-proof cement.—L. E.

Saccharine fruit juices [Wine making]; Process of desulphurising ——. E. A. Barbet, Paris. Eng. Pat. 13,217, June 7, 1906. Under Int. Conv., Oct. 27, 1905.

THE juice passes through regenerator tubes to the top of a column containing a series of plates, each provided with caps, acting as baffles, or with small holes, and an overflow. The descending juice is raised to ebullition (at a minimum temperature of 67° C.) by an ascending hot air current, which is introduced from a heater through a valve adjusted to give the requisite reduction of pressure. The air carries the sulphurous acid and other volatile substances to a condenser, the condensation products being run to waste. The juice passes from the bottom of the column to the above-mentioned heater, then through the regenerator and a cooler, to the fermenting vat. The plates of the column, and some other parts of the apparatus, are made of sandstone, the metallic parts with which the juice comes in contact being constructed of pure tin.—L. E.

FRENCH PATENT.

Starch or alcohol; Process for extracting —— *from potatoes, together with a paste rich in nutritive matter.* C. Steffen. Fr. Pat. 368,002, July 12, 1906. XVIII.A., page 1230.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 1169.)

(A.)—FOODS.

Food products; Standards of purity for — —. U.S. Dept. of Agric., Circular No. 19, 1906.

IN this circular the standards of purity recommended by a Committee of the Association of Official Agricultural Chemists, and endorsed by the U.S. Secretary of Agriculture, are given. Brief extracts from these standards are given below.

1. *Animal products.—Lard*, it is stated, contains, necessarily incorporated in the process of rendering, not more than 1 per cent. of substances other than fatty acids and fat. *Leaf lard* has an iodine value not greater than 60. *Milk* contains not less than 8·5 per cent. of non-fatty solids and not less than 3·25 per cent. of milk fat. *Cream* contains not less than 18 per cent. of milk fat. *Milk fat* or *butter fat* has a Reichert-Meissl value not less than 24 and a sp. gr. not less than 0·905 at 40°/40° C. *Butter* contains not less than 82·5 per cent. of milk fat. *Cheese* contains not less than 50 per cent. of milk fat referred to the water-free substance.

2. *Vegetable products.—Flour* contains not more than 13·5 per cent. of moisture, 1 per cent. of ash, and 0·5 per cent. of crude fibre, and not less than 1·25 per cent. of nitrogen. *Maize meal, corn meal*, or *Indian corn meal* contains not more than 14 per cent. of moisture and 1·6 per cent. of ash, and not less than 1·12 per cent. of nitrogen. *Oatmeal* contains not more than 12 per cent. of moisture, 1·5 per cent. of crude fibre, and 2·2 per cent. of ash, and not less than 2·24 per cent. of nitrogen. *Molasses* contains not more than 25 per cent. of water and 5 per cent. of ash. *Refiners' syrup* or *treacle* contains not more than 25 per cent. of water and 8 per cent. of ash. *Starch sugar, anhydrous*, contains not less than 95 per cent. of dextrose and not more than 0·8 per cent. of ash; 70 per cent. *sugar* or *brewers' sugar* contains not less than 70 per cent. of dextrose and not more than 0·8 per cent. of ash; and 80 *sugar, climax sugar*, or *acme sugar* contains not less than 80 per cent. of dextrose and not more than 1·5 per cent. of ash. *Glucose, mixing glucose*, or *confectioners' glucose* has a density at 100° F. (37·7° C.) of from 41° B. (not more than 21 per cent. of water) to 45° B. (not more than 14 per

cent. of water), and contains not more than 1 per cent. of ash on a basis of 41° B. *Honey* contains not more than 25 per cent. of water, 0·25 per cent. of ash, and 8 per cent. of sucrose. *Edible vegetable oils and fats:* The standards are given in the following table :—

Oil or fat.	Refractive index at 25° C.	Iodine value.
Olive oil	1·4660—1·4680	79—90
Cotton-seed oil	1·4700—1·4725	104—110
"Winter-yellow" cotton-seed oil	—	110—116
Peanut, earthnut, or arachis oil	1·4690—1·4707	87—100
Sesamé, gingili, or teel oil	1·4704—1·4717	103—112
Cocoa- or cacao-butter m pt 30°—35° C	1·4566—1·4598 (40° C.)	33—38
Cotton-seed oil stearine	—	85—100

Chocolate, plain chocolate, bitter chocolate, chocolate liquor, or *bitter chocolate coating* contains not more than 3 per cent. of ash insoluble in water, 3·50 per cent. of crude fibre, and 9 per cent. of starch, and not less than 45 per cent. of cocoa fat.

Beverages.—*Wine* contains 7—16 per cent. of alcohol by volume, and in 100 c.c. at 20° C. not more than 0·1 grm. of sodium chloride and 0·2 grm. of potassium sulphate, and not more than 0·14 grm. for red wine, or 0·12 grm. for white wine of volatile acids, calculated as acetic acid. *Dry wine* contains in 100 c.c. at 20° C. less than 1 grm. of sugars, and for red wine not less than 0·16 grm. of grape ash and 1·6 grms. of sugar-free grape solids, and for white wine not less than 0·13 grm. of grape ash and 1·4 grms. of sugar-free grape solids. For vinegars the minimum standards are as follow :—

Kind of vinegar.	100 c.c. at 20°C contain :—			Water-soluble ash from 100 c.c.	
	Acetic acid.	Solids	Ash	Contains phosphoric acid (P_2O_5)	Requires for neutralisation.
	grms	grms not less than	grm	mgrms.	c.c of $N/10$ acid.
*Cider, apple, (lævo-rotatory)	4	1·6	0·25	10	30
Wine, grape	,,	1·0	0·13	—	—
Malt, (dextro-rotatory)	,,	2·0	0·2	9	4
Sugar	,,	—	—	—	—
Glucose	,,	—	—	—	—
Spirit, distilled, grain	,,	—	—	—	—

*Solids contain not more than 50 per cent. of reducing sugars.

Table salt, dairy salt contains not more than 1·4 per cent. of calcium sulphate, 0·5 per cent. of calcium and magnesium chlorides, and 0·1 per cent. of insoluble matter, referred to water-free substance. (See also this J., 1906, 651.) A. S.

Cocoa nut oil; Alcoholysis of ——. A. Haller and Youssoufian. XII., page 1226.

Vicianin, a cyanogenetic glucoside contained in vetches. G. Bertrand. XX., page 1231.

English Patent.

[*Milk*] *Separators; Centrifugal* ——. Aktiebolaget Separator, Stockholm. Eng. Pat. 21,424, Sept. 27, 1906. Under Int. Conv., Oct. 23, 1905.

The claim is for a feeding device for milk separators, which fits into the neck of the apparatus, and is divided vertically into several channels. The milk is fed down some of these into the space opposite the distributing holes in the discs, and the separated cream rises up the other channels to the outlet.—W. H. C.

French Patent.

Starch or alcohol; Process for extracting —— from potatoes, together with a paste rich in nutritive matter. C. Steffen. Fr. Pat. 368,002, July 12, 1906.

Potato slices are fed continuously into a mixer provided with a transport arrangement, together with potato juice in sufficient quantity to extract the starch, the juice being then led into a separator, in which it is more or less freed from starch, and afterwards returned to the mixer to act on fresh potato slices. The residue of the potatoes is submitted to pressure in presses similar to those employed for pressing beet slices, the juice thus obtained being added to the juice with which the potato slices are treated. The excess of juice, either as it is or after removal of the albumin by precipitation and filtration, is converted by evaporation into syrup of convenient concentration, which is mixed with the pressed potatoes, either before or after these are dried; the mixture can be employed directly for agricultural purposes. This process can be used in potato-spirit distilleries, so that in addition to the alcohol, a dry material suitable for fodder, is obtained.—T. H. P.

(*B.*)—SANITATION; WATER PURIFICATION.

Refuse destructor at Burslem Electricity Works. Elect. Engin., 1906, **38**, 294—296. Science Abstracts, 1906, **9B**, 504—505.

The destructor is of the "Heenan" type, with three cells, which are fed from the front. The normal capacity of these cells is 25 tons of refuse per 18 hours. The combustion chamber is arranged at right angles to the cells, and from it the gases pass through a Babcock and Wilcox boiler capable of evaporating 6,000 lb. of water per hour at a pressure of 200 lb. per sq. in. The gases leaving the boiler are used to heat the air used for forced draught. The air required for this purpose is taken from the clinkering floor, which tends to keep the building well ventilated. The forced draught is obtained by means of an electrically-driven centrifugal fan. The following are the figures from an official test of this destructor carried out on Nov. 14, 1905: Duration of test, 7½ hours; total fire-grate area, 75 sq. ft.; heating surface of boiler, 1,966 sq. ft.; class of refuse dealt with during test, trade and domestic. Total refuse burnt during test, 26,572 lb.; average rate of burning per hour per sq. ft. of grate area, 48·8 lb.; total water evaporated during test (actual), 49,990 lb.; evaporation per lb. of refuse (actual), 1·87 lb.; equivalent per lb. of refuse from and at 212° F., 2·16 lb.; temperature of feed-water entering tank, 45° F.; average temperature of combustion chamber during test, 2,032° F.; percentage of clinker (by weight), 26·5.

Refuse destructor at Brünn. S. Bourdot. Elekt. Runds., 1906, **23**, 331—333, 343—346, 366—369, and 380—381. Science Abstracts, 1906, **9B**, 505.

Trials at Cologne, carried out in March, 1904, with the destructor of A. Custodis and F. A. Herbertz, were entirely successful. The plant consists of seven destructor cells, with a capacity of 52,500 kilos. of refuse per 24 hours. The refuse is collected in special wagons, which are provided with discharging doors in the bottom. A transporter system carries the refuse to the storage bin, which is of 126 cb. m. capacity, and has openings opposite to each of the cells. The refuse is burnt upon the grate with an air pressure of 350 mm. water (14 in.), at the rate of 313 kilos. per sq. m. of grate surface per hour. Two chambers lined with refractory material are built behind the cells, and complete the combustion of the lighter particles of refuse carried away with the draught. A Babcock and Wilcox Water-tube boiler is installed next to the destructor cells, having 108 tubes and 220 sq. m. of heating surface. This boiler can be heated either by the destructor cell gases or independently by coal. An economiser and a chimney 40 m. in height complete the plant. The steam generated is used or driving a 300-h.p. turbine and dynamo, which

supply the power required for running the destructor plant, A 25-h.p. motor drives the fans which provide the blast for the destructor cells. These deliver 105 cb. m. and 130 cb. m. of air per minute respectively. The clinker from the cells is ground in a special mill and sold. A test run with the plant gave an evaporative effect of 1·13 kilos. of water for 1 kilo. of refuse, with 8·8 per cent. of carbon dioxide in the exit gases, and an exit temperature from the boiler plant of 279° C. The total material charged during this run was 26,898 kilos., at the rate of 2,782 kilos. per hour, and the weight of clinker removed was 12,038 kilos., with an additional 3,473 kilos. of flue dust and ashes. Extended trials with the destructor plant during January, February, and March, 1906, show a mean evaporative effect of 1·05 kilos. of water per 1 kilo. of refuse.

ENGLISH PATENT.

Water for boiler feeding, laundry, and other work; Apparatus for softening, heating, and purifying — —. A. B. C. and J. A. Danks, Netherton, Staffs. Eng. Pat. 20,277, Oct. 7, 1905.

THE heated water is run into a small tank, fitted with a float operating the valve of the reagent tank, so as to admit a predetermined quantity of the reagent into the water tank. The mixture is discharged into a mixing chamber, fitted with sloping shelves; and from the bottom of this chamber it ascends into an intermediate settling chamber, in which it flows through a number of narrow orifices and over inclined shelves, to induce the deposition of the precipitated impurities. From the top of this chamber, the water is drawn through a pipe into the bottom of a second settling chamber, from the top of which again it flows to a bottom filtration chamber, and thence to the soft-water tank. Means are provided for heating the water as it enters the apparatus, and keeping it at a regular temperature during its passage through the same, either by direct, live steam or by exhaust steam in pipes.—C. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 1170.)

ENGLISH PATENT.

Sizing composition for use in the manufacture of paper, and process of producing same. Soc. Anon. Mirabet, Barcelona, Spain. Eng. Pat. 10,486, May 4, 1906. Under Int. Conv., May 5, 1905.

SEE Fr. Pat. 355,852 of 1905; this J., 1905, 1252.—T. F. B.

FRENCH PATENTS.

Celluloid; Non-inflammable —— containing no camphor. L. Béthisy, L. Fouchard, and E. Vignes. Fr. Pat. 368,004, July 12, 1906.

BLEACHED tetranitrocellulose, containing 40 to 45 per cent. of water, is incorporated with about 5 per cent. of a liquid hydrocarbon, preferably essential oil of aspic, and also with the necessary colouring matter. The mixture is then treated with a mixture of alcohol, ether, acetone, and amyl acetate for about six hours, when it is rolled into sheets between rollers heated to 60° C. A mixture of ether, boric acid, calcium ethylate (75 per cent.), and ammonium thiocyanate is then run on to the sheets, and the rolling is continued. The product is submitted, in a closed vessel, to a pressure of 150 atmospheres, and is heated by steam at 90° C., for five to six hours, after which it is cooled by means of water while still under great pressure, and dried.—T. F. B.

Silk, artificial; Production of —— from collodions made with acetone or ethyl acetate. J. A. E. H. Bouillier. Fr. Pat. 368,190, July 19, 1906. V., page 1217.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 1173.)

Quinine formates. H. Lacroix. J. Pharm. Chim., 1906, **24**, 493—494.

Neutral quinine formate commences to lose its acid at 50° C., and is completely dissociated at 95° C., the residue being alkaloidal quinine and not a basic formate. The salt also dissociates on solution in cold water into free formic acid and basic quinine formate. *Basic quinine formate* or "quinoform" is stable, even in boiling aqueous solution; it loses part of its acid near the melting point, which is 109° C., and not 132° C. as previously stated (this J., 1905, 902). Its rotation is now stated as $[\alpha]_D^{20°} = -144·2°$, and not $[\alpha]_D = -141·1°$.—J. O. B.

Vicianin, a cyanogenetic glucoside contained in vetches. G. Bertrand. Compt. rend., 1906, **143**, 832—834.

THIS glucoside is contained in a member of the vetch family, *Vicia angustifolia*, widely distributed in France. It crystallises in the form of colourless needles, and is very soluble in hot water, but only slightly so in cold water; whilst being soluble to a small extent in alcohol, it is insoluble in petroleum spirit, benzene, carbon bisulphide, and chloroform. It melts at 160° C., and its saturated aqueous solution at 16° C. has the rotatory power −20°.7. The glucoside contains 3·2 per cent. of nitrogen, which, on treatment with emulsin, is liberated entirely as hydrocyanic acid. The seeds of the plant yield about 0·075 per cent. of hydrocyanic acid, which fact renders their presence in fodder dangerous to animals.—W. P. S.

Hydrazine salts; Iodometric determination of ——, and its application in volumetric analysis. E. Rimini. XXIII., page 1233.

ENGLISH PATENTS.

Ergot; New or improved substance from ——. G. B. Ellis, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 239, Jan. 3, 1906.

CLAIM is made for the manufacture of a crystalline substance from ergot, by treating an aqueous extract of ergot with barium hydroxide, removing the excess of baryta from the filtrate, filtering, and evaporating to a syrupy residue. The residue is crystallised from alcohol. Or, the aqueous extract may be evaporated, and the residue extracted with boiling dilute alcohol. Claim is made for the substance so obtained, which has the following properties. It is a nitrogenous substance easily soluble in water, but insoluble in absolute alcohol, ether, and light petroleum. It crystallises from 75 per cent. alcohol in colourless needles. When carefully heated it sublimes. (See this J., 1906, 906.)—F. SHDN.

Catechine; Process of converting —— into catechu-tannic acid. W. Osborne and H. Schupp, Munich, Germany. Eng. Pat. 18,004, Aug. 10, 1906. Under Int. Conv., Aug. 14, 1905.

CATECHIN [catechuic acid] can be converted into catechu tannic acid by heating pure catechin, or catechu containing catechin, in a melted resinous mass of colophony, mastic, Burgundy pitch or the like, with or without the addition of stearine, paraffin, wax, guttapercha or the like. The advantage of this method is that the proper temperature for the reaction can be easily maintained, and the acid is protected from oxidation.—F. SHDN.

Alcohols, and especially ethyl alcohol; Depriving —— of water. Elektrochem. Werke, G.m.b.H., Bitterfeld, Germany. Eng. Pat. 21,567, Sept. 29, 1906. Under Int. Conv., Sept. 29, 1905.

THE alcohol is heated one or more times in presence of granulated calcium, and then distilled.—C. S.

UNITED STATES PATENT.

Carbon tetrachloride; Manufacture of ——. J. M. Matthews, Philadelphia, Assignor to F. Darlington, Great Barrington, Mass. U.S. Pat. 835,307, Nov. 6, 1906.

A MIXTURE of an alkaline-earth chloride (preferably calcium chloride) and carbon in suitable proportions is heated to a high temperature, *e.g.*, by an electric current, in presence of a non-oxidising gas, whereby a mixture of a carbide and chlorine compounds of carbon is produced; the carbon chlorides are subsequently treated with chlorine to convert them into carbon tetrachloride.
—T. F. B.

FRENCH PATENTS.

Dialkylbarbituric acids; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 367,872, July 7, 1906. Under Int. Conv., Dec. 7, 1905.

DIURETHANES of dialkylmalonic acids are converted into dialkybarbituric acids by heating, either alone, or in presence of urea, diphenyl carbonate, &c. The diurethanes, obtained by the condensation of 2 mols. of urethane with 1 mol. of dialkylmalonic acid, may be heated for five hours, at 200° to 210° C., or a mixture of 10 parts of the diurethane with 7 parts of urea may be similarly heated. (Compare Eng. Pats. 14,161 and 23,718 of 1905; this J., 1905, 1188, and 1906, 1002.)—T. F. B.

Salicylic acid; Process for preparing new derivatives of ——, *and new intermediate products therefor.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 368,133, July 17, 1906. Under Int. Conv., March 22, 1906.

BY the action of phosphorus pentahalides on anhydromethylene-citric acid $(HOOC.CH_2)_2C<\begin{matrix}O\\CO.O\end{matrix}>CH_2$, the corresponding acid halides are obtained; these may be combined with salicylic acid, forming anhydromethylene-citrylsalicylic acid.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 1174.)

Light; A new action of ——, *and its photographic application.* F. Alefeld. Chem.-Zeit., 1906, **30**, 1087—1090, 1127—1128.

BY coating sheets of material, capable of resisting a dull red heat, with thin, amorphous layers of certain solutions capable of yielding coloured residues, drying, exposing to light behind a negative, and finally heating strongly, positives were obtained, in which the shadows were represented by the residue of metal, the substance having apparently migrated towards the more transparent parts of the negative under the influence of light; no chemical action of any kind was detected. The most suitable substances are the resinates and thioresinates of the heavy metals, such as are used in potteries in the production of "lustre ware"; all the heavy metal compounds tried gave similar results, as also did an aqueous solution of ferric chloride, and certain solutions of organic substances, *e.g.*, colophony in toluol, Venetian turpentine, and certain other essential oils, natural asphaltum dissolved in chloroform, benzene, &c., collodion, and a solution of an extract of yeast. Glass, porcelain, and metal are most suitable as supports. The process possesses the disadvantage that it is not found possible to obtain pure whites, owing to part of the metal, &c., always remaining beneath the dense portion of the negatives. The time required for full exposure is 15 to 30 minutes, but a few seconds only suffices to produce some effect upon plates dried for a short time at the ordinary temperature. The duration and temperature of the drying of plates have a very great effect on their sensitiveness, high temperatures especially tending to reduce the rapidity of the action.—T. F. B.

Photographic plates or papers; Hardening the gelatin film of —— in the fixing bath. A. and L. Lumière and A. Seyewetz. Phot. Wochenbl., 1906, **32**, 41. Chem.-Zeit., 1906, **30**, Rep., 408.

FORMALDEHYDE in its different forms, and aluminium and chromium salts cannot be used in the fixing solution for various reasons; it is, however, found that aluminium or chromium salts in conjunction with sodium bisulphite will satisfactorily harden the gelatin film of photographic plates or papers when added to the thiosulphate solution. Five grms. of chrome alum, or 15 grms. of potash alum and 10 to 15 c.c. of "commercial" bisulphite solution are added to 1 litre of 15 per cent. sodium thiosulphate solution; no advantage is obtained by further addition of bisulphite or alum. After the chrome alum treatment, the gelatin will withstand a temperature of 100° C., but the film treated with potash alum cannot be heated above 75° C. with safety. The above treatment does not prejudice subsequent intensification, reduction, or colouring of the film.—T. F. B.

Diffraction gratings; Intensification of glass ——. R. W. Wood. Phil. Mag., 1906, **12**, 585—588.

IMPERFECTLY ruled glass diffraction gratings can be much improved by immersion for one or two minutes in 1 per cent. hydrofluoric acid solution, the back of the glass being covered with paraffin wax to prevent the development of latent scratches.—T. F. B.

ENGLISH PATENT.

Photographic and other prints; Production of ——. J. Rieder, Munchen, Germany. Eng. Pat. 23,109, Nov. 10, 1905.

SEE Fr. Pat. 359,218 of 1905; this J., 1906, 393.—T. F. B.

FRENCH PATENT.

Ossein; Preparations and applications of ——. A. Helbronner and E. A. Vallée. Fr. Pat. 361,796, Sept. 26, 1905. XIV., page 1227.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 1175.)

ENGLISH PATENTS.

Explosives. W. Venier, Vienna. Eng. Pat. 6705, March 20, 1906.

SEE Fr. Pat. 364,461 of 1906; this J., 1906, 911.—T. F. B.

Explosives. C. G. Luis and J. C. Williamson, London. Eng. Pat. 20,889, Sept. 20, 1906.

GREEN-OIL or red-oil, an oil purified by fractional distillation from the tar obtained from certain varieties of "brown coal," is mixed with an oxidising agent such as ammonium nitrate or ammonium perchlorate. This explosive, it is claimed, is very powerful, does not freeze, and is therefore useful as a blasting explosive. A mixture of 12 per cent. of green-oil, 72 per cent. of ammonium perchlorate, and 16 per cent. of trinitrotoluene gave good results on trial.—B. J. S.

UNITED STATES PATENT.

Powder stripe; Machine for cutting ——. J. T. Thompson, Assignor to the E. I. Du Pont De Nemours Powder Co., Wilmington, Del. U.S. Pat. 827,674, July 31, 1906.

SEE Fr. Pat. 367,945 of 1906; following these.—T. F. B.

FRENCH PATENT.

Powder; Machine for cutting bands of ——. The E. I. Du Pont De Nemours Powder Co. Fr. Pat. 367,945, July 10, 1906.

THE machine comprises a series of rollers, arranged in groups, with different working apertures; a disc provided with corresponding orifices; a cutting disc with blades, the rollers and perforated disc being relatively adjustable,

so that their orifices can be set opposite each other, a variable speed gear enabling the rollers to be run at speeds corresponding with the orifice employed; a double shoot for carrying off the cut fragments of powder and fitted with a valve closing each shoot alternately; also a mirror arranged behind the cutters and tilted at an angle enabling the operator to see the cut fragments.

—C. S.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 1176.)

INORGANIC—QUANTITATIVE.

Copper; Volumetric determination of —— with potassium iodide. H. Cantoni and M. Rosenstein. Bull Soc. Chim., 1906, **35**, 1069—1073.

The authors show, by several series of experiments, that the accuracy of the iodine-thiosulphate method for determining copper, is dependent on certain conditions under which the analysis may be performed. The titration is considerably affected by the degree of dilution, by the presence of free acetic acid, and, to a small extent by the presence of sulphates of potassium, sodium, ammonium, zinc, and manganese. In working with copper acetate and the alkali acetates, the differences which result are but trifling and may be neglected. The standardisation of the thiosulphate solution should be executed under definite conditions, and these same conditions should be subsequently adhered to as closely as possible in the analyses.

—L. E.

Zinc; Ferrocyanide method for the determination of ——. W. H. Seamon. Mining World, 1906, 544—545.

The author has made a large number of experiments to determine the influence of varying conditions on the ferrocyanide method for zinc. He shows that Low is right in giving warning against the use of granulated lead for the removal of copper, as adopted by the Committee on Uniformity of Analysis of the Society of Western Chemists and Metallurgists (Pennsylvania). Some of the lead used passes into solution and then consumes ferrocyanide, leading to high results. Instead of lead, aluminium should be used to remove the copper, the presence of aluminium in the solution not affecting the results.—A. G. L.

Beryllium [Glucinum]; Separation of ——from aluminium. C. Friedheim. Ber., 1906, **39**, 3868—3869.

Glassmann's proposal (this J., 1906, 1121), to effect the separation of beryllium from aluminium by means of sodium thiosulphate, is not new. Chancel in 1858 first proposed the use of thiosulphate to precipitate alumina, and Joy, in 1863, applied the reaction, unsuccessfully, to separate aluminium from beryllium. Zimmermann in 1888, at the author's suggestion, revised Joy's work, and found that good results were obtainable provided the two metals were present in about equal proportions. Glassmann's results were obtained on mixtures in about these proportions. The precipitate is not simply a mixture of alumina and sulphur, but contains in addition basic sulphate and sulphite. (See also this J., 1906, 1147.)

—J. T. D.

Nitrates; Determination of —— F. S. Sinnatt. Chem. Soc. Proc., 1906, **22**, 255.

Knecht and Hibbert's method for the estimation of picric acid (this J., 1903, 762) may be applied to the estimation of nitrates. The process depends on the conversion of the nitrate into picric acid by means of phenolsulphonic acid, the picric acid being subsequently estimated by titanium trichloride. Ten c.c. of the solution of potassium nitrate containing 0·1 per cent. of potassium salt were evaporated to dryness in a steam oven, 5 c.c. of a solution of phenolsulphonic acid added, and the heating continued for half an hour. The whole was then washed into a flask, and, after adding hydrochloric acid, titrated with titanium trichloride. Three titrations carried out in the above manner required for 0·01 grm. of potassium nitrate, 20·14, 20·47, and 20·2 c.c. of titanium trichloride (1 c.c. = 0·0004860 grm. of potassium nitrate), corresponding to 0·009788, 0·009948, and 0·009817 grm. of potassium nitrate respectively. The error is not so great as when the colorimetric method is used.

Hydrazine salts; Iodometric determination of ——, and its application in volumetric analysis. E. Rimini. Org. Quant., see next abstract.

ORGANIC—QUANTITATIVE.

Hydrazine salts; Iodometric determination of ——, and its application in volumetric analysis. E. Rimini. Atti R. Accad. dei Lincei, Roma, 1906, **15** [2], 320—325. Chem. Centr., 1906, **2**, 1662—1663.

The author has simplified his method for the determination of hydrazine (this J., 1899, 1059) by working in alkaline solution, and thus avoiding the formation of iodine from the interaction of iodide and iodate. With hydrazine sulphate, the reaction proceeds according to the equation:

$$3(N_2H_4,H_2SO_4)+2KIO_3+6KOH = 3N_2+2KI+3K_2SO_4+12H_2O.$$

The evolution of nitrogen is complete and rapid.

In the determination of formaldehyde by Riegler's method (this J., 1901, 510) the excess of hydrazine should be titrated with iodate in alkaline solution. If iodide be present, the solution must be acidified in order to decompose the excess of iodate, and titrated back with sodium thiosulphate, 2 mols. of iodate being equivalent to 3 mols. of hydrazine.

The following method is recommended in place of that of Ebler (this J., 1905, 1257) for the determination of mercury. A concentrated solution of hydrazine sulphate is made neutral to methyl orange, and a measured excess of $N/2$ sodium hydroxide solution and the mercury salt under examination, are added. After heating, the whole is made up to a definite volume, and in an aliquot part of the clear solution, the remaining alkali is determined by titration with $N/2$ acid. The reaction is expressed by the equation:

$$N_2H_4,H_2SO_4+2HgCl_2+5NaOH = 4NaCl+NaHSO_4+2Hg+N_2+5H_2O.$$

Pannain's method (this J., 1904, 882) for the determination of persulphates is stated to give too high results. The following method is proposed:—A solution of the persulphate, neutral to methyl orange, is treated with a solution of hydrazine sulphate neutralised with potassium hydroxide, then shaken with a known quantity of a standardised solution of potassium hydroxide, and after five minutes, the excess of alkali titrated back.

$$2K_2S_2O_8+N_2H_4,KHSO_4+5KOH = N_2+5K_2SO_4+5H_2O.$$

—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 1177.)

Sulphur; Note on the sublimation of —— at ordinary temperatures. R. J. Moss. Scient. Proc. Roy. Dublin Soc., 1906, **11**, 105—106.

Twenty-five years ago the author placed some fragments of sulphur in a glass tube, which was then exhausted, sealed, and placed in a drawer. After nearly twenty years had elapsed a very minute crystal was observed on the wall of the tube, which was then hung on a wall and examined at intervals. At the present time the whole of the side of the tube furthest from the wall is studded with minute crystals, which are apparently rhombic, but show greater complexity than crystals deposited from solutions of sulphur.—A. S.

Mineral springs; Fractionation of the rare gas from the waters of ——. Proportions of helium. C. Moureu and R. Biquard. Compt. rend., 1906, **143**, 795.

The authors have fractionated the residue of argon, helium, neon, &c., remaining after removing the other gases from the gas obtained from various mineral springs, by means of the absorptive action of charcoal at a low temperature. The table below gives the amounts, expressed

as percentages of the total volume of gas obtained, of the rare gases as a whole, and of the helium present :

Spring.	Total rare gases.	Helium.
Badgastein	1·35	0·160
Spa	0·279	0·064
Plombières, Vauquelin	2·03	0·258
,, No. 3	1·78	0·292
,, Crucifix	1·56	0·201
,, No. 5	1·65	0·104
,, Capucins	1·45	0·036
Bains-les-Bains	1·24	0·198
Luxeuil, Dames	2·09	0·87
,, Grand Bain	2·11	0·77
Maizières	6·39	5·34
Bourbon-Lancy, Reine	2·90	1·75
,, Lymbe	3·04	1·84
Aix-les-Bains	1·19	0·037
Salins-Moutiers	0·77	0·21
Saint Honoré	2·08	0·91
Pougues	0·015	0·002
Néris	2·10	1·06
Vichy, Hôpital	0·09	0·0012
,, Chomel	0·124	0·0013
,, Boussange	0·0428	0·0038
Châtel-Guyon	0·024	0·00063
Dax, Nêhe	1·44	0·0345
,, Trou des paubres	1·2	0·005
Ax, Viguerie	1·55	0·097
Bagnères, Salies	1·60	0·04
Cauterets, César	1·56	0·237
,, Mauhourat	1·53	0·04
,, Bois	1·52	0·102
,, Raillère	1·21	0·108
Eaux-Bonnes	1·80	0·613
Eaux-Chaudes	1·43	0·140
Caldellas	1·16	0·017

—J. T. D.

Carbon and hydrogen ; Direct union of —— at high temperatures. J. N. Pring and R. S. Hutton. Chem. Soc. Trans., 1906, **89**, 1591—1601.

In the authors' experiments, which were carried out at temperatures ranging from 1000° C. up to about 2800° C., a carbon rod mounted at its ends in water-cooled brass tubes was heated electrically in an atmosphere of hydrogen, in a glass tube, or a water-jacketed metal bell-jar. The carbon was previously purified by heating in a vacuum, and in some cases, also, by heating in chlorine. Minute quantities of acetylene are produced at 1700° C., but below 1800° C. the percentage is scarcely measureable by ordinary gas-analysis methods. The percentages of acetylene in the gas after the experiments are given in a table, from which the following figures are taken :—At 1870° C. in 9 mins., 0·42 per cent. ; 1900° (17 minutes), 0·26 ; 2000° (20 minutes, 0·55 ; 2000° (16 minutes, carbon specially purified with chlorine), 0·88 ; 2400° (4 minutes), 3·26 ; 2500° (4 minutes), 4·20 ; 2700° (2 minutes), 2·75—3·05 ; and 2800° C. (1 minute, equilibrium probably not obtained), 2·73 per cent. In all cases a small amount of methane was produced, but this was less when the carbon was specially purified with chlorine, and in general the greater the precautions were to improve the quality of the carbon, the less methane was formed. This tends to support Berthelot's view that with pure materials hydrocarbons are not formed at 1200° C. as stated by Bone and Jerdan (this J., 1901, 696).—A. S.

Solutions ; Contributions to the theory of ——. I. The nature of the molecular arrangement in aqueous mixtures of the lower alcohols and acids of the paraffin series. II. Molecular complexity in the liquid state. III. Theory of the intermiscibility of liquids. J. Holmes. Chem. Soc. Trans., 1906, **89**, 1774—1786.

1. The differences in volume which occur on mixing the lower alcohols (methyl, ethyl, and normal propyl) and acids (formic, acetic, propionic, and normal butyric) of the paraffin series with water, were calculated from available data, and it was found that in all cases the greatest difference between the percentage of alcohol or acid by volume in the mixture and the theoretical percentage, assuming that no contraction took place on mixing, occurred approximately at the point representing an admixture of equal molecular volumes, referred to the gaseous state. The results are discussed on the assumption that the free path of a liquid molecule can be represented by a spherical surface and it is argued that they show the molecular complexity of water is approximately the same as that of each of the alcohols and acids named, and that the existence of hydrates must be excluded from the theory of solutions. II. Working on somewhat similar lines to those mentioned above, the author concludes that if the degree of aggregation of water and the alcohols be taken as 1, that of ethyl ether and of pyridine is also 1, that of chloroform and of benzene is 2, and that of carbon bisulphide is 3. III. From the relative molecular volumes of a number of organic liquids compared with that of water at the same temperature as unity, and from the degree of aggregation of the different compounds in the liquid state, the true molecular volumes were deduced, and it was found that, with one exception, a decrease of solubility occurs with increase in molecular volume. Also, liquids standing near to each other in the series (arranged in the order of the true molecular volumes), and possessing molecular volumes within certain dimensions are mutually miscible. —A. S.

Dextrose ; Decomposition of —— with ammoniacal zinc hydroxide in the presence of acetaldehyde. A. Windaus. Ber., 1906, **39**, 3886—3891.

It has been previously shown (see this J., 1905, 515) that dextrose, on treatment with ammonia and zinc hydroxide or caustic potash, is converted, in part, into α-methyl-imidazole. The mechanism of the reaction appears to consist of the conversion of dextrose into glyceric aldehyde, and of the latter into methylglyoxal, which then condenses with ammonia and formaldehyde to α-methyl-imidazole, and the fact that the yield of the latter is increased by addition of formaldehyde to the reacting substances, tends to confirm this view. By substituting acetaldehyde for formaldehyde, the author has obtained α-μ-dimethyl-imidazole (together with the α-methyl-imidazole)

$$CH_3.CO.CHO + 2NH_3 + CH_3.CHO = \begin{matrix} CH_3.C-NH \\ \quad\quad\quad\

EXPORTS.

Articles.	Value 1904.	Value 1905.
	£	£
Sugar, raw	1,472,000	1,788,000
Sugar, refined	2,030,000	2,276,000
Fats of all sorts	928,000	848,000
Olive oil	168,000	324,000
Chemicals	4,060,000	4,588,000
Copper and copper ore	1,352,000	1,544,000
Pig iron and steel	1,844,000	2,280,000
Coal and coke	868,000	1,292,000
Building materials	1,264,000	1,264,000
Oils, other than olive	920,000	1,036,000
Oil cake	864,000	924,000
Oil seeds and nuts	280,000	236,000
Indigo	48,000	32,000
Saffron	152,000	136,000
Leather manufacture	2,528,000	2,600,000
Pottery and glassware	2,992,000	3,252,000
Dye-wood extracts	724,000	492,000
Perfumery	692,000	712,000
Colours	516,000	572,000
Soap, common	672,000	548,000
Candles, stearine, &c.	192,000	172,000

With regard to French trade with the United Kingdom, further figures show a decrease in the value of imports of chemicals into France from £950,000 in 1904 to £913,000 in 1905. Indiarubber, however, increased from £605,000 to £831,000, and indiarubber goods from £374,000 to £411,000. Coal-tar exports from England to France in the two years were valued at £272,000 and £275,000 respectively. Among the exports from France to the United Kingdom, chemicals increased in value from £617,000 to £699,000; oils, other than essential oils, from £112,000 to £221,000, and caoutchouc and gutta-percha from £319,000 to £533,000. Essential oils, on the other hand, decreased from £164,000 to £139,000.

During the first six months of 1906 (as compared with those of 1905) French imports of rubber increased by £627,240, and chemicals by £62,960; sodium nitrate, oil-seeds, vegetable and mineral oils, and minerals showed falls in value. Exports of raw sugar increased £447,800 in value, and of refined, £449,560. Exports of minerals rose £66,240 in value.

GERMAN CHEMICAL INDUSTRIES IN 1905.

Bd. of Trade Commercial Series, No. 20, Nov. 25, 1906.

The total number of chemical works of all kinds in Germany increased last year from 8004 to 8278, and the number of hands employed therein from 179,792 to 188,386. The total amount paid in wages rose from £9,068,627 to £9,681,372. As regards the foreign trade both in chemical raw materials and in chemical manufactures, the total value of the imports rose last year from £18,509,807 to £21,117,647, an increase of 14·1 per cent.; whilst the total value of the exports rose from £23,210,784 to £26,583,333, an increase of 14·5 per cent. This increase was largely due to the then approaching alteration in the German tariff (which came into force last March), for the increase in imports and exports in the previous year had been 7 per cent. and 5 per cent. respectively (*cf.* this J., 1906, 1178) Whilst there was an improvement in the alkali and acid industry and business in soda was satisfactory, the condition of the potash industry was less favourable, because potash made from potassium chloride had to compete with caustic potash lye and with molasses-ash, and, at times, with Russian and Bohemian potash. The price of ferrocyanide salts kept low, but an improvement is anticipated owing to reduction of output. The demand for sulphuric acid was brisk, especially on the Rhine and in Westphalia, where the output of ammonium sulphate from coke works had largely increased. In spite of this, prices remained as before, the manufacturers being already committed at low prices. The strong demand for nitric acid by colour and explosive works continued, but prices did not keep pace with the rise in the raw material. Business in pharmaceutical, photographic, scientific and technical preparations was not favourable. There was a slight falling off in comparison with 1904, although sales were brisk, but keen competition and foreign hostile tariffs prevented the industry from recouping the increased cost of labour and raw materials. This was especially the case in regard to alkaloids and pharmaceutical products, the consumption of which rose considerably both in Germany and abroad, but suffered from severe competition, especially on the part of the French manufacturers. The attention of the industry in France was drawn by foreign exhibits at the Paris Exhibition to compounds such as cocaine, theobromine, pilocarpine, physostigmine, &c., and now, under the protection of a high import duty, the French are able to place their superfluous output abroad and compete against Germany. The condition of the photographic preparations industry is similar, especially in regard to sensitised silver paper, the price of which had to be reduced in view of American and Belgian competition. The German import duty is said to have afforded insufficient protection against such competition, for the high tariffs of the United States, Spain, France, and Austria-Hungary enabled manufacturers there to export some of their output at low prices. The oil-lacquer and oil-varnish industries, as well as mineral and lacquer-paints, sold well in consequence of activity in the building trade, but without any marked increase in output. The same may be said of organic acids and spirit preparations, the export of which suffered not only from the higher duties levied abroad, but also from the favour which is said to be given to the foreign trade by the German spirit ring. Essential oils have risen in price as consumption increases, and will probably go higher, since the new commercial treaties do not seriously affect this industry, and the new German Customs tariff now allows spice seeds (such as aniseed, fennel, coriander, &c.) to come in free of duty for this manufacture. The manufacture of artificial silk still further developed during the past year, and now promises to become profitable. The aniline dyestuff industry, the average output of which rose from 11·68 per cent. to 13·54 per cent., was entirely satisfactory. Exports, which form the greater part of the output, are increasing, and to this result the rapid advance of German synthetic indigo has materially contributed. Business in artificial manures was on the whole good, and profits rose from 8·66 per cent. to 9 per cent. The demand for superphosphates was brisk, and consumption was about 5 per cent. greater than in the previous year. Prices rose owing to mutual agreement among the manufacturers, but the rise of 40 per cent. in raw materials for all factories which had failed to protect themselves in time, prevented general improvement. Consumption of Thomas meal kept pace with increased production of Thomas slag; this manure also, which, on account of its cheapness, had interfered with the use of superphosphates, rose in price. After some fluctuation, there was a further rise in the price of ammonium sulphate, the production of which, in the last few years, has risen about 150,000 tons. Business in explosives was unaltered, but profits rose from 10·4 per cent. to 11·96 per cent. The match industry, which for a long time has had to be content with very modest profits, also improved. The prohibition of the use of yellow phosphorus, which is to come into force in 1907, will probably increase the demand for safety matches. The lignite industry was satisfactory in 1905, profits increasing from 7·38 per cent. to 7·64 per cent. Business in paraffin oils was profitable, and the consumption of this oil by Diesel motors increased. The sale of paraffin and of paraffin candles was normal. The indiarubber industry was affected by the supply of raw material failing to keep pace with the demand, and by a rise in price owing to sources of supply becoming more and more distant. Prices of manufactured india-rubber remained low, partly owing to competition amongst india-rubber manufacturers. In October the latter agreed to raise prices 10 per cent. and this has been accepted by the consumers. Nevertheless, the German india-rubber industry is not yet regarded as satisfactory. Profits for 1905 were only 7·95 per cent., as against 8·92 in 1904.

New Books.

PORTLAND CEMENT: ITS COMPOSITION, RAW MATERIALS, MANUFACTURE, TESTING, AND ANALYSIS. By RICHARD K. MEADE, Chemist to the Dexter Portland Cement Company, &c. The Chemical Publishing Company, Easton, Pa., U.S. America. 1906. Price 14*s.* 6*d.*

8vo volume, containing 376 pages of subject matter, an appendix, covering four pages, and an alphabetical index. There are 100 illustrations. The subject matter is classified as follows:—I. History of the Development of the American Portland Cement Industry. MANUFACTURE. II. Chemical Composition of Portland Cement. III. Raw Materials. IV. Proportioning the Raw Materials. V. Quarrying, Excavating, Drying, and Mixing the Raw Materials. VI. Grinding the Raw Material, and Grinding Machinery. VII. Kilns and Burning. VIII. Cooling and Grinding the Clinker; Storing and Packing the Cement, &c. ANALYTICAL METHODS. IX. Analysis of Cement. X. Analysis of Cement Mixtures, Slurry, &c. XI. Analysis of the Raw Materials. PHYSICAL TESTING. XII. Inspection of Cement. XIII. Specific Gravity. XIV. Fineness. XV. Time of setting. XVI. Tensile Strength. XVII. Soundness. MISCELLANEOUS. XVIII. Detection of Adulteration in Portland Cement. XIX. Trial Burnings.

THE NEW PHYSICS AND CHEMISTRY: A SERIES OF POPULAR ESSAYS ON PHYSICAL AND CHEMICAL SUBJECTS. By W. A. Shenstone, F.R.S. Smith, Elder & Co., 15, Waterloo Place, London. 1906. Price 7*s.* 6*d.* net.

8vo volume, containing 360 pages of subject matter, sub-divided under the following heads:—I. Matter, Motion, and Molecules. II. Some recent Speculations on the Constitution of Matter. III. Some recent theories of the Ether. IV. Modern Theories of Light. V. Weighing a World VI. On Weighing Atoms. VII. Some aspects of the new Chemistry. VIII. The Mechanics of Chemical Change. IX. Radium. X. Radium, and the Interpretation of Radio-active Changes. XI. Carbon and the Shapes of Atoms. XII. Ferments and Fermentations. XIII. About Solutions. XIV. The Origin of Life.

CLAYS: THEIR OCCURRENCE, PROPERTIES, AND USES, WITH SPECIAL REFERENCE TO THOSE OF THE UNITED STATES. By HEINRICH RIES, Ph.D., Assistant Professor of Economic Geology in Cornell University, &c. John Wiley & Sons, New York, U.S. America. 1906. Chapman & Hall, Ltd., London. Price 21*s.* net.

LARGE 8vo volume, containing 467 pages of subject matter, with 141 illustrations, and the alphabetical index. The subject matter is arranged according to the following scheme:—I. Origin of Clay. II. Chemical Properties of Clays. III. Physical Properties of Clay. IV. Kinds of Clay. V. Methods of Mining and Manufacture. VI. Distribution of Clay in the United States: Alabama and Louisiana. VII. Maine, North Carolina. VII. North Dacota to Wyoming. VIII. Fuller's Earth.

HERMANN VON HELMHOLTZ. By LEO KOENIGSBERGER Translated by FRANCES A. WELBY. With a Preface by LORD KELVIN. The Clarendon Press, Oxford. 1906. Price 16*s.* net.

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THE PRINCIPLES OF QUALITATIVE ANALYSIS. From the Standpoint of the theory of Electrolytic Dissociation and the Law of Mass Action. By WILHELM BÖTTGER, Privatdocent in the University of Leipsic. Translated with the Author's sanction, and revised with his co-operation by William Gabb Smeaton, Instructor in General Chemistry in the University of Michigan. Rebman, Limited, 129, Shaftesbury Avenue, London, W.C. 1906. Price 9*s.*

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Two 8vo volumes, Vol. I. and Vol. II. Vol. I. containing 1,092 pages of subject matter, and Vol. II. 141 pages, and the alphabetical index. The text is illustrated with 104 engravings. The subject matter is classified as follows:—I. CHEMISTRY OF THE RESINS. II. THE AUTHOR'S OWN INVESTIGATIONS (A. Resinotannolresins or Tannolresins. B Resene-resins. C. Resinolic acid Resins. D. Resinolresins E. Aliphatoresins (Fat-resins). F. Chromoresins (Colour Resins). G. Enzymoresins. H. Glucoresins. I. Lactoresins (Milky juices. Guttapercha group. Caoutchouc group). Chemistry of Caoutchouc. J. Pseudoresins. K. Unclassified resins. Vol. II. is devoted to the botanical aspects of the subject.

HOME OFFICE. VENTILATION OF FACTORIES AND WORKSHOPS. Illustrations of Methods of Dust Extraction in Factories and Workshops. Compiled by Commander Sir Hamilton P. Freer-Smith, R.N. (Late H.M. Superintending Inspector of Factories). Darling and Son, Ltd., 34—40, Bacon Street, London, E. 1906. Price 4*s.* 6*d.* Purchaseable directly or through any bookseller, from Wyman and Sons, Ltd., Fetter Lane, London, E.C., and 32, Abingdon Street, Westminster, London, S.W., or Oliver and Boyd, Edinburgh, or E. Ponsonby, 116, Grafton Street, Dublin.

COAL TABLES. 1905. Wyman and Sons, Fetter Lane, London, E.C. Price 6d.

THIS is the twelfth number of a publication annually prepared in the Commercial, Labour, and Statistical Department of the Board of Trade, showing the production and consumption of coal in the principal countries of the world during each of the years from 1885 to 1905, or to the most recent years for which the figures are available. In addition to statistics of production and consumption, particulars are also given of the average value per ton at the collieries, the number of persons employed in coal mining, coal imports and exports, &c. Statistics of lignite production and petroleum production in certain countries are also contained in the return (see also page 1209-1210.)

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Dr. F. J. Smale, c/o Wm. Davies Co., Toronto, Canada.

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Editor.

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NOTE: "O.M." MEANS "ORIGINAL MEMBER."

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1902. Acker, Chas. E., 105, Gluck Building, Niagara Falls, N.Y., U.S.A., Manufacturer.
1903. Ackermann, Franz W., 86, Pierrepont Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Acton, J. Rowland, Wicklewood, Maze Road, Kew, S.W., Civil Servant.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1897. Adams, Thos. H., Endon Villa, Victoria Avenue, Borrowash, near Derby, Analyst.
1905. Adams, William W., Norwood, Mass., U.S.A., Leather Works Manager.
1895. Adamson, G. P., c/o The Baker and Adamson Chemical Co,, Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.
1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.
1898. Adiassewich, Alex. V., 14, Addison Park Mansions, Kensington, W., Oil Engineer.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.
1888. Adriance, Dr. John S., The Union League Club, New York City, U.S.A., Analytical Chemist.
1899. Adrot, Léon, Woodside, Long Island, N.Y., U.S.A., Chemist.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1884. Akitt, Thos., Mijnbouw Maatschappij Katahoen, Lebong Soelit, Benkoelen, Sumatra, Chemist.
1883. Albright, G. S., Bromesberrow Place, Ledbury, Chemical Manufacturer.
O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.
1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.
1891. Alcock, Jno. W., Central Brewery, Mott Street, Birmingham, Maltster and Brewer.
1902. Alden, Frederick, 342, 22nd Avenue, Milwaukee, Wis., U.S.A., Chemist.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1906. Alder, H. W., 18, Holyhead Road, Coventry, Works Chemist.
1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.
1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Works Sub-Manager.
1905. Aleon, Armen P., 372/4, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1899. Alexander, D. Basil W., 1020, Date Street, Los Angeles, Cal., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502-510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.
1891. Allan, F. H. Tielke, Portobello House, Wakefield, Analytical Chemist.
1898. Allan, John, 55, Northen Grove, West Didsbury, near Manchester, Chemist.
1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.
1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.
1903. Allen, Chas. A., 95, Manor Road, Darwen, Lancashire, Chemist.
1902. Allen, Chas. D., jun., 541, 6th Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1901. Allen, R. F., 1241, South 47th Street, Philadelphia, Pa., U.S.A., Chemist.
1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond & Co., Ltd., Sandbach, Cheshire, Analytical Chemist.
1904. Allen, Thos. E., c/o American Aristotype Co., Jamestown, N.Y., U.S.A., Chemist.
1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., 35, Eglantine Avenue, Belfast, Ireland, Chemical Works Manager.
1887. Alliott, J. B., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1895. Allison, Wm. O., 100, William Street, New York, City, U.S.A., Publisher of "Oil, Paint and Drug Reporter."
1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.
1904. Alpers, Wm. C., Broadway and 31st Street, New York City, U.S.A., Manufacturing Chemist.
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., 137, Grove Street, Stamford, Conn., U.S.A., Chemist.
1901. Alston, Robt. A., c/o Glencairn Main Reef G. M. Co., P.O. Box 191, Germiston, Transvaal, Mining Engineer.
1904. Alton, W. Lester, 11, Briar Walk, Putney, S.W., Chemist.
1898. Ambler, Chas. Taaffe, Dharhara Station, E. I. Ry., Bengal, India, Mine Owner and Contractor.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1900. Anderson, Jas. W., The Paddock, Halling, near Rochester, Kent, Analytical Chemist.
1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.
1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist and Metallurgist.
O.M. Anderton, G. H., Howendyke, Howden, Yorks, Chemical Manufacturer.
1905. Andreae, Dr. E. P., Crestalta, Champion Hill, London, S.E., Chemist.

1889. Andrews, C. W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).
1903. Anfilogoff, N. A., St. Vincent's, Orsett Road, Grays, and (Journals) Central Wharf, Bow, E., Chemist.
O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1892. Annandale, C. J. R., The Briary, Shotley Bridge, Co. Durham, Paper Maker.
1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.
1887. Annison, R. H., 16, Water Lane, Tower Street, London, E.C., Master Lighterman.
1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.
1903. Anspach, Dr. R., 14, Oakroyd Terrace, Manningham, Bradford, Chemist.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1899. Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.
1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.
1906. Appleby, L. C. B., c/o Messrs. R. Bishop & Sons, Newark-on-Trent, Maltster.
1895. Appleby, Prof. W. R., 911, 5th Street, S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1897. Appleton, Dr. Jno. Howard, 209, Angell Street, Providence, R.I., U.S.A., Professor of Chemistry.
1900. Appleyard, Geo. H., c/o British Oil and Cake Mills, Ltd., 151, Cleveland Street, Hull, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
1904. Appleyard, Percy, Albany, West Australia, Chemist.
1903. Arbogast, Ralph, c/o Edison Storage Battery Co., Silver Lake, N.J., U.S.A., Chemist.
1901. Archbold, Dr. Geo., c/o J. D. Conover Co., 101, Franklin Street, New York City, U.S.A., Chemist.
O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.
1901. Ardagh, Edw. G. R., School of Practical Science, Toronto, Canada, Chemist.
1900. Ardern, Edw., 4, Westbourne Road, Urmston, Manchester, Chemist.
1901. Argall, Philip, 728–732, Majestic Buildings, Denver, Colo., U.S.A., Manager (Gold Extraction Works).
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, Lodge Hotel, King's Road, Reading, Works Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).
1899. Arnott, G. W. Campbell, 114, Victoria Street, Toronto, Canada, Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1901. Arundel, Arthur S. D., Penn Street Works, Hoxton, N., Paper Box Manufacturer.
1901. Asano, K., 25, Kitachoyaoho, Kyobashi, Tokyo, Japan, Mining Chemist.
1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.
1903. Ashley, Frank R., Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Chemist.
1900. Ashley, Harrison Everett, Newell, West Va., U.S.A., Metallurgical Chemist.
1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.
1890. Ashton-Bost, W.D. *See* Bost, W. D. Ashton.
1885. Ashwell, J. H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1903. Ashworth, Jno. B., 11, The Promenade, Egremont, Cheshire, Manager.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Agricultural Department, Wellington, New Zealand, Chemist.
1891. Atkins, C. E., Teignmace, Byculiah Park, Enfield, N., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1902. Atkinson, Edwin B., Furze Glen, Lambert Road, Great Grimsby, Lecturer in Chemistry.
1905. Atkinson, James P., Dept. of Health, 55th Street and 6th Avenue, New York City, U.S.A., Chemist.
1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., jun., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1901. Auden, Dr. H. A., Westwood, Grassendale, Liverpool, Chemist.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1887. Austen, Prof. Peter T., (Journals) 204, West 86th Street, and (communications) 89, Pine Street, New York City, U.S.A., Professor of Chemistry.
1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Chemist.
1902. Avery, D., Working Mon's College, Melbourne, Vic., Australia, Teacher of Chemistry.
1890. Aykroyd, H. E., Scaitcliffe, Queen's Road, Ilkley, Yorks, Dyer.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.
1903. Ayres, W. J., P.O. Box 187, Pernambuco, Brazil, Sugar Expert.

B

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1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
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1897. Bacon, Wm., 4, New Court, Lincoln's Inn, W.C., Chemist.
1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A., Manufacturing Chemist.
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1885. Bailey, Edwin M., Almond Hill, Pumpherston, Mid-Calder, N.B., Technical Chemist.
1883. Bailey, Dr. G. H., Marple Cottage, Marple, Cheshire, Chemical Lecturer.

1903. Bailey, Harold J., Maritime Coke Works, Pontypridd, S. Wales, Chemist.
1898. Bailey, Henry, 6, Elsenham Road, Wimbledon Park, S.W., Analytical Chemist.
1906. Bailey, Ralph, W., c/o Messrs. Stillwell & Gladding, 55, Fulton Street, New York City, U.S.A., Chemist.
1888. Bailey, Dr. T. Lewis, Glassford Creek, *viâ* Miriam Vale, Queensland, Australia, Chemist.
1888. Bailey, Sir W. H., Albion Works, Salford, Manchester, Chemical Engineer.
1888. Bailey, Walter P., Empresa de Gas, 13, San Roque, Seville, Spain, Chemical Engineer and Manager.
1902. Bain, Jas. Watson, School of Practical Science, Toronto, Ont., Canada, Chemist.
1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.
1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, 96, Blackburn Road, Darwen, Lancs., Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1905. Baker, Henry, 18, Booth Street, Manchester, Secretary.
1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.
1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., Staincsbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.
1886. Baker, Theodore, P.O. Box 71, Wilmington, Del., U.S.A., Analytical Chemist.
1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1903. Ball, S. F., Hull Avenue and 209th Street, New York City, U.S.A., Analytical Chemist.
1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
O.M. Ballard, Edw. G., 7, Godstall Chambers, Chester, Alkali Works Inspector.
1891. Ballinger, Jno., Free Library, Cardiff, Librarian.
1903. Baltzly, E. B., c/o Semet Solvay Co., Syracuse, N.Y., U.S.A., Superintendent.
O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.
1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks., Dyer.
1905. Bampton, Geo. F., Room 24, 68, Essex Street, Boston, Mass., U.S.A., Chemist.
1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.
O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.
1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.
1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).
1885. Banner, Samuel, 4, Ivanhoe Road, Liverpool, Petroleum Merchant.
O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.
O.M. Bannister, W., Victoria Lodge, Cork, Ireland, Manufacturing Chemist.
1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.
1906. Barbour, Robt. B., Eclipse Chemical Manufacturing Co., Chelmsford, Mass., U.S.A., Manager.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1895. Bardwell, Fred. L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.
1903. Baringer, Fred. J., Eagle White Lead Works, 1020, Broadway, Cincinnati, Ohio, U.S.A., Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1905. Barker, Perry, c/o U.S. Fuel Testing Plant. Boiler Division, St. Louis, Mo., U.S.A., Chemist.
1895. Barlow, Clinton W., 103–105, Greene Street, New York City, U.S.A., Merchant.
1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 311, Market Street, Droylsden, near Manchester, Analytical Chemist.
1906. Barnes, A. G., Grassmoor Collieries, Chesterfield, Colliery Proprietor.
1891. Barnes, Edward A., Sundalen, Aasenfjorden, Norway, Technical Chemist.
1901. Barnes, Fred., 2, Fairview, Canterbury Road, Sittingbourne, Kent, Paper Mill Chemist.
1905. Barnes, F. V., 44, Lucknow Avenue, Nottingham, Gas Works Chemist.
1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1898. Barnicott, Jas. A., Messrs. May and Baker Ltd., Garden Wharf, Church Road, Battersea, S.W., Chemical Manufacturer.
1904. Baron, Wm. Briscoe, c/o The Fuel Saving and Water Treating Co., Ltd., 2, Booth Street, Albert Square, Manchester, Chemist.
1901. Barr, Geo., c/o Trimble Dyeing and Printing Co., Philadelphia, Pa., U.S.A., Calico Printer.
O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1905. Barraclough, C. E., Wood View, Manningham, Bradford, Chemist.
1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.
1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
1890. Barrett, Arthur A., 5, Strada del Pozzo Leone, Messina, Sicily, Manufacturer of Essential Oils.
1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Analytical Chemist.
1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.
1906. Barrs, Chas. E., 20, Carlingford Road, Hampstead, N.W., Analyst.
1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.
1900. Barton L. Edward, Broadway, cor. Thatcher Street, Albany, N.Y., U.S.A., Chemist.
1903. Bartripp, Geo. F., 20, Grove Road, Wanstead, Essex, Analytical Chemist.
1905. Baruch, Edgar, c/o Alta California Beet Sugar Co., Hamilton, Glenn Co., Cal., U.S.A., Chemical Engineer.

1895. Beskerville, Dr. Chas., College of the City of New York, New York, U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1899. Bassett, Wm. H., 146, Litchfield Street, Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, "Ladbroke," Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H. 34, Bridge Avenue, Hammersmith, W., Chemist.
1903. Bates, C. O., c/o Coe College Library, Cedar Rapids, Iowa, U.S.A., Teacher of Chemistry.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1903. Baty, E. J., British Insulated and Helsby Cables, Ltd., Prescot, Lancs., Chief Chemist.
1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1906. Bauer, H. F., 809, McAllister Avenue, Waukegan, Ill., U.S.A., Chemist.
1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1898. Baxter, John G., 143, Milton Road, Gravesend, Kent, Chemist.
O.M. Baxter, W. H., Nuthurst, Streatham, S.W., Brewery Director.
1899. Bayly, Francis W., Assayer.
1904. Bayly, Harold G., Usine Ste. Madeleine, San Fernando, Trinidad, Analytical Chemist.
O.M. Baynes, J., Royal Chambers, Scale Lane, Hull, County and Borough Analyst.
1897 Beadle, Alec A., Greenbeys, Granville Road, High Barnet, Herts., Electro-Chemist.
1886. Beadle, Clayton, Halewood, Sideup, Kent, Consulting Chemist.
1890. Bealey, Adam C., c/o A. C. Bealey and Sons, Radcliffe, Lancashire, Bleacher and Alkali Manufacturer.
1904. Bean, Percy, 10, Marsden Street, Manchester, Analytical Chemist.
O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1905. Beasley, Jno. K., c/o Hong Kong and Shanghai Banking Corporation, Ltd., Singapore, S.S., Metallurgical Chemist.
1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.
1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.
1898. Beck, Herbert H., 105, South Queen Street, Lancaster, Pa., U.S.A., Chemist.
1905. Beckers, Dr. Wm., 128, Duane Street, New York City, U.S.A., Chemist.
O.M. Beckett, G. H., Hartford, South Beach Avenue, Ardrossan, Scotland, Analytical Chemist.
1898. Beckett, Jos. H., Duffryn House, Ebbw Vale, Mon., Analytical Chemist.
1903. Beckwith, Edw. Pierrepont, Garrison on the Hudson, N.Y., U.S.A., Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Westwood, Headingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beebe, Murray C., University of Wisconsin, Madison, Wis., U.S.A., Engineer.
1901. Beevers, Clifford J., c/o Brotherton and Co., Ltd. Holmes Street, Dewsbury Road, Leeds, Analyst.
1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
O.M. Beilby, George T., 11, University Gardens, Glasgow, Chemical Engineer.
1902. Bek, Lars, P., Goondi, Johnston River, North Queensland, Australia, Analytical Chemist.
1906. Belden, A. W., Fuel Testing Plant, St. Louis, Mo., U.S.A., Coke Expert.
1902. Bell, Edwin L., Grenzhausen, bei Coblentz, Germany, Manager.
1906. Bell, H. N., Tay Street, Invercargill, New Zealand, Company Manager.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., 3, Mincing Lane, London, E.C., Chemist.
O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Commonwealth of Australia Offices, 72, Victoria Street, London, S.W., until June 15th; then Explosives Dept., 423, Flinders Lane, Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
1902. Bement, Alburto, American Trust Building, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 295, North Road, Clayton, Manchester, Manufacturing Chemist.
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert, Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist, A.M.
1904. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1906. Bennett, A. E. J., Bethel, Vermont, U.S.A., Leather Manufacturer.
1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Messina, Sicily, Chemist.
1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., Canal Bank, Point St. Charles, Montreal, Canada, Chemist.
1884. Bennett, Thos., Birch Vale, near Stockport, Calico Printer.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1906. Benson, Richard W., Public Analysts' Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.
1905. Bentley, Prof. W. B., 42, Morris Avenue, Athens, Ohio, U.S.A., Professor of Chemistry.
1901. Bentley, Wm. H., 6, Woodbine Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.
1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1900. Bermingham, Jno., jun., California Powder Works, Pinole, Contra Costa Co., Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., c/o Chas. Hadfield, Viaduct House, Dinting, near Manchester, and (Journals) Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.
1900. Berolsheimer, D. D., 11, East 59th Street, New York City, U.S.A., Chemist.
1906. Berry, A. J., 5, University Gardens, Glasgow, Student of Chemistry.
1897. Berry, Albert E., 62, Claremont Road, Forest Gate, Essex, Works Manager.
1883. Berry, E. E., Bordighera, Italy, Technical Chemist.
1889. Berry, G. F., Atlas Chemical Works, West Ferry Road, Millwall, E., Manager.
1903. Berry, W. C., 329, West 53rd Street, New York City, U.S.A., Chemist.

1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.
O.M. Bevan, E J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.
O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1900. Bevington, Col. S. B., 42, St. Thomas Street, Southwark, S.E., Leather Dresser.
1893. Bhaduri, Prof. K., Canning College, Lucknow, India, Professor of Chemistry.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.
1902. Biach, Dr. Ludwig K., 223, Central Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.
1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Student.
O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.
1901. Bielecki, Dr. Jan, "Chemik Polski," 66, Krakowski Przedmiescie, Warsaw, Poland, Chemist.
1903. Bierwirth, L. W., c/o E.I. du Pont & Co., Central National Bank Building, Wilmington, Del., U.S.A., Civil Engineer.
1884 Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.
O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.
O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billings, Edgar F., 178, Freeport Street, Dorchester, Mass., U.S.A., Manufacturing Chemist.
1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1898. Binney, Harold, Washington Life Building, 141, Broadway, New York City, U.S.A., Patent Lawyer.
1902. Binning, Stevenson, 101, Shooter's Hill Road, Blackheath, S.E., Technical Chemist.
1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.
1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.
1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.
1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.
1903. Bird, Thos., 59A, Brook Street, Grosvenor Square, London, W., Surgeon.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred, c/o Burmah Oil Co., Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.
1905. Bjerregaard, August P., c/o Emil Calman & Co., Long Island City, N.Y., U.S.A., Varnish Chemist.
1904. Black, J. Wyelif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, The Limes, New Street, Braintree, Essex, Chemist.
1894. Blackmore, H. S., 906, South Ninth Avenue, Mount Vernon, N.Y., U.S.A., Chemist (Pure Aluminium and Chemical Company).
1899. Blackwell, G. G., 44-47, The Albany, Liverpool, Mineral and Metal Merchant.
1896. Blagden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.
1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1902. Blakemore, Geo. H., Great Cobar Copper Mining Syndicate, Lithgow, N.S.W., Australia, Metallurgist.
1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.
1904. Bleakley, Wm., Dean's Mill, Swinton, Lancs., Cotton Mill Manager.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.
O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.
1905. Bliss, H. J. W., c/o The Thames Varnish Co., Island Wharf, Rainham, Essex, Chemist.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.
1890. Bloxam, W. Popplewell, Clothworkers Research Laboratory, The University, Leeds, Research Chemist.
1903. Blumenthal, Lionel, The Lindens, Stanley Road, Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 77, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.
1906. Blyth, M. Wynter, 36, Eastcheap, London, E.C., Analytical and Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., 2, Summerfield, Leith, N.B. Lecturer on Chemistry.
1901. Bolton, E. Richards, 16, Flanchford Road, Ravenscourt Park, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.
1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.
1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.
1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1896. Boot, John C., Klatten, Java, Netherlands Indies, Chemist.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.
1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.
1891. Boothby, Chas., (Journals) 10, Church Row, Limehouse, E., and 70, Bedford Court Mansions, Bedford Square, London, W.C., Chemist.
1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., P.O. Box 683, Concord, Mass., U.S.A., Smokeless Powder Manufacturer.

O.M. Berland, W. D., Beacon Lodge, Bean, via Dartford, Kent, Manufacturer of Explosives.

1903. Bernett, S., 19, St. Dunstan's Hill, London, E.C., Technical Chemist.

1903. Berosohek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.

1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.

1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.

O.M. Bothamley, C. H., Tanglewood, Southside, Weston-super-Mare, Somerset, County Director of Technical Instruction.

1890. Bott, Dr. W. Norman, 16, St. Helen's Place, London, E.C., Consulting Chemist.

1884. Böttinger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.

O.M. Bottle, Alex., 4, Godwyne Road, Dover, Pharmaceutical Chemist.

1901. Bottomley, Dr. J. Frank., c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.

1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.

O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1890. Boulton, James, Crayford, Mills, Stratford, E., Manufacturing Chemist.

O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.

1900. Bourcoud, Augustin E., Comp. General de Productos Quimicos del Abofio, Gijón, Spain, Civil Engineer.

1905. Bourne, Lyman M., 119, Montague Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Boutwell, Arthur T., c/o Smith & Dove Manufacturing Co., Andover, Mass., U.S.A., Bleacher and Dyer.

1884. Bow, R. H., 7, South Gray Street, Edinburgh, Civil Engineer.

1904. Bowden, Thos., Durn Lea, Todmorden Road, Littleborough, Lancs., Dyer and Chemist.

1905. Bowen, Henry, c/o St. Louis Chemical Co., St. Louis, Mich., U.S.A., Secretary.

1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.

1885. Bowen, S. B., Brickfield Chemical Works, Llanelly, South Wales, Chemical Manufacturer.

1899. Bowen, Wm., R.R.I., Fowler (Rural Route), Fresno Co., Cal., U.S.A., Chemist.

1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.

1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.

1903. Bowey, John, jun., 567, Dufferin Avenue, London, Ont., Canada, Chemist.

1889. Bowing, Jno., 101, North Street, Wandsworth, S.W., Consulting Chemist.

1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, and (Journals) 64, Redcliffe Gardens, London, S.W., Chemical Manufacturer.

1899. Bowley, J. Plunkett, 1, Wellington Road, Battersea, and (Journals) 64, Redcliffe Gardens, London, S.W., Varnish Manufacturer.

1883. Bowman, Dr. F. H., 4, Albert Square, Manchester, Chemical Manufacturer.

1894. Bowman, Jas. H., Canada Chemical Manufacturing Co., London, Ont., Canada, Chemist.

1894. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.

1907. Bowman, Richard S., Sea View Terrace, Seaton Carew, Co. Durham, Chemist.

1898. Bowman, William, 29, Cortlandt Street, New York City, U.S.A., Chemist.

1904. Boyce, Frances E., near Fire Brigade Station, Fort, Bombay, India, Technical Chemist.

1893. Boyes, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.

O.M. Boyd, W., P.O. Box 212, Germiston, Transvaal, Technical Chemist.

1899. Boyes, Herb. J., 7, Alameda Barao de Piracicaba, Sao Paulo, Brazil, Chemist.

1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.

1906. Bracegirdle, Harold W., 1 Mytton Street, Hulme, Manchester, Chemist.

1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.

1883. Bradbury, A., Queen Buildings, 11, Dale Street, Liverpool, Chemical Broker.

1902. Bradbury, S., Fernoliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.

1895. Bradford, Henry, c/o A. H. Carey, Goodwood, near Chichester, Analytical Chemist.

1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.

1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.

1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.

1904. Braman, Winfred W., Box 353, State College, Pennsylvania, U.S.A., Assistant Instructor.

1903. Brame, J. S. S., 5, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.

O.M. Bramham, W., 86, Bow Road, London, E., and (communications) 115, Broadhurst Gardens, West Hampstead, N.W., Chemical Engineer.

O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.

1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Production, Aussig, Austria, Chemical Manufacturer.

1906. Brandt, H. O., 66, Sackville Street, Manchester, Merchant.

1902. Branegan, Jas. Aug., 555, North 16th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.

O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.

1903. Brassard, Fred. A., 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.

1901. Brearley, Harry, Salamander Stahlwerke, Jaegel, Riga, Russia, Analytical Chemist.

1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.

1888. Breffitt, Wm., Glasshoughton, Castleford, Yorks., Glass Manufacturer.

1905. Brettell-Vaughan, E., 15, Queen Street, London, E.C., Storage Battery Analyst.

1901. Brewer, Dr. C. E., Wake Forest, N.C., U.S.A., Professor of Chemistry.

1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.

1894. Breyer, Theodor, 842, Lunt Avenue, Rogers Park, Chicago, Ill., U.S.A., Chemist.

1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.

1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.

1894. Briggs, J. Burnett, Vauxhall Soap Works, 4, Blackstock Street, Liverpool, Soap Manufacturer.

1893. Briggs, J. F., 2, Frankfort Road, Herne Hill, S.E., Technical Chemist.

1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.

1890. Brindley, G. F., 3, Itchome, Ushiwatsu Cho, Kojimachi-Ku, Tokio, Japan, Chemical Engineer.

1905. Bristol, Dr. H. Stanley, 74, Pinckney Street, Boston, Mass., U.S.A., Chemist.

1886. Bristow, G. W., c/o Walter J. Crook, 20, Billiter Lane, London, E.C., Chemical Manager.

1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.

1898. Broadhurst, W. Hanson, 393, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1899. Brook, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brook, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1905. Broemmel, G. M., 2501, California Street, San Francisco, Cal., U.S.A., Chemist.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Laboratory, Singapore, S.S., Chemist.
1894. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1895. Brookman, Fred W., 6, West Street, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o The Borneo Co., Ltd., Kuching, Sarawak, Metallurgist.
1903. Brooks, H. Kibbe, Claremont, N.H., U.S.A., Chemist.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1901. Broome, Jos., 5, Webster Terrace, Roselle Park, N.J., U.S.A., Chemical Engineer.
O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., 133, Kent Street, London, Ont., Canada, Metallurgist.
1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1904. Brown, Dr. Fred. W., 470, Lenox Avenue, New York City, U.S.A., Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1905. Brown, Harold G. S., c/o Messrs. G. H. Ogston and Moore, Strada degle Argentieri, 19, Messina, Sicily, Analyst.
1900. Brown, Harry F., c/o E. I. du Pont Co., 716, Market Street, Wilmington, Del., U.S.A., Chemist.
1905. Brown, Hawthorne J., Oak Villa, Elton, Bury, Lancs., Paper Maker.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square Kensington, S.W, Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel, Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Savile Town, Dewsbury, Manufacturing Chemist.
1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining, Director.
1906. Brown, Percy S., c/o Western Electric Co., West and Bethune Streets, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter R., Victor Chemical Works, 89, Board of Trade Buildings, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 213, Courtland Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, Cordale Works, Renton, Dumbartonshire, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1890. Bruce, Jas., Craik, Saskatchewan, Canada, Distiller.
1900. Bruce, Wm. T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1892. Bruckmann, G. T., 192, 18th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle and Co.,
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, Winnington Park, Northwich, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
O.M. Brunner, Sir J. T., Bart., M.P., Druid's Cross, Wavertree, Liverpool, Chemical Manufacturer.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1905. Brunt, R. A., Box 71, Windsor, Ont., Canada, Sugar Chemist.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, 80, Beeches Road, West Bromwich, Analytical Chemist.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o Gibbs and Co., Iquique, Chili, Analyst.
1904. Buchanan, E. F., 80, Byers Avenue, Akron, Ohio, U.S.A., Chemist.
1888. Buchanan, Jas., jun., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, J. L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1906. Buckie, Robert H., 82, Sydenham Road, London, S.E., Works Chemist.
1897. Bucknill, Jno. A., P.O. Box 52, Government Patent Office, Pretoria, Transvaal, Comptroller General.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.
1902. Bull, Irving C., P.O. Box, 294, Middletown, N.Y., U.S.A., Chemist.
1899. Bult, Herbert J., 18, Billiter Street, London, E.C Chemist.
1907 Bult, Stanley R., 18, Billiter Street, London, E.C Chemist.
O.M. Bamby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.

O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., c/o Peruvian Corporation, Ltd., Lima, Peru, Analyst.
1894. Bunting, W. Lightfoot, Forest Bank, Crawshawbooth, near Manchester, Calico Printer.
1905. Bunzl, Hugo, 175, High Street, Chorlton-on-Medlock, Manchester, Chemist.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., 10, Clifton Terrace, St. Helens, Lancashire, Chemical Works Manager.
1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Hale Road, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1889. Burkhardt, Dr. G. A., c/o Bohrgesellschaft Erkelenz, Erkelenz, Rheinland, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.
1900. Burleigh, Wm. F., c/o Murphy Varnish Co., Newark, N.J., U.S.A., Technical Chemist.
1897. Burls, Frank B., 4, Dyer's Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) Foulis Terrace, Onslow Gardens, S.W., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd, Hammersmith, W., Manager.
O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
1907. Burnham, Frank E., c/o Avery Chemical Co., 7, Sears Street, Boston, Mass., U.S.A., Chemist.
1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burnside, Chas. F., California Powder Works, Santa Cruz, Cal., U.S.A., Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1906. Burrough, Ernest J., Cale Street Distillery, Chelsea, S.W., Rectifier.
1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager
1907. Burt, Dr. Milo C., c/o Taylor, Burt & Co., Holyoke, Mass., U.S.A.
1905. Burtenshaw, Wm. H., P.O. Box 814, Detroit, Mich., U.S.A., Secretary, Michigan Carbon Works.
1901. Burton, Alf., 44, York Street, Toronto, Canada, Dyer and Finisher.
1905. Burton, Jas. K., 336, Drexel Building, Philadelphia, Pa., U.S.A., Consulting Chemist.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904. Burton, T. R., c/o Scott, Greenwood and Son, 19, Ludgate Hill, London, E.C., Technical Journalist.
1892. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1897. Burwell, A. W., Kyle Street, Lakewood, *via* Cleveland, Ohio, U.S.A., Consulting Chemist.
1895. Bury, J. H., Church Chemical Works, near Accrington, Chemical Manufacturer.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1903. Butler, Fredk., Ash Tree Lane, Hough Green, near Widnes, Manager (Ditton Copper Works).
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, T. H., c/o Frau Wensel, Forstweg 14, Jena, Germany, Chemical Student.
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
1903. Buttenshaw, E. L., Thurleigh, Priory Road, Gale, Cheshire, Analytical Chemist.
O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 28–31, Bishopsgate Street Within, London, E.C., and (Journals) Rosalawn, Berkeley, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
1902. Butterworth, F. J., P.O. Box 54, Newark, N.J., U.S.A., Chemist.
1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.
O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado, 8, Bilbao, Spain, Technical Chemist.
1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1899. Byrnes, Dr. Eugene A., 918, F. Street, N.W., Washington, D.C., U.S.A., Patent Lawyer.
1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 82, Water Street, Boston, Mass., U.S.A., Chemist.
1906. Caddick, Arthur, 9, Albert Crescent, Lincoln, Works Chemist.
1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.
1902. Cady, Wm. H., 127, Power Street, Providence, R.I., U.S.A., Colour Chemist.
1905. Cain, Dr. J. C., 28, Pembury Road, Lower Clapton, N.E., Colour Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1891. Caldecott, W. Arthur, Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Chemical Manufacturer.
1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.
1891. Calkin, Wm. S., Spring Forge, Pa., U.S.A., Paper Pulp Works Chemist.
1902. Calm, Chas. E., 190, Michigan Street, Chicago, Ill., U.S.A., Manufacturing Chemist.
1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1901. Calvert, Jos. E., 293, Butler Street, Etna, Allegheny Co., Pa., U.S.A., Analytical Chemist.
1895. Cambier, Jacob, 910, Spruce Street, Pueblo, Colo., U.S.A., Chemist.
1894. Cameron, Alex., Whitcher Place, Rochester Road, Camden Road, N.W., Chemical Engineer.
1891. Cameron, Jas., 70, Old Chester Road, Woodside, Rock Ferry, Cheshire, Chemist.
1904. Cameron, Walter S., 220, West 146th Street, New York City, U.S.A., Manufacturing Perfumer.

O.M. Cammack, J., 67, King Edward Road, Denton's Green, St. Helens, Lancashire, Technical Chemist.

1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneedaw, Rangoon, Burmah, Analytical Chemist.

O.M. Campbell, Archibald, Berry Lodge, Rugeley, Staffordshire, Technical Chemist.

1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Yarraville Refinery, Melbourne, Vic., Australia, Analytical Chemist.

1906. Campbell, Geo. H., 15, Spadina Road, Toronto, Canada, Manufacturing Chemist.

1899. Campbell, Jas. Eunyce, 22, Cambridge Street, Worcester, Mass., U.S.A., Chemical Engineer.

1904. Campbell, J. H., 41, Summit Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1904. Campion, A., Laboratory, 144, Wellington Street, Glasgow, Chemist and Metallurgist.

1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.

1893. Cannon, J. C., Staverton House, Shoreham, Sussex, Analyst

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, E.C., Distiller.

1904. Carel, Prof. Hubert C., Laboratory, University of Minnesota, Minneapolis, Minn., U.S.A., Chemist, (State Board of Health).

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, William G., Moulton Settlement, Lyman Mission, City Road, London., E.C., Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming and Co., Rangoon, Burmah, East India Merchant.

O.M. Carlile, T., St. Bryde's, Dunblane, N.B., Chemical Manufacturer.

1895. Carlsson, Hugo, Fagersta, Sweden, Analytical Chemist.

1893. Carmichael, Dr. H., 176, Federal Street, Boston, Mass., U.S.A., Analytical Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1903. Carneiro da Cunha, J. M., Comp. Agricola and Mercantil, Rua do Apollo, 28, Pernambuco, Brazil, Manager.

1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

O.M. Caro, Dr. H., C. 8 N. 9, Mannheim, Baden, Germany, Technical Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin, Germany, Analytical Chemist.

1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

1903. Carpenter, H. C. Harold, 11, Oak Road, Withington, Manchester, Chemist and Metallurgist.

1906. Carpenter, P. H., Cawnpore Sugar Works, Cawnpore, India, Analyst.

O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughes, Wellcome and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1904. Carroll, Jas. L., 23, Division Place, Newark, N.J., U.S.A., Secretary (American Oil and Supply Co.).

1886. Carruthers, J. G., Burnbrae House, Milngavie, N.B., Dyeworks Manager.

1901. Carson, Geo. C., Hotel Broadway, Denver, Colo., U.S.A., Mining Engineer.

1906. Cart, John Trevor, c/o Messrs. C. A. Parsons and Co., Heaton Works, Newcastle-on-Tyne, Chemist.

O.M. Carteighe, M., 180, New Bond Street, London, W., Pharmaceutical Chemist.

1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.

1895. Carter, Stewart F., Glenlyon Dyeworks, Sayleville, R.I., U.S.A., Superintending Chemist.

1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1906. Casaburi, Dr. V., c/o Ford Morocco Co., Wilmington, Del., U.S.A., Leather Chemist.

1903. Caspari, Dr. W. A., 28, Coleshill Road, Teddington, Chemist and Physicist.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.

1900. Cayvan, Llewellyn L., 927, West Monroe Street, Chicago, Ill., U.S.A., Chemist.

1902. Cerasoli, Alburto, c/o Dr. L. Mond, 18, Avenue Rd., Regent's Park, N.W., Engineer.

1906. Chadsey, S. B., c/o International Harvester Co., Hamilton, Ontario, Canada, Chemist.

1891. Chadwick, Walter M., 24, West 3rd Street, Bayonne, N.J., U.S.A., Chemical Works Manager.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 103, South Kensington Avenue, La Grange, Ill., U.S.A., Chemist.

1902. Champion, Edmund C., 510, South Washington Avenue, Iola, Kansas, U.S.A., Chemist.

O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.

1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks., Analytical Chemist.

1906. Chaplin, Wm. H., 13, Penywern Road, Earl's Court, London, S.W., Wine Merchant.

1890. Chapman, Alf. C., 8, Duke Street, Aldgate, E.C., Analytical Chemist.

1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.

1905. Chapman, D. L., 10, Parsonage Road, Withington, Manchester, Demonstrator in Chemistry.

1906. Chapman, E. A., 2, Kensington Park, Stapleton Road, Bristol, Works Chemist.

1903. Chapman, Geo. W., Swift Fertilizer Works, 913 Prudential Building, Atlanta, Ga., U.S.A., Superintendent.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.

1902. Charlton, Thos., 252, Irvington Place, Denver, Colo., U.S.A., Manufacturing Chemist.

1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.

1902. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.
1896. Chattock, Herbert E., 73, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1905. Cheeseman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1905. Cheke, Thos. W., 105, London Road, Sawbridgeworth, Analytical Chemist.
1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.
1885. Cheyne, A. M., c/o Messrs. Burgoyne, 16, Coleman Street, London, E.C., Analytical Chemist.
1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.
1902. Chilwell, John, Post Office, Auckland, New Zealand, Analyst.
1906. Chittenden, George, The Francis Frost Co., Ltd., Toronto, Canada, Chemist.
1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.
O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1906. Christie, Dr. W. A. K., Technical Chemist.
1898. Christison, Geo., Cremona, Cambridge Drive, Glasgow, Engineer.
O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1904. Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks., Brewery Chemist.
O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.
1896. Claflin, Alan A., (Communications) Box 1189, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., Laurel Bank, Wilsden, near Bradford, Yorks., Technical Chemist.
1905. Clapp, Geo. A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Iceland Wharf, Old Ford, E., Ammonia Works Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, Hepscott, Morpeth, Northumberland, Schoolmaster.
1905. Clark, Alfred N., Box 168, Wallaceburg, Ont., Canada, Technical Chemist and Engineer.
1906. Clark, Allan J., c/o Homestake Mining Co., Lead, S. Dakota, U.S.A., Metallurgist.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1896. Clark, Donald, Bairnsdale, Victoria, Australia, Director of School of Mines.
1904. Clark, Ernest, Royal Technical Institute, Salford, Assistant Lecturer in Chemistry.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
1904. Clark, Dr. Homer, c/o The Vacuum Varnish and Chemical Co., 6, Seaview Avenue, East Norwalk, Conn., U.S.A., Chemical Manufacturer.
O.M. Clark, Dr. J., 138, Bath Street, Glasgow, Analytical
1900. Clark, Jno., Broadway Works, Millwall Docks, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., Rockbank, Partickhill, Glasgow, Chemist.
1906. Clark, T. W. Firth, Laboratory, Johnson Street, Mile End, London, E., Analyst.
1906. Clark, Wm. B., 42, Robertson Street, Greenock, Chemist.
1907. Clark, Wm. H., 152, Newport Road, Middlesbrough, Analytical Chemist.
1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.
1902. Clark, Wm. Linus, Champion Coated Paper Co., Hamilton, Ohio, U.S.A., Chemist.
1904. Clarke, A. R., 613–617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
1891. Clarke, Goddard, M.P., South Lodge, Champion Hill, S.E.; and (Journals) 60—64, Artillery Lane, London, E., Drysalter.
1903. Clarke, Robt. W., (Journals) c/o Clinical Research Association, Ltd., 1, Southwark Street, London, S.E., (subs.) 3, Aberdeen Villas, Chase Road, Southgate, N., Analyst.
1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
O.M. Claudet, A. C., 6, Coleman Street, E.C.; and (Journals) 9, Daleham Gardens, Hampstead, N.W., Metallurgist.
1889. Claus, Wm. H., c/o Claus and Ree, Clayton, Manchester, Manufacturing Chemist.
O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.
1895. Clayton, Dr. G. C., Etonfield, Wavertree, Liverpool.
1891. Clayton, J. W., c/o Clayton and Jowett, Ltd., Concert Street, Liverpool, Essence Distiller.
1894. Clayton, Robt. H., Woodleigh, Blackfield Lane, Kersal, Manchester, Chemist.
1905. Clayton, W. E., Royal Victoria Yard, Deptford, S.E., Superintendent.
1907. Clement, Leonard, 13, Champion Park, Denmark Hill, London, S.E., Chemist.
1893. Clemes, J. H., The Bracken, Newquay, Cornwall.
1886. Cleminshaw, E., Alkali Works, Oldbury, near Birmingham, Technical Chemist.
1883. Clemons, G. H., Cudbear Street, Hunslet Road, Leeds, Dyeware Manufacturer.
1884. Clerk, Dugald, 18, Southampton Buildings, Chancery Lane, W.C., Engineer.
1899. Cleveland, D. B., 1403, First National Bank Building, Cincinnati, Ohio, U.S.A., Chemist.
1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein & Co.).
1906. Clifford, Jos., Ivy House, Prestbury, near Macclesfield, Chemist.
1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, London, E.C., Metallurgist.
O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).
1891. Clutton, J. H., Elliott's Metal Co., Ltd., Burry Port, R.S.O., Carmarthenshire, Assayer.
1900. Clymer, Wm. R., c/o National Carbon Co., Cleveland, Ohio, U.S.A., Chemist.
1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.
1904. Coblentz, Lambert, 1708, Sutter Street, San Francisco, Cal., U.S.A., Chemist.
1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Chemistry.
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A.

1898. Cochrane, A. Lynde, 9, Charles Street, Boston, Mass., U.S.A., Clerk (Cochrane Chemical Co.).
1901. Cockburn, John A., Ardeer, Stevenston, Ayrshire, Analytical Chemist.
1902. Cocking, Allan T., Carhampton House, Four Oaks, Sutton Coldfield, Ammunition Manufacturer.
1905. Coes, Chas. S., 119, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
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1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
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1905. Collett, John H., Hillfield, Gloucester, Chemical Manufacturer.
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1901. Colley, Bernard T., c/o Velardena M. and S. Co., Velardena, Durango, Mexico, Assayer.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.
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1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.
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1905. Cuming, R. Burns, Currie Street, Adelaide, South Australia, Manufacturing Chemist.
1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.
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1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.
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1903. Dole, Richard B., c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.
1902. Donald, Dr. Jas. T., 112, St. Francois Xavier Street, Montreal, Canada, Consulting Chemist.
1906. Donald, Richard A., 80, King Street East, Toronto, Canada, Wood Distiller.
[illegible] Donald, W., Saltcoats, N.B., Analytical Chemist.
1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.
1902. Donaldson, Thos., c/o South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.
1905. Donnan, Prof. F. G., Physico-Chemical Laboratory, The University, Liverpool, Professor of Physical Chemistry.
1886. Doolittle, Orrin S., c/o Semet Solvay Co., 160, William Street, New York City, U.S.A., Chemist.
1905. Doolittle, Roscoe E., 17, South 15th Street, Newark, N.J., U.S.A., Chemist.
1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.
1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.
O.M. Dott, D. B., Ravenslea, Musselburgh, N.B., Analytical Chemist.
1906. Doty, Henry D., c/o Manhattan Rubber Manufacturing Co., Passaic, N.J., U.S.A., Chemist.
1897. Douglas, Geo., Heather Bank, Bingley, Yorks., Dyer.
1894. Douglas, Loudon M., 3, Lauder Road, Edinburgh, Chemical Manufacturer.
1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.
1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.
1900. Dow, Dr. Allan W., 73, Upper Mountain Avenue, Montclair, N.J., U.S.A., Chemist.
1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.
1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.
1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.
1901. Doxrûd, Christian, Christiania, Norway, Professor of Chemical Technology.
1902. Drake, Bryant S., Barksdale, Wis., U.S.A., Chemist.
1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.
1886. Dreaper, W. P., 41, Quilter Road, Felixstowe, Suffolk, Technical Chemist.
O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.
1906. Drew, W. Newton, Raincliffe, Eccleshield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1905. Dreyfus, Dr. Isaac, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chief Chemist.
1904. Dreyfus, Dr. L. A., c/o The Muralo Co., New Brighton, N.Y., U.S.A., Chemist.
1893. Dreyfus, S., 1, Sunnyside Terrace, North Road, Clayton, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 162, East 95th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.
1889. Drummond, Hon. Sir George, K.C.M.G., Montreal, Canada.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1904. Dubois, Dr. Norman A., 22, Hawthorne Avenue, Yonkers, N.Y., U.S.A., Instructor in Chemistry.
1903. Dubuque, Edwin D., 310, Realty Building, Elmira, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 161, Front Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1907. Ducca, Dr. Wilhelm, 315, Avenue C., Bayonne, N.J., U.S.A., Chemist.
1905. Duché, E., 6, Eastcheap, London, E.C., Merchant.
1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1905. Duckworth, Harry S., Dover, N.H., U.S.A., Paper-works Chemist.
1899. Dudley, Dr. C. B., 1219, 12th Avenue, Altoona, Pa., U.S.A., Analytical Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.

1906. Duerr, E. Oliver, Alan Drive, Hale, Cheshire, Fruit Preserver.
1899. Duff, Wm. S., Sebert Villa, Bushwood, Leytonstone, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Las Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1901. Dufty, Lawrence, 8, Clarke Street, Sheffield, Analytical Chemist.
1905. Duggan, Edw. J., The Charles E. Sholes Co., 164, Front Street, New York City, U.S.A., Vice-President.
O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, E.C., Chemist.
1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Bentcliffe, Pendleton, Manchester, Analytical Chemist.
1904. Duncan, R. A., P.O. Box, 509, Honolulu, Hawaii, Chemist.
1904. Duncan, Wm. Wheeler, 406, Massachusetts Avenue, Boston, Mass., U.S.A., Chemist.
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.
1898. Dunham, Edw. K., 338, East 26th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.
1905. Dunlop, Harry, Cragdarroch, Cove, Dumbartonshire, Chemist.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
Q.M. Dupré, Dr. A., F.R.S., Edinburgh Mansions, Howick Place, S.W., Consulting Chemist.
1905. Durand, Halsey, Dept. of Health, 55th Street and 6th Avenue, New York City, U.S.A., Chemist.
1897. Durant, H. T., P. O. Box 603, Buluwayo, Matabeleland, South Africa, Metallurgist.
1905. Durfee, Winthrop C., 190, High Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Assistant Professor of Chemistry.
1907. Durrans, Thos. H., 1, Cornwall Terrace, Regent's Park, London, N.W., Chemist.
1899. Duryea, Chester B., c/o Edwardsburg Starch Co., Cardinal, Ont., Canada, Starch Manufacturer.
1906. Dushman, Saul, School of Practical Science, Toronto, Canada, Electrochemist.
1891. Dvorkovitz, Dr. P., 45, St. Mary Axe, London, E.C., Technical Chemist.
1903. Dyck, George E., c/o Virginia Carolina Chemical Co., Station C., Memphis, Tenn., U.S.A., Analytical Chemist.
O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
1892. Dyson, Septimus, 8, Belmont Avenue, Harrogate, Manufacturing Chemist.

E

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1899. Earnshaw, Edward H., c/o The Union Gas and Electric Co., 4th and Plum Streets, Cincinnati, Ohio, U.S.A., Chemist.
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1902. Easterbrooks, Frank D., Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.
O.M. Eastick, J. J., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Petroleum Works Manager.
1905. Easton, Herbert Fyfe, Herodsfoot, St. Keyne, R.S.O., Cornwall, Manager of Explosives Factory.
1891. Eastwick, Jos. H., 2216, North 51st Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 90, Peel House Lane, Widnes, Chemist.
1906. Eaton, B. J., Institute of Medical Research, Kuala Lumpur, Selangor, Fed. Malay States, Government Chemist.
1903. Eaton, Edward N., 1628–315, Dearborn Street, Chicago, Ill., U.S.A., Chemist.
1902. Eckel, Edwin Clarence, U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.
1901. Eddy, W. Clifton, corner of Glover and Penn Streets, Woodbury, N.J., U.S.A., Superintendent.
1894. Ede, Henry E., 10 Violet Bank, Nether Edge, Sheffield, Chemist.
1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.
1900. Edgerley, Daniel W., Chilton Paint Co., 120, High Street, Boston, Mass., U.S.A., Chemist.
1902. Edison, Thos. Alva, Edison Laboratory, Orange N.J., U.S.A., Inventor and Manufacturer.
1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.
1903. Edwards, R. S., Columbia Hotel, Portland, Maine, U.S.A., Chemist.
1906. Egleson, J. E., Capelton, Quebec, Canada, Chemist.
1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute York, Pa., U.S.A., Professor of Chemistry.
1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany Research Chemist.
1895. Ekenberg, Dr. M., 72, Victoria Street, Westminster S.W., Technical Chemist.
1885. Elborough, T., 59, Mark Lane, London, E.C. Manure Manufacturer.
1901. Elkan, Leo A., 594, Dearborn Avenue, Chicago Ill., U.S.A., Tanner.
1901. Elkins, Arthur W., 520, Park Avenue, East Orange N.J., U.S.A., Civil Engineer.
1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irvin Place, New York City, U.S.A., Chemist.
1906. Elliott, Edward, c/o Reckitt and Sons, Ltd. Bourke Street, Redfern, Sydney, N.S.W. Chemical Engineer.
1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.
1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street Sydney, N.S.W., Manufacturing Chemist.
1904. Elliott, Philip, c/o Lanosoap, Ltd., Marion Street Works, Bradford, Yorks, Works Chemist.
1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney N.S.W., Australia, Manufacturing Chemist.
1906. Ellis, Arthur E., 7, West 129th Street, New York City, U.S.A., Chemist.
1905. Ellis, Carleton, 168, South Broadway, White Plains N.Y., U.S.A., Chemical Engineer.
1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow Technical Chemist.
1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh Analytical Chemist.

1894. Ellis, G. Bolee, 70, Chancery Lane, London, W.C., Patent Agent.
O.M. Ellis, T., 120, Regent Road, Leicester, Chemical Merchant.
1907. Ellis, Theodore H., 641, Calvert Building, Baltimore, Md., U.S.A., Oil Refiner.
1891. Ellis, Prof. W. Hodgson, School of Practical Science, Toronto, Ont., Canada, Professor of Applied Chemistry.
1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.
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1907. Elsden, A. Vincent, 77, Coleraine Road, Blackheath, S.E., Analytical Chemist.
1904. Elson, J. Hugh, Monroe Drug Co., Unionville, Mo., U.S.A., General Manager.
1901. Emerson, Dr. W. H., Georgia School of Technology, Atlanta, Ga., U.S.A., Professor of Chemistry.
1902. Emery, Arthur L., c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A., Chemical Engineer.
1905. Emery, Delevan, Bradford, Pa., U.S.A., Oil Refiner.
1899. Emery, E. G., Pinole, Contra Costa Co., Cal., U.S.A., Technical Chemist and Engineer.
1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.
1907. Emrich, Horace H., Perth Amboy Plant, Am. S. and R. Co., Mauser, N.J., U.S.A., Mining Engineer.
O.M. Endemann, Dr. H., 23, William Street, New York City, U.S.A., Analytical Chemist.
1897. Enequist, Erik W., 1651, New York Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.
1904. Englehard, Charles, 41, Cortlandt Street, New York City, U.S.A., Platinum Importer.
1895. English, Frank H., 47, Shelley Avenue, East Ham, E., Analytical Chemist.
1899. Enright, Bernard, c/o St. Louis Portland Cement Co., St. Louis, Mo., U.S.A., Chemist.
1906. Ephraim, Dr. Julius, Königgraetzerstrasse 69, Berlin, S.W., 11, Germany, Chemist and Patent Agent.
1904. Erdmann, Prof. Dr. H., Bismarck Strasse 12 II., Charlottenburg, Berlin, Professor of Inorganic Chemistry.
1907. Erdoes, Julius, 242, East 122nd Street, New York City, U.S.A., Chemical Engineer.
1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.
1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.
1905. Ernst, C. A., Lansdowne, Pa., U.S.A., Chemist.
1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.
1897. Escher, Paul, c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A., Chemist.
1884. Eslman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.
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1905. Etheridge, Arthur T., 22, Ardoch Crescent, Stevenston, Ayrshire, N.B., Chemist.
1903. Euler, C. G., 18-20, Platt Street, New York City, U.S.A., Agent for Essential Oils.
1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.
1898. Evans, Ernest D., The Western Tanning Co., Bedminster, Bristol, Tanner.
1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.
1905. Evans, Geo. A., 332, Yonge Street, Toronto, Canada, Pharmacist.
1896. Evans, Jacob V. R., Ridgway, Pa., U.S.A., Chemist.
1894. Evans, James Bittenhouse, 19, High Street, Pottstown, Pa., U.S.A., Chemist.
1883. Evans, Sir John, K.C.B., F.R.S., Britwell, Berkhamsted, Herts, Paper Maker.
1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.
1899. Evans, R. E., 3, Glanrea, Stratford-on-Avon, Brewing Chemist.
1896. Evans, Dr. Thos., University of Cincinnati, Ohio, U.S.A., Instructor in Technical Chemistry.
1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.
1904. Everitt, Walter, 83, The Grove, Ealing, W., Analyst.
O.M. Evershed, F., c/o Clarke, Nickolls and Coombs, Hackney Wick, N.E., Chemist.
1903. Evershed, John, Union Oil Mills, Copenhagen Place, Limehouse, E., Chemist.
1907. Eves, Archie P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.
1894. Ewan, Dr. Thos., 57, Montgomerie Street, Kirklee, Glasgow, Chemist (Aluminium Co.).
1904. Ewing, Dr. A. Ramsay, 1, Alton Gardens, Hillhead, Glasgow, Technical Chemist.
1892. Exley, Arthur, Braemore, Vesper Road, Kirkstall, Leeds, Tanner.
1905. Eynon, Lewis, 57, Darenth Road, Stamford Hill, N., Chief Chemist (London Beetroot Sugar Association).

F

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O.M. Fahlberg, Dr. C., Nassau a/Lahn, Germany, Manufacturing Chemist.
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1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.
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1905. Fairchild, Jno. G., 150, Rodney Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Fairhall, E. J., c/o A. Boake, Roberts & Co., Ltd., 4, Rue Lamartine, Lille (Nord), France, Chemist.
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O.M. Fairlie, H. C., Camelon Chemical Works, Falkirk, N.B., Chemical Manufacturer.
1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.
1894. Fairweather, Wallace, 62, St. Vincent Street, Glasgow, Patent Agent.
1902. Fairweather, Wallace C., 65-66, Chancery Lane, W.C., Engineer.
1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.
1891. Fallon, J. H. M., Boulhaf-le-Dyr, Ligne de Tebessa, Algeria, Fertiliser Expert.
1897. Farmer, John E., Beddington Farm, near Croydon, Assistant Manager (Sewage Works).
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1902. Fasnacht, E. A., The Hollies, Clayton Bridge, Manchester, Technical Chemist.
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1891. Fawcett, Jas. H., c/o Bank of Australasia, 4 Threadneedle Street, London, E.C., Metallurgist.
1884. Fawsitt, C. A., Atlas Chemical Works, East Milton Street, Glasgow, Chemical Manufacturer.
1903. Fawsitt, Dr. Chas. E., 9, Tennessee Terrace, Glasgow, Assistant in Chemistry.

1906. Easley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.
1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.
1902. Feld, Walther, Hauptstrasse 14, Zehlendorf-Wannseebahn, Germany, Chemical Works Director.
1905. Felton, Herbert L., 524, East Second Street, South Boston, Mass., U.S.A., Distiller.
1899. Ferguson, Geo., Gleniffer Soap Works, Paisley, N.B., Soap Manufacturer.
1900. Ferguson, Geo. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Analytical Chemistry.
1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.
O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
1905. Fernberger, Harry M., Dollar Bay, Houghton Co., Mich., U.S.A., Chemist.
1906. Fernyhough, F., The Abbey Cottage, Leek, Staffordshire, Printworks Manager.
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1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
1905. Field, Charles, III., 57, Waban Hill Road, Chestnut Hill, Mass., U.S.A., Research Chemist.
1885. Field, E. W., Cloud House, Sandiacre, near Nottingham, Brewer.
1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.
1891. Field, Wm. Eddington, 65, Sutherland Road, Armadale, Melbourne, Victoria, Chemist.
1884. Filcock, P., Sunny Bank, Prestbury Road, Macclesfield, Analytical Chemist.
1900. Fillis, Frank, Brookland, London Road, Neath, South Wales, Cement Works Manager.
1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.
1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.
1905. Findlay, Dr. Alex., The University, Birmingham, Lecturer on Physical Chemistry.
1899. Fingland, Jno. J., Sandon, B.C., Canada.
1899. Finley, Norval H., 7229, Hermitage Street, Belmar Station, Pittsburg, Pa., U.S.A., Chemist.
1904. Finn, Cornelius P., Pontefract Road, Castleford, Yorks, Technical Chemist.
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1905. Fish, Chas. H., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Textile Manufacturer.
1900. Fisher, Henry, 57, East 63rd Street, New York City, U.S.A., Teacher of Chemistry.
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1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.
1904. Fitch, A. J., 19, Grange Road, Canonbury, N., Brewer's Chemist.
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1897. Fitzgerald, Francis A. J., Fitzgerald and Bennie Laboratories, P.O. Box 29, Niagara Falls, N.Y., U.S.A., Chemical Engineer.
1902. FitzGibbon, Thos., 116, Harbord Street, Fulham, S.W., Analytical Chemist.
1900. Fitz-Randolph, E. R., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
1893. Flamme, E., c/o Kraemer and Flamme, Halbrenn a/N., Germany, Manufacturing Chemist.
1901. Flavelle, Jos. W., Toronto Technical School, College Street, Toronto, Canada, Chemist.
1892. Fleming, J. Arnold, Britannia Pottery, 126, Glebe Street, Glasgow, Potter.
1903. Fleming, Jno. A., 1757, Willard Street, N.W., Washington, D.C., U.S.A., Engineer.
O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.
1893. Fletcher, E. Morley, 3, Woodhouse Cliff, Leeds, Alkali Works Inspector.
O.M. Fletcher, F. W., c/o Fletcher, Fletcher & Co., Ltd., Holloway, N., Manufacturing Chemist.
1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.
1904. Fletcher, Wm. E., Box 83, Tamaqua, Pa., U.S.A., Chemist.
1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J. U.S.A., Civil Engineer.
1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.
1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.
1900. Fogetti, Lucien, 4070, Lake Avenue, Chicago, Ill., U.S.A., Chemist.
1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer on Chemistry.
1901. Folsom, Herbert A., 112, Water Street, Boston, Mass., U.S.A., Textile Chemist.
1900. Forbes, Eli, Clinton, Mass., U.S.A., Chemist.
1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.
1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.
1905. Foregger, Dr. R. von, c/o Roessler & Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City, U.S.A., Chemist.
1899. Forel, Geo., 18, Rue Hohenlohe, Strasburg, Alsace, Germany, Chemist.
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1904. Forrest, Chas. N., New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemist.
1898. Forrest, J. Kerr, Hawsleigh, Balaclava Road, St. Kilda East, Victoria, Australia, Manufacturing Chemist.
1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.
1905. Forrester, H. A., Usina de Gas, Retiro, Buenos Ayres, S. America, Chemical Works Manager.
1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.
1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.
1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.
1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., 18 and 19, Fenchurch Street, London, E.C., Chemical Merchant.
1884. Forth, Henry, Meadowcroft, Marple, Cheshire, Drysalter.
1907. Forward, Charles C., Iroquois, Ontario, Canada, Chemist.
O.M. Foster, R. Le Neve, Bollindane, Wilmslow, Cheshire, Manufacturing Chemist.
1906. Foster, Robt. K., 120, Victoria Parade, Collingwood, Melbourne, Victoria, Pharmaceutical Chemist.
1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.
1903. Fotheringham, John, North Brazilian Sugar Factories, Ltd., Tiuma, Pernambuco, Brazil, Chemist.
1906. Foucar, J. Louis, 29, St. John's Park, Blackheath, S.E., Chemist.
1904. Foust, Thomas B., c/o Box Ash C. & I. Co., Abbott Creek, Tenn., U.S.A., Chemist.

1891. Fowler, Sir Gilbert J., Broad Oak, Urmston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).

1898. Fowler, Thos. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1903. Fox, A. Stanley, Rosehurst, Athelstan Road, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).

1898. Fox, Jno., 42, Highfield Road, Rock Ferry, Cheshire, Analyst.

O.M. Fox, T., jun., c/o Fox, Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.

1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.

1901. France, G. Herbert, Woodroyd Dyeworks, Low Moor, Bradford, Yorks., Dyer.

1899. Franchot, Stanislaus P., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., Chemist.

1885. Francis, Edwd., Park Ravine, Nottingham, Chemical Lecturer.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

O.M. Francis, G. B., 38, Southwark Street, London, S.E., Wholesale Druggist.

O.M. Francis, W. H., Cleveland, Thornton Road, Clapham Park, S.W., Wholesale Druggist.

1902. Francksen, Dr. Aug., 4903, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Frank, Prof. Dr. A., Berlinerstrasse 26, Charlottenburg, Germany, Chemist.

1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.

1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.

1904. Frankl, A., Clotilde Chemical Works, Nagy Bocskó, Hungary, Chief Manager.

O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbro', Analytical Chemist.

O.M. Frankland, Prof. P. F., F.R.S., The University, Birmingham, Professor of Chemistry.

1906. Fraps, Geo. S., Texas A. & M. College, College Station, Texas, U.S.A., Professor of Chemistry.

1904. Frasch, George B., Chemist.

1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.

1900. Frasch, Herman, 82, Beaver Street, New York City, U.S.A., Oil Refiner.

1904. Fraser, Jas. D., 8, Percy Street, Ibrox, Glasgow, Chemist.

1891. Fraser, L. McG., 98, Commercial Road East, London, E., Chemical Engineer.

1902. Fraser, R. A., 519, Produce Exchange, Manchester, Fellmonger.

1886. Fraser, W. J., 121, Adelaide Road, London, N.W., Mechanical Engineer.

1907. Fraser, Wm. M., c/o The Texas Co., Port Arthur, Texas, U.S.A., Chemist.

1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.

1885. Freear, H. M., Hardwick Road, Woburn Sands, Beds., Analytical Chemist.

1899. French, Alf., St. Bartholomew's Hospital, Rochester, Kent, Dispenser.

1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.

1903. Frerichs, Dr. F. W., Herf and Frerichs Chemical Co.; and (Journals), 3823, Westminster Place, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1903. Frew, John, Dunrod Cottage, Hamilton, N.B.

1907. Frewing, Henry, c/o Otto Isler and Co., Manchester, Chemical Merchant.

1908. Friend, C. Cleaver, c/o The D. B. Martin Co., 2001, North 24th Street, Philadelphia, Pa., U.S.A., Chemist.

1894. Frey, H., [illegible] E. 52, Beach Street, New York

1902. Frey, Jno. W., Waukesha, Schuh, [illegible] U.S.A., Cotton Manufacturer.

O.M. Friswell, R. J., 43-48, St. Dunstan Street, London, E.C., Consulting Chemist.

1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.

1899. Fritzsche, Karl, c/o Schimmel and Co., Miltitz, near Leipsig, Germany, Manufacturer of Essential Oils.

1906. Frohner, Edward, jun., c/o Standard Table Oil Cloth Co., Youngstown, Ohio, U.S.A., Manager.

1890. Frost, Dr. Howard V., 3068, Drexel Boulevard, Chicago, Ill., U.S.A., Professor of Chemistry.

1884. Frost, Joe, Storths Mill, Moldgreen, Huddersfield, Manufacturing Chemist.

O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.

1904. Fryer, Percival J., 27, Minster Road, West Hampstead, N.W., Analyst.

1906. Fuchs, Herman C., 83, Marlborough Road, Brooklyn, N.Y., U.S.A., Dry Colour Chemist.

1903. Fudge, T., 604, Avenue E., Bayonne, N.J., U.S.A., Chemist.

1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 2, Stone Street, New York City, U.S.A., Chemical Merchant.

1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.

1902. Fuller, Henry C., c/o E. E. Brown, 6, State Street, Worcester, Mass., U.S.A., Analytical Chemist.

1899. Fuller, Robt. F., Neston Park, Corsham, Wilts., Rubber Manufacturer.

1899. Fuller, W. M., c/o Morris and Griffin, Malindee, Newport, Mon., Chemical Manufacturer.

O.M. Fuller, Wm., 8, Orchard Road, Blackheath, S.E., Chemist.

1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.

1896. Fulton-Smith, I., 20, Bold Street, Warrington, Brewer.

1906. Furlong, John R., 182, Commercial Road, London, E., Research Chemist.

1906. Futers, Stephen H., Glenraven House, Hael-y-Fal, Maesteg, Glamorgan, Analyst.

1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

1898. Gabain, Chas. E., Messrs. Gabain Frères, Havre, France, Manufacturer of Edible Fats.

O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E.; (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.

1904. Gadd, Henry Wippell, 190, Pace Street, Boston, Analytical Chemist.

1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.

1884. Gall, Henry, 4, Rue Albert July, Versailles, France, Technical Chemist.

1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.

1897. Gallatly, J. C., 101, Armadale Street, Dennistoun, Glasgow, Assistant to Professor of Metallurgy.

1905. Gallinagh, James P., Electricity Works, Limerick, Ireland, Borough Electrical Engineer.

1901. Gallivan, Frank B., 48, Wallingford Road, Boston, Mass., U.S.A., Chemist.

1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.

1901. Gallup, W. Arthur, Amstel Printworks, North Adams, Mass., U.S.A., Printer.

1901. Galpin, Henry P., 32, West 23rd Street, New York City, U.S.A., Chemist.

1901. Galt, Hugh, Alum, Ontario, Canada, [illegible]

1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.
O.M. Gamble, Sir Josias, Bart., Haresfinch, St. Helens, Lancs., Chemical Manufacturer.
1894. Gane, Eustace H., 95, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.
1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfort a/Main, Germany, Dye Works Manager.
1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus and Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1893. Gardiner, H. J., 90, Cannon Street, London, E.C., Chemical Manufacturer.
1905. Gardner, Franc E., 633, North Western Avenue, Chicago, Ill., U.S.A., President, Gardner-Barada Chemical Co.
1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemistry and Dyeing Department.
1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.
1905. Garle, John L., Sanctuary House, Tothill Street, Westminster, Consulting Chemist.
1904. Garnar, G. Lestor, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent of Leather Works.
1904. Garnaus, John C., P.O. Box 326, New York City, U.S.A., Dyestuff Merchant.
1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.
1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.
1899. Garroway, Wm., 694, Duke Street, Glasgow, Chemical Manufacturer.
1898. Garry, H. Stanley, 66, Mapperley Road, Nottingham, Manure Works Manager.
O.M. Garton, R., Messrs. Hill, Garton, & Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.
1886. Gascoyne, Dr. W. J., 2741, North Charles Street, Baltimore, Md., U.S.A., Analytical Chemist.
O.M. Gaskell, Holbrook, Woolton Wood, Woolton, near Liverpool, Alkali Manufacturer.
O.M. Gaskell, Holbrook, jun., Erindale, Frodsham, Cheshire, Engineer.
1902. Gaskell, Holbrook III., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.
1897. Gaster, Leon, 32, Victoria Street, Westminster, S.W., Electrical Engineer.
1895. Gate, Tom Erskine, (Journals) The Santubong Cutch and Tanning Extract Co., Ltd., Santubong, Sarawak, Borneo, and (subscriptions) Calder House, Dewsbury, Yorks., Manufacturing Chemist.
O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.
1906. Gaunt, Percy, Norman Road, Rusholme, Manchester, Chemist.
1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.
1904. Gazdar, J. J., 5, Wroxham Mansions, Canfield Gardens, South Hampstead, N.W., Barrister-at-Law.
1905. Geisenheimer, Albert, P.O. Box 994, New York City, U.S.A., Dyestuff Merchant.
1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison St., New York City, U.S.A., Consulting Chemist.
1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.
1901. Gent, Percy W., 789, Highland Avenue, Forest Hill, Newark, N.J., U.S.A., Chemist.
1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.
1905. Genth, Fred. A., jun., 232, Walnut Street, Philadelphia, Pa., U.S.A., Chemist.
1905. George, J. K., 60, Wall Street, New York City, U.S.A., Manufacturer.
1902. George, Wm. K., c/o Standard Silver Co., Ltd., 35, Hayter Street, Toronto, Ont., Canada, Manufacturer.
1903. Georgii, Max, 606, F. Street, N.W., Washington, D.C., U.S.A., Patent Attorney.
1904. Gerard, Thos. A., 122, Foxhill Road, Nottingham, Soap Manufacturer.
1906. Gerkensmeyer, Henry H., 109, South Eastern Avenue, Joliet, Ill., U.S.A., Chemist.
O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.
1905. Geussler, Dr. Otto, c/o Farbenfabr. vorm. F. Bayer, Elberfeld, Germany, Chemist.
1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.
1891. Gibb, Thos., Wilford, Dornoch Terrace, Brisbane, Queensland, Metallurgist.
1903. Gibbings, Wm., 11, Howard Drive, Grassendale, Liverpool, Works Manager.
O.M. Gibbins, H. B., 177, Redland Road, Bristol
1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.
1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.
1883. Gibbs, D. Cecil, Soap Manufacturer.
O.M. Gibbs, Wm. P., Fabriken, Hjerpen, Jemtland, Sweden, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.
O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *via* Chester, Brick and Tile Manufacturer.
1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.
1906. Gibson, Robt. R., Boise, Idaho, U.S.A., Chemist.
1905. Gibson, Wm. F., Burham Cement Works, near Aylesford, Kent, Works Chemist.
1904. Giese, Otto E., 4, Cedar Street, Manhattan, New York City, U.S.A., Importer.
1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
1892. Gilbard, T. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.
1905. Gilbertson, Isaac H., 5, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.
1903. Gilby, Joseph W., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Stourton, Leeds, Works Chemist.
O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Chequer Lawn, St. Albans, Herts.
1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middlesboro', Ky., U.S.A., Chemist.
O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass, U.S.A., Assoc. Professor of Technical Analysis.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
1903. Gillean, R. Hampson, c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.
1901. Gilles, Wm. S., The Cottage, Rocking, near Braintree, Essex, Technical Chemist.
1903. Gillett, Wm. Lowry, Hotel San Remo, Central Park West and 75th Street, New York City, U.S.A., Chemical Engineer.
1906. Gillies, Donald B., Tonopah, Nevada, U.S.A., Mining Engineer.
1905. Gilliland, Elijah P., 79, Highland Avenue, Salem, Mass., U.S.A., Foreman Tanner.
1888. Gillman, Gustave, Ferrocarril de Murcia a Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1892. Gilmour, J. D., 192, Bathcadgens Road, Glasgow, Chemist.
1891. Gimingham, Edw. A., 28, Stamford Hill Mansions, Stamford Hill, N., Electrician.
1904. Ginsburg, Louis, 438, Main Street, New Britain, Conn., U.S.A., Match Manufacturer.
1886. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.
1906. Girtin, Thomas, H. L. Raphael's Refinery, Thomas Street, Burdett Road, London, E., Bullion Refiner.
1903. Gladding, Thos. S., 55, Fulton Street, New York City, U.S.A., Analytical Chemist.
1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.
1906. Glasel, Dr. Chas. J., Tanner.
1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.
1906. Glass, A. Melville, 37, Chancery Lane, London, W.C., Patent Agent.
1907. Gleason, Fred. J., Walpole, Mass., U.S.A., Superintendent (Mass. Chemical Co.).
1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1890. Glen, J., jun., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.
1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.
1904. Glendinning, T. A., Wellpark Brewery, Glasgow, Brewery Chemist.
1895. Glenn, Wm., Baltimore Chrome Works, 1348, Block Street, Baltimore, Md., U.S.A., Chrome Manufacturer.
1888. Gloag, Robt. F., Grove Hill, Middlesbrough, Secretary
O.M. Glover, G. T., 24, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.
1896. Glover, H., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.
1905. Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.
O.M. Glover, William, 25, North View, Heaton, Newcastle-on-Tyne, Technical Chemist.
1903. Goetschius, Howard B., Little Ferry, N.J., U.S.A., Chemist.
1896. Goetz, Isidore, 5, Brondesbury Park, London, N.W., Mine Manager.
1905. Gokhale, Dr. K. N., The Indian Pharmacy, Girgaum, Bombay, India, Manager.
1898. Golding, Jno., Ashby Road, Kegworth, Derby, Agricultural Chemist.
1906. Goldschmidt, Dr. Karl, Chemical Works, Essen-Ruhr, Germany, Manufacturing Chemist.
O.M. Goldschmidt, Dr. S. A., 43-51, Sedgwick Street, Brooklyn, N.Y., U.S.A., Chemical Manufacturer.
1897. Goldschmiedt, Dr. Guido, Laboratory, II Salmgasse 1, Prag, Austria, Professor in Imperial German University.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Dr. Jno. N., British Xylonite Co., Ltd., Manningtree, Essex, Chemist.
1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.
1900. Goodchild, Wm. H., (Journals) Porcura, Boicza, Vei Devs, Hungary, and (subscriptions) Elmwood Lodge, Long Lane, Finchley, N., Chemist.
1898. Goode, J. Archibald, 18, Crampton Street, London, S.E., Analytical Chemist.
1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.
1903. Gooding, E. Claude, Willow House, Washford, Somerset, Chemical Student.
1898. Goodrich, Chas. G., Akron, Ohio, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Beechfield, St. Margaret's Road, Altrincham, Cheshire, Accountant.
1894. Goodwin, Dr. W. L., The School of Mines, Kingston, Canada, Professor of Chemistry.
O.M. Goppelsroeder, Dr. F., Lutzenstrasse, 38, Basel, Switzerland, Professor of Chemistry.
1898. Gordon, Colin, Stores' Wharf, Wharf Road, Poplar, E., Chemical Engineer.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1883. Gore, Dr. G., F.R.S., 20, Easy Row, Birmingham, Metallurgist.
1906. Gorrie, David, c/o D. Gorrie & Sons, South Methven Street, Perth, N.B., Engineer.
1905. Goraline, Wm. H., Rochester Sewer Pipe Co., Rochester, N.Y., U.S.A., Secretary and Manager.
1891. Gorvin, Jno. C., English Crown Spelter Co., Ltd., Swansea, Works Manager.
O.M. Gossage, F. H., Camp Hill, Woolton, Liverpool, Alkali Manufacturer.
1897. Gossage, W. Winwood, Widnes, Lancashire, Soap Manufacturer.
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.
1903. Govers, F. X., 250, Main Street, Owego, Tioga Co., N.Y., U.S.A., Manager and Chemist.
O.M. Gowland, Prof. W., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).
1886. Goyder, G. A., 12, Pirie Street, Adelaide, South Australia, Chemist.
1890. Grabfield, Dr. J. P., c/o Morris and Co., 35th Street and 11th Avenue, New York City, U.S.A., Chemist.
1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.
O.M. Graham, Prof. C., The Reculvers, Hastings, Consulting Chemist.
O.M. Graham, C. C., Oriel House, Scarborough, Yorks., Technical Chemist.
1883. Grandage, H., City Chambers, 2, Darley Street, Bradford, Dyer.
1897. Granger, Dr. J. Darnell, 25, All Saints Street, Nottingham, Analytical Chemist.
1900. Granja, Rafael, Ceres Chemical Co., Kingston, N.Y., U.S.A., Chemist.
1905. Grant, Alexander, 13, Kilgraston Road, Edinburgh, Baker.
1903. Grant, Henry C., c/o Grasselli Chemical Co., 80, Wall Street, New York City, U.S.A., Manager.
1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 364, Harkness Avenue, Cleveland, Ohio, U.S.A., Chemist.
1895. Gray, Elisha B., c/o United Oil and Refining Co., Beaumont, Texas, U.S.A., Oil Inspector and Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1904. Gray, Jas., Heymann's Laboratory, P.O. Box 3427, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, Glengoyt, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 13, Queen's Road, Rock Ferry, near Birkenhead, Oil Works Chemist.
1902. Gray, John, Port Credit, Ont., Canada, Starch Manufacturer.
1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., Foot 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).
1896. Gray, Dr. Thos., The Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Australia, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks., Works Chemist.
1891. Greaves, I. A. S., Morton, [illegible]

1894. Greaves, Wm., Powell-Duffryn Coal, Ltd., Bye Product Works, Bargoed, near Cardiff, South Wales, Chemical Engineer and Chemist.
1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.
1900. Green, Alfred H., Oaklands, Lowton, Newton-le-Willows, Lancs., Manufacturing Chemist.
O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and Clothworkers' Department, The University, Leeds, Professor of Dyeing.
1907. Green, Clarence, c/o Nicholson and Co., Beaumont Works, St. Albans, Herts, Chemist.
1906. Green, Ernest, 113, Hulton Street, Moss Side, Manchester, Science Teacher.
1903. Green, G. F. Dudbridge, Lea Conservancy Board, Hackney Wick, N.E., Manufacturing Chemist.
O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
1896. Green, Jno. Wilberforce, 108, Kenilworth Avenue, Wimbledon Park, S.W., Technical Chemist.
O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1906. Greene, George M., 99, Mercer Street, Jersey City, N.J., U.S.A., Chemist.
1884. Greenhalgh, Jas. Herbert, Whitebirk, Green Mount, Bury, Lancs., Assistant Manager of Printworks.
O.M. Greenway, T. J., Chillagoe, North Queensland, Australia, Metallurgist.
1902. Greenwood, Conrad Varley, Horsfield, Colne, Lancs., Cotton Mill Manager.
O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Lancashire, Technical Chemist.
1897. Gref, Anthony, 128, Duane Street, New York City, U.S.A., Patent Lawyer.
1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.
1905. Greiner, F. M., Ensley, Alabama, U.S.A., Steel Melter.
O.M. Greville, H. L., 39, Croft Road, Bromley, Kent, Consulting Chemist.
1906. Grice, Walter T., 9, Dalhousie Square, Calcutta, India, Chemist.
1900. Griffin, Dr. Jno. J., Catholic University of America, Washington, D.C., U.S.A., Professor of Chemistry.
1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., Mechanicville, Saratoga Co., N.Y., U.S.A., Consulting Chemist.
1902. Griffiths, Manfred E., Temple Road, Stowmarket, Suffolk, Explosives Chemist.
1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.
1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.
O.M. Grimwood, R., 60, Woodland Rise, Muswell Hill Road, N., Analytical Chemist.
1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.
O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.
1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.
1906. Groenewoude, Sidney H., 36, Grosvenor Road, Highbury, N., Analytical Chemist.
1897. Gronemeyer, Herman H., 315, Amesbury Avenue, Cleveland, Ohio, U.S.A., Chemical Superintendent.
O.M. Grossmann, Dr. J., Northern Assurance Buildings, Albert Square, Manchester, Consulting Chemist and Chemical Engineer.
O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).
1903. Grundy, F. Barnes, Victoria Mills, Bredbury, near Stockport, Technical Chemist.
1888. Gudeman, Dr. Edw., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.
1906. Guess, Geo. A., c/o Cananea Consolidated Copper Co., Cananea, Sonora, Mexico, Chemist.
1898. Guest, Harry A., c/o Federal Lead Co., Flat River, Mo., U.S.A., Chemist.
1899. Guest, Edw. Graham, 5, Church Hill, Edinburgh, Cereals Chemist.
1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.
1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.
1905. Gummere, W., 125, East Hanover Street, Trenton, N.J., U.S.A., Chemist.
1904. Gundlach, Walter, 155, East 79th Street, New York City, U.S.A., Superintendent of Colour Works.
1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.
1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.
1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.
1902. Günther, Wm. J. W., c/o Colonial Sugar Refining Co., Ltd., 1, O'Connell Street, Sydney, N.S.W., Australia, Inspector.
1894. Gurney, J. Clare, Fundicion de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain, Analytical Chemist.
1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.
1903. Guthrie, Alan, South End, Northallerton, Yorks, and (Journals) c/o Cooper, Allen and Co., Cawnpore, India, Leather Chemist.
1903. Guthrie, Alex., Inglewood, Eaton Road, Coventry, Manager.
1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.
1903. Guttmann, Dr. Leo F., College of the City of New York, New York City, U.S.A., Research Chemist.
1892. Guttmann, Oscar, 12, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.
1904. Gyr, Dr. K. H., Zug, Switzerland, Analytical Chemist.

H

1902. Haas, Herbert, Union Ironworks, San Francisco, Cal., U.S.A., and (Journals) c/o Compania Metallurgica de Torreon, Torreon, Coahuila, Mexico, Metallurgical Engineer.
O.M. Habirshaw, W. M., 341, Madison Avenue, New York City, U.S.A., Chemical Engineer.
1904. Hacking, D. H., Henfield House, Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.
1883. Hacking, W. H., The Grange, Clayton-le-Moors, near Accrington.
1900. Haddock, Arthur G., 60, Highbury, Newcastle-on-Tyne, Technical Chemist.
1907. Haddock, Franklin, 27, Marion Street, West Lynn, Mass., U.S.A., Leather Manufacturer.
1898. Haddow, Geo., Parkview, Redding, Polmont Station, N.B., Chemist.
1887. Hadfield, R.A., Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) Parkhead House, Sheffield, Steel Founder.
1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.
O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.
1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.
1906. Haefele, J. E., 44, Randolph Avenue, East Rutherford, N.J., U.S.A., Chemist.
1902. Haff, Max M., Laboratory, 188, Metcalfe Street, Ottawa, Canada, Chemist.
1906. Hagen, Dr. Carl, 47, Victoria Street, London, S.W., Representative of Du Pont Powder Co.
1887. Haig, Robert, Dallarfield, [illegible] Engineer.

1906. Haigh, S. Wilson, 4, York Street, Dewsbury, Yorks., Chemical Engineer.

1898. Haigh, De Lagnel, 22, Norwood Avenue, Summit, N.J., U.S.A., Chemist.

1883. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.

1905. Haines, Harold W., 183, West 121st Street, New York City, U.S.A., Chemist.

1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Hake, C. N., 423, Flinders Lane, Melbourne, Victoria, Australia, Inspector of Explosives.

1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.

1903. Hale, Dr. Frank E., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.

1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.

1886. Hall, Archibald D., 7, Fenchurch Avenue, London, E.C., Analytical Chemist.

1898. Hall, Clarence A., 51, Allen Lane, Mount Airy, Philadelphia, Pa., U.S.A., Chemist.

O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.

1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.

1903. Hall, Jas. W., Bombay, Baroda and Central India Railway, Sabarmata, near Ahmedabad, India, Linseed Oil Mills Manager.

1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.

1900. Hall, Jos. J., 810, Sixth Avenue East, Cedar Rapids, Iowa, U.S.A., Chemist.

O.M. Hall, S., East London Soap Works, Bow, London, E., Soap Manufacturer.

1896. Hall, S. Godfrey, East London Soap Works, Bow, E.; (Journals) 19, Aberdeen Park, Highbury, N., Soap Maker.

1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1903. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.

1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.

1900. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.

1892. Hamaguchi, K., Hiro Mura, Arito Gori, Wakayama Ken., Japan, Soy Manufacturer.

1904. Hamblet, Abel Martin, c/o Oxford Paper Co., Rumford Falls, Maine, U.S.A., Chemist.

1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.

1901. Hambuechen, Carl, c/o Pittsburg Reduction Co., East St. Louis, Ill., U.S.A., Electro-Chemist.

1904. Hamilton, E. H., c/o Arizona Smelting Co., Humbolt, Arizona, U.S.A., General Superintendent.

1885. Hamilton, Oswald, Lancaster Cottage, Old Stratford, near Stony Stratford, Chemical Engineer.

1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.

1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.

1903. Hammersley, W. Stanley, 15, Rue des Carriers, Soignies, Belgium, Tanner.

O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.

O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.

1902. Hampson, B. A., Hampson's Collieries, Waschbank, Natal, S. Africa, Assayer.

1903. Hampton, F. T., Hill City, Tenn., U.S.A., Civil Engineer.

1906. Hancock, H. Irving, Blue Point, N.Y., U.S.A., Chemist.

1903. Hancock, Thos. J., c/o General Chemical Co., Hagemeyer, Ia., U.S.A., Chemist.

1906. Hancock, Walter C., 16, Upper Charlotte Street, Middleton Square, London, E.C., Chemist.

1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.

1899. Handy, Jas. O., 325, Water Street, Pittsburg, Pa., U.S.A., Chemist.

1888. Hanks, Abbot A., 2562, Washington Street, San Francisco, Cal., U.S.A., Assayer.

1901. Hanna, Charles E., P.O. Box 2302, Montreal, Canada, Secretary.

1899. Hanna, Dillinger C., 4262, Parkside Avenue, Philadelphia, Pa., U.S.A., Chemist and Superintendent.

1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.

1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.

1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.

1904. Hard, Dr. James, M.B., Cordobanes 16, Mexico City, Mexico, Chemist and Pathologist.

1901. Hardcastle, G. Fred., 17, Chaucer Street, Leicester, Teacher of Science and Technology.

1894. Harden, Dr. Arthur, 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.

1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Haskins Hey, Liverpool, Chemist.

1905. Hardy, Chas. H., c/o Reckitt & Sons, Ltd., Hull, Chemist.

1902. Hardy, G. D., 11, Montague Place, Toronto, Ont., Canada, Metallurgist.

1906. Hargreaves, Frank, c/o The Electrolytic Alkali Co., Ltd., Middlewich, Cheshire, Chemist.

1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.

O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.

1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.

O.M. Harland, R. H., Plough Court, 37, Lombard Street, London, E.C., Consulting Chemist.

1904. Harley, B., 12, Russell Street, Falkirk, N.B., Analytical Chemist.

1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.

1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.

1905. Harper, Dr. Henry W., University of Texas, 2706, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.

1904. Harrington, Dr. B. J., University Library, McGill University, Montreal, Canada, Director.

1903. Harrington, E. M., 109, Broad Street, Woodbury, N.J., U.S.A., Explosives Manufacturer.

1905. Harrington, John H., 139, High Street, Perth Amboy, N.J., U.S.A., Chemist.

O.M. Harrington, W. B., Leeview, Montenotte, Cork, Ireland, Chemical Manufacturer.

1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.

1885. Harris, Booth, jun., Beeleigh, Victoria Road, Barkhurst Hill, Essex, Soap Maker.

O.M. Harris, David, F.R.S.E., Lyncombe Bank, Prior Park Road, Bath, Chemical Manufacturer.

1897. Harris, Fred. W., Corporation Chemical Department, 26, John Street, Glasgow, Public Analyst.

1906. Harris, Jonathan, W., 259, South Clinton Street, Chicago, Ill., U.S.A., Chemist.

1900. Harris, L. A., Wyoming, Wood Vale, Leckhill Lane, London, S.E., Chemist.

1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchants.

1906. Harris, Wm. G., jun., 31, William Street, Toronto, Canada, Metallurgist.

O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.

1905. Harrison, E. E., Langdale, Bowker Vale, Todmorden, South Croydon, Analytical Chemist.

1883. Harrison, G. Heather, Hagley, Stourbridge, Chemist.

1904. Harrison, H. E., 1668, Buckingham Place, Chicago, Ill., U.S.A., Chemist.
1892. Harrison, Prof. John B., C.M.G., 45, Westbourne Park Road, Bayswater, W., Government Analyst.
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.
O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.
1890. Hart, H. W., 5, Cambridge Road, Ansdell, Lytham, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1883. Hartley, Joseph, 102, Kirkmanshulme Lane, Longsight, Manchester, Technical Chemist.
1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.
O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.
1897. Hartmann, Ernest E., c/o United Club, No. 4, Yokohama, Japan, Chemist.
1892. Hartridge, Jas. Hills, Holmwood, Hendon, N., Manufacturing Chemist.
1905. Hartshorne, Wm. D., 40, Pleasant Street; and (Journals) Arlington Mills, Methuen, Mass., U.S.A., Agent.
1905. Hartwell, F. O., c/o Holyoke Card and Paper Co., Springfield, Mass., U.S.A., Purchasing Agent.
1901. Hartwell, S. Warren, 215, North 2nd Street, Easton, Pa., U.S.A., Chemist.
1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.
1899. Harvey, Chas., 17, Alloa Road, Goodmayes, Ilford, Essex, Manufacturing Chemist.
1892. Harvey, E. Feild, Omrac, St. John's, Newfoundland, Chemist.
1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.
1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.
1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.
1900. Haslwanter, Chas., 86, Pilling Street, Brooklyn, N.Y., U.S.A., Analytical Chemist.
1897. Hasslacher, Jacob, P.O. Box 1999, New York, U.S.A., President, Roessler-Hasslacher Chemical Co.
1903. Hasting, J. J., c/o Louis Leavitt, North 11th Street and Driggs Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.
1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.
1906. Hattrick, J. M., 7, Bridge Street, Sydney, N.S.W., Australia, Agronom.
1900. Havens, Dr. F. S., 1434 Pine Street, Philadelphia, Pa., U.S.A., Silk Conditioner.
1906. Havercroft, Arthur E., 3, Carlton Terrace, Hornsea, Yorks, Chemist.
1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.
1895. Hawker, E. W., Adelaide Club, Adelaide, South Australia, Metallurgist.
1902. Hawkins, Clement C., c/o The Chatfield Manufacturing Co., Carthage, Ohio, U.S.A., Chemist.
1897. Hawkins, Ernest M., Lime Tree Farm House, Stone Street, Petham, Canterbury, Chemist.
O.M. Hawkins, H., White's Farm, Gottenham, Chippenham, Wilts, Explosive Works Manager.
1905. Hawkins, Henry, Moyola Villa, Lisnadown, Limerick, Ireland, Gas Engineer.
1893. Hawkins, J. Dawson, c/o Colo. Phila. Reduction Co., Colorado City, Colo., U.S.A., Smelting Works Manager.
1905. Hawley, Fred G., Box 10, La Canasea, Sonora, Mexico, Assayer and Chemist.
1887. Hawliczek, Josef, 77A, Lord Street, Liverpool, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.
1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1898. Haycraft, Jos. H., St. Peter's, Adelaide, South Australia, Metallurgical Chemist.
1904. Hayman, Jack V. J., Semper Aurea, Burwell, Cambridge, Chemist.
1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."
1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Chemist.
1906. Hayworth, W. P., 119, Clapton Common, London, N.E., Chemist.
1902. Hazard, Dr. Elmer C., Shrewsbury, N.J., U.S.A., Chemist.
1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).
1903. Hazen, Chas. R., 106a Belmont Place, Westmount, Quebec, Canada, Chemist.
1894. Heal, Carlton, Duston, near Northampton, Chemist.
1903. Heald, Henry I., Hove House, Adwick Road, Mexborough, near Rotherham, Yorks, Manager of Earthenware Factory.
1890. Heape, Chas., 19, George Street, Manchester, Calico Printer.
O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.
1905. Heathcote, Henry L., Warwick Avenue, Earlsdon, Coventry, Research Chemist.
1904. Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.
1895. Hebden, Jno. C., P.O. Box 824, Providence, R.I., U.S.A., Works Manager and Chemist.
1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.
1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.
1895. Hecker, Paul, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1889. Heckmann, C., 9, Görlitzerufer, Berlin, S.O., Germany, Chemical Apparatus Maker.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.
1895. Hedley, Geo. H., Hedge Mill, Loudwater, Bucks., Chemical Manufacturer.
1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.
1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Hehner, Charles, c/o H. and A. Saunders, Eclipse Building, King Street, Toronto, Canada, Assistant Manager.
O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.
1902. Heike, Rudolph E., American Sugar Refining Co., P.O. Box L, Jersey City, N.J., U.S.A., Chemist.
1905. Heilborn, Jacob, 503, Washington Street, Brookline, Mass., U.S.A., Traveller.
1898. Hellaman, W. H., 2530, Regent Street, Berkeley, Cal., U.S.A., Expert Field Assistant.
1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.
1885. Hellon, Dr. E., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

O.M. Helps, H. J., 87, Hassocks Road, Bromley, Kent, Government Analyst.

1903. Helps, D. H., c/o Reading Gas Co., King's Road, Works, Reading, Engineer and Manager.

1903. Hemingway, Frank C. R., 132, Front Street, New York City, U.S.A.

1883. Hemingway, H., 6, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paotingfu, North China, Professor of Chemistry and Physics.

1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.

1902. Henderson, J. C. A., 120, Bishopsgate Street Within, London, E.C.

1894. Henderson, Jos., Thornaby Ironworks, Thornaby-on-Tees, Metallurgical Chemist.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.

1906. Henderson, Thos., 14, Dey Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.

1906. Henius, Dr. Max, 327, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1904. Henley, F. R., 9, Beaufort Gardens, London, S.W., Brewer's Chemist.

1889. Hannin, Alphonse, Portoferraio, Elba, Italy, Metallurgical Chemist.

1905. Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.

1906. Henning, C. I. B., P.O. Box 42, Santa Cruz, Cal., U.S.A., Chemist.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1894. Hepburn, J. G., Priory Works, Dartford, Kent, Leather Manufacturer.

1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.

1891. Heriot, T. H. P., 37, Church Crescent, Muswell Hill, N., Analytical Chemist.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.

1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.

1899. Herrick, Rufus F., 16, Herrick Street, Winchester, Mass., U.S.A., Chemist.

1887. Herriot, Wm. Scott, Ravenswood, Partickhill, Glasgow, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.

O.M. Herschel, Prof. A. S., F.R.S., Observatory House, Slough, Bucks., Hon. Professor of Experimental Physics.

1896. Hersey, Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.

1901. Hershey, Aldus N., c/o Sharpe and Dohme, Baltimore, Md., U.S.A., Chemist.

1903. Herstein, Dr. Bernard, 9a, Trask Avenue, Bayonne, N.J., U.S.A., Technical Chemist.

1906. Harty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.

1903. Herz, Dr. Albert, Rosemount, Hipperholme, Halifax, Yorks, Chemist.

1898. Herzog, Oliver, Fernholme, Prince's Road, St. Helens, Lancs., Analytical Chemist.

1895. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.

1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.

1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.

1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.

1904. Heurich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.

1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, and (Journals) Spring Vale, near Gurnard, Isle of Wight, Engineer.

O.M. Hewitt, Dr. D. B., Oakleigh, Northwich, Cheshire, Alkali Manufacturer.

1903. Hewitt, H. R., 329, Bradford Road, Manchester, Chemical Works Manager.

1896. Hewitt, Dr. J. Theo., 7, The Avenue, Surbiton, Lecturer.

1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.

1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.

1905. Heymann, Dr. Fritz, (Journals) temporary, 83, Dorotheenstr., Berlin, N.W.; and 7, Elsworthy Terrace, Hampstead, N.W., Analytical Chemist.

1906. Heys, Charles H., 124, Yonge Street, Toronto, Canada, Consulting Chemist.

1884. Heys, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.

1883. Heywood, J. H., 231, Drake Street, Rochdale, Technical Chemist.

1897. Hibbard, Paul L., 2657, North 42nd Court, Chicago, Ill., U.S.A., Starch Chemist.

1906. Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.

1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.

1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.

1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.

1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.

1893. Hicks, Jas. A., c/o Dr. B. Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.

O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.

1886. Higgins, C. L., 79, Bedford Street South, Liverpool, Manufacturing Chemist.

1905. Higgins, Eric, 5, Oak Terrace, Beech Street, Liverpool, E., Chemist.

1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.

1901. Highley, Arnold, 26, Parkfield Avenue, Bradford Moor, Bradford, Chemist.

1904. Hildebrand, Charles C., Costello, Pa., U.S.A., Chemist.

1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Chemist.

1897. Hill, George, Barton-on-Humber, Chemical Works Manager.

1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Technology.

O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.

1892. Hill, Sydney, Eastholme, Prince's Avenue, and (Journals) c/o Blundell, Spence & Co., Ltd., Hull, Analytical Chemist.

1903. Hill, W. Basil, James Street Leather Works, York, Tanner.

1902. Hill, Wm. G. H., jun., American Radiator Co., Cambridgeport, Mass., U.S.A., Chemist.

1898. Hill-Jones, Thos., Invicta Mills, East Greenwich Lane, London, E., Manufacturing Chemist.

O.M. Hills, C. H., Andrews Copper Works, Lemington, Newcastle-on-Tyne, Copper Smelter.

1894. Hills, Harold T., Commercial Gas Works, Stratford, London, E., Analytical Chemist.

O.M. Hills, W., 225, Oxford Street, London, W., Pharmaceutical Chemist.
1898. Hilton, Edgar G., 17, Howard Drive, Grassendale, Liverpool, Varnish and Paint Manufacturer.
1899. Hinchley, J. W., 15, Fawcett Street, London, S.W., Chemical Engineer.
1906. Hinckley, Everett H., Sayleaville, R.I., U.S.A., Foreman.
1904. Hinckley, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Hind, H. Lloyd, 55, Stanton Road, Burton-on-Trent, Analytical Chemist.
O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertram C., 48, Sydenham Hill, Sydenham, S.E., Metallurgical Chemist.
1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.
1905. Hiorns, A. H., Caerleon, Chester Road, Erdington, near Birmingham, Science Teacher.
1900. Hirsh, Jos. E., 1245, 85th Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Hirshfield, E., c/o United Chemical Co., 52, Broadway, New York City, U.S.A., Chemist.
1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks., Works Chemist.
1886. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.
1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.
1900. Hobbs, Dr. Perry L., Western Reserve Medical College, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1906. Hobsbaum, Isaac B., 79, Claremont Road, Forest Gate, E., Analytical Chemist.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1904. Hochstetter, Henry, Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Chemist.
1894. Hodge, Andrew, Dalmonach Works, Bonhill, Dumbartonshire, Printworks Chemist.
1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.
O.M. Hodgkinson, Dr. W. R., 18, Glenluce Road, Blackheath, S.E., Professor of Chemistry.
O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Wicklow, Ireland, Technical Chemist.
1905. Hodgson, T. R., 23, Aberdeen Road, Highbury, N.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1903. Hoffmann, W. F., 23, Division Place, Newark, N.J., U.S.A., Chemical Merchant.
1906. Hogarth, Julius W., 37, Annandale Street, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1896. Hogben, W., 9, Duddingston Crescent, Portobello, Edinburgh, Chemist.
O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.
1903. Holde, Dr. D., Königl. Materialprüfungsamt, Grosser Lichterfelde, W., Germany, Principal.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1903. Holden, G. E., 23, Durnford Street, Middleton, near Manchester, Works Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman K., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., 30, [illegible] Dyer.
1904. Holgate, Arthur, c/o Wm. [illegible] Earl Street, Liverpool, Corn Miller.
1885. Holgate, T. E., 173, Hollins Grove, [illegible] cashire, Metallurgist.
1884. Holgate, Thos., 5, Victoria Street, [illegible] S.W., Gas Engineer.
O.M. Holland, Philip, 22, Tavitton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1901. Hollick, Herbert, c/o General Chemical Co., Camden N.J., U.S.A., Works Manager.
1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield Chemical Manufacturer.
1896. Hollings, J. Spencer, Yrondeg, near Wrexham North Wales, Works Manager.
1903. Hollinshead, Peter, 19, The Hollow Way, Runcorn Cheshire, Chemist.
1900. Hollinshead, Dr. W. H., Vanderbilt University Nashville, Tenn., U.S.A., Teacher of Chemistry
1904. Holloway, E. G., c/o Jas. S. Kirk and Co., Chicago Ill., U.S.A., Chemist.
1890. Holloway, G. T., 57-58, Chancery Lane, London W.C., Analytical and Consulting Chemist.
1900. Hollway, Jno., 6, Highbury Grange, London, N. and (Journals) c/o Wm. Galbraith, 97, William Street, Sheffield, Mine Owner.
1883. Holmes, Ellwood, Wynoote, Jesmond Park East Newcastle-on-Tyne, Colour Manufacturer.
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1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works Bradford Road, Manchester, Chemist.
1892. Holton, E. C., 601, Canal Road, S.W., Cleveland Ohio, U.S.A., Chemist.
1893. Holzapfel, Max, Milburn House, Newcastle-on-Tyne Manufacturer.
1893. Homfray, D., The Ings, Misterton, near Gainsborough, Analytical Chemist.
1905. Hook, Arthur Henry, Box 25, Greenwood, B.C. Canada, Chemist.
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1889. Hooper, Ernest F., Wear Fuel Works, Hendon Dock Sunderland, Technical Chemist.
1888. Hope, Jas., Dean House, Lenzie, N.B., Nickel Works Manager.
1904. Hopewell, Fredk., 86, Youville Square, Montreal Canada, Manager.
1892. Hopkins, Erastus, Lake Helen, Fla., U.S.A., Consulting Chemist.
1894. Hopkins, Herbert W., (Journals) c/o Waihi G. M. Co., Waihi, Paeroa, N.Z.; and 13, Harrington Gardens, South Kensington, S.W., Metallurgist
1905. Hoppenstedt, A., W., 138, Joralemon Street Brooklyn, N.Y., U.S.A., Chemist.
1898. Hopwood, Wm. H., Lovenbank Cottage, Jamestown, Dumbartonshire, Printworks Chemist.
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1900. Horsfall, Jno., 4, Grange Avenue, Fawtonside, Manchester, Analytical and Consulting Chemist.
1902. Horsfall, L. H., c/o Binny and Co., Madras, India Chemist.
1901. Horton, Edw., jun., 10, Smith Square, Clapham, S.W., Student.
1906. Hosmann, Jas. H., Sun Building, [illegible] Manchester, Chemical Manufacturer.

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1906. [illegible], Chemist, Rosetta Park, Belfast, Ireland.

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1899. Howard, Herman E., 80, Lady Margaret Road, Southall, Middlesex, Chemist.

1893. Howarth, John, 26, Princess Street, Manchester, Dyemaker.

O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.

1901. Howard, Bernard F., Quintocks, Montalt Road, Woodford Green, Essex, Chemist.

O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.

1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.

1903. Howard, Fred. A., 254, Montello Street, Brockton, Mass., U.S.A., Chemist.

1898. Howard, Henry, Dymoke Street, Brookline, Mass., U.S.A., Chemical Engineer.

1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.

1904. Howard, T., c/o Williams Bros. and Co., Hounslow, Chemist.

O.M. Howard, W. D., City Mills, Stratford, London, E., Chemical Manufacturer.

1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.

1905. Howe, Roland E., 196, Commonwealth Avenue, Concord Junction, Mass., U.S.A., Explosives Chemist.

1904. Howell, Walter L., Appraiser's Office, Custom House, New Orleans, La., U.S.A., Chemist.

1906. Howland, George W., 293, Dufferin Street, Toronto, Canada, Manager.

1899. Howles, Fred., c/o McDougall Bros., Millwall Docks, London, E., Chemist.

1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.

1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.

1894. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.

1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).

1898. Hudson, Albert W., Rigby Mining and Reduction Co., Mayer, Ariz., U.S.A., Metallurgist.

1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.

1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.

1905. Hudson, C. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.

O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.

1898. Hughes, Raymond M., Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.

1900. Hulley, Geo. D., c/o J. Eavenson and Sons, Delaware Avenue and Penn Street, Camden, N.J., U.S.A., Soapworks Chemist.

1906. Hulme, Robert B., c/o Kentucky Refining Co., Louisville, Ky., U.S.A., Chief Chemist.

1903. Hulton, H. F. E., 11, Colinette Road, Putney, S.W., Chemist.

1906. Hunal, Edward J., 7912, Grace Avenue, S.W., Cleveland, Ohio, Chemist.

1903. Humbray, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.

1901. Humphrey, H. C., c/o Corn Products Refining Co., Room 1202, 90, Broadway, New York City, U.S.A., Chemist.

1[illegible]. [illegible], John, 79, Great Russell Street, London, W.C., [illegible] Technological Record, [illegible].

1903. Humphrey, Hugh L., U.S. [illegible], Exposition Grounds, St. Louis, Mo., U.S.A., Civil Engineer.

1903. Humphreys, A. C., 31, Nassau Street, New York City, U.S.A., Engineer.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts, Gas Engineer.

1895. Hunicke, Dr. H. Aug., 3522, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.

1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.

O.M. Hunt, Bertram, 121, West George Street, Glasgow, Technical Chemist.

O.M. Hunt, Chas., 15, Victoria Street, Westminster, London, S.W., Gas Engineer.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.

1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.

1893. Hunter, Prof. Matthew, Cowside, Settle, Yorks, Professor of Chemistry.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.

1904. Huntzinger, Alfred, Route de Condette, Pont de Briques, Pas de Calais, France, Chemist and Colourist.

1903. Hurlburt, Allen S., c/o General Chemical Co., Hudson River Works, Hudson Heights, N.J., U.S.A., Chemist.

1904. Hurren, F. H., 31, Melville Road, and (Journals) c/o The Rover Co., Ltd., Coventry, Analytical Chemist.

1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, and (Journals) The Red House, Broadstairs, Mechanical Engineer.

O.M. Huskisson, P. L., 77, Swinton Street, London, W.C., Chemical Manufacturer.

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1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.

1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.

O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.

1900. Hutchinson, E. George, Gas Works, Stockport, Gas Engineer.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1901. Hutton, Dr. Robt. S., The University, Manchester, Lecturer on Electro-Chemistry.

1906. Hutton, James S., 61, Plymouth Road, Malden, Mass., U.S.A., Chemist.

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1906. Huyett, Miles C., 1203, Traders Bank Building, Toronto, Canada, Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., P.O. Box 93, Rumford Falls, Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, 80, West Street, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Greatley, 26, Whitefriars Street, Fleet, Common, S.W., Analyst.

1901. Hyman, Leonard W., 501, South [illegible], Albany, N.Y., U.S.A., Analytical Chemist.

1896. Hyndman, W. F., Rosslyn, 27, Ravenscroft Road, Kensington, W., Consulting [illegible].

1898. Ibbotson, E. C., Gysinge, Sweden, Metallurgist.
1900. Ichioka, Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).
1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.
1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.
1902. Ihart, John P., 373, West 35th Street, New York City, U.S.A., Technical Chemist.
1900. Imrie, John, 415, Shields Road, Glasgow, Analytical Chemist.
1906. Ingalls, Robert C., 53, Commercial Street, West Lynn, Mass., U.S.A., Sales Manager.
1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten I., N.Y., U.S.A., Mining Engineer and Metallurgist.
1889. Ingle, Dr. Harry, Creskeld, Balwearie Road, Kirkcaldy, Fifeshire, Organic Chemist.
1891. Ingle, Herbert, Dept. of Agriculture, Government Buildings, Pretoria, Transvaal, Chemist.
1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks, Lecturer.
1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.
1906. Innes, Dr. W. Ross, 6, Griffiths Road, Wimbledon, S.W., Chemist.
1904. Irlam, H. A., Cleveden, Hightown Road, Luton, Beds., Manager and Chemist.
1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.
1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.
O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.
1893. Isaac, J. F. V., Research Chemist.
1896. Isaacs, Louis A., 110, Greencroft Gardens, West Hampstead, N.W., (Journals) c/o Yeatman and Co., Ltd., Denmark Street, E., Manufacturer.
1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.
1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

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1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.
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1903. Jackson, Dr. D. H., 73, Parliament Hill, Hampstead, N.W., Chemist.
O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
1904. Jackson, Ernest W., 11, Queen's Terrace, Middlesbro', Analytical Chemist.
1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
1883. Jackson, Frederick, 14, Cross Street, Manchester. Laboratory Furnisher.
1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
1901. Jackson, Percy G., Chemical Laboratory, Locomotive Dept., Midland Railway, Derby, Chemist.
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1890. Jackson, Saml., c/o H. S. Duncan, Roundhay, Harrington's Road, Chetput, Madras, India, Analytical Chemist.
1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).
1898. Jackson, Thos., Clayton Chemical Works, Clayton, Manchester, Chemical Manufacturer.
1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.
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1903. Jackson, Wm. D. N., 291, Station Road, Wallsend-on-Tyne, Analytical Chemist.
1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.
1899. Jackson, W. Morton, c/o Manchester Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.
O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1901. Jacobs, Charles B., 52, Beaver Street, New York City, U.S.A., Chemist.
1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."
1900. Jacoby, Areli H., c/o American Dyewood Co., 156, William Street, New York City, U.S.A., Chemist.
1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
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1889. James, Alf., 2, Broad Street Place, London, E.C., Mining Engineer.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliff Street, Bristol, Chemical Lecturer.
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1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
1902. Jameson, Lewis, 83, Queen Victoria Street, London, E.C., Consulting Chemist.
1903. Janes, Frank W., Wolseley Street, Surrey Hills, Victoria, Australia, Assayer.
1890. Jantzen, Paul, 133, Fenchurch Street, London, E.C., Chemical Merchant.
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1906. Jardine, Samuel, c/o Dallyn, Jardine and Co., 23, Scott Street, Toronto, Canada, Chemical Merchant.
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1900. Jarvie, Jas., Monkland House, Kirkintilloch, N.B., Chemist.
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1894. Jenks, Robt. L., Central Excise Laboratory, Kasauli, Punjab, India, Chemist.
1905. Jennison, Jas., 103, Lynwood Avenue, Darwen, Lancashire, Chemist.
1904. Jepson, John Elliott, The Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist (Gelatni Works).

99. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
04. Jessup, Alfred E., Tientsin, North China, Assayer.
04. Jewell, Wm. M., Cable Building, Chicago, Ill., U.S.A., Chemist and Engineer.
04. Jewson, F. T., Thornly Park Terrace, Paisley, N.B., Chemist.
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06. John, David, Haileybury, Ontario, Canada, Chemist.
86. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
04. Johnson, Cedric, Field House, Winnington, Northwich, Chemical Engineer.
06. Johnson, Chas. C., Vandreuil Station, Quebec, Canada, Chemical Engineer.
05. Johnson, Chas. F., Avery Chemical Co., Littleton, Mass., U.S.A., Superintendent.
02. Johnson, Chas. M., 701, Orchard Street, Avalon, Allegheny Co., Pa., U.S.A., Chemist.
91. Johnson, Edmond E., The Gales, Roding Lane, Woodford Bridge, Essex, Chemical Engineer.
00. Johnson, Edw., c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil, Sugar Works Manager.
02. Johnson, Emil F., 96–98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
00. Johnson, F. Carter, National Acid Co., 714, Union Street, New Orleans, La., U.S.A., Chemical Engineer.
04. Johnson, F. M. G. (Journals), 286, Peel Street, Montreal, Canada; and (communications) University College, London, W.C., Chemist.
04. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
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1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.
1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.
1906. Lee, William, 43, Daisy Bank, Heaton Park, Manchester, Works Chemist.
1886. Leeds, F. H., 26, East Bank, Stamford Hill, N., Analytical Chemist.
1903. Leerburger, Henry, 54, Beekman Street, New York City, U.S.A., Essential Oil Merchant.
1903. Leese, Jos., jun., 3, Ash Grove, Victoria Park, Manchester, Analytical and Technical Chemist.
1901. Lefebvre, Georges, Compagnie du Phospho-Guano, 27 Rue La Rochefoucauld, Paris, Director.
1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.
1907. Lehmann, Dr. Adolf, Bangalore, India, Agricultural Chemist.
1901. Leibfried, Jno. E., Bethlehem, Pa., U.S.A., Analytical Chemist.
1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.
1906. Leigh, Edw. Collier, Caixa 147, Pernambuco, Brazil, Gas Works Manager.
1902. Leighton, A. E., Cordite Factory, Aruvankad, Nilgiris, India; and Journals (until May 31st only) to Whitcott, Edgware, Middlesex, Analytical Chemist.
1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.
1904. Le Maistre, Fred J., Eastern Laboratory, Chester, Pa., U.S.A., Research Chemist.
1898. Leman, Wm. T., c/o The Texas Co., Port Arthur, Tex., U.S.A., Oilworks Manager.
1901. Lengfeld, Dr. Felix, 1804, Fillmore Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.
1883. Lennard, F., c/o Forbes, Abbott & Lennard, Ltd., Chemical Works, Shoreham, Sussex, Chemical Manufacturer.

884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.
903. Lepsius, Prof. Dr. B., Griesheim a/M., Germany, Director (Chem. Fabr. Griesheim-Elektron).
888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII'.), France.
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907. Leslie, Fred A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Assistant Chemist.
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904. Lessing, Dr. Rudolf, 3, Moriston Place, Clydach, R.S.O., Glam., Chemist.
900. Lessner, Chas. B., Carrill, Spain, Metallurgical Chemist.
892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.
904. Le Sueur, E. A., 50, MacLaren Street, Ottawa, Ont., Canada, Electrical and Chemical Engineer.
899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.
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901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.
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896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.
904. Lewis, Edw. W., c/o J. G. Ingram and Son, London India Rubber Works, Hackney Wick, N.E., Chemist.
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900. Lewis, John, 35, Mundania Road, Honor Oak, S.E., Cashier (Paint Works).
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1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs., Chemist and Manager.
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1895. Lovejoy, Frank W., Kodak Park, Rochester, N.Y., U.S.A., Chemical Engineer.
1904. Loveland, Jas. W., 8, Kenwood Street, West Somerville, Mass., U.S.A., Superintendent of Soap Works.
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1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., Dayton, Ohio, U.S.A., Paint and Varnish Maker.
1906. Lowe, James, City Chambers, 45, John Street, Glasgow, Gas Engineer.
1906. Lowe, Jos. A., Fitchburg, Mass., U.S.A., Paper Manufacturer.
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1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.
1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.
1895. Lucas, Alf., Survey Department, Giza, Egypt, Analyst.
1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
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1900. Lummus, Walter E., 62, Newhall Street, Lynn, Mass., U.S.A., Manager (Commonwealth Manufacturing Co.).
1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Lundholm, Carl O., Nobel's Explosives Co., Ltd., Ardeer Factory, Stevenston, Ayrshire, Manager.
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1895. Luxmoore, Dr. Chas. M., University College, Reading, Lecturer on Chemistry.
1899. Luxton, Thos., 28, Albany Street, Hull, Teacher of Chemistry.
1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James, Ardeseo, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.
1896. Lynn, Arthur H., 71, College Road, Bromley, Kent, Chemical Works Manager.
1906. Lynch, W. D., 10, Pinckney Street, Boston, Mass., U.S.A., Analytical Chemist.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.
1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.
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1904. Mabee, Fred. Carleton, Sumner Hall, Cambridge, Mass, U.S.A., Assistant in Chemistry.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1891. Macadam, Herbert E., Milton House, Selsdon Road, Wanstead, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.
1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.
1892. Macara, Thos., jun., 30, Oakfield Road, Stroud Green, N., Chemist.
1889. McArthur, Jno., 196, Trinity Road, Wandsworth Common, S.W., Chemist.
1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Chemist.
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1892. McArthur, Thos., 7, Temple, Dale Street, Liverpool, Drysalter and Dyewood Extractor.
1905. McCallum, A. L., Queen Building, Halifax, N.S., Canada, Analytical and Consulting Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
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1894. McCann, Owen, c/o J. Gilton and Co., Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.

1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
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1897. McCrae, Dr. John, jun., P.O. Box 434, Pretoria, Transvaal, and (Journals) 7, Kirklee Gardens, Kelvinside, Glasgow, Chemist, Dept. of Agriculture.
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1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.
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1902. Macdonald, Peter, jun., c/o Mazapil Copper Co., Ltd., Concepcion del Oro (Apartado No. 5), Saltillo, Zacatecas, Mexico, Analytical Chemist.
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1906. McDowall, Wm., c/o Inglis, Lomax and Co., Antofagasta, Chile, South America, Analytical Chemist.
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O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.
1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).
1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
1893. Mann, Harold H., Indian Tea Association, Royal Exchange Buildings, Calcutta, India, Research Chemist.
1899. Mann, Jas. S., 97, Greengate Street, Plaistow, Essex, Analyst.
1891. Mann, John C., 9, Lambert Street, Hull, Chemist.
1903. Mannhardt, Hans, c/o Heath & Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Mannington, H. T., Marchlea, Beaconsfield Road, Farnworth, Widnes.
1892. Mansbridge, Wm., 27, Elmbank Road, Sefton Park, Liverpool, Chemist.
1893. Marchlewski, Dr. L., Strzelecka 9, Krakow, Austria.
1904. Marckworth, O. S., Ohio Testing Laboratory, 25 and 26, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.
1903. Mardick, Jno. R., Westminster, Md., U.S.A., Chemical Engineer.
1904. Maréchal, H., Eugene Maréchal et fils, Vénissier (Rhone), France, Oilcloth Manufacturer.
1883. Markel, Dr. K., Tower House, Bewsey, Warrington, Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Yorks., Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.
1904. Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.
1904. Marschall, Adolf J., Madison, Wis., U.S.A., Chemist.
1901. Marsden, Dr. Fred., c/o Messrs. H. Ashwell & Co., New Basford, Nottingham, Chemist.
1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
1905. Marsh, John, Massarah Cement Works, near Heluan, Egypt, Cement Works Chemist.
O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, The Cottage, Dartford, Kent, Explosives Chemist.
1906. Marshall, Dexter, c/o McClure Co., Fourth Avenue, and 23rd Street, New York City, U.S.A.
1895. Marshall, Francis G., 4, Woodhouse Terrace, Bewick Road, Gateshead, Technical Chemist.
1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.
1901. Marshall, Jos. W., 143, De la Pole Avenue, Hull, Science Lecturer.
1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.
1883. Marshall, Wm., Carisbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass, U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist
1895. Martin, Chas., H., 40, Bolton Road, Pendleton, Salford, Oil and Soap Works Manager.
O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1899. Martin, Wm. E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
O.M. Martin, W. H., 183B, King's Road, Chelsea, London, S.W., Analytical Chemist.
1887. Martineau, Sydney, Northwood, Rydal Road, Streatham, S.W., Sugar Chemist.
1894. Martyn, T. Graham, 11, Stratton Terrace, Truro, Cornwall, Metallurgist.
1905. Marx, Dr. Emil, Fährstrasse 102, Wilhelmsburg, Hamburg, Germany, Research Chemist.
1902. Marx, Joseph S., California Powder Works, Pinole, Cal., U.S.A., Chemist.
1905. Marx, Dr. Max, 81, Shanley Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1904. Mason, Dr. Edward D., 22, George Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.
1906. Mason, Frederic S., 90, Beckman Street, New York City, U.S.A., Manufacturing Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.
1906. Mason, M. Edgar, 510, Talbot Avenue, Boston, Mass., U.S.A., Chemist.
1892. Mason, Thos., Beech Avenue, Nottingham, Manufacturing Chemist.
1906. Massa, Corradino, Castelguelto Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1904. Masson, Victor E., Pleasant Valley Wine Co., Rheims, Steuben Co., N.Y., U.S.A., Chemist.
1902. Masujima, Prof. Bunjiro, 23, Midoricho Itchome, Honjoku, Tokyo, Japan, Prof. of Applied Chemistry.
1903. Masure, Gaston, 7, Rue de Constantine, Rouen, France, Chemist.
1902. Masury, Fred L. M., Lock Box 144, Sharon, Pa., U.S.A., Explosives Manufacturer.
O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1904. Mather, J. Cecil, 15, The Holloway, Runcorn, Cheshire, Works Chemist.
1900. Mather, Wm., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1907. Matheson, A. Greville E., c/o South Staffordshire Mond Gas Co., Tipton, South Staffordshire, Engineer.
1890. Matheson, W. J., c/o Cassella Colour Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Shanklin, Lucion Road, Upper Tooting, S.W., Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Crucible Steel Co. of America, Syracuse, N.Y., U.S.A., Chemist.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Mâtos, Louis J., 105, North 19th Street, East Orange, N.J., U.S.A., Chemist.
1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio Japan, Chemical Engineer.
O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1899. Matthews, Dr. J. Merritt, 320, South Broad Street, Philadelphia, Pa., U.S.A., Professor of Chemistry and Dyeing (Philadelphia Textile School).
1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1906. Mawson, Fred. E., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle, Cumberland, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.
1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1902. Meade, Richd. K., Nazareth, Pa , U.S.A., Chemist.
1904. Meads, Charles J., Bel Air, Dartmouth, Inland Revenue Officer.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatsheaf Works, Alexandria, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, Basle Chemical Works, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Chemist.
O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1901. Meldrum, Dr. And. N., 16, Mooroaks Road, Sheffield, Lecturer on Chemistry.
O.M. Mellon, W. W., 9, Glenart Avenue, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.
1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.
1893. Mensching, Dr. C., Anilinfabrik., Greppen bei Bitterfeld, Germany, Chemist.
1905. Menzies, David, 11, Camphill Avenue, Langside, Glasgow, Analyst.
O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire.
1890. Merck, E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.
1887. Merrell, Geo., Lock Box 780, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.
1903. Merrill, Herbert C., c/o Eimer & Amend, 205, Third Avenue, New York City, U.S.A., Chemical Engineer.
1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
1905. Merrin, A. C., 44, Bishopsgate Street Without, London, E.C., Assistant Editor and Analyst.
1902. Merritt, Wm. G., 643, Second Avenue, Detroit, Mich., U.S.A., Chemical Engineer (Berry Bros. Varnish Manufacturers).
1904. Merry, Jno. B., 12, Mayfield Road, Handsworth, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks, Chemist.
1903. Merseau, Gail, 181, Pearl Street, New York City U.S.A., Chemist.
1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A. General Superintendent, Heller and Merz Co.
1905. Merzbacher, Aaron, Laboratory, Reading Iron Co. Reading, Pa., U.S.A., Chemist.
1897. Meslans, Prof. M., 59 Quai de la Baronnie, Ablon (Seine et Oise), France, Professor of Chemistry.
O.M. Messel, Dr. R., 147, Victoria Street, London, S.W. Chemical Manufacturer.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke Mass., U.S.A.
1886. Metcalf, Jno., Moorfield, Altham, near Accrington Tar Distiller.
1905. Methley, Bernard, 21, Clifton Mount, Rotherham, Yorks., Engineering Chemist.
1898. Metz, Herman A., P.O. Box 78, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz., Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Product Co., Louisville, Ky., U.S.A., Chemist.
1904. Meyenberg, Dr. Alex., 9, Nelson Street, Plymouth Grove, Manchester, Works Manager.
1907. Meyer, Dr. Erwin, The Hartford Rubber Works Co., Hartford, Conn., U.S.A.
1898. Meyer, Dr. Franz, 52, Broadway, New York City, U.S.A., Metallurgical and Chemical Engineer.
1902. Meyer, Dr. Fredk. L., 2028, Park Avenue, Philadelphia, Pa., U.S.A., Chemist.
1900. Meyer, Karl, Sortedams Dossering 95A, Copenhagen, O., Denmark, Technical Chemist.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule Braunschweig, Germany, Professor of Chemistry
1902. Meyrick, L. J., 137, City Road, Birmingham Assistant Analyst.
1904. Mighill, Thos. A., 15, Exchange Street, Boston Mass., U.S.A., Chemist.
1906. Mihalovitch, Sydney F., 514, East Pearl Street Cincinnati, Ohio, U.S.A., Chemist.
1896. Miles, G. Wellington, 29, Central Street, Boston Mass., U.S.A., Analytical Chemist
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1899. Millar, Jas. H., P.O. Box 120, Durban, Natal, Manufacturing and Analytical Chemist.
1897. Millard, Edgar J., 40–42, Charlotte Street, London, E.C., Chemist and Manager.
1903. Millen, J. Dunlop, Mount Bischoff Mine, Waratah, Tasmania, Assistant General Manager.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
1904. Miller, Chas. E., 58, Chardon Street, Boston, Mass., U.S.A., Manufacturing Chemist.
O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1899. Miller, Geo., Clydesdale, Groes Road, Cressington, Liverpool, Technical Chemist.
1900 Miller, Hampton K., Lake City, Flo., U.S.A., Chemist (Florida A. and M. College).
1893. Miller, Dr. Harry E., 1015, Chestnut Street, Oakland, Cal., U.S.A., Chemist.
1902. Miller, H. Harold, 303, Front Street East, Toronto, Canada, Chemist.
1883. Miller, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1904. Miller, Jas., Pharmacist.
1894. Miller, Dr. John A., 40–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.
1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1899. Miller, P. Schuyler, 3500, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1901. Miller, Stuart B., c/o Eastern Dynamite Co., Lewisburg, Ala., U.S.A., Chemical Engineer.

1904. Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.
1901. Miller, W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
1904. Millroy, Alfred T., 53, Guilford Street, London, W.C., Laboratory Furnisher.
O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus, Professor of Technical Chemistry and Consulting Chemist.
1904. Mills, Dr. J. E., University of North Carolina, Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.
1901. Milroy, Andrew, Glenbarry, Giffnock, Glasgow, Manager.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1889. Miniati, T. K., Penketh, near Warrington, Chemist.
1904. Minor, John C., jun., Saratoga Springs, N.Y., U.S.A., Manufacturer.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1901. Mitchell, Frank H., c/o Dill and Collins, Richmond and Tioga Streets, Philadelphia, Pa., U.S.A., Tutor in Chemistry.
1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.
1883. Mitchell, J. W., Plantation House, Clough Fold, near Manchester, Waste Bleacher.
1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.
1904. Mitsugi, R., Weimarerstrasse 9, II., Charlottenburg, Germany, Chemist.
O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.
1902. Möckel, Heinrich A., Paper Mill, Altdamm, near Stettin, Germany, Chemist and Engineer.
1905. Modi, Dr. E. M., Opposite Grant Road Station, Sleater Road, Bombay, India, Manufacturing and Analytical Chemist.
1906. Moe, Eldor H., 24, South First West Street, Salt Lake City, Utah, U.S.A., Chemist.
1903. Möhlau, Prof. Dr. Rd., Semperstrasse 4, Dresden, A., Germany, Professor of Colour Chemistry.
O.M. Mohr, Dr. B., 69a, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1894. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.
1902. Molesworth, F. H., Jersey Road, Antarmon, N.S.W., Australia, Analytical Chemist.
1906. Moller, Emil A., 44, Sherman Avenue, Tompkinsville, N.Y., U.S.A., Manager (Sanitas Co.).
1903. Mommers, Richard, South Manchester, Conn., U.S.A., Chemical Engineer.
1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.
O.M. Mond, Dr. L., F.R.S., 20, Avenue Road, Regent's Park, N.W.; and 64, Via Sistina, Rome, Alkali Manufacturer.
1891. Mond, Robt. L., Winnington Hall, Northwich, Chemist.
1905. Monell, Ambrose, 43, Exchange Place, New York City, U.S.A., President (International Nickel Co.).
1906. Monier-Williams, G. W., The Lamman, Esher, Surrey.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.
1901. Moody, Chas. J., Lake View Consols Mine, Boulder, West Australia, Analyst and Assayer.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.
1898. Moody, Dr. Herbert R., College of the City of New York, New York City, U.S.A., Science Instructor.
1884. Mook, Chas., 2, Kapellenstrasse, Eisenach, Germany, Alkali Works Director.
1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.
1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.
1901. Moore, Chas. W., 38, Demesne Road, Whalley Range, Manchester, Chemist.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
1906. Moore, F. H., 39, Lime Street, London, E.C., Analytical Chemist.
1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1905. Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.
1899. Moore, Quintin, jun., c/o Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, Works Manager.
1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.
1899. Moore, Dr. Russell W., 47, Linden Place, Orange, N.J., U.S.A., Chemist (U.S. Appraiser's Office).
1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.
1905. Moorwood, F. Colin, c/o Flockton, Tompkin and Co., Ltd., Newhall Steelworks, Sheffield, Steel Manufacturer.
1903. Moran, Geo. A., 333, Haverhill Street, Lawrence, Mass., U.S.A., Chemist.
1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.
1902. More, Andrew, 61, Quarrendon Street, Fulham, S.W., Government Analyst.
1906. Morewood, C. Darcy, Frodingham Ironstone Mines, Scunthorpe, near Doncaster, Analytical Chemist.
1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1905. Morgan, Jerome J., College Park, Md., U.S.A., Teacher.
1890. Morgan, J. Jas., Laboratory, Cammell, Laird and Co., Workington, Cumberland, Assayer.
1907. Morgan, Leonard G., United States Mint, Philadelphia, Pa., U.S.A., Electro-Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Wavertree, Liverpool, Manufacturing Chemist.
1885. Morgans, Thos., 60, Queen Square, Bristol, Civil Engineer.
1907. Morhous, Oakley A., 1839, 82nd Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Morison, Jas., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1897. Morison, Samuel L., c/o John Brett, 8, Lendal, York, Water Engineer.
O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.
1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.
1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.
1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.
1906. Morris, A. H., 27, Hartington Road, Bolton, Lancs., Brewer.

1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.
1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.
1890. Morris, Herbert N., 13, Birch Grove, Rusholme, Manchester, Technical Chemist.
O.M. Morris, J. Haydn, 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.
1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.
1906. Morrow, Jas. M., 7, Rosebery Terrace, Kirkcaldy, N.B., Analytical Chemist.
1901. Morse, Willard S., Seaford, Del., U.S.A., Assistant Manager.
O.M. Morson, T., 38, Elsworthy Road, Primrose Hill, N.W.; and (Journals) Summerfield Works, Ponder's End, N., Manufacturing Chemist.
1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.
1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.
1889. Morton, Jas., Dalquhurn Works, Renton, N.B., Dyeworks Manager.
1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, F. R., c/o Heald Extract Co., Lynchburg, Va., U.S.A., Chemist.
1905. Moseley, F. A. D. H., Box 1057, Johannesburg, Transvaal, Analytical Chemist.
1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.
1903. Mosher, Walter R., 4274, West Avenue, Buffalo, N.Y., U.S.A., Chemist.
1906. Moss, Wm., Moss Chemical Manufacturing Co., Foot of Carlaw Avenue, Toronto, Canada, Chemical Manufacturer.
1894. Moszczenski, J. von, Tartar Chemical Co., Ninth Street and Gowanus Canal, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1897. Motion, Jno., c/o Valvoline Oil Co., Edgewater, N.J., U.S.A., Oil Refinery Chemist.
1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.
1901. Moule, Jno. W., c/o The Chillagoe Co., Ltd., Chillagoe, Queensland, Metallurgist.
1884. Moult, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.
1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).
1905. Mrazsek, F. M., 29, Mincing Lane, London, E.C., Consulting Chemist.
1904. Muckenfuss, A. M., c/o University of Mississippi, University, Miss., U.S.A., State Chemist.
1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Muir, Jas. Stanley, 8, Westminster Gardens, Glasgow, W., Chemist.
1906. Muir, Wm., Regent Factory, Linlithgow, Scotland, Analytical Chemist.
1894. Muir-Smith, W., c/o A. B. Fleming and Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.
O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.
1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.
1900. Munsell, Dr. Chas. E., c/o Devor and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
1900. Munton, Fred T., The Oak House, Winsford, Cheshire, A.R.S.M., Analytical Chemist.
1897. Murch, D. Wilshin, 6, Victoria Road, Wednesbury, Staffs., Chemist.
1904. Murdoch, Alexander, 557, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.
1886. Murdoch, R. H. M., Shore Road, Stevenston, Ayrshire, Explosives Chemist.
1899. Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.
1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.
1903. Murray, Chas. B., 611, Bailey Farrell Building, Pittsburg, Pa., U.S.A., Chemist.
1899. Murray, Jas. J., Iron King Mine, Blanchard, Arizona, U.S.A., Mining Engineer.
1901. Murray, Jas. P., Toronto Carpet Manufacturing Co., Ltd., King Street and Fraser Avenue, Toronto, Canada, Carpet Manufacturer.
1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
1896. Murray, Dr. Thos. S., 1, Nelson Street, Dundee, Professor of Chemistry.
1905. Murray, Wm. Wallace, c/o Union Abattoir Co., Baltimore, Md., U.S.A., Chemist.
1905. Murrill, Dr. Paul I., P.O. Box 986, Wilmington, Del., U.S.A., Representative, E.I. du Pont Co.
O.M. Muspratt, E. K., Seaforth Hall, near Liverpool, Alkali Manufacturer.
1894. Muspratt, Max, 2, Mannering Road, Sefton Park, Liverpool, Technical Chemist.
O.M. Muspratt, S. K., 14, Northgate, Regent's Park, N.W., Alkali Manufacturer.
1907. Musso, Louis A., Department of Agriculture, 140, George Street, North Sydney, N.S.W., Australia, Assistant Viticulturist.
O.M. Muter, Dr. Jno., Winchester House, Horley, Surrey; and (Journals) 325, Kennington Road, London, S.E., Chemical Lecturer.
1895. Muurling, I. J. R., P.O. Box 1935, New York City, U.S.A., Dyestuff Importer.
1891. Myers, Wm. S., Nitrate of Soda Propaganda, 12, John Street, New York City, U.S.A., Director.
1906. Myles, C. D., 16, St. Loo Mansions, Cheyne Gardens, London, S.W.

N

1902. Naef, Dr. Ernest E., Clydach, Swansea, South Wales, Chemist.
1903. Nagel, Dr. Oscar, c/o De la Vergne Machine Co., Foot of East 138th Street, New York City, U.S.A., Chemist.
1903. Nagel, Oskar H. L., c/o Larned and Baker Co., Syracuse, N.Y., U.S.A., Superintendent (Chemical Works).
1897. Nairn, Michael, Ben Dhu, Kirkcaldy, N.B., Linoleum Manufacturer.
1901. Nakagawa, Sosuke, c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan, Chief Engineer.
1903. Nakayama, Takakichi, c/o Fuji Paper Co., Sanjikkenbori, Tokyo, Japan, Chemist.
1901. Nanabhai, Krishnalal, 8-10, Nepean Sea Road, Malabar Hill, Bombay, India, Technological Chemist.
1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.
1904. Napper, Sidney S., c/o S. Courtauld & Co., Ltd., Foleshill Road, Coventry, Chemist.
1903. Nash, A. Douglas, 280, State Street, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.
1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
1906. Nathan, Albert, 60, Wall Street, New York City, U.S.A., Patent Lawyer.

1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent.
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
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1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.
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1898. Neil, Jas. Millar, 12 Woodland Avenue, Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., P.O. Box 615, Durban, Natal, Analytical Chemist.
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1903. Neiman, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
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1906. Nestell, Raymond J., 115, West 68th Street, New York City, U.S.A., Chemical Instructor.
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1903. Neumann, Dr. Max, Capellenstrasse 51, Wiesbaden, Germany.
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1900. Newton, Dr. Wm., Ashcombe, London Road, Dorking, Chemist.
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1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
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1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., President, San Carlos Copper Co.
1897. Nicholson, Harry, St. David's Mines, Ltd., Bontddu, Dolgelly, North Wales, Assayer.
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1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
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1906. Nielsen, Dr. Carl, c/o General Electric Co., Laboratory, Schenectady, N.Y., U.S.A., Chemist.
1898. Nightscales, Geo., 2, St. James' Parade, Hull, Oil Merchant.
1899. Niboul, Dr. Edw., Waremme, Belgium, Director of the Liège Tannery School.
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1885. Nishigawa, T., 12, Yamamato Dori, Nichome, Kobe, Japan, Director of Sulphuric Acid and Soda Works.
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1900. Norman, Geo. M., Woodbury, N.J., U.S.A., Chemist.
1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.
1904. Norris, Cassius W., 612, Commerce Street, Milwaukee, Wis., U.S.A., Tannery Chemist.
1899. Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.
1902. North, Barker, Glenholme, Glenholme Road, Manningham, Bradford, Lecturer in Chemistry.
1890. North, E. Gordon N., Technical Chemist.
O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.
1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1905. Norton, F. A., National Canners' Laboratory, Aspinwall, Pa., U.S.A., Chemist.
O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., U.S. Consulate, Smyrna, Turkey-in-Asia, Ph.D., Sc.D., U.S. Consul.
1901. Novarme, John L., 289, Myrtle Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C., Engineer.
1901. Noyes, Prof. Wm. A., Melrose Street, Chevy Chase, Md., U.S.A., Editor (J. Amer. Chem. Society).

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1904. Oberländer, Dr. Otto, Laboratory, Chamber of Commerce Buildings, Oxford Court, Cannon Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Bureau of Central Sugar Mills, Brisbane, Queensland, Supervising Chemist.
1900. O'Brien, Frederick, 87, Dongola Road, Horfield, Bristol, Analytical Chemist.
1906. O'Brien, John W., c/o Grasselli Chemical Co., Grasselli, Ind., U.S.A., Acid Manufacturer.

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1900. O'Byrne, Leo C., 996, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.
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1901. O'Connor, Chas. P., 55, Church Street, Montclair, N.J., U.S.A., Analytical Chemist.
1887. Oddie, Jas., School of Mines, Ballarat, Australia, Chemical Lecturer.
1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1888. Ogata, Saburo, Zobei Shikyoku, Okurasho, Tokyo, Japan, Assayer.
1905. Ogden, Alfred W., Room 1007, 641, Washington Street, New York City, U.S.A., Chemist.
1901. Ogden, Richard L., 314 North Main Street, Bethlehem, Pa., U.S.A., Chemist (U.S. Navy).
1906. Ogilvie, Alex. M., 9, Belmont Drive, Giffnock, Renfrewshire.
1896. Ogilvy, D. J., Gest Street and C. H. and D. R. R., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1901. Ogston, Alex. G., Heath Park, near Aberdeen, N.B., Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., 20, St. Dunstan's Hill, London, E.C., Chemical Merchant.
1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1901. Olivier, Dr. Louis, 22, Rue du Général-Foy, Paris, 8e, Directeur (Revue Générale des Sciences).
1905. Ollenbach, D. S., Cordite Factory, Aruvankad, Nilgiris, India, Assistant Government Surgeon.
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1904. Olney, L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1903. O'Loughlin, C. C., c/o Pittsburg Reduction Co., Niagara Falls, N.Y., U.S.A., Analyst.
1904. Olshausen, B. A., 1505, St. Andrew's Place, Los Angeles, Cal., U.S.A., Student.
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1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
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1905. Ormandy, Dr. W. R., Bewsey Cottage, Warrington, Chemist.
1898. Ormerod, Dr. Ernest, Research Chemist.
1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.
O.M. Orr, A., 35A, Bligh Street, Sydney, New South Wales, Analytical Chemist.
O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.
1884. Orr, Robert, c/o Jas. Miller, Son and Co., 79, West Nile Street, Glasgow; and (Journals), Kinnaird, Larbert, N.B., Manufacturing Chemist.
1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, Chemist.
1905. Osborne, Frank W., Oxford Club, Lynn, Mass., U.S.A., Chemist.
1897. Osborne, Thos. B., Box 164, New Haven, Conn., U.S.A., Chemist.
1900. Osbourne, Jno. P., 572, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.
1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Science (University of Sheffield).
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
1905. Otsuki, Prof. Chiri, 16, Shinsuwachō, Koishikawa, Tokyo, Japan, Professor of Applied Chemistry.
1898. Oushkoff, John P., c/o P. K. Oushkoff and Co., Moscow, Russia, Chemical Manufacturer.
1903. Outwater, Raymond, 1312, B. Street S.W., Washington, D.C., U.S.A., Chemist.
1887. Overtoun, Lord, 7, West George Street, Glasgow, Chemical Manufacturer.
1904. Owen, Halsall, Newholme, Latchford, Warrington, Engineer.
1906. Oxley, Horace F., c/o British Algin Co., and (Journals), Bryn Derwen, Holywell, North Wales, Chemist.
1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

P

1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.
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1899. Paessler, Dr. Joh., Vorstand der Deutschen Versuchsanstalt für Lederindustrie, Freiberg in Sachsen, Germany, Chemist.
1904. Page, Edwin P., 31, Market Street, Stourbridge, Worcestershire, Chemist.
O.M. Page, F. J. M., 54, Sutherland Street, Pimlico, S.W., Chemical Lecturer.
1907. Page, Leslie, c/o Swift and Co., Soap Works, 37, Medford Street, Somerville, Mass., U.S.A., Chemist.
1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 41, Park Row, New York City, U.S.A.; and (Journals) c/o Richard Stutz, Johnsonburg, Pa., U.S.A., President of Paper Making Co.
O.M. Paine, S., Devisdale, Bowdon, Cheshire, Pharmaceutical Chemist.
1902. Pakes, Dr. Walter C. C., Box 4581, Johannesburg, Transvaal, S. Africa, Analyst and Bacteriologist.
1905. Palethorpe, Percy R., The Tobacco Warehousing and Trading Co., 11th and Magnolia Avenue, Louisville, Ky., U.S.A., Chemist and Manager.
1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President of Dye and Chemical Co.
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1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.
1887. Palmer, Thos. C., 98, Commercial Road East, London, E.; and (Journals) Beechwood, Moss Lane, Pinner, Engineer.
1906. Papazzoni, Chas. F., c/o Keystone Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemist.
1902. Paquin, Felix, Memphis, Tenn., U.S.A., Chemist.
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1906. Parke, Jas., School of Practical Science, Toronto, Canada, Chemist.
1888. Parker, Chas. E., Penketh, Warrington, Tanner.
1894. Parker, Chas. E., U.S. Dept. of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chemist.
1898. Parker, Charles H., Merrills House, March End, Wednesfield, Staffs., Chemist.
1891. Parker, Edw., Thorncliffe, Denton, Manchester, Analytical Chemist.
1906. Parker, Elias G., 238, Grafton Avenue, Newark, N.J., U.S.A., Chemist.
1904. Parker, [illegible], c/o Messrs. Haddock, Parker and Co., 14, [illegible] Street, Liverpool, Chemical Broker.

1894. Parker, Dr. J. Gordon, Herold's Institute, Drummond Road, Bermondsey, S.E., Head of Tanning School.
1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., N.Y. Testing Laboratory, Long Island City, N.Y., U.S.A., Analytical Chemist.
O.M. Parker, Thos., Electrical Engineer.
1894. Parker, Thos. J., 25, Broad St., New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
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1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
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1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.
1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1901. Paterson, David, Leabank, Rosslyn, Midlothian, Colour Chemist.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alliott and Co., Ltd., Nottingham, Mechanical Engineer.
1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.
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1891. Paul, Jas., H., 19, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
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1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, c/o G. B. Pearce, The Beeches, Hayle, Cornwall, Smelting Works Manager.
1903. Pearce, Sidney H., P.O. Box 149, Johannesburg, Transvaal, South Africa, Metallurgist.
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1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1893. Pearson, Frank P., 8, Richmond Street, Haverhill, Mass., U.S.A., Chemist.
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1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.
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1906 Peile, Henry, Millburn House, Newcastle-on-Tyne, Colliery Owner.
1906. Peirce, Edwin H., c/o American Telephone and Telegraph Co., 125, Milk Street, Boston, Mass., U.S.A., Chemist.
1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.
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1887. Perkin, Dr. W. H., jun., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.
1903. Perkins, Frank G., 136, Newton Street, Waltham, Mass., U.S.A., Starch Manufacturer.
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1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.

1901. Persons, Ashton C., 74, Oak Street, Willimantic, Conn., U.S.A., Chemist.

1897. Peter, Dr. A. H., c/o Zinsser and Co., Hastings-on-Hudson, N.Y., U.S.A., Chemist.

1906. Peterson, Charles A., 104, Front Street East, Toronto, Canada, Chemist.

1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1883. Pettigrew, J., 6, St. Helen's Place, Bishopsgate, London, E.C., Technical Chemist.

1892. Pettigrew, Robt., c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 375, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Peucheu, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.

1905. Pouchot, A., 129, Crosby Street, New York City, U.S.A., Chemical Manufacturer.

1906. Peverley, Frank, 21, Gladstone Street, Skipton, Yorks, Dyer.

1904. Peyser, Horace F., 68, West 47th Street, New York City, U.S.A., Chemist.

O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham, Chemical Manufacturer.

1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 328, Montgomery Block, San Francisco, Cal., U.S.A., Chemist.

1904. Pfahler, H. W., 907, Delaware Avenue, South Bethlehem, Pa., U.S.A., Chemist.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.

1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.

1904. Phillips, Edw. W., c/o Fairmont Coal Co., and (Journals) 800, Gaston Avenue, Fairmont, W. Va., U.S.A., Chemist.

1891. Phillips, G. Brinton, (Journals) 622, Race Street; and (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.

1904. Phillips, V. C., Haselmere, Morris Avenue, Manor Park, E., Chemist.

1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.

1906. Phipps, Chas. B., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1883. Phipson, Dr. T. L., Casa Mia, Putney, S.W., Analytical and Consulting Chemist.

1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.

O.M. Pick, Dr. S., Direction der Soda Fabrik, Szczakowa, Galizien, Austria, Chemical Engineer and Manager.

1904. Pickard, Glenn H., c/o The Spencer-Killogg Co., Buffalo, N.Y., U.S.A., Chemist.

1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.

1902. Pickard, R. H., Isca, Merlin Road, Blackburn, Teacher and Analyst.

1904. Pickett, Chas. E., 26, East 33rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.

1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.

1888. Pilkington, G., 263, Walmersley Road, Bury, Lancashire, Analytical Chemist.

1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.

1894. Pilling, John E., Agnew Villas, 78, Whitegate Drive, Blackpool, Chemist.

1906. Pincott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).

1905. Pinnock, H. T., Beacon House, Dudley Port, Tipton, Chemist.

1883. Pipe, Jas., Messrs. Wm. Henderson & Co., Irvine, N.B., Chemical Manufacturer.

1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1905. Pirie, Frank D., Stoneywood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.

1900. Pitman, Jno. R., c/o Laflin and Rand Powder Co., Haskell, N.J., U.S.A., Chemist.

1907. Pitman, Brig.-Gen. John, c/o J. R. Pitman, Haskell, N.J., U.S.A., U.S. Army (retired).

O.M. Pitt, T., 16, Coleman Street, London, E.C., Manufacturing Chemist.

1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.

1905. Pittock, C. K., Baithney Estate, Saklaspur, Hassan, India, Coffee Grower and Chemist.

1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.

1899. Pizey, Jas. H., Bella Vista, 19, Minas de Rio Tinto Prov. de Huelva, Spain, Chemist.

1905. Plath, Dr. F., Deutsche Ton- und Steinzeugwerke, A.-G., Berlinerstrasse 22 B., Charlottenburg, Germany, Managing Director.

1894. Platten, Frank, 12, Montague Road, Edgbaston, Birmingham, Metallurgical Chemist.

1890. Platts, Jno. C., 12, Alton Terrace, Fairfield, Manchester, Metallurgical Chemist.

1896. Plaut, Albert, 120—128, William Street, New York City, U.S.A., Wholesale Druggist.

1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.

1907. Playter, Geo. H., 6, Beacon Street, Boston, Mass., U.S.A., Mining Engineer.

1891. Pocklington, Hy., 41, Virginia Road, Leeds, Assurance Co.'s Local Manager.

1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).

1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.

1902. Pollitt, Jas. C. T., Church Hill, Solihull, Warwickshire, Managing Chemist.

1893. Pollitt, R. B., Civil Engineer.

1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.

1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.

1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.

O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.

1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.

1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.

1892. Pope, Frank, c/o The Dunwoody Bros. Soap Co., Denver, Colo., U.S.A., Chemist.

O.M. Pope, S., 35, Victoria Road, Runcorn, Chemical Works Manager.

1899. Pope, Thos. H., The University, Birmingham, Chemist.

1900. Pope, Prof. W. J., F.R.S., Municipal School of Technology, Manchester; and (Journals), Corchester, Bramhall, Cheshire, Professor of Chemistry.
1900. Popplewell, Jos. M., Provan Chemical Works, Provanmill, Glasgow, Chemist.
1899. Porter, A. Felix, 1613, Rodney Street, Wilmington, Del., U.S.A., Chemist.
1896. Porter, Herbert, 80, Lancaster Avenue, Fennel Street, Manchester, Alkali Inspector.
1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.
1906. Porter, John J., Box 551, Staunton, Va., U.S.A., Chemist and Metallurgist.
1901. Porter, Jno. L., New Orleans Sewerage Board, 602, Carondelet Street, New Orleans, La., U.S.A., Chemist.
1904. Portner, Edward G., Robert Portner Brewing Co., Alexandria, Va., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1905. Potter, Chas. Ed., c/o City Dairy Co., Ltd., Spadina Crescent, Toronto, Canada, General Manager.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
O.M. Potter, E. P., Salwick Hall, near Preston, Alkali Manufacturer.
1906. Potter, Dr. H. Noel, 510, West 23rd Street, New York City, U.S.A., Electrical Engineer.
1905. Potter, N. S., jun., c/o Western States Portland Cement Co., Independence, Kas., U.S.A., Chemist.
1899. Potter, Rowland S., Eastbury, Upland Park Avenue, Loughton, Essex, Chemist.
1900. Potts, Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.
1900. Pough, Frank H., c/o T. and S. C. White Co., 28, Burling Slip, New York City, U.S.A., Manager.
1889. Powell, A., Ernest, 46, Monton Street, Moss Side, Manchester, Oil Merchant.
1900. Powell, Harry J., 506, Lordship Lane, London, S.E., Glass Manufacturer.
1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.
1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.
1902. Powney, Wm. E. F., Department of Mines, Edfu, Upper Egypt., Analytical Chemist.
1900. Pratt, N. P., Laboratory, Atlanta, Ga., U.S.A., Manufacturing Chemist.
1889. Pratt, Walter E., Patchetts, Caton, near Lancaster, Analytical Chemist.
1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist
1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India Chemist.
1905. Prentiss, G. L., c/o Parson Manufacturing Co., 299, Broadway, New York City, U.S.A., Treasurer.
1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Instructor in Bacteriology.
1905. Preston, Jas. F., Lowell, Mass., U.S.A., Manufacturing Chemist.
1906. Preston-Jackson, J. W. A., Castleford, Yorkshire, Consulting and Analytical Chemist and Druggist.
O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.
1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.
1904. Prichard, Norman B., Tweed, Ontario, Canada, Superintendent.
1904. Prideaux, E. B. R., 62, Queen Street; and (Journals), Heriot Watt College, Edinburgh, Research Chemist.
1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.
1906. Priestman, A., 17, Falkner Square, Liverpool, Drysalter.
1906. Pring, J. N., Linden Bank, Sandbach, Cheshire, Student.
1899. Prinsen-Geerligs, H. C., Pekalongan, Java, Netherlands Indies, Director of Sugar Cane Experimental Station.
1893. Pritchard, Edgar J., 5, Cumberland Gate, Kew, Surrey, Works Manager.
1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.
1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.
O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Yorks., Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.
O.M. Proctor, C., 43A, London Road, Forest Hill, S.E., Analytical Chemist.
1901. Propach, C., 224, Randolph Street, Chicago, Ill., U.S.A., Colour Merchant.
1894. Proude, Jas., 30, Cromwell Terrace, Halifax, Yorks., Soap Works Chemist and Manager.
1907. Puckhaber, Geo. C., 165, Rodney Street, Brooklyn, N.Y., U.S.A., Glue Maker.
1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.
1905. Pugh, John V., Ginting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).
1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.
1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.
O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.
O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.
1903. Pullin, Sydney R., Attasi Mines, Princisu, Dunkwa Station, Sekondi, Gold Coast Colony, Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.
1906. Purves, Geo., The Refinery, Canal Bank, St. Ambriose Street, St. Henri de Montreal, Canada, Chemist and Works Manager.
1905. Pyman, Dr. Frank Lee, The Oaks, Hitchin, Herts., Chemist.

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1903. Queeny, Jno. F., (Journals) Monsanto Chemical Works, and (communications) 1810, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.
1905. Queiroz, Dr. Luiz M. Pinto de, Caixa 255, Sao Paulo, Brazil, Manufacturing Chemist.
1903. Queneau, Augustin L., c/o New Jersey Zinc Co., South Bethlehem, Pa., U.S.A., Mining Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., c/o De Beers Explosives Works, Somerset West, C.C., South Africa, Chemist.
1897. Quinan, Wm. R., (Journals) General Manager, De Beers Explosives Works, Dynamite Factory, Cape Colony, South Africa; and (subscriptions) c/o De Beers Consolidated Mines, 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).
1897. Quirk, Jno. S., Lead Smelting Works, St. Helens, Lancs., Manager.

R

1898. Radcliffe, Lionel G., 431, Stretford Road, Manchester, Chemist.
1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.
1906. Rafft., Dr. Albert K., Moosic, Pa., U.S.A., Chemist.
1901. Ralston, Wm., 3, Windsor Terrace, Linthouse, Glasgow, Government Chemist.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1898. Ramsden, Andrew, York Villa, Walmersley Road, Bury, Lancs., Sugar Works Manager.
1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A. Librarian.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., 78, St. George's Square, London, S.W., Engineer.
1904. Rapelje, Walter S., 957, Liberty Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
1893. Ratcliff, Frank D., The Cottage, Green Hill, Bromsgrove, Worcestershire, Vinegar Brewer.
1904. Ratcliffe, C. F., c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston, Glasgow, Tar Distiller.
1904. Ratcliffe, Mrs. F. A., The Orchard, Dulwich Common, West Dulwich, S.E.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1895. Rau, Dr. H. M., 130-132, Pearl Street, New York City, U.S.A., Chemist.
1901. Rauter, Dr. G., Cauerstrasse, 2, Charlottenburg, I, bei Berlin, Germany, Engineering Chemist.
1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
O.M. Rawson, Chris., 2, Melbourne Place, Bradford, Consulting Chemist.
1906. Raymond, R. S., Marshall's Co-operative Breweries Co., Ltd., Paddington, Sydney, N.S.W., Australia, Brewer.
1895. Read, E. J., St. Ives, The Avenue, Gravesend, Kent, Analyst.
1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.
O.M. Readman, Dr. J. B., Mynde Park, Hereford, Analytical and Consulting Chemist.
1907. Rebhun, Frank E., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A.
1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.
1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.
O.M. Redwood, Sir Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.
1884. Redwood, Ityd J., The Chestnuts, Erith Road, Bexley Heath, Kent, Technical Chemist.
1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.
1891. Redwood, T. Horne, Olveston, Sedlescombe Road, St. Leonard's-on-Sea, Analytical Chemist.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.
1902. Reed, Hebert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.
1905. Reed, Herbert W., 153, Milk Street, Boston, Mass., U.S.A., Dye Salesman.
1895. Reed, Dr. J. Hastings, Hambledon Mill, via Cairns, North Queensland, Sugar Manufacturer.
1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman (Desilverising Works).
1893. Reekie, J. A., Woodhouse, Hayfield, Derbyshire, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.
1906. Rees, Walter J., c/o Chann, Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., c/o Repauno Chemical Co., Chester, Pa., U.S.A., Chemist.
1897. Reid, Andrew, 37, Mount Stuart Street, Shawlands, Glasgow, Chemist.
1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.
1905. Reid, Dr. John H., 11, Glover Street, Birkenhead, Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemical Student.
1895. Reid, T. Anderson, c/o Johnsen, Jörgensen, and Wettre, 38, Victoria Buildings, Manchester, Works Manager.
O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., Jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.
1906. Reinhold, Gustave, 11, Hervey Road, Blackheath, S.E., Works Manager.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.
1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.
1884. Renaut, F. W., 17, Emanuel Avenue, Friar's Park, Acton, W., Secretary.
1905. Render, Fredk., Underley House, Whitefield, Manchester, Explosives Manufacturer.
O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1901. Renwick, Frank F., Cromer Villa, Warley Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 143, West 111th Street, New York City, U.S.A., Chemist.
1905. Revis, Cecil, 77, King Street West, Hammersmith, W., Analyst.
O.M. Reynolds, Dr. J. Emerson, F.R.S., 29, Campden Hill Court, Kensington, W., Professor of Chemistry.
1904. Rhett, Edmund, American Ether Co., Richmond, Va., U.S.A., Superintendent.
O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Church Bridge House, Accrington, Dye and Print Works Manager.
1902. Rhodin, B. E. F., Sault Ste. Marie, Ont., Canada, Chemical Engineer.
1905. Richard, Francis C., Range Quarters, Mount Morgan, Queensland, Assayer (Mt. Morgan G.M. Co.).
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1888. Richardson, Clifford, New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemical Engineer.

1903. **Richardson, F. J.**, Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1894. **Richardson, F. W.**, City Analyst's Office, Bradford; and (Journals) Oak Lea, Menston-in-Wharfedale, Yorkshire, Analytical Chemist.
1900. **Richardson, Jno. H.**, c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. **Richardson, L. G.**, Russell Buildings, 10, Leeds Street, Bradford, Yorks., Chemist.
1889. **Richardson, S. M.**, 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. **Richardson, Walter W.**, Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. **Richardson, Wm.**, 2, Thornfield Road, West Park, Headingley, Leeds, Drysalter.
1900. **Richardson, Wm. Derrick**, 4306, Forestville Avenue, Chicago, Ill., U.S.A., Chemist (Swift and Co.).
1894. **Richardson, Wm. H.**, Newsky Thread Mills, Malaja Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1904. **Richardson, Wm. S.**, 201, High Street, Lincoln, Chemical Manure Manufacturer.
1886. **Richmond, H. D.**, 8, Woodfield Road, Ealing, W., Chief Chemist (Aylesbury Dairy Co.).
1898. **Richmond, Jno. R.**, 14, North Road, West Kirby, Cheshire, Alkali Works Manager.
1901. **Richmond, Sylvester O.**, 12, Ambleeote Road, Grove Park, Lee, S.E., Analytical Chemist.
1907. **Ricketts, Guy D.**, 25, Huskisson Street, Liverpool, Lecturer on Metallurgy (Liverpool University).
1886. **Riddell, R.**, 87, Horninglow Street, Burton-on-Trent, Brewer.
1894. **Ridding, Howard C.**, School of Mines, Clinton Road, Redruth, Cornwall, Principal.
1884. **Rideal, Dr. Samuel**, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. **Ridge, H. M.**, Owton Manor, Seaton Carew, Co. Durham, Mining Engineer.
O.M. **Ridsdale, C. H.**, Ravenscroft, Roman Road, Linthorpe, Middlesbrough, Analytical Chemist.
1899. **Riederer, Emil J.**, c/o Eastern Dynamite Co., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. **Riederer, Dr. Herman S.**, 251, West 95th Street, New York City, U.S.A., Chemist.
1907. **Rigg, Gilbert**, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1892. **Riker, Jno. J.**, 46, Cedar Street, New York City, U.S.A., Merchant.
O.M. **Riley, E.**, 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
O.M. **Riley, J. E.**, c/o John Riley & Sons, Hapton, near Accrington, Chemical Manufacturer.
1884. **Riley, Jno.**, Mayfield, Thornliebank, near Glasgow, Print Works Manager.
1905. **Riley, Louis J.**, 8, Newton Road, London, W., Chemist.
1904. **Riley, W. A.**, Hazeldene, College Road, Norwich, Brewer.
1899. **Rink, Arnold**, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. **Rintoul, Wm.**, 4, Sewardstone Road, Waltham Abbey, Essex, Explosives Chemist.
1901. **Ripley, Philip F.**, 48, Central Street, Andover, Mass., U.S.A., Chemist.
1885. **Ritson, T. N.**, 1, West Cliff Villas, West Cliff Road, Ramsgate, Gas Engineer.
1906. **Rivière, Harry V.**, 232, Lafayette Street, Salem, Mass., U.S.A., Chemist and Leather Superintendent.
O.M. **Rix, W. P.**, Frocester House, Kinglake Road, Egremont, Cheshire, Potter.
1890. **Roberts, C. F.**, Linfitts, Delph, *via* Oldham, Chemical Merchant.
O.M. **Roberts, F. G. Adair**, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.
1901. **Roberts, H. E. U.**, 14, Newton Road, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).
1885. **Roberts, R. Wightwick**, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.
1900. **Roberts, Wm. Brittain**, Wilderspool House, Warrington, Brewer and Analyst.
1902. **Roberts, Wm. H.**, Lynwood, Wellington Field, Wavertree, Liverpool, Analytical Chemist.
1902. **Robertshaw, Chas. D.**, c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.
1891. **Robertson, Alex. A.**, Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. **Robertson, Andrew, J.**, 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1903. **Robertson, Fred.**, 128, Wellington Street, Glasgow, Analytical Chemist.
1900. **Robertson, Jas.**, 6, Windsor Terrace, Lefroy Street, Coatbridge, N.B., Analytical Chemist.
1891. **Robertson, Dr. Robt.**, 9, Sewardstone Road; (Journals) Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1905. **Robertson, Robt.**, 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Salesman.
1897. **Robinson, Clarence J.**, Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1900. **Robinson, Edw. B.**, 2, Westcott Street, Hull, Oil Distiller.
1904. **Robinson, Prof. Franklin C.**, Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
1902. **Robinson, Hy. Fishwick**, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. **Robinson, H. H.**, 75, Finborough Road, West Brompton, S.W., Analytical Chemist.
1907. **Robinson, Herbert W.**, Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
O.M. **Robinson, Jno.**, 8, Albert Road, Widnes, Chemical Engineer.
O.M. **Robinson, Jos.**, Farnworth, Widnes, Chemical Manufacturer.
1887. **Robinson, Thomas**, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.
1902. **Robitschek, Carl**, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1884. **Rodger, Edw.**, 1, Clairmont Gardens, Glasgow, W.
1904. **Rodger, Robert**, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. **Rodger, R. L.**, Suffolk House, Cannon Street, London, E.C., Manager (Pena Copper Mines).
1904. **Roeber, Dr. E. F.**, 114, Liberty Street, New York City, U.S.A., Editor, "Electrochemical Industry."
1903. **Roelofsen, Dr. J. A.**, c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1905. **Rogers, Dr. Allen**, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. **Rogers, Geo. J.**, Wallaroo Smelting Works, South Australia, Chemist.
1890. **Rogers, Harry**, 5, Stoke Newington Common, London, N.
1899. **Rogers, John**, Ardeer Factory, Stevenston, Ayrshire, N.B., Chemist.
1907. **Roller, Frank R.**, 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.
1898. **Roller, H. C.**, Verona, and Riversdale Avenues, Newark, N.J., U.S.A., Superintendent.
1899. **Rollin, Chas.**, Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
O.M. **Rollin, J. C.**, 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1905. **Romanes, J. W.**, Minas de Rio Tinto, Huelva, Spain, Chemical Engineer.
1898. **Roode, Rudolf de**, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.
O.M. **Roscoe, Sir Henry, F.R.S.**, 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1901. **Roscow, Jas.**, 471, Park Avenue, Paterson, N.J., U.S.A., Colourist and Chemist.
1893. **Roscow, Jno. F.**, P.O. Box 417, Boonton, N.J., U.S.A., Print Works Chemist.
1899. **Roscow, Wm.**, 24, Prince Street, Pawtucket, R.I., U.S.A., Analytical Chemist.

1900. Ross, Jnº, Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Ross, Jno. Leonard, Gorton Brook Chemical Works, Manchester, S.E., Chemist.
1902. Rosebrugh, Prof. T. K., 666, Spadina Avenue, Toronto, Canada, and (Journals) 203, Kirk Avenue, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.
1904. Rosenblatt, A. H., Chemist.
1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1905. Rosenhain, Walter, Park View, Park Road, Teddington, Chemist and Metallurgist.
1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.
1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.
1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.
1906. Rossi, Louis M., c/o Perth Amboy Chemical Works, Perth Amboy, N.J., U.S.A., Mining Engineer.
1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.
1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.
1905. Rothwell, Robert R., 48, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.
O.M. Rottenburg, Paul, Castle Chambers, 55, West Regent Street, Glasgow, Chemical Merchant.
1899. Rouse, H. W., 62, Russell Road, Custom House, E., Foreman (Sulphuric Acid Works).
1903. Rouse, Wm., 25, Albert Street, Alexandria, Dumbartonshire, Chemist.
1906. Rowell, Herbert W., c/o Locke, Lancaster and Co., Ltd., Bridge Road, Limehouse, E., Analytical Chemist.
O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.
1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.
1901. Rowley, Walter Eugene, c/o Schoellkopf, Hartford and Hanna Co., 100, William Street, New York City, U.S.A.
1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.
1896. Royal-Dawson, H., c/o Messrs. Peyton & Son, Chemical Works, Lister Street, Birmingham, Chemist.
1898. Royle, Chas. L., c/o Parry and Co., Samalkot, Godaveri District, Madras, India, Sugar Chemist.
1898. Royle, Thos. H., (Journals) 12, Barfield Villas, George Lane, Woodford, Essex, and (communications) Bareilly, United Provinces, India, Chemist.
O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
1902. Rücker, Dr. Hermann von, 675, Potomac Avenue, Buffalo, N.Y., U.S.A., Chemist.
1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.
1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.
1904. Ruef, Harry H., c/o The Warner Chemical Co., Carteret, N.J., U.S.A., Chemist.
1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.
1905. Rüger, Richard, 8, Alroy Road, Anfield, Liverpool, Chemist.
1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.
O.M. Rumble, C., Belmont Works, Battersea, London, S.W., Candle Works Chemist.
1899. Rumbold, Wm. R., 47, Watling Street, London, E.C., Electro-Metallurgist.
1895. Rump, Ernst, The Leeds Phosphate Works, Hunslet, Leeds, Manager.
1903. Runting, D. A., Moreland Grove, Coburg, Melbourne, Vic., Australia, Assayer.
1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.
1899. Rushby, Wm., Broomfield House, Batley, Yorks., Analyst.
1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.
1884. Russell, Jno., Anchor Brewery, Britten Street, Chelsea, London, S.W., Brewer.
O.M. Russell, Dr. W. J., F.R.S., 34, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.
1901. Rust, Robt. R., 1315, Fourth Street, Peru, Ill., U.S.A., Chemist.
1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.
1905. Ryan, Prof. F. G.; (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., 111, Queen Victoria Street, London, E.C., Manufacturing Chemist.
1906. Ryan, Ironæus F., 452, Fairmount Avenue, Jersey City, N.J., U.S.A., Chemist.
1905. Ryland, Chawner, 53, Park Road, Aston, Birmingham, Brewer and Chemist.

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1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.
1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.
1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.
1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.
1896. Sadtler, Dr. S. S., 29, South 10th Street, Philadelphia, Pa., U.S.A., Chemist (U.S. Customs).
1905. Safford, E. Brigham, Albuquerque, New Mexico, U.S.A., Chemist.
1897. Sage, C. Edward, 160—162, Kennington Park Road, London, S.E., Consulting Chemist.
1907. Saiki, Kenkichi, 38, West 68th Street, New York City, U.S.A., Chemist.
1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.
1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.
1884. Salis-Mayenfeld, Dr. E. von., 9, Macpherson Terrace, Albany, N.Y., U.S.A., Technical Chemist.
1902. Salm, Louis N., 22, Cliff Street, New York City, U.S.A. Chemist.
1902. Salter, M. J., Greyrick House, Mickleton, Campden, Gloucestershire, Analytical Chemist.
1905. Sammet, Dr. G. Victor, 68, Northampton Street, Boston, Mass, U.S.A., Chemist.
O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.
1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.
1906. Sanders, J. McConnell, c/o Direccion General de Aduanas, Palacio Nacional, Mexico, D. F., Analytical Chemist.
1902. Sanders, Warren W., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.
1898. Sanderson, T. C., Duboise Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.

O.M. Sanford, P. Gerald, 20, Cullum Street, London, E.C., Public Analyst and Consulting Chemist.

1904. Sanger, Prof. Charles Robt., Harvard College, Cambridge, Mass., U.S.A., Professor of Chemistry.

1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.

1901. Sargent, Dr. Geo. W., Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.

1903. Saunders, Lewis E., c/o Norton Emery Wheel Co., Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.

1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.

1895. Savage, Arthur E., Charles Street, Elsternwick, Victoria, Australia, Metallurgist.

1895. Sawers, Wm. D., 1, Athole Gardens Place, Glasgow, Chemist.

1903. Sawin, Luther R., Mt. Kisco Laboratory, Mount Kisco, N.Y., U.S.A., Bacteriologist.

1901. Sawyer, Dr. Harris E., c/o Felton and Son, 524, East Second Street, South Boston, Mass., U.S.A., Chemist.

1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.

1895. Sayer, Harry, 5, Orchard Road, High Barnet, Herts., Metallurgical Chemist.

1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.

1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.

1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Schack-Sommer, Dr. G., 48, Marlborough Mansions, Victoria Street, London, S.W., Sugar Refiner.

1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.

1903. Schanche, Herman G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1906. Scheffer, Heinrich, 7, Conyngham Road, Rusholme, Manchester, Chemical Apparatus Manufacturer.

1903. Scheidel, Dr. Aug., Union Club, Sydney, N.S.W., Australia, Managing Director.

1880. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.

1904. Schenck, Henry, 15, University Place, New York City, U.S.A.

1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.

1895. Schieffelin, Dr. W. Jay, 841, Southern Boulevard, New York City, U.S.A., Manufacturing Chemist.

1901. Schieren, G. Arthur, Dixie Tannery, Bristol, Tenn., U.S.A., Mechanical Engineer and Tanner.

1905. Schill, Dr. Emil, c/o G. Siegle Co., 79, Duane Street, New York City, U.S.A., Chemist.

1902. Schlegel, Jno. Wm., cor. Main and Toledo Avenues, Elmhurst, Long Island, N.Y., U.S.A., Chemist.

1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.

1902. Schlesinger, Basil E., 92, Mount Vernon Street, Boston, Mass., U.S.A., Chemist.

1901. Schlichting, Emil, 1716, Chestnut Street, Philadelphia, Pa., U.S.A., Chemist.

1905. Schmidt, Herman B., 2523, Essex Place, W.W.H., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.

1906. Schmidts, J., Cross Street, Burton-on-Trent, Works Manager.

1907. Schmitt, Charles A., The Carter's Ink Co., 172, Columbus Avenue, Boston, Mass., U.S.A., Chemist.

1906. Schneible, Joseph, 14th Floor, Rector Building, Chicago, Ill., U.S.A., Chemical Engineer.

1901. Schneider, Edw. J., c/o Union Carbide Co., Niagara Falls, N.Y., U.S.A., Chemist.

1905. Schneider, Dr. F. G., Continental Color and Chemical Co., 32, India Street, Boston, Mass., U.S.A., Technical Chemist.

1898. Schniewind, Dr. F., c/o United Coke and Gas Co., 17, Battery Place, New York City, U.S.A., Chemist.

1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 62, Greene Street, New York City, U.S.A., Vice-President and Treasurer.

1897. Schoder, Dr. Robt., 6, Brandreth Road, Balham, S.W., Chemist.

1904. Schoeller, Dr. Walter R., c/o D. C. Griffith & Co., Victoria Avenue, Bishopsgate Without, London, E.C., Analytical Chemist.

1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.

O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.

1898. Scholes, Geo. R., Dépôt Général de la Liebig's Extract of Meat Co., Ltd., Antwerp, Belgium, Analytical Chemist.

1906. Schramm, Quirin, Otto-Hilgenstock Coke Oven Co., Ltd., Tingley, near Wakefield, Chief Chemist.

1906. Schroeder, C. M. E., 221, Pearl Street, New York City, U.S.A., Analytical Chemist.

1895. Schroeder, E. August, c/o Church and Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Schulten, Dr. C., 11, Clive Row, Calcutta, India, Analytical Chemist.

1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.

1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.

1893. Schüpphaus, Dr. R. C., 175, Pearl Street, New York City, U.S.A., Consulting Chemist.

1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.

1902. Schwarz, Gustav A., Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.

1889. Schweich, Emile. *See* Mond, Emile S.

1903. Schweickert, Karl, 45, Hazelwood Avenue, Rahway, N.J., U.S.A., Chemist.

1894. Schweitzer, Dr. H., 128, Duane Street, New York City, U.S.A., Analytical Chemist.

1905. Schweizer, Alfred, 14, Rue de Calais, Paris, France.

1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.

1906. Scott, Alex C., Davington House, Faversham, Kent, Assistant Manager (Cotton Powder Co.).

1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.

1906. Scott, A. Putnam, Dominion Iron & Steel Co., Sydney, C.B., Canada, Chemist.

1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C.; and (Journals) 67, Lord Street, Liverpool, Soap Works Chemist.

1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.

1894. Scott, Jno. Gillespie, 33, Sciennes Road, Edinburgh, Analytical Chemist.

1902. Scott, Walter, c/o The Powell Duffryn Steam Coal Co., Ltd., Aberaman, near Aberdare, Chemist.

1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical Chemist.

1889. Scovell, M. A., Lexington, Kentucky, U.S.A., Agricultural Chemist.

1904. Scoville, Wilbur L., 50, Washington Street, Boston, Mass., U.S.A., Analytical Chemist.

O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.

1895. Seabrooke, H. Cecil, Black Ash, Grays, Essex, Research Chemist.

1906. Seabury, Richard W., c/o Loando Hard Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.

1900. Searby, Fred. M., West Berkeley, Cal., U.S.A., Oilworks Superintendent.

1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.

1898. Searle, Alfred B., 29, Ashfield Terrace West, Newcastle-on-Tyne; and (Journals) Cliftonville, Claremont, Sheffield, Analytical Chemist.

1905. Seaver, Joshua, 212, Milk Street, Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.

1907. Sebold, George, 354, Elizabeth Avenue, Elizabeth, N.J., U.S.A.